KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E-MECHATRONICS ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Mechatronics Engineering the unique of its kind in the field of Research and Development towards Industrial Automation & Robotics.

MISSION:

To impart highly innovative and technical knowledge in Mechatronics Engineering to the urban and unreachable rural student folks through "Total Quality Education"

PROGRAM EDUCATION OBJECTIVES:

Educational objectives of the course Bachelor of Mechatronics Engineering programme can be divided into

PEO 1: Graduates will be able to apply their multi-disciplinary knowledge to formulate, design, develop and analyse Mechatronics Systems.

PEO 2: Graduates will be able to come up with solution for any real time problems in the field of Mechatronics Engineering and allied areas demanded by the Industry and Society.

PEO 3: Graduates will be able to get familiarized with economical issues in Mechatronics Engineering and work in multi-disciplinary teams with ethical code of conduct.

PROGRAM OUTCOMES:

After going through the four years of study, the Mechatronics Engineering graduates will have the ability to

	Graduate Attribute	**Programme Outcome**
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: Graduates will be able to design and develop cost effective Mechatronics systems by adopting multi-disciplinary skills in Design, Manufacturing, Automation and Electronics.

PSO2: Graduates will be able to apply their knowledge in sensors, drives, actuators, controls, mechanical design and modern software & hardware tools to develop systems for performing specified tasks.

PSO3: Graduates will be able to become Technocrats and Entrepreneurs, build the attitude of developing new concepts on emerging fields and pursuing higher studies**.**

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CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1373	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2	EC1371	Digital Electronics	PC	3	0	0	3	3
3	MT1301	Analog Devices and Circuits	PC	3	0	0	3	3
4	MT1302	Fluid Mechanics and Thermal Sciences	PC	3	0	0	3	3
5	MT1303	Solid Mechanics	PC	3	0	0	3	3
6	MT1306	Electrical Circuits and Machines	ES	3	0	0	3	3
PRACTICAL								
7	MT1311	Solid and Fluid Mechanics Laboratory	PC	0	0	4	4	2
8	MT1316	Electrical Circuits and Machines Laboratory	ES	0	0	4	4	2
9	HS1321	Interpersonal Skills-Listening and Speaking	EE	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1402	Statistics and Numerical Methods	BS	3	1	0	4	4
2	EE1471	Control Systems Engineering	PC	3	0	0	3	3
3	ME1471	Kinematics of Machinery	PC	3	0	0	3	3
4	MT1401	Manufacturing Technology	PC	3	0	0	3	3
5	MT1402	Microprocessors and its Applications	PC	3	0	0	3	3
6	MT1403	Sensors and Instrumentation	PC	3	0	0	3	3
PRACTICAL								
7	MT1411	Manufacturing Technology and Sensors Laboratory	PC	0	0	4	4	2
8	MT1412	Microprocessors and its Applications Laboratory	PC	0	0	4	4	2
9	HS1421	Introduction to Advanced Reading and Writing	EE	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1373 TRANSFORMATIONS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of PDE used in solving partial differential Equations.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To acquaint the students with Fourier transform and Z-transform techniques.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two- dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 Form the partial differential equations and solve them using various techniques.

CO2 Find the Fourier constants and frame the Fourier series of periodic functions.

CO3 Classify and solve the initial and boundary value problems such as wave and heat flow equation

CO4 Compute the Fourier transforms of standard functions and learn the properties.

CO5 Apply the techniques of Z- transform to get the solutions of differential Equations.

TEXTBOOKS

1. Erwin kreyszig, 2015, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th Edition, New Delhi.
2. Grewal B,S, 2017*, Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, New Delhi.

REFERENCES

1. Bali, N, Goyal, M, & Watkins C, 2009*, Advanced Engineering Mathematics,* Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.
2. Narayanan, S, Manicavachagom Pillay T, K&Ramanaiah, G ,1998, *Advanced Mathematics for Engineering Students*, Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai.
3. Glyn James, 2011, *Advanced Modern Engineering Mathematics*, Pearson Education, 4 th Edition, New Delhi.
4. Peter V, O'Neil, 2012, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi.
5. Ramana, 2010, B,V*, Higher Engineering Mathematics*, Tata McGraw Hill, 11th Reprint, New Delhi.

WEB REFERENCES

1. http://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf
2. http://sv.20file.org/up1/692_0.pdf
3. http://www.scribd.com/document/462665493/B-V-Ramana-Higher-Engineering-Mathematics-McGraw-Hill-Education-2018-pdf

EC1371 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To provide the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

UNIT 1 DIGITAL FUNDAMENTALS 9

Review of Number systems - Logic gates - Boolean algebra - Boolean postulates and laws - De-Morgan's Theorem, Principle of Duality - Simplification using Boolean algebra - Canonical forms, Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation.

UNIT 2 COMBINATIONAL CIRCUIT DESIGN 9

Realization of combinational logic using gates - Design of combinational circuits - Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Code converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder.

UNIT 3 SEQUENTIAL CIRCUITS 9

Latches - Flip-Flops - SR, JK, D and T, Master Slave Flip Flops - Shift registers - SISO, SIPO, PISO, PIPO - Binary counters – Synchronous and asynchronous up/down counters, mod - N counter, Counters for random sequence - Johnson counter - Ring counter.

UNIT 4 SYNCHRONOUS CIRCUIT DESIGN 9

Design of Synchronous Sequential Circuits - State Table and State Diagram - Design of Mealy and Moore FSM - Overlapping & Non-overlapping Sequence detector - Hazards - Hazard free realization - Case study on Vending Machine FSM.

UNIT 5 LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – RTL, TTL, ECL and CMOS - Basic memory structure – ROM, PROM, EPROM, EEPROM - RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL - FPGA - Basic Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Outline the Boolean functions and various minimization techniques.

CO2 Illustrate the combinational circuits used to perform basic digital operations.

CO3 Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4 Construct the synchronous sequential circuits with hazard and hazard free conditions.

CO5 Interpret the different types of memories for the implementation of combinational logic circuits and various logic families.

TEXT BOOKS

1. M Morris Mano, M.D.C., 2017. *Digital design: with an introduction to the verilog HDL, VHDL, and system Verilog,* 6th Edition, Pearson Education.

REFERENCES

1. Charles H.Roth, 2013. *Fundamentals of Logic Design*, 6th Edition, Thomson Learning.
2. Wakerly J F, 2002. *Digital Design: Principles and Practices*, 2nd Ed., Prentice Hall.
3. D. D. Givone, 2003. *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
4. Thomas L. Floyd, 2011. *Digital Fundamentals*, 10th Edition, Pearson Education Inc.
5. Stephen Brown & Zvonko Vranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, Third Edition, McGraw-Hill Higher Education, New Delhi, India.

MT1301 ANALOG DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To study the basic characteristics of Diodes, Transistors, Rectifiers and oscillators.
- To study characteristics; realize various Circuits using Op-Amp ICs.
- To understand the various functionalities of ICs and Waveform generators.
- To study the internal functional blocks of test and Measuring Instruments.
- To study the characteristics of various electronic display devices.

UNIT I ANALOG ELECTRONICS 9

Semiconductor Diodes –Bipolar Junction Transistor – Characteristics Rectifiers and Filters - Regulated Power Supply –Switching Power Supplies, Thermal Considerations - Feedback and power amplifiers - Oscillators: Colpitts oscillator, Hartley oscillator and Wien bridge oscillator

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS 9

Operational amplifiers – Principles, Specifications, characteristics and applications-. Arithmetic Operations, Integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, A/D & D/A converters.

UNIT III WAVEFORM GENERATORS AND ICs 9

Triangular, Saw tooth and Sine wave generators - Multivibrators - Function generator ICs – Timer ICs –Voltage regulator ICs: fixed, Adjustable and General purpose - V/F and F/V converters – Optocouplers

UNIT IV TEST AND MEASURING INSTRUMENTS 9

Measurement of voltage, current, frequency and power using Multi meters, oscilloscopes, recorders, data loggers, voltage-controlled oscillators, counters, analyzers and printers.

UNITV DISPLAY DEVICES 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Touch Screens,

Numeric Displays, Photo transistor, Solar cell, CCD.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Apply the various switching devices in electronic circuits.

CO2 Apply Op-Amp application circuits for signal analysis.

CO3 Design various Signal Generation, Voltage regulation circuits using ICs.

CO4 Analyze various internal functional blocks of test & measurement devices.

CO5 Comprehend the principles of various display devices.

TEXT BOOKS

1. Salivahanan S., Suresh kumar N. and Vallavaraj A.,2012, *Electronic Devices and Circuits*, Tata McGraw Hill publishing company, New Delhi, 3rd edition.
2. Roy Chowdhury D. and Jain Shail B., 2018, *Linear Integrated Circuits*, New Age Int. Pub., 5th edition.

REFERENCES

1. Albert Malvino and Bates J.,2013, *Electronic Principles*, Tata McGraw- Hill Pub. Company Ltd., 7th edition.
2. Millman J., Halkias C.C. and SatyabrataJit., 2010, *Electronic Devices and Circuits,* Tata McGraw Hill, New Delhi, 3rd edition.
3. Thomas L. Floyd.,2010,*Electronic Devices*, Pearson Education Asia, 9th edition.
4. NPTEL Video Lecture Notes on *"Analog Electronic Circuits" and "Integrated Circuits, MOSFETs, Op-Amps and their applications*.
5. Donald A Neaman., 2012 *Semiconductor Physics and Devices*, Fourth Edition, Tata McGraw Hill Inc.2012.

MT1302 FLUID MECHANICS AND THERMAL SCIENCES

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of fluid mechanics.
- To introduce the applications of the conservation laws to flow through pipes.
- To make students understand the working principle of different types of pumps and Hydraulic turbines.
- To make students understand the basic laws of thermodynamics.
- To introduce various mechanisms of heat transfer

UNIT I PROPERTIES OF FLUIDS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – Concept of control volume - Application of continuity equation, Energy equation and Momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – Types of boundary layer thickness – Darcy Weisbach equation – Friction factor- Moody diagram- Commercial pipes- Minor losses – Flow through pipes in series and parallel - Basics of dimensional analysis.

UNIT III HYDRAULIC MACHINES 9

Introduction and classification of hydraulic machines - Reciprocating pump: constructional details, working principle, co-efficient of discharge, slip, power required. Centrifugal pump: classification and working principle, specific speed. Turbines: classification, working principle of impulse and reaction turbine.

UNIT IV LAWS OF THERMODYNAMICS 9

Thermodynamic system and surroundings – Properties of system – State and Equilibrium – Forms of energy – Quasi static process – Zeroth law of thermodynamics – Work and heat transfer – Path and point functions – First law of thermodynamics applied to open systems – SFEE equation and its applications. Second law of thermodynamics applied to Heat engines,

Refrigerators & Heat pumps - Carnot's theorem and Clausius inequality – Concept of entropy applied to reversible and irreversible processes – Third law of thermodynamics.

UNIT V HEAT TRANSFER MECHANISMS 9

Heat transfer mechanisms: Conduction – Fourier's Law, thermal resistance. Convection – Newton's law of cooling. Radiation – Wien's law, Kirchhoff's law, Stefan-Boltzmann law. Heat exchangers – LMTD – NTU – Fins.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Describe the properties of fluids and its importance in selection of fluid for suitable application

CO2 Identify the major and minor losses involved in the fluid flow through pipes

CO3 Differentiate the types of hydraulic machines and describe the working principle.

CO4 Apply the basic laws of thermodynamics for different applications.

CO5 Distinguish various modes of heat transfer and determine the heat transfer rate.

TEXT BOOKS

1. Rajput R.K., 2008, *Heat and Mass transfer*, S.Chand and Co Publishing.
2. Modi PN., Seth SM.,2015, *Hydraulics and fluid mechanics including hydraulic machines*", 20th edition, Standard publishers.

REFERENCES

1. Cengel YA., Cimbala J M.,2010, *Fluid Mechanics – Fundamentals and applications*, 2nd Edition, McGraw Hill higher education.
2. Bansal RK., 2011, *Fluid Mechanics and Hydraulics Machines*, 9th edition, Laxmi publications (P) Ltd., New Delhi.
3. Holman, J.P.,2007,*Heat Transfer*, 3rd Edition, McGraw-Hill.
4. White FM., 2011, *Fluid Mechanics*, 7th Edition, Tata McGraw-Hill, New Delhi.
5. Nag P.K.,2005, *Engineering thermodynamics*, Tata McGraw hill.

MT1303 SOLID MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS AND STRAIN 9

Stress and strain at a point – Tension, Compression, Shear Stress - Deformation of simple and compound bars – Hooke's Law – Relationship among elastic constants – Stress Strain Diagram for Mild Steel – Ultimate Stress – Yield Stress – Factor of Safety – Thermal Stresses – Thin Cylinders and Shells – Strain Energy due to Axial Force – Resilience – Stresses due to impact and Suddenly Applied Load – Compound Bars.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – Types transverse loading on beams – Shear force and bending moment in beams– Cantilevers – Simply supported beams and Over – hanging beams - Theory of simple bending–Bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and Deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double integration method – Macaulay's methods – Area moment method – Conjugate beam method for computation of slopes and deflections of determinate beams.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and Deformation in thin and thick cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.

CO2 Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.

CO3 Apply basic equation of simple torsion in designing of shafts and helical spring

CO4 Calculate the slope and deflection in beams using different methods.

CO5 Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS

1. Bansal, R.K., 2016, *Strength of Materials*, Laxmi Publications (P) Ltd.
2. Jindal U.C., 2009, *Strength of Materials* Asian Books Pvt. Ltd., New Delhi.

REFERENCES

1. Egor. P.Popov, 2002, *Engineering Mechanics of Solids* Prentice Hall of India, New Delhi.
2. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole, 2005, *Mechanics of Materials*, Tata McGraw Hill Publishing 'co. Ltd., New Delhi.
3. Hibbeler, R.C., 2013, *Mechanics of Materials*, Pearson Education, Low Price Edition.
4. Subramanian R., 2010, *Strength of Materials*, Oxford University Press, Oxford Higher Education Series.
5. Timoshenko Timothy., *Strength of Materials,* CBS Publishers & Distributors, 2002.

MT1306 ELECTRICAL CIRCUITS AND MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES

This course will enable the students to

- To discuss electric circuits and provide knowledge on the analysis of circuits using network theorems
- To understand single and three phase circuits, wiring & working principle of transformer
- To describe the working principle, types, characteristics of DC machines
- To describe the working principle of AC machines
- To explain different types of starters and speed control methods of three phase induction motor & Synchronous motor

UNIT I ELECTRICAL CIRCUITS 9

Basic circuit components – Ohms Law - Kirchhoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem- Linearity and Superposition Theorem.

UNIT II AC CIRCUITS 9

Introduction to AC circuits – Waveforms and RMS value – Power and Power factor, Single phase and Three-phase balanced circuits – Three phase loads - House wiring, Industrial wiring, materials of wiring – Principle of Operation of Transformers – EMF Equation of Transformers.

UNIT III DC MACHINES 9

Types - Constructional details – Principle & operation - Emf equation -Methods of excitation of D.C. generators - Characteristics of series, shunt generator - Principle operation of D.C. motor - Back emf and torque equation - Characteristics of series shunt and Compound motors

UNIT IV AC MACHINES 9

Constructional details, principle of operation and performance characteristics Single phase induction motor, Three phase induction motor, Synchronous motors.

UNIT V SPEED CONTROL AND STARTING 9

Speed control of D.C. motors – Three phase induction motors - Synchronous motor – starting methods of D.C. motor, Three phase induction motor and Synchronous motor

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Comprehend the basic laws, mesh current, nodal voltage, voltage and current division for solving circuit problems.

CO2 Solve the networks having DC and AC inputs using network theorems.

CO3 Select DC Machines for a particular application based on its Characteristics.

CO4 Select AC Motor for a particular application based on its Characteristics.

CO5 Differentiate between various types of starting and speed control methods.

TEXTBOOKS

1. D P Kothari and I.J Nagarath, *Electrical Machines Basic Electrical and Electronics Engineering*, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2. Thereja .B.L., *Fundamentals of Electrical Engineering and Electronics*, S. Chand & Co. Ltd., 2008

REFERENCES

1. Del Toro., 2007, *Electrical Engineering Fundamentals*, Pearson Education, New Delhi.
2. John Bird., 2006, *Electrical Circuit Theory and Technology*, Elsevier, First Indian Edition.
3. Allan S Moris., 2006, *Measurement and Instrumentation Principles*, Elsevier, First Indian Edition.
4. Rajendra Prasad., 2006, *Fundamentals of Electrical Engineering*, Prentice Hall of India.
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel., 2009, *Basic Electrical Engineering*, McGraw Hill Education(India) Private Limited.
6. N K De, Dipu Sarkar., 2016, *Basic Electrical Engineering*, Universities Press (India) Private Limited

MT1311 SOLID AND FLUID MECHANICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To study the mechanical properties of materials when subjected to different types of loading.
- To study the effect of hardening and tempering process on materials
- To perform microscopic examination on the hardened and tempered samples
- To verify the principles studied in Fluid Mechanics theory by performing experiments in pumps.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in turbines.

SOLID MECHANICS **30**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

FLUID MECHANICS **30**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.

2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, Students will be able to

CO1 Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

CO2 Perform shear, impact and deflection test.

CO3 Use the measurement equipments for flow measurement.

CO4 Perform test on different pump.

CO5 Perform test on different turbines.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Qty.
Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
Torsion Testing Machine (60 NM Capacity)	1
Impact Testing Machine (300 J Capacity)	1
Brinell Hardness Testing Machine	1
Rockwell Hardness Testing Machine	1
Spring Testing Machine for tensile and compressive loads (2500 N)	1
Metallurgical Microscopes	3
Muffle Furnace (800 C)	1
Orifice meter setup	1

Venturi meter setup	1
Rotameter setup	1
Pipe Flow analysis setup	1
Centrifugal pump/submergible pump setup	1
Reciprocating pump setup	1
Gear pump setup	1
Pelton wheel setup	1
Francis turbine setup	1
Kaplan turbine setup	1

MT1316 ELECTRICAL CIRCUITS AND MACHINES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To understand the basic concepts of electrical circuits and associated theorems.
- To understand the fundamentals of DC shunt motors and induction motors.
- To understand the load test and performance characteristics of DC shunt motor, stepper motor and induction motors.
- To give practical exposure to students on various electrical and electronics components.
- To give hands-on practice on design of simple analog circuits.

LIST OF EXPERIMENTS:

1. Verification of Ohm's Law & Kirchhoff's Laws.
2. Verification of Thevenin theorem
3. Verification of Norton's theorem
4. Load test on D.C. shunt motor.
5. Speed control of D.C. shunt motor.
6. Swinburne's test.
7. Load test on three phase induction motor.
8. No load and blocked rotor tests on three – phase induction motor.

9. Load test on single phase induction motor.
10. No load and blocked rotor tests on single phase induction motor.
11. Load test on Synchronous motors.
12. Performance characteristics of Stepper motor.
13. Performance characteristics of Single phase transformer.
14. Study of Starters

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Compute the performance of the DC machines for varying load.

CO2 Compute the performance of single phase & three phase AC motor for varying load.

CO3 Select suitable speed control method of AC and DC motor.

CO4 Calculate the performance parameters of stepper motor and transformers

CO5 Apply basic electrical laws and network theorems for solution of simple DC & AC circuits.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Quantity
Shunt motor 5HP	3
Single phase Induction Motor 2HP	2
Three phase induction Motor 5HP	2
Single phase transformer 2KVA	1
Three phase auto transformer	2
Single phase auto transformer	2
3 point starter	3
DPST, TPST Each	2
DC source 300v, 100A	1
Ammeter(0-5A),(0-10A)MC Each	2
Ammeter(0-5A),(0-10A)MI Each	2
Voltmeter(0-300V) MC	3
Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
Wattmeter 150/300V, 5/10A UPF	2

Wattmeter 300/600V,5/10A UPF	2
Wattmeter 150/300V,5/10A LPF	2
Wattmeter 300/600V,5/10A LPF	2
Stepper motor 5Kg	1
Synchronous motor 5KW	1
Rheostat 360 ohm/1.2A	3
Tachometer	5
Rheostat 50 ohm/5A	3
Resistors & Breadboards	-
Dual Regulated power supplies	6
Ammeter A.C and D.C	20
Voltmeters A.C and D.C	20

HS1321 INTERPERSONAL SKILLS- LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES

The course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

Unit I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

Unit II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation –– taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to

producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

Unit III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

Unit IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

Unit V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs

CO5 Explain directions and instructions in academic and business contexts

TEXTBOOKS

1. Brooks, Margret,2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke,2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES

1. Bhatnagar, Nitin&MamtaBhatnagar,2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate,2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack,2006,*Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter,2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.html

SEMESTER IV

MA1402 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVES

The Course will enable students to

- To make them understand the knowledge of testing of hypothesis for small and large samples.
- To describe the concept of design of experiment to make the judgments in the real life problem.
- To explain the techniques for solving the transcendental equations, system of equations and eigen value problems.
- To introduce the numerical techniques for interpolation in various intervals, differentiation and integration which plays an important role in engineering and technology disciplines.
- To solve the ordinary differential equation with initial conditions.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions -Statistical Hypothesis-Tests for single mean and difference of means of large samples (z-test) and Small samples (t-test) – F-test for variance – Chi square test to test the goodness of fit and independence of attributes

UNIT II DESIGN OF EXPERIMENTS 12

Basic principles of experimental deign: Completely randomized design – Randomized block design – Latin square design-2^2 factorial designs.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations : Fixed point iteration method –Newton Raphson method – Solution of linear system of equations: Gauss elimination and Gauss Jordan methods - Iterative methods: Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Interpolation-Lagrange's and Newton's divided difference interpolations for unequal intervals – Newton's forward and backward difference interpolation for equal intervals– Approximation of derivates using interpolation polynomials – Numerical Solution of single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods : Taylor series method, Euler's method , Modified Euler's method and Fourth order Runge-Kutta method for solving first order equations – Multi step methods : Milne's and Adam –Bashforth predictor corrector methods for solving first order equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After completing this course, students will be able to:

CO 1 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO 2 Apply the basic concepts of classifications of design of experiments.

CO 3 Apply the techniques for solving the transcendental equations, system of equations and eigen value problems.

CO 4 Apply the numerical techniques of differentiation and integration for engineering problems.

CO 5 Solve the ordinary differential equations with initial conditions by various Methods.

TEXT BOOKS

1. Johnson, R A, Miller, I, & Freund, J E 2015, *Miller & Freund's Probability and Statistics for Engineers*, 8th Edition, Pearson Education, Asia.
2. Grewal, B S, & Grewal, J S 2016, *Numerical Methods in Engineering and Science,* 10th Edition Reprint, Khanna Publishers, New Delhi, India.

REFERENCES

1. Walpole, R E, Myers, R H, Myers, S L, & Ye, K 2007, *Probability and Statistics for Engineers and Scientists*, 8th Edition, Pearson Education, Asia.
2. Gupta, S C, & Kapoor, V K 2020, *Fundamentals of Mathematical Statistics*, 12th Edition Reprint, Sultan Chand & Sons.
3. Sankar Rao, K 2018, *Numerical Methods for Scientists and Engineers*, 4th Edition, Prentice Hall of India Private.

4. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.
5. Gerald, C F, & Wheatley, P O 2007, *Applied Numerical Analysis,* 7th Edition, Pearson Education, Asia, New Delhi.

WEB REFERENCES

1. https://fac.ksu.edu.sa/sites/default/files/probability_and_statistics_for_engineering_and_the_sciences.pdf
2. http://www.elcom-hu.com/Mshtrk/Statstics/9th%20txt%20book.pdf
3. https://fac.ksu.edu.sa/sites/default/files/numerical_analysis_9th.pdf

EE1471 CONTROL SYSTEMS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approaches for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS 9

Standard Inputs - Transient response & Steady state response - Measures of performance of the standard first order and second order system - Effect on an additional zero and an additional pole- Steady error constant and system type number -PID control - Analytical design for PD, PI,PID control systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead

compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Identify the various control system components and their representations.

CO2 Analyze the various time domain parameters.

CO3 Analysis the various frequency response plots and its system.

CO4 Apply the concepts of various system stability criterions.

CO5 Design various transfer functions of digital control system using state variable models

TEXT BOOK

1. M.Gopal., 2012, *Control System – Principles and Design*, Tata McGraw Hill, 4th Edition.

REFERENCES

1. J.Nagrath and M.Gopal, 2007, *Control System Engineering*, New Age International Publishers, 5 th Edition.
2. K. Ogata., 2012 , *Modern Control Engineering*, 5th edition, PHI.
3. S.K.Bhattacharya.,2013, *Control System Engineering*, 3rd Edition, Pearson.
4. Benjamin.C.Kuo.,1995, *Automatic control systems*‖*,* Prentice Hall of India, 7th Edition

ME1471 KINEMATICS OF MACHINERY

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – Kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and Cycloidal tooth profiles – Spur Gear terminology and definitions –Gear tooth action – Contact ratio – Interference and undercutting. Helical, Bevel,

Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction in Plate clutches – Axial clutches – Cone Clutches-Internal expanding rim clutches – Electromagnetic clutches. Friction in Band and Block brakes – External shoe brakes – Internal expanding shoe brake

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Define various components of mechanisms and explain the various inversions of a mechanism

CO2 Illustrate the kinematic linkages with respect to displacement, velocity, and acceