MT15301 MANUFACTURING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To understand the basics and working principle of various manufacturing processes
- To impart knowledge on both conventional and non-conventional machining processes
- To make familiar with modern manufacturing operations, including their capabilities, limitations, and how to design for lowest cost.
- To learn how to analyse products and be able to improve their manufacturability and Lower costs.
- To study the relationship between customer desires, functional requirements, Product materials, product design, and manufacturing process selection

UNIT I FOUNDRY TECHNOLOGY 9

Pattern and Core making: Pattern types, allowances, types of cores, core print - Moulding sand: types, properties, green sand moulding - Melting furnaces: Induction furnaces, CO2 process, Centrifugal Castings, Shell Casing, Investment Casting, Die casting, Defects in casting. Hot working and cold working

UNIT II FORMING – PROCESSES 9

Hot and Cold Working. Rolling: Introduction – Rolling Mills – Rolling Operations – Production of Seamless Tubing and Pipe. Forging: Introduction – Related Forging Operations – Drop forging. Extrusion and Drawing: Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Sheet metal operations – Blanking, Punching and Piercing.

UNIT III MATERIAL – REMOVAL PROCESSES 9

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Tapes-Tool nomenclature, cutting speed, feed, machining Time calculations.

UNIT IV SPECIAL MACHINES 9

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping. Grinding Process – Abrasives – Finishing operations –lapping, Honing Powder coating.

UNIT V PRINCIPLES AND APPLICATIONS OF JOINING PROCESSES 9

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser– Beam Welding, Ultrasonic Welding, Friction Welding, Electro slag, Resistance welding, Principles and application of Brazing and Soldering.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On Completion of this course, the student will be able to

- understand the basics and working principle of various manufacturing processes
- understand both conventional and non-conventional machining processes
- gain awareness on automation used in manufacturing sectors
- learn the application of Joining Processes
- able to apply Milling Machines and Operations

TEXT BOOKS

1. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson education India,4th edition, 2001(ISBN 81 78081 571)
2. P. N. Rao, Manufacturing Technology - Vol I and II, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.

REFERENCES

1. Hajra Choudhury, S.K., and Haqjra Choudhury, A.K., "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
2. Paul Degarma E, Black J.T. and Ronald A. Kosher, eighth edition, Materials and Processes in Manufacturing Prentice – Hall of India, 1997.
3. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 1999.
4. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson education India, 4th edition, 2001.

WEB LINKS

1. https://books.google.com/books?id=sT6jwN1LKTQC&printsec=frontcover&dq=Manufacturing+Technology&hl=en&sa=X&ei=NWUaVZfkNMyyogSG9YCACA&ved=0CDgQ6AEwAw#v=onepage&q=Manufacturing%20Technology&f=false
2. https://www.google.com/search?tbm=bks&hl=en&q=Manufacturing+Technology

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	3	-	3	3	-	3	2	-
CO2	3	-	-	-	3	-	2	-	2	3	-	3	3	-
CO3	3	-	-	-	3	-	3	-	2	3	-	3	3	-
CO4	3	-	-	-	2	-	3	-	2	3	-	3	3	-
CO5	3	-	-	-	3	-	3	-	3	3	-	3	2	-

MT15304 FLUID MECHANICS AND MACHINERY 3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of fluid mechanics for thorough understanding of the properties of fluids.
- To introduce the dynamics of fluids through the control volume approach.
- To understand the concepts of dimensionless parameters and its applications.
- To study the working principles of pumps and turbines, also their applications.
- To describe and learn the working of reciprocating and rotodynamic hydraulic machines

UNIT I INTRODUCTION 9

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equiation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbachequaition. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES 9

Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES 9

Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this course the student will be able to

- understand the fundamentals of fluid mechanics, including the basics of hydraulics, types of fluids-water, oils and its uses along with fluid properties.

- analyze fluid flow phenomena with the application of momentum and energy equation.
- perform dimensional analysis and to learn the several non-dimensional numbers with real time applications.
- acquire knowledge about the working principle of turbo machinery.
- learn the different types of pumps, fluid machineries and its working principles.

TEXT BOOKS

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, DhanpatRai& Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.
4. Grabel.W.P, Engineering Fluid Mechanics, Taylor Francis, Indian Reprint, 2011.
5. Modi P.N and Seth S.M, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi 2004.

WEB LINKS

1. www.mechanical.in/fluid-mechanics-and-machinery
2. http://nptel.ac.in/courses/105101082/1

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	-	1	3	2	2	-	-	1	1	-
CO2	2	2	2	-	-	1	-	2	-	2	-	1	1	-
CO3	2	-	2	-	2	1	-	-	-	2	-	-	1	1
CO4	2	2	2	-	2	1	3	2	-	2	-	-	1	-
CO5	2	2	-	-	-	1	3	2	2	2	-	-	-	1

MT15302 DIGITAL ELECTRONICS 3 2 0 4

COURSE OBJECTIVES

- To understand the fundamentals of digital logic & minimization technique
- To impart students with various number systems and codes
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.

UNIT I NUMBER SYSTEM, BOOLEAN LOGIC AND MINIMIZATION TECHNIQUES 15

Introduction to Number systems- Binary, Octal, Hexadecimal, BCD, Grey code, Excess 3 code - Binary arithmetic, 1's complements, 2's complements, and Code conversions. Boolean theorems, Boolean algebra – AND, OR, NOT, NAND & NOR operation, Sum of Product and Product of Sum forms. Minimization – K- Map, Don't care conditions - Five Variable K maps, Tabular Minimization Procedures.

UNIT II COMBINATIONAL CIRCUITS 15

Half and Full Adders - Half and Full Subtractors - Code Converters Encoder – Decoder - Multiplexer- Demultiplexer -Binary/ BCD adders, Subtractors - Carry look ahead adder – parity checker – parity generators- Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS 15

General model of sequential circuits – Latch, Flip Flops– SR, D, JK and T, Level triggering, Edge triggering, Master slave configuration. Realization of one flip flop using other flip flop. Binary counters, Modulo–n counter- Decade - BCD counters. Ring counter, Johnson counter**.**

UNIT IV DESIGN OF SEQUENTIAL CIRCUITS 15

Classification of sequential circuits – Moore and Mealy - Design of Asynchronous counters- state diagram- State table –State minimization –State assignment- Register – shift registers - Universal shift register – Ring counters. Hazards: Static – Dynamic.

UNIT V MEMEORY, PROGRAMMABLE LOGIC DEVICES AND VHD 15

Memories - ROM, PROM, EPROM, Programmable Array Logic (PAL), Programmable Array Logic (PAL) - Implementation of combinational logic using PROM and PLA, PAL. Introduction

to VHDL -Behavioural, Data Flow and Structural Model - Operators – Data objects - Data types, Attributes - Test Benches –Simple.

TOTAL: 75 PERIODS

COURSE OUTCOMES

On Completion of this course, the student will be able to

- solve the fundamentals of digital logic with various number systems and codes by designing various combinational and sequential circuits
- design complex arithmetic and logic circuit and to evaluate its function realization using gates.
- acquire knowledge on the basics about synchronous and asynchronous circuits
- design the complex logic memories, programmable logic devices and test its functionality and timing
- understand the VHD programming language

TEXT BOOKS

1. Morris Mano M., "Digital Circuits and Logic Design", Prentice Hall of India, II Edition, 1996.
2. Ronald J. Tocci Neal S. Widmer and Gregory L. Moss, Digital Systems: Principles and Applications,
3. Prentice Hall of India, New Delhi, 2010.
4. ZainalabedinNavabhi, VHDL Analysis and Modeling of Digital Systems, McGraw-Hill, 1998.

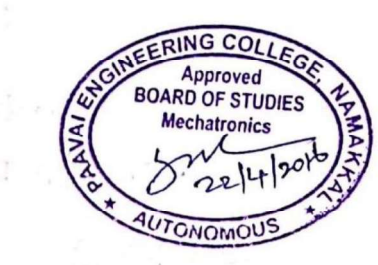
REFERENCES

1. W.H. Gothmann, "Digital Electronics – Introduction Theory and Practice", PHI, 1992.
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 2nd Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2004.
3. W.H. Gothmann, "Digital Electronics – Introduction Theory and Practice", Prentice Hall of India Pvt. Ltd New Delhi, 1992.
4. R.R. Jain, "Modern digital electronics", Third edition, Tata McGraw – Hill, 3rd edition 2003.
5. Leach and Malvino, "Digital Principles of Electronics & Applications", Tata McGraw – Hill, 5th Edition, 2003.

WEB LINKS

1. https://en.wikipedia.org/wiki/Digital_electronics
2. http://www.electrical4u.com/digital-electronics/
3. http://www.asic-world.com/digital/tutorial.html

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	3	3	2	-	-	3	1	-
CO2	-	-	2	-	-	1	-	3	-	2	-	3	1	-
CO3	2	-	2	-	2	1	-	3	-	2	-	3	1	-
CO4	2	2	2	-	2	1	3	3	-	2	-	3	1	-
CO5	-	2	-	-	-	1	3	3	2	2	-	2	1	-



EE15305 ELECTRICAL MACHINES AND DRIVES 3 0 0 3

(Common to Mechanical and Mechatronics)

COURSE OBJECTIVES

- To impart students with fundamentals of energy conversion, construction and principle of operation.
- To facilitate students to understand the characterization of electrical machines and various drives.
- To give awareness to concept of starting methods and speed control of electrical machines.
- To analyse the operation of solid state speed control of D.C. drives
- To understand the solid state speed control of A.C. drives

UNIT I DC MACHINES 9

DC Generator-Construction and Principle of operation, EMF Equation, types, OCC and External characteristics cures. DC Motors-Principle of operation, types, Characteristics – Starters - Braking methods.

UNIT II AC MACHINES 9

AC Generator-Construction and working principle - Three Phase Induction motors, Construction, types, principle of operation, characteristics and starting methods, Single phase induction motor- Construction and working principle of operation.

UNIT III FUNDAMENTALS OF ELECTRIC DRIVES 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – loading conditions and classes of duty – Selection of power rating for drive motors - Load variation factors.

UNIT IV CONVENTIONAL AND SOLID STATE CONTROL OF DC DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system – Solid state control using controlled rectifiers (Single phase Half & Full wave) and DC choppers – applications.

UNIT V CONVENTIONAL AND SOLID STATE CONTROL OF AC DRIVES 9

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On Completion of this course, the student will be able to

- select and utilize various dc machines.
- employ effective control techniques to electrical motors.
- understand the concept applied in Electric drives.
- able to apply solid state speed control of D.C. drives.
- select appropriate electrical drive for engineering applications.

TEXT BOOKS

1. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 2004.
2. VedamSubrahmaniam, "Electric Drives (concepts and applications)", Tata McGraw- Hill, 2001.
3. Pillai S.K., "A First course on Electrical Drives", New Age International Publishers, 2011.

REFERENCES

1. Theraja B.L and Theraja A.K., "A Text book of Electrical Technology", Volume – II, S,Chand& Co., 2007.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998
3. R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., 2003.
4. Bimal K Bose, "Modern Power Electronics and AC Drives", Prentice-Hall of India Pvt. Ltd., 2003.
5. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, 2004.

WEB LINKS

1. https://en.wikipedia.org/wiki/DC_motor
2. https://en.wikipedia.org/wiki/AC_motor
3. http://www.electrical4u.com/control-of-electrical-drives/
4. http://www.kbelectronics.com/Variable_Speed_DC_Drives.html.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	3

MT15303 KINEMATICS OF MACHINERY 3 2 0 4

COURSE OBJECTIVES

- To impart students with the knowledge about the basics of Mechanisms and understand the geometry of motion at any point in a link of a mechanism
- To facilitate students to understand the types of cam and follower, motion and profile drawing of cam
- To give awareness to students on the phenomenon of direction of rotation, speed and torque determination for simple, compound and planetary gear systems
- To understand the effects of friction in motion transmission and in machine components
- To analyse the motion resulting from a specified set of linkages in a mechanism.

UNIT I BASICS OF MECHANISMS 15

Terminology and Definitions – Degree of Freedom Mobility – Kutzbach criterion – Grashoff's law – Kinematic Inversions of 4 – bar chain and slider crank chains – Mechanical Advantage – Transmission angle – Description of common Mechanisms – Single, double and offset slider mechanisms – Quick return mechanisms Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms – Straight line generators – Design of Crank – rocker Mechanisms.

UNIT II KINEMATICS 15

Displacement, velocity and acceleration and analysis in simple mechanisms – Graphical Method velocity and acceleration polygons – Vector Approach, Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis Acceleration.

UNIT III KINEMATICS OF CAM 15

Classifications – Displacement diagrams – parabolic Simple harmonic and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams– Pressure angle and undercutting.

UNIT IV GEARS 15

Spur gear Terminology and definitions – Fundamental Law of toothed gearing and involute gearing – Inter changeable gears – gear tooth action - Contact ratio – Terminology – Interference and undercutting – Nonstandard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears (Basics only) – Gear trains – Parallel axis gear trains – Epicyclic gear trains – Differentials

UNIT V FRICTION 15

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives, Friction aspects in Brakes – Friction in vehicle propulsion and braking

TOTAL: 75 PERIODS

COURSE OUTCOMES

On Completion of this course, the student will be able to

- gain knowledge of basics of mechanisms and the geometry of motion at any point in a link of a mechanism
- construct the profile of cam for any given combination and condition
- understand the determination of speed and torque for simple, compound and planetary gear systems
- identify the effects of friction in motion transmission and in machine components
- learn about the Sliding and Rolling friction

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw – Hill Publishing Company Ltd., New Delhi,1998.
2. Shigley J.E and Uicker J.J, "Theory of Machines and Mechanisms", McGraw – Hill,Inc.1995.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East – West Pvt. Ltd., New Delhi, 1998.
3. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley – Eastern Ltd., New Delhi, 1992.
4. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low – Prices Student Edition, 1999.
5. Khurmi, R.S., "Theory of Machines",14th Edition, S Chand Publications, 2005

WEB LINKS

1. www.asic-world.com/digital/tutorial.html
2. https://www.britannica.com/science/friction

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	1	3	-	-	-	-	-	-	-	2	-
CO2	1	-	3	-	-	-	-	-	-	-	2	-	2	-
CO3	-	-	2	3	3	-	-	-	-	-	-	-	1	-
CO4	-	-	1	-	-	-	-	-	-	-	2	-	1	-
CO5	1	-	-	3	3	-	-	-	-	-	-	-	-	-

MT15306 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To reinforce and enhance the understanding of the fundamentals of fluid mechanics and hydraulic machines
- To introduce a variety of classical experimental and diagnostic techniques, and the principles behind these techniques
- To provide practice in making engineering judgements, estimates and assessing the reliability of the measurements and skills which are very important in all engineering disciplines
- To discuss and practise standard measurement techniques of fluid mechanics and their applications

UNIT I FLOW MEASUREMENT

Calibration of Flow Measuring instruments – Venturimeter, orifice meter, rotometer, Calibration of flows in open channels – weirs and notches. Estimation of friction factor in flow through pipes.

UNIT II PUMPS

Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps – reciprocating and gear pumps.

UNIT III TURBINES

Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On Completion of this course, the student will be able to

- understand the fundamentals of fluid mechanics and hydraulic machines
- have experimental knowledge on classical, experimental and diagnostic techniques
- estimate and assess the reliability of measurements which are very important in all engineering disciplines
- use rotometer, venturimeter and orifice meter to determine the fluid flow parameters.

REFERENCES

1. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, Delhi, 1991.
2. S. S. Rattan, A Text Book of Fluid Mechanics, Khanna Publishers, Delhi, 1994.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	-	-	-	-	-	-	-	-	2	2
CO2	1	1	3	-	-	-	-	-	-	-	-	-	2	-
CO3	-	1	2	3	-	-	-	-	-	-	-	-	2	2
CO4	-	1	1	-	-	-	-	-	-	-	-	-	2	-

EE15306 ELECTRICAL ENGINEERING LABORATORY 0 0 4 2

(Common to Mechanical and Mechatronics)

COURSE OBJECTIVES

- To expose the students to the basic operation of basic electronics, Electrical apparatus, electrical machines, and impact knowledge for them to develop experimental skills.
- To make the students conduct various experiments on D.C. machines and transformers and analyze their performance.
- To conduct the relevant experiments for determining the performance characteristics of AC machines.
- To expose the students to the operation of DC machines, Transformers, synchronous machines and induction motors and to give them experimental skills.

LIST OF EXPERIMENTS

1. Load test on DC shunt motor and DC Series motor.
2. Open circuit characteristics and load characteristics of DC shunt.
3. Speed Control of DC Shunt Motor (Armature and Field control)
4. Load test on single phase transformer.
5. OC & SC test on single phase transformer.
6. Load test on three phase alternator.
7. Swinburne's test.
8. Load test on three phase squirrel cage induction motor.
9. Speed control of three phase squirrel cage induction motor.
10. Load test on single phase induction motor.
11. Study of DC &AC Starters.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- summarize the characteristics of dc motors under loaded and unloaded conditions.
- implement the various starting methods in ac motors.
- implement the speed control in dc shunt motor.
- predict the performance characteristics of AC motors.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	-	-	-	-	3	-	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	3	-	3	3

MT15305 COMPUTER AIDED MACHINE DRAWING 0 0 2 1

COURSE OBJECTIVES

- To know the specifications and symbols of standard machine components used in machine drawing
- To expose the students to the concept of various tolerances and fits used for component design
- To understand and practice the drawings of machine components and simple assemblies using standard CAD packages
- To understand and create drawings manually or using any one CAD packages for standard machine components and assemblies with tolerance

LIST OF EXERCISES (Use 2D & 3D Software package)

1. Introduction to Machine Drawing - Dimensioning, Sectional views, Welding symbols, surface finish symbols.
2. Study of Limits, Fits and tolerances.
3. Free hand sketching of Machine Elements - Keys, Hexagonal and Square Head Bolts and Nuts, Conventional representation of Threads.
4. Converting given isometric view into orthographic views
5. Part and Assemble drawing of Universal coupling and Flange Coupling
6. Part and Assemble drawing of Bearings.
7. Part and Assemble drawing of Valves.
8. Part and Assemble drawing of Machine Elements – Tail Stock, Screw Jack and Connecting Rod Assembly.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- decide the dimensioning, sectional views, welding symbols.
- construct the various part and assemble drawing of bearings.
- examine the various part and assemble drawing of couplings.
- predict the various part and assemble drawing of valves.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	-	1	-	2	2	-	-	3	-	3
CO2	3	-	2	-	-	1	-	3	-		-	3	-	3
CO3	2	-	2	-	-	-	-	3	1		-	3	-	-
CO4	2		2	-	-	1	-	2	-		-	3	-	-

MT15401 DYNAMICS OF MACHINERY 3 2 0 4

COURSE OBJECTIVES

- To impart the knowledge about the static and dynamic force analysis on various parts of reciprocating engine.
- To understand the function of flywheel and to construct the various turning moment diagram.
- To give awareness to the knowledge about balancing of various parts for different engine.
- To elaborate the analysis and causes of forced vibration.
- To expose the effects of vibration in various beams under different load conditions and the basic concepts of governor and gyroscopes.

UNIT I FORCE ANALYSIS 15

Rigid Body dynamics in general plane motion – Equations of motion- Dynamic force analysis – Inertia force and Inertia torque – D. Alemberts principle – The principle of superposition –Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses – Bearing loads – Crank shaft Torque – Turning moment diagrams – Fly wheels.

UNIT II BALANCING 15

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine Balancing Multi – cylinder Engines – Partial balancing in locomotive Engines – Balancing linkages.

UNIT III FREE VIBRATION 15

Basic features of vibratory systems – Degrees of freedom – Single degree a freedom – Free vibration – Equations of motion – natural frequency – Types of Damping – Damped vibration critical speeds of simple shaft – Torsional systems; Natural frequency of two and three rotor systems

UNIT IV FORCED VIBRATION 15

Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force transmissibility and amplitude transmissibility vibration isolation.

UNIT V MECHANISM FOR CONTROL 15

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling Force - Other governor mechanisms. Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- carry out static and dynamic force analysis on various parts of reciprocating engine
- construct turning moment diagram of flywheel
- perform balancing of various parts for different engine
- know the basic concepts of governor and gyroscopes
- acquire knowledge on the Mechanism for Control of Centrifugal governors

TEXT BOOK

1. S. S. Rattan, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2011.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East- West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms ", McGraw – Hill, Inc., 1995.
4. Rao J.S. and Dukkipati R.V., "Mechanism of Machine Theory", Wiley – Eastern Limited, New Delhi, 1992.
5. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low – Priced Student Edition, 1999.

WEB LINKS

1. http://nptel.ac.in/courses/112104114/
2. http://freevideolectures.com/Course/2364/Dynamics-of-Machines

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	-	-	-	-	-	-	-	3	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	3	2
CO3	-	2	3	3	3	-	-	-	-	-	-	-	3	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	1	2	-	3	0	-	-	-	-	-	-	-	-	-

MT15402 CONTROL SYSTEMS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To describe feedback control and basic components of control systems
- To understand the various time domain and frequency domain tools for analysis and design of linear control systems
- To study the methods to analyze the stability of systems using root locus technique
- To describe the methods of designing compensators and applications of control systems
- To provide sound knowledge in the basic concepts of linear control theory and design of control system.

UNIT I BASIC CONCEPTS AND SYSTEM REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems with example –Mathematical model of Translational, Rotational & Electrical systems – Transfer function – Block diagram reduction techniques – Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 9

Introduction – Time domain specifications – Types of test inputs I and II order system response– Steady state error – Error coefficients – Generalized error series – P, PI, PD, PID Controlled characteristics.

UNIT III FREQUENCY RESPONSE ANALYSIS AND DESIGN 9

Introduction – Frequency domain specifications – Bode plots and polar plots – Constant M and N circles and Nichols chart – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEMS 9

Characteristics equation – Location of roots in s-plane for stability – Routh Hurwitz criterion –Root locus construction – Gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATION DESGIN & APPLICATIONS OF CONTROL SYSTEMS 9

Realization of basis compensation – Lag, Lead and Lag – lead networks – Compensator design using Bode plots. Stepper motors- AC & DC Servo Motor-Hydraulic Controller-Pneumatic Controller - Overview of Distributed control system and PLC.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Possess knowledge on feedback control and basic components of control systems
- understanding various time domain and frequency domain tools for analysis and design of linear control systems
- conduct analysis to know the stability of systems from transfer function forms and to define the methods of designing compensators
- know the application areas of control system.
- acquire knowledge on Compensation Design

TEXTBOOK

1. I.J. Nagrath and M. Gopal, Control System Engineering, New Age International Publisher, New Delhi, 2011.

REFERENCES

1. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education 2003.
2. I.J.Nagrath& M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. B.C.Kuo, "Automatic control systems", Prentice Hall of India ltd, New Delhi 1995.
4. Dorf R.C. and Bishop R.H., "Modern Control systems", Addison – Wesley, 1995 (MATLAB reference).
5. Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems,"

WEB LINKS

1. http://nptel.ac.in/courses/108101037/1
2. https://en.wikipedia.org/wiki/Control_engineering

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	3	-	3	-	2		-	-	-	-	2
CO2	3	2	-	2	-	3	-	2		-	-	-	-	-
CO3	2	2	-	2	-	3	-	-	-	-	2	-	-	-
CO4	2	2	-	2	-	3	-	-	-	2	2	-	-	-
CO5	-	-	-	2	-	3	-	-	-	-	2	-	-	2

MT15403 **MECHANICS OF SOLIDS** **3 2 0 4**

COURSE OBJECTIVES

- To develop the theoretical basis about the stress, strain and elastic modulus
- To understand the concepts in various components with sound mathematical principles and to enable students to systematically solve engineering problems regardless of difficulty
- To familiarize with finding shear force, bending moment, deflection and slopes in various types of beams with different load conditions
- To understand the concept of confidence and competence in solving problems related to the machine components like shafts, columns, springs and purposes
- To provide sound knowledge in the basic concept in Torsion in Shafts and Springs

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 15

Properties of mild steel, cast iron, aluminum alloys, copper alloys and magnesium alloys - Mechanical properties of Materials - Simple stress and strain - Stresses and strains due to axial force - Hooke's law - Factor of safety -Poisson's ratio - Elastic constants and their relationship Stress-Strain Curve for Ductile and Brittle Materials.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSIONS 15

State of stresses at a point - Normal and tangential stresses on inclined planes - Principal planes and stresses – Plane of maximum shear stress - Mohr's circle for biaxial stresses. Behavior of thick wall pressure vessels

UNIT III BEAMS 15

Types of beams: Supports and Loads - Theory of simple bending - Stresses in beams: bending and shear stress - Stress variation along the length and section of the beam, Slope and Deflection of beams: Double integration for Cantilever and simply supported beams Section modulus

UNIT IV COLUMNS 15

Columns - Buckling of long columns due to axial load - Equivalent length of a column - Euler's and Rankine's formulae for columns of different end conditions Deflection in overhanging beams

UNIT V TORSION IN SHAFTS AND SPRINGS 15

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section – Compound shafts.

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- compute stress, strain and elastic moduli under given loading
- construct shear force and bending moment diagrams of standard beams
- demonstrate deflection and slopes in various types of beams with different load conditions
- solve problems related to the machine components like shafts, columns, springs and purposes
- know the application areas of springs

TEXTBOOKS

1. R. K. Bansal, A text book of Strength of Materials, Laxmi Publications (P) Limited, New Delhi, 2010.
2. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning. Ltd., New Delhi, 2010.

REFERENCES

1. R.K.Rajput, Engineering Materials, S. Chand and Company Ltd, New Delhi, 2007.
2. P. Purushothama Raj and V. Ramasamy, Strength of Materials, Pearson Education, India, 2013.
3. S. Rattan, Strength of Materials, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2011.
4. B. K. Sarkar, Strength of Materials, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
5. Irring H. Shames and James M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India Learning. Ltd., New Delhi, 2009.
6. R. Subramaniam, Strength of Materials, Oxford University Press, New Delhi 2012.

WEB LINKS

1. www.engineersedge.com/strength_of_materials.html
2. www.me.mtu.edu/~mavable/MoM2nd.htm

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	3	3	-	3	3	3	-	3	-
CO2	3	3	-	3	-	2	3	-	3	3	3	-	2	-
CO3	3	3	-	2	-	2	2	-	3	3	-	-	2	-
CO4	3	3	-	2	-	2	3	-	3	3	-	-	2	-
CO5	3	2	-	2	-	3	2	-	3	2	3	-	2	-

MT15404 METROLOGY AND COMPUTER AIDED INSPECTION 3 0 0 3

COURSE OBJECTIVES

- To understand the concept of Metrology
- To learn about Metrology instruments and application for various measurements
- To introduce concept of computer applications in Metrology.
- To enhance the principles of various Inspection, Instruments and Methodology
- To enhance knowledge in the area of non-contact inspection

UNIT I BASIC CONCEPTS AND COMPARATORS 9

Basic concept – Legal metrology – Precision – Accuracy – Types of errors – standards of measurement – traceability – interchangeability and selective assembly, gauge blocks, limit gauges – tailor's principle of gauge design. Comparators: Mechanical, Electronic, optical and Pneumatic – Automatic gauging.

UNIT II ANGULAR MEASUREMENT AND SURFACE FINISH MEASUREMENT 9

Angular measurement: sine bar – Autocollimator, optical projectors: profile projectors –toolmakers microscope, measurement of surface finish: Terminology – roughness – waviness –analysis of surface finish – stylus probe instrument –Talysurf.

UNIT III SCREW THREAD AND GEAR METROLOGY 9

Screw thread metrology: errors in thread – pitch error – drunkenness – measurement of various elements thread – two and three wire method – best wire size – Thread gauges – floating carriage micrometer. Measurement of gears – Terminology – measurement of various elements of gear – tooth thickness – constant chord and base tangent method – Parkinson Gear Tester.

UNIT IV LASER METROLOGY 9

Laser Metrology: LASER interferometer – constructional features, sources of error, measurement of positional error, straightness and flatness of machine tools – LASER Alignment Telescope – LASER Micrometer – LASER Triangulation technique – in process and on line measurement.

UNIT V ADVANCES IN METROLOGY 9

Coordinate measuring machine (CMM): Constructional features – types, applications, Applications of Image Processing in measurement – computer aided inspection. Introduction to machine vision system.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- demonstrate different measurement technologies and to make use of them in Industrial Components

- compute angular measurement and surface finish measurement
- acquire knowledge on screw thread metrology
- carry out laser metrology
- demonstrate Coordinate measuring machine

TEXT BOOKS

1. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005.
2. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.

REFERENCES

1. Connie Dotson, et al., “Fundamentals of Dimensional Metrology”, Thomas Asia, Singapore, First print, 2003.
2. Doeblin E.O., “measurement system applications and design” First Edition, 1990.
3. Groover M.P., “Automation, production system and computer integrated manufacturing“, Prentice – Hall, New Delhi, 2003.

WEB LINKS

1. http://nptel.ac.in/courses/112102103//Module%20G/Module%20G(2)/p2.htm
2. https://en.wikipedia.org/wiki/Computer-aided_inspection

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	2	-	2	3	-	2	-	-	3	1	-
CO2	3	-	-	2	-	1	1	-	2	2	-	3	1	-
CO3	2	2	-	2	-	1	2	-	1	1	-	3	2	-
CO4	2	1	-	2	-	2	-	-	3	2	-	3	1	-
CO5	3	1	-	2	-	1	3	-	-	2	-	3	2	-

EE15412 MICROPROCESSORS AND APPLICATIONS 3 0 0 3

COURSE OBJECTIVES

- To study the architecture of 8085.
- To understand the addressing modes and instruction set of 8085.
- To impart knowledge of commonly used peripheral devices.
- To gain the knowledge of interrupt controller / interfacing ICs.
- To cognizant the applications of microprocessor

UNIT I INTRODUCTION 9

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction and machine cycles with states and timing diagram.

UNIT II MEMORY AND I/O DEVICES 9

Need for Interfacing – Memory Interfacing: address space partitioning – address map – Address decoding –Bus contention. I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts. MA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 systems – serial data transfer.

UNIT III INTERFACING DEVICES 9

Programmable peripheral device – programmable interval timer (8253) – Programmable communication interface (USART) – Programmable interrupt controller – Programmable DMA Controller (8257), programmable peripheral interface (8255)

UNIT IV DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 -Design of Keyboard and display interfacing using 8279

UNIT V MICROPROCESSOR APPLICATIONS 9

Temperature monitoring system – Automotive applications – Closed loop process control –Stepper motor control.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand the architecture of 8085, instruction set and addressing modes of 8085 and illustrate with simple programs.
- get knowledge about commonly used peripheral / interfacing i/o.
- analyse the concepts of i/o interfacing, execution.
- design microprocessor-based systems using peripheral devices.
- device selection and the applications of microprocessor.

TEXT BOOK

1. Ramesh Goankar, "Microprocessor Architecture, Programming and Applications with 8085",
2. Penram International, 2009.
3. Umashankar B.S., Udaya Kumar K, "The 8085 Microprocessor: Architecture, Programming and Interfacing", Publisher: Pearson Education, 2008.
4. R.Theagarajan, S.Dhanasekaran, S.Dhanapal, "Microprocessors and its applications", New Age International, 2004

REFERENCES

1. V. Douglas Hall, "Microprocessors and Interfacing Programming and Hardware", Tata McGraw - Hill Publishing Company Ltd., 2002.
2. K. Ray and K. M. Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata McGraw - Hill Publishing Company Ltd., 2006.
3. Aditya P. Mathur, "Introduction to Microprocessor", Tata McGraw-Hill Publishing Company Ltd., 2003.
4. Rafiquzzaman M., "Microprocessors Theory and Applications: Intel and Motorola", Prentice Hall, 2003.
5. Krishnakant "Microprocessors and Microcontrollers Architecture Programming and System Design", 8085- 8086- 8051- 8096", PHI, 2007

WEB LINKS

1. https://en.wikipedia.org/wiki/Microcontroller
2. http://www.zseries.in/embedded%20lab/8085%20microprocessor/other%20applications.
3. http://www.nptel.ac.in/courses/Webcourse.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	3	2	-	-	-	-	-	-	2	3	2
CO2	-	-	3	3	2	-	-	-	-	-	-	2	3	2
CO3	-	-	3	3	2	-	-	-	-	-	-	2	3	2
CO4	-	-	3	3	2	-	-	-	-	-	-	2	3	2
CO5	-	-	3	3	2	-	-	-	-	-	-	2	3	2

EE15413 MICROPROCESSOR LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To able to write program using arithmetic operations of microprocessors.
- To understand various IC interfacing with 8085.
- To experimentally understand the operation of Intel 8085 microprocessor
- To know about the Sorting of number series and Code conversion

LIST OF EXPERIMENTS

I. Programming

1. Addition and subtraction of two 8 bit numbers.
2. Addition and subtraction of two 16 bit numbers.
3. Decimal addition and subtraction of two 8 bit numbers
4. To arrange a series of numbers in ascending order.
5. To arrange a series of numbers in descending order
6. To find the largest and smallest number in given array.
7. Multiplication and Division of 8 bit numbers
8. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.

II. Interfacing

1. Analog to digital conversion.
2. Digital to analog conversion.
3. Stepper motor controller.
4. Temperature controller.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- execute programs for various arithmetic operations in 8085.
- transfer data to corresponding memory locations.
- convert analog and digital data for interfacing applications.
- implement programming for stepper motor and temperature control applications.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	1	3	3
CO2	3	2	2	2	2	-	-	-	-	-	1	1	3	3
CO3	3	2	2	2	2	-	-	-	-	-	1	1	3	3
CO4	3	2	2	2	2	-	-	-	-	-	1	1	3	3

MT15405 MANUFACTURING TECHNOLOGY LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To impart knowledge and skill in the field of conventional machine tools used in the industries.
- To supplement the theory, course on machining processes.
- To demonstrate and to study of the following machines.
- To understand the machine capabilities and processes completely.

LIST OF EXPERIMENTS

UNIT I LATHE PRACTICE

a. Plain Turning
b. Taper Turning
c. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

a. Drilling
b. Tapping
c. Reaming.

UNIT III Milling

a. Surface Milling.
b. Gear Cutting.
c. Contour Milling.

UNIT IV Planning and Shaping

a. Cutting Key Ways.
b. Dove tail machining.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

- get the experience of common conventional machine tools used in the industries.
- correlate the theory course on machining processes.
- ability to operate milling make parts by performing milling and cutting process.
- imagine the shaping and machining process.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	3	-	2	-	3	-	2	3	-
CO2	3	-	-	-	3	3	-	3	-	2	-	3	2	-
CO3	3	-	-	-	3	3	-	3	-	2	-	2	3	-
CO4	3	-	-	-	3	3	-	3	-	3	-	2	3	-

MT15406 MACHINE DYNAMICS LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To explain the various practical aspects of instrumentation with emphasis on mechanical domain.
- To introduce the various types of governor, cam, balancing of rotating masses and to determine the M.I. of various systems.
- To explain the concept of mechanical measurement and various methods used for measuring the variables.
- To know about the single and multi-degree freedom suspension systems.

LIST OF EXPERIMENTS

1. Governor – Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors.
2. Cam – Study of jump phenomenon and drawing profile of the cam.
3. Motorized Gyroscope – Verification of law's – Determination of gyroscopic couple.
4. Whirling of shaft – Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system spring mass – system – Determination of damping co – efficient of single degree of freedom system.
9. Determination of influence co – efficient for multi degree freedom suspension system.
10. Determination of transmissibility ratio – vibrating table.
11. Determination of torsional natural frequency of single and Double Rotor systems. - Undamped and Damped Natural frequencies.
12. Transverse vibration of Free-Free beam – with and without concentrated masses.

TOTAL: 30 PERIODS

COURSE OUTCOMES

- relate the different characteristics of governors and verify with gyroscopic relation.
- draw the cam profile with different followers and study of jump phenomenon.
- identify the system response, natural frequency and resonance for free, forced, torsional.
- know experimental verification of dynamic balancing of rotating masses, reciprocating masses.

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	1	-	-	-	-	-	-	-	1	1
CO2	2	-	3	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	2	-	1	-	-	-	-	-	-	-	2	1
CO4	1	-	2	-	-	-	-	-	-	-	-	-	-	-

MT15407 **TECHNICAL SEMINAR** **0 0 2 1**

COURSE OBJECTIVE

- To improve the skills to formulate a technical seminar.
- To explain the various tasks of the seminar and standard procedures.
- To Teach the use of new tools, algorithms and techniques required to carry out the seminar.
- To analyze the various procedures for validation of the product and analyze the cost effectiveness

GUIDELINE FOR REVIEW AND EVALUATION

During the seminar session, each student is exposed to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also. Students are motivated to use various teaching aids such as overhead projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On the completion of the course,

- formulate the real-world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies and use the new tools, algorithms, techniques that contribute to obtain the solution of the concepts.
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.
- explain the acquired knowledge through preparation of report and oral presentations.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak)

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	3	3	3	2	2	-
CO2	3	-	2	-	-	-	-	-	3	3	3	2	1	-
CO3	3	-	2	-	-	-	-	-	3	3	3	2	1	-
CO4	3	-	2	-	-	-	-	-	3	3	3	2	1	-

ME6503 **DESIGN OF MACHINE ELEMENTS** **L T P C**
3 0 0 3

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of acomponent to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
  (Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS **10**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS **8**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines – crankshafts - Rigid and flexible couplings

UNIT III TEMPORARY AND PERMANENT JOINTS **9**

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS **9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS **9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to successfully design engine components

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design",4thEdition,Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010

4. Bernard Hamrock,Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements",2nd Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-HillBook Co, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Prentice Hall, 2003.

EE6503 POWER ELECTRONICS L T P C
3 0 0 3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWERSEMI-CONDUCTOR DEVICES 9

Study of switching devices, Diode, SCR,TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance— Gate Circuit Schemes for Phase Control–Dual converters.

UNIT III DC TO DC CONVERTER 9

Step-down and step-up chopper-control strategy–Forced commutated chopper–Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV INVERTERS 9

Single phase and three phase voltage source inverters(both 120^0modeand 180^0mode)–Voltage& harmonic control-PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.

3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins,' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition,2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

MT6501 SENSORS AND SIGNAL PROCESSING L T P C 3 0 0 3

OBJECTIVES:

- Students will be exposed to basics of sensors and the methods of processing their signals.

UNIT I SCIENCE OF MEASUREMENT 9

Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers

UNIT II MECHANICAL MEASUREMENTS 9

Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.'

UNIT III ELECTRICAL MEASUREMENTS 9

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT IV SMART SENSORS 9

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT V SIGNAL CONDITIONING AND DATA ACQUISITION 9

Amplification – Filtering – Sample and Hold circuits –Data Acquisition: Single channel and multi channel data acquisition – Data logging.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to use Sensors, various electrical and mechanical instruments in industries.

TEXT BOOKS:

1. Doebelin. E. O., "Measurement Systems – Applications and Design", Tata McGraw Hill, 1992
2. Patranabis. D, “Sensors and Transducers”, 2nd Edition PHI, New Delhi, 2003.

REFERENCES:

1. Ian Sinclair .R "Sensors and transducers", Newnes ,Elaiver Indian print 2011.
2. Beckwith, Marangoni and Lienhard, "Mechanical Measurements", Addison Wesley, 2000..
3. Venkatesan. S.P, "Mechanical Measurements", Ane Books Pvt Ltd, India 2008.

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd Edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

MF6505 **CNC MACHINING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

Upon completion of this subject, student will be able to:

- Understand evolution and principle of CNC machine tools
- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

UNIT I INTRODUCTION TO CNC MACHINE TOOLS 6

Evolution of CNC Technology, principles, features, advantages, applications,CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection

UNIT II STRUCTURE OF CNC MACHINE TOOL 10

CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

UNIT III DRIVES AND CONTROLS 9

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer.

UNIT IV CNC PROGRAMMING 11

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

UNIT V TOOLING AND WORK HOLDING DEVICES 9

Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course the student and can to provide knowledge on principle, constructional features, programming, tooling and workholding devices in CNC machine tools

TEXT BOOKS:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, "Computer Numeric Control", Fourth Edition – Thomson Delmar, 2002.

REFERENCES:

1. James Madison, "CNC Machining Hand Book", Industrial Press Inc., 1996.
2. Ken Evans, John Polywka & Stanley Gabrel, "Programming of CNC Machines", Second Edition – Industrial Press Inc, New York, 2002
3. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000

4. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency, 2002.
6. Rao P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.

MT6502 THERMODYNAMICS PRINCIPLES AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:

- The laws of thermodynamics are introduced. Types of I.C engines ,air conditioning and refregiration techniques and heat transfer methods are introduced.

UNIT I FIRST LAW OF THERMODYNAMICS 8

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities CV and CP – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 8

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

UNIT III INTERNAL COMBUSTION ENGINES 12

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system,
MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of refrigeration, refrigerator& heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 9

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to apply the thermodynamics laws in the design of I.C engines , air conditioning and refrigeration equipments.

TEXT BOOK:

1. Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill, 2005.

REFERENCES:
1. Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 2nd Edition, Mc Graw-Hill India, 2006.
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, 2000.
3. Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P) Publishers, 2002.
4. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2000.

MT6511 POWER ELECTRONICS LABORATORY L T P C 0 0 3 2

OBJECTIVES:
- To introduce the students different power electronics components an duse of them in electronic circuits.
- To study characteristic of different power electronics of components.

LIST OF EXPERIMENTS
1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1

13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	15
14	Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	16
15	CRO ,Transformer 1KVA, 1:1, 230V	Each 3

MT6512 SENSORS AND SIGNAL PROCESSING LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To provide knowledge sensors and signal processing
- To provide hand experience to measure different signal using sensor and processing them in required form.

LIST OF EXPERIMENTS

1. Measurement of temperature using thermocouple, thermistor and RTD
2. Measurement of displacement using POT, LVDT & Capacitive transducer
3. Torque measurement using torque measuring devices
4. Strain Measurement using strain gauge
5. Servomotor position control using photo electric pickup
6. Wave Shaping circuit
7. Analog to Digital Converters
8. Digital Comparator
9. Voltage to frequency converter
10. Frequency to Voltage Converter
11. Position and velocity measurement using encoders
12. Study on the application of data acquisition system for industrial purposes.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the sensors for the measurement of different signals and use of signal processing techniques to convert them to useful signal.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module	1
6	Position and Velocity measurement using encoder kit	1
7	Servomotor Position control kit	1
8	Speed measurement and closed loop control of DC	1
9	Motor using photo electric pickup kit	1
10	RTD module	1
11	Thermistor module	1
12	Thermocouple module	1
13	Absolute encoder	1
14	Potentiometer trainer pickup	1
15	Strain gauge module	1
16	Load cell module	1

MT6513 **CNC LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To train the students in manual and computer assisted part programming, tool path generation and control, operation and control of CNC machines tools.

LIST OF EXPERIMENTS

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
   (i) Linear and Circular interpolation
   (ii) Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to write manual part programming using G code and M code for simple components
- Ability to operate CNC controlled machine tools

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. CNC Lathe with Fanuc control
2. CNC Milling Machine with Fanuc control
3. Master CAM software
4. Computer nodes

MG6851 **PRINCIPLES OF MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, , 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

MT6601 MICROCONTROLLER AND PLC **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the basic features, programming methods and applications of Micro controllers .The design of systems using PLC is introduced in detail.

UNIT I INTRODUCTION TO MICROCONTROLLER **9**

8051 Architecture:– Memory map - Addressing modes, I/O Ports –Counters and Timers – Serial data - I/O – Interrupts –Instruction set,, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions , Assembly Language Programming tools.

UNIT II MICROCONTROLLER PROGRAMMING **9**

8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

UNIT III MICROCONTROLLER APPLICATIONS **8**

Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Serial Data Communication – Network Configuration.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 9

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules , CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,

UNIT V APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS. 9

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will learn the theory, programming and application of microcontroller And design of systems using Programmable Logic Controllers

TEXT BOOKS:

1. Muhammad Ali Mazdi ,J.G.Mazdi & R.D.McKinlay “The 8051 Microcontroller& Embedded systems Using assembly & C “ 2nd Edition Pearson Education , Inc ,2006
2. Udayasankara.v & Mallikarjunaswamy .M.S ,’8051 Microcontroller, Hardware, Software & Applications ,Tata McGraw Hill Education Pvt Limited. New Delhi ,2009.
3. Gary Dunning , ‘Introduction to Programmable Logic Controllers‘’ Thomson Learning, 2001.

REFERENCES:

1. Singh. B.P., "Microprocessors and Microcontrollers", Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
2. Parr, "Programmable Controllers: An Engineers Guide", 3rd Edition, Elsevier, Indian Reprint, 2013
3. Valdes-Perez, Microcontrollers: Fundamentals and Applications with PIC, Taylor & Francis, Indian Reprint, 2013.
4. Bolton , "Programmable Logic Controllers” 5th Edition Newnes, ,2009

MT6602 APPLIED HYDRAULICS AND PNEUMATICS L T P C
3 0 0 3

OBJECTIVES:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II HYDRAULIC ACTUATORS AND VALVES 9

Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Servo and Proportional valves - Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols - Problems

UNIT III HYDRAULIC SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT IV PNEUMATIC SYSTEMS 9

Properties of air– Perfect Gas Laws- Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit cascade method- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to operate and maintain various pneumatic and hydraulic systems in industrial environments.

TEXT BOOK:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.

REFERENCES:

1. Shanmugasundaram.K, “Hydraulic and Pneumatic Controls”, Chand & Co, 2006.
2. Majumdar, S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata McGraw Hill, 2001
3. Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata McGraw Hill, 2007.
4. Dudelyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
6. Joji.P, “Pneumatic Controls”, Wiley India, 2008

MT6603 DESIGN OF MECHATRONICS SYSTEM L T P C

3 0 0 3

OBJECTIVES:

- The students will be exposed to design mechatronics system in Labview & Vim –Sim Environments

UNIT I INTRODUCTION TO MECHATRONICS SYSTEM 9

Key elements – Mechatronics Design process –Design Parameters – Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Industrial design and ergonomics, safety.

UNIT II SYSTEM MODELLING 9

Introduction-model categories-fields of application-model development-model verification-model validation-model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.

UNIT III REAL TIME INTERFACING 9

Introduction-selection of interfacing standards Elements of Data Acquisition & control Systems- Over view of I/O process, General purpose I/O card and its installation, Data conversion process, Application Software- Lab view Environment and its applications, Vim-Sim Environment & its applications -Man machine interface.

UNIT IV CASE STUDIES ON MECHATRONIC SYSTEM 9

Introduction –Fuzzy based Washing machine – pH control system – Autofocus Camera, exposure control– Motion control using D.C.Motor& Solenoids – Engine management systems.– Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing

UNIT V MICRO MECHATRONIC SYSTEM 9

Introduction- System principle - Component design – System design – Scaling laws – Micro actuation – Micro robot – Micro pump – Applications of micro mechatronic components.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to design systems in mechatronics approach using modern software packages.

TEXT BOOKS:

1. Devdas shetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition ,Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL’s, John wiley and sons Ltd, 2003

REFERENCES:

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013

MT6604 OBJECT ORIENTED PROGRAMMING IN C++ L T P C
3 0 0 3

OBJECTIVES:

- To introduce the C++ programming and its use in object oriented environment.

UNIT I OOP PARADIGM : 9

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages–Applications of OOP – A simple C++ program – More C++ statements – Structure of C++ Program.

UNIT II INTRODUCTION TO C++: 10

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators– Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.

UNIT III CLASSES AND OBJECTS : 9

Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors– Destructors.

UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 10

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.

UNIT V CASE STUDIES 7

Over view of typical object oriented systems – Case studies- Applications

TOTAL:45 PERIODS

OUTCOMES:

- The students will be able to develop C++ programs for object oriented systems and test the systems

TEXT BOOK:

1. Balagurusamy. E., “Object Oriented Programing wih C++”, Tata McGraw Hill,1997.

REFERENCES:

1. Herbert Schildt,”C++ The Complete Reference”, Tata Mc Graw Hill Edition, 2003
2. Bjanne Stroustrup, “The C++ Programming Language”,3rd Edition, Addison Wesley, 2000
3. Stanley, B.Lippman,JoveLagrie,”C++Primer”,3rd Edition, Addison Wesley,1998
4. Baarkakati. N., ‘Object Oriented Programming in C++’, Prentice Hall of India, 1997.

MT6611 MICRO CONTROLLER AND PLC LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To introduce and train the students to use microcontroller and PLC for actuation, control of speed.

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.

6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to use microcontroller and PLC to control different motor/equipment.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray osalloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2
8	PLC trainer kit and related software	2
9	Hudraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

MT6612 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

LIST OF EXPERIMENTS:

C++:

1. program using functions
   - functions with default arguments
   - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
   - classes with primitive data members,
   - classes with arrays as data members
   - classes with pointers as data members
   - classes with constant data members
   - classes with static member functions
3. compile time polymorphism

- operator overloading
- function overloading

4. run time polymorphism
   - inheritance
   - virtual functions
   - virtual base classes
   - templates
5. file handling
   - sequential access
   - random access

TOTAL :45 PERIODS

OUTCOMES

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Standalone desktops with C++ complier (or) Server with C++ compiler supporting 30 terminals or more.	30 Nos.

MT6613 APPLIED HYDRAULICS AND PNEUMATIC LABORATORY L T P C
0 0 3 2

OBJECTIVES:

- To introduce and provide hand on experience to students to design nd test hydraulic circuit to control press, flow etc.,
- To provide hands on experience to design and test the pneumatic circuit to perform basic operations
- To introduce the MAT Lan/ LABVIEW software to simulate hydraulic, pneumatic and electrical circuit.

LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as

i) Pressure control
ii) Flow control
iii) Direction control
iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic
Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as

i. Pressure control
ii. Flow control
iii. Direction control
iv. Circuits with logic controls

v. Circuits with timers
vi. Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using

MATLAB/LABVIEW software.

3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to design and test hydraulic, pneumatic circuits
- Use of MATLAB/LABVIEW software for simulation of hydraulic, pneumatic and electrical circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	NAME OF THE EQUIPMENT	Qty
Hydraulic equipment		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotory actuator	1
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
11	PLC	1
Pneumatics equipment		
1	Pnumatic trainer kit with FRL Unit, Single acting cylinder, push	
	buttons	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder,	
	manually actuated DCV	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot	
	actuated DCV	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double	
	solenoid actuated DCV, DCV with sensos/ magnetic reed switches	1
5	PLC with Interface card	1
6	LABVIEW Software	1
7	Automation studio software	1

MT6701 MEDICAL MECHATRONICS L T P C
3 0 0 3

OBJECTIVES:

- The students will be exposed to sensors and actuators used in biomedical system design

UNIT I INTRODUCTION 9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

2. Barry Hollembeak, “Automotive Electricity, Electronics & Computer Controls”, Delmar Publishers, 2001.
3. Richard K. Dupuy “Fuel System and Emission controls”, Check Chart Publication, 2000.
4. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.

MT6811 PROJECT WORK L T P C
0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

MT6001 ADVANCED MANUFACTURING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I SHEET METAL WORKING OF METALS 8

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

UNIT II NON TRADITIONAL MACHINING 9

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications and limitations.

UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10

Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating(PVD, CVD).

UNIT IV EDM AND ECM 10

Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications.Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring-honingapplications

UNIT V JIGS AND FIXTURES 8

Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulicactuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use different manufacturing process and use this in industry for component production

TEXTBOOKS:

1. Rao P.N., “Manufacturing Technology, Metal cutting and Machine Tools”, Tata McGraw Hill, 2000.
2. Sharma .P.C., “A text book of Production Technology- vol I &II ”, S.Chand & Company Ltd, New Delhi, 1996.

REFERENCES:

1. HajraChoudhary.S.K. and Hajra Choudhary.A.K, “workshop Technology”, Vol-I &Vol-II”, Media Publishers 1986.
2. Donaldson. C. “Tool design”, Tata McGraw Hill Co. Ltd.,1985.
3. H.M.T Bangalore "Production Technology" Tata McGraw Hill, 2001

GE6757 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

- The principles and techniques used in TQM and various quality control systems are introduced**.**

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement - PDSA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9000-2000 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM Implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to implement various quality control procedures in manufacturing and service sectors including IT.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

IT6502 DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

OBJECTIVES:

- To introduce discrete Fourier transform and its applications.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To introduce signal processing concepts in systems having more than one sampling frequency.

UNIT I SIGNALS AND SYSTEMS 9

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution – Correlation.

UNIT II FREQUENCY TRANSFORMATIONS 9

Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms - Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.

UNIT III IIR FILTER DESIGN 9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT IV FIR FILTER DESIGN 9

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

UNIT V FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 9

Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

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

- Perform frequency transforms for the signals.
- Design IIR and FIR filters.
- Finite word length effects in digital filters

TEXT BOOK:

1. John G. Proakis and Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education, Prentice Hall, 2007.

REFERENCES:

1. Emmanuel C.Ifeachor, and Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education, Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Third Edition, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.

IE6011 PRODUCT DESIGN AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION 5

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

UNIT II CONCEPT GENERATION AND SELECTION 5

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE 10

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT IV INDUSTRIAL DESIGN 10

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

1. Kari T.Ulrich and Steven D.Eppinger, ”Product Design and Development”, McGraw-Hill International Edns. 1999.

REFERENCES:

1. Kemnneth Crow, "Concurrent Engg./Integrated Product Development”, DRM Associates,26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal,”Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, ”Tool Design –Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, New york, NY.

MT6002 DIAGNOSTIC TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- The basics of various diagnostics techniques for proper maintance and monitoring the equipment are introduced.

v. Circuits with timers
vi. Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using

MATLAB/LABVIEW software.

3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to design and test hydraulic, pneumatic circuits
- Use of MATLAB/LABVIEW software for simulation of hydraulic, pneumatic and electrical circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	NAME OF THE EQUIPMENT	Qty
Hydraulic equipment		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotory actuator	1
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
11	PLC	1
Pneumatics equipment		
1	Pnumatic trainer kit with FRL Unit, Single acting cylinder, push	
	buttons	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder,	
	manually actuated DCV	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot	
	actuated DCV	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double	
	solenoid actuated DCV, DCV with sensos/ magnetic reed switches	1
5	PLC with Interface card	1
6	LABVIEW Software	1
7	Automation studio software	1

MT6701 MEDICAL MECHATRONICS L T P C
3 0 0 3

OBJECTIVES:

- The students will be exposed to sensors and actuators used in biomedical system design

UNIT I INTRODUCTION 9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION 9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY 9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscillagraphic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT IV MEDICAL SUPPORT 10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC– defibrillator patient safety - electrical shock hazards. Centralized patent monitoring system.

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION 8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TOTAL :45 PERIODS

OUTCOMES:

- The students will be ale to design , use and maintain various medical equipments

TEXT BOOKS:

1. Siamak Najarian " Mechatronics in Medicine – A Bio medical engg approach" , McGraw – Hill Education , 2011
2. Cromwell, Weibell and Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Printice Hall of india , 1999
3. Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Pub., 2002

REFERENCES:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 1989.
2. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3rd Edition, John Wiley and Sons, 1995.
3. Tompkins W.J., "Biomedical Digital Signal Processing", Prentice Hall of India, 1998

MT6702 MODELING AND SIMULATION L T P C

3 0 0 3

OBJECTIVES:

- To provide an exposure on how to simulate a system or a process or an activity for detailed analysis, optimization and decision making which is essential to reduce the product design and development cost and time.

UNIT I SYSTEM AND SYSTEM ENVIRONMENT 9

Component of a System – Continuous and discrete systems– Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queues – inventory system.

UNIT II RANDOM NUMBER GENERATION 9

Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

UNIT III RANDOM – VARIATE GENERATION 9

Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

UNIT IV ANALYSIS OF DATA 9

Analysis of simulated Data – Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

UNIT V SYSTEM IDENTIFICATION 9

Concepts of System Identification – Identification using normal operating records (Integration method) – Identifiability conditions – System order determination

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to design and develop products using simulation techniques**.**

TEXT BOOK:

1. Banks J., Carson J.S. and Nelson B.L., "Discrete – Event System Simulation", 3rd Edition, Pearson Education, Inc 2004 (ISBN 81-7808-505-4).

REFERENCES:

1. Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2003.
2. Narsingh Deo., "System Simulation with Digital Computer", Prentice Hall of India, 2003.
3. Birta, "Modelling and Simulation: Exploring Dynamic System Behaviour", Springer, Indian Reprint, 2010

MT6703 ROBOTICS AND MACHINE VISION SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- Students will learn about basics of robots , programming and Machine vision applications in robots

UNIT I BASICS OF ROBOTICS 9

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space-accuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives

UNIT II ROBOT END EFFECTORS 9

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III ROBOT MECHANICS 10

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT IV MACHINE VISION FUNDAMENTALS 9

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

UNIT V ROBOT PROGRAMMING 8

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited, 2008

REFERENCES:

1. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Sixth edition, Tata McGraw-Hill Publication, 2003.
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, 1987.
3. John.J.Craig, "Introduction to Robotics: Mechanics & control", Second edition, 2002.
4. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010

ME6602 AUTOMOBILE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance ,Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Standard Publishers, Seventh Edition, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Heinz Heisler , "Advanced Engine Technology," SAE International Publications USA,1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2007.

MT6711 COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To provide an overview of how computers are being used in design

LIST OF EXPERIMENTS:

1. Modelling of a part using Pro-E / CATIA / UNIGRAPHICS.
2. Modelling of a component using Pro-E / CATIA / UNIGRAPHICS.
3. Modelling and assembling of the mechanical assembly using Pro-E / CATIA / UNIGRAPHICS.
4. Structural analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
5. Beam deflection analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
6. Thermal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
7. Vibration or modal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
8. Modelling and tool path simulation using Master CAM (MILL) or any CAM package.
9. Modelling and tool path simulation using Master CAM (Lathe) or any CAM package.
10. NC code generation for milling using Master CAM (MILL) or any CAM package.
11. NC code generation for turning using Master CAM (Lathe) or any CAM package.

TOTAL : 45 PERIODS

EQUIPMENTS FOR A BATCH OF 30 STUDENTS
NOTE - Any solid modelling or suitable software packages can be used for exercise.

OUTCOMES:

- The students can able to apply the students can able to apply mathematical knowledge in modeling and assembly of parts

MT6712	ROBOTICS LABORATORY	L T P C
		0 0 3 2

OBJECTIVES:

- To introduce different types of robotics and demonstrate them to identify differnt parts and components.
- To write programming for simple operations like pick and place, rotoxim etc.,

LIST OF EXPERIMENTS:

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

TOTAL: 45 PERIODS

OUTCOMES:

- Use of Adam's software and MAT Lab software to model the different types of robots and calculate work volume for different robots.

EQUIPMENTS FOR A BATCH OF 30 STUDENTS
Adam's software and Mat lab software packages are to be used to carry out the listed experiments

MT6713	DESIGN AND FABRICATION PROJECT	L T P C
		0 0 4 2

OBJECTIVES:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION
The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based

on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 60 PERIODS

OUTCOMES:

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

MT6801 AUTOMOTIVE ELECTRONICS L T P C
3 0 0 3

OBJECTIVES:

- Students will be exposed to application of electronics in automotives systems

UNIT I INTRODUCTION 8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION. SYSTEMS 10

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS 7

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to use advanced sensors and actuators in the upgradation of automobiles.

TEXT BOOKS:

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint, 2013

REFERENCES:

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.

2. Barry Hollembeak, “Automotive Electricity, Electronics & Computer Controls”, Delmar Publishers, 2001.
3. Richard K. Dupuy “Fuel System and Emission controls”, Check Chart Publication, 2000.
4. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.

MT6811 PROJECT WORK L T P C
0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

MT6001 ADVANCED MANUFACTURING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I SHEET METAL WORKING OF METALS 8

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

UNIT II NON TRADITIONAL MACHINING 9

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications and limitations.

UNIT II CONCEPT GENERATION AND SELECTION 5

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE 10

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT IV INDUSTRIAL DESIGN 10

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

1. Kari T.Ulrich and Steven D.Eppinger, ”Product Design and Development”, McGraw-Hill International Edns. 1999.

REFERENCES:

1. Kemnneth Crow, "Concurrent Engg./Integrated Product Development”, DRM Associates,26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal,”Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, ”Tool Design –Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, New york, NY.

MT6002 DIAGNOSTIC TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- The basics of various diagnostics techniques for proper maintance and monitoring the equipment are introduced.

UNIT I DEFECTS AND FAILURE ANALYSIS 9

Maintenance Concept, Maintenance objective, Challenges in maintenance. Defect generation - Types of failures - Defect reporting and recording - Defect analysis -Failure analysis -Equipment down time analysis - Breakdown analysis - FTA - FMEA - FMECA.

UNIT II MAINTENANCE SYSTEMS 9

Planned and unplanned maintenance - Breakdown maintenance - corrective maintenance- Opportunistic maintenance - Routine maintenance - Preventive maintenance – Predictive Maintenance - Condition based maintenance system - Design out maintenance – Maintenance by objectives – Selection of maintenance system

UNIT III SYSTEMATIC MAINTENANCE 9

Codification and Cataloguing - instruction manual and operating manual - Maintenance manual and departmental manual - Maintenance time standard - Maintenance work order and work permit - job monitoring – Feedback and control – Maintenance records and documentation. Introduction to Total Productive Maintenance (TPM).

UNIT IV COMPUTER MANAGED MAINTENANCE SYSTEM 9

Selection and scope of computerization – Equipment classification – Codification of breakdown,material and facilities - Job sequencing - Material management module – Captive engineering module. Decision making in maintenance.Economic aspects of maintenance.

UNIT V CONDITION MONITORING 9

Condition monitoring techniques – Visual monitoring – Temperature monitoring – Vibration monitoring – Lubricant monitoring – Cracks monitoring – Thickness monitoring - Noise and sound monitoring – Condition monitoring of hydraulic system. Machine diagnostics – Objectives - Monitoring strategies – Examples of monitoring and diagnostics - Control structures for machine diagnosis.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to analyze the defects and rectify the faults. Also they will be able to monitor and maintain the equipment..

TEXTBOOK:

1. Sushil Kumar Srivastava, “Industrial Maintenance Management”, S.Chand & Company Ltd, New Delhi, 1998.

REFERENCES:

1. Manfred, H. "Bibring, Handbook of Machine Tools", Vol.3, John Wiley & Sons
2. Mishra R.C., Pathak K. "Maintenance Engineering and Management", Prentice Hall of India Private Ltd., New Delhi, 2002

MG6072 MARKETING MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.

TOTAL: 45 PERIODS

OUTCOMES :

- The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXTBOOKS:

1. Philip Kolter & Keller, "Marketing Management", 14th edition, Prentice Hall of India, 2012.
2. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill – Vijaynicole, 2010.

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to Marketing Theory and Practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian Reprint, 2007.

MT6003 ENGINEERING ECONOMICS AND COST ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- Basics of economic analysis and cost analysis are introduced. Method adopted For capital budgeting and depreciation estimation are introduced.

UNIT I DEMAND AND SUPPLY ANALYSIS 9

Nature and scope of engineering economics – definition and scope of study- importance of economic analysis in business. Demand and supply analysis – demand determinants- Law of demand – elasticity of demand – demand forecasting. Law of supply – elasticity of supply – market price

UNIT II COST ANALYSIS 9

Types of cost - Fixed cost, variable cost, marginal cost. Cost output relationship in short and long run. Pricing decisions – situations demanding pricing decisions, pricing techniques in practice – full cost pricing, marginal cost pricing, going rate pricing, bid pricing, price fixing for a rate of return. Statutory requirements.

UNIT III MONEY AND BANKING 9

Value of money – inflation – deflation, banking- commercial bank and its functions, central bankand its functions. New economic environment – globalization, liberalization and privatization.

UNIT IV CAPITAL BUDGETING 9

Need for capital budgeting – method of apprising project profitability – rate of return method, payback period method, present value comparisons method, cost benefit analysis. Preparation of feasibility report, appraisal process, economic and commercial feasibility, financial feasibility, technical feasibility.

UNIT V DEPRECIATION AND COST ANALYSIS 9

Causes of depreciation, objectives, methods of computing depreciation, simple problems. Breakeven analysis, breakeven point – assumptions, breakeven chart, uses of breakeven analysis, simple problems. Financial statements – cash flow statement, profit and loss account, balance sheet and evaluation of projected financial statements.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to carryout cost analysis for capital subjecting based on depreciation, money available , supply of material and demand of products.in their management profession.

TEXTBOOK:

1. James L Riggs, David D. Bedworth, "Engineering Economics", Tata McGraw Hill, 1998

REFERENCES:

1. Varshney R Lnd Maheswari K L, "Managerial Economics", S.Chand& Co, 1993
2. Samuelson P A and Nordhaus W D, "Economics", Tata McGraw Hill, 2001
3. Prasanna Chandra, “Projects”, Tata McGraw Hill, 2003
4. Patel Bhavesh . M, "Project Management, Strategic Financial Planning Evaluation and Control", Vikas Publishing House, New Delhi, 2000

GE6084 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

MT6004 **INDUSTRIAL ELECTRONICS AND APPLICATIONS** **L T P C**
3 0 0 3

OBJECTIVES:

- Students will be exposed to electronics devices and their controls used in industrial environment

UNIT I INTRODUCTION **9**

Industrial control classification- motion and process control- feed forward control-interfacing devices-Operational Amplifier-review of thyristor- SCR- TRIAC-Phototransistor

UNIT II CONVERTERS AND INVERTERS **9**

Analysis of controlled and fully controlled converters-Dual converters-Analysis of voltage source and current source- current source and series converters

UNIT III INDUSTRIAL MOTOR CONTROL **9**

Method of controlling speed- Basic control circuit-DC motor control- AC motor control- Servo motor control- Stepper motor control- micro controller based speed control – solid state motor control-PLL control of a DC motor control

UNIT IV RELAYS, HEATING & WELDING CONTROL **9**

Introduction- principle of relays- electromechanical relay- solid state relays- Latching relays timing relays- Induction heating- dielectric heating- resistance welding.

UNIT V PROCESS AND MOTION CONTROL **9**

Elements of process control- temperature control- Flow control- Level control- Methods of motion control- feedback control- Direct digital control

TOTAL :45 PERIODS

OUTCOMES:

- The students will be able to design various electronic industrial controllers

TEXT BOOK:

1. Chitode .J.S " Industrial Electronics " Technical Publications ,2009

REFERENCES:

1. Terry Baltelt, "Industrial electronics, devices, systems and applications", Delmar publishers, 1997
2. Stephan L.Herman, Walter N.Alerich, "Industrial Motor Control", fourth edition, Delmar publishers, 1998
3. Biswanath Paul, "Industrial Electronics and Control" Prentice Hall India publisher-2004.
4. P.Harrott- "Process Control"- Tata McGraw Hill-1991

ME6501 COMPUTER AIDED DESIGN **L T P C**
3 0 0 3

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS **9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING **9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM **9**

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS **9**

Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS **9**

Standards for computer graphics- **Graphical Kernel System** (GKS) - standards for exchangeimages- **Open G**raphics Library **(OpenGL)** - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

IT6005 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

UNIT I DIGITAL IMAGE FUNDAMENTALS 8

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

UNIT II IMAGE ENHANCEMENT 10

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of this course, students will be able to:

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

TEXT BOOK

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
5. http://eeweb.poly.edu/~onur/lectures/lectures.html.
6. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

EE6007 MICRO ELECTRO MECHANICAL SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III SENSORS AND ACTUATORS-II 9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING **9**

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS **9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

MF6009 RAPID PROTOTYPING **L T P C**
3 0 0 3

OBJECTIVES:

- Generating a good understanding of RP history, its development and applications.. To expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

UNIT I INTRODUCTION **8**

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 10

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS 10

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS 10

Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING and NEW TECHNOLOGIES 7

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TOTAL: 45 PERIODS

OUTCOMES:

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields

TEXT BOOKS:

1. Rafiq I. Noorani, "Rapid Prototyping – Principles and Applications", Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.

REFERENCES:

1. Hopkinson N., R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
2. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereolithography", McGraw Hill 1993.
4. D.t.Pham and S.S. Dimov, "Rapid Manufacturing", Springer Verlog 2001.

MT6005 VIRTUAL INSTRUMENTATION L T P C

3 0 0 3

OBJECTIVES:

- The principle and applications of virtual instruments are introduced in mechatronics systems.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISTION BASICS 9

AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

UNIT IV COMMON INSTRUMENT INTERFACES 9

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office &.Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS 9

Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to use virtual instruments to design various mechatronics systems

TEXT BOOK:

1. Gupta ," Virtual Instrumentation Using Lab view" 2nd Edition, Tata McGraw-Hill Education, 2010

REFERENCES:

1 Gary Jonson, "Labview Graphical Programming", Second Edition, McGraw Hill, New York, 1997
2. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998.
3. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.

ME6015 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS **6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Taha H.A., "Operations Research", Prentice Hall of India, Sixth Edition, 2003,

REFERENCES:

1. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Hillier and Libeberman, "Operations Research", Holden Day, 1986
5. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6. Tulsian and Pasdey V., "Quantitative Techniques", Pearson – Asia 2002.

MG6071 ENTERPRENEURSHIP DEVELOPMENT **L T P C**
3 0 0 3

OBJECTIVES :

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP **9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION **9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS **9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING **9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXTBOOKS :

1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th edition, Cengage Learning, 2014.

REFERENCES :

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, Enterprenuership theory at cross roads: paradigms and praxis"Dream tech, 2nd edition 2005.
3. Rajeev Roy, 'Entrepreneurship' 2nd edition, Oxford University Press, 2011.
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

GE6075 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -

Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOME :

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

MG6088 SOFTWARE PROJECT MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of the course the students will be able to practice Project Management principles while developing a software.

TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki “Effective Software Project Management”, Wiley Publication,2011.
2. Walker Royce: “Software Project Management”- Addison-Wesley , 1998.
3. Gopalaswamy Ramesh, “Managing Global Software Projects”, McGraw Hill Education (India), Fourteenth Reprint 2013.

CS6302 DATABASE MANAGEMENT SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To expose the students to the fundamentals of Database Management Systems.
- To make the students understand the relational model.
- To familiarize the students with ER diagrams.
- To expose the students to SQL.
- To make the students to understand the fundamentals of Transaction Processing and Query Processing.
- To familiarize the students with the different types of databases.
- To make the students understand the Security Issues in Databases.

UNIT I INTRODUCTION TO DBMS 10

File Systems Organization - Sequential, Pointer, Indexed, Direct - Purpose of Database System- Database System Terminologies-Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization

UNIT II SQL & QUERY OPTIMIZATION 8

SQL Standards - Data types - Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL - QUERY OPTIMIZATION: Query Processing and Optimization - Heuristics and Cost Estimates in Query Optimization.

UNIT III TRANSACTION PROCESSING AND CONCURRENCY CONTROL 8

Introduction-Properties of Transaction- Serializability- Concurrency Control – Locking Mechanisms-Two Phase Commit Protocol-Dead lock.

UNIT IV TRENDS IN DATABASE TECHNOLOGY 10

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases-Mobile and web databases- Data Warehouse-Mining- Data marts.

UNIT V ADVANCED TOPICS 9

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges –Cryptography- Statistical Databases.- Distributed Databases-Architecture-Transaction Processing-Data Warehousing and Mining-Classification-Association rules-Clustering-Information Retrieval- Relevance ranking-Crawling and Indexing the Web- Object Oriented Databases-XML Databases.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the Query Processor and Transaction Processor.
- Apply security concepts to databases.

TEXT BOOK:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2008.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.

4. Alexis Leon and Mathews Leon, “Database Management Systems”, Vikas Publishing House Private Limited, New Delhi, 2003.
5. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, Tata Mc Graw Hill, 2010.
6. G.K.Gupta, “Database Management Systems”, Tata Mc Graw Hill, 2011.
7. Rob Cornell, “Database Systems Design and Implementation”, Cengage Learning, 2011.

CS6551 COMPUTER NETWORKS **L T P C**
3 0 0 3

OBJECTIVES:
The student should be made to:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

UNIT I FUNDAMENTALS & LINK LAYER **9**
Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

UNIT II MEDIA ACCESS & INTERNETWORKING **9**
Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP)

UNIT III ROUTING **9**
Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV TRANSPORT LAYER **9**
Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V APPLICATION LAYER **9**
Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

TEXT BOOK:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.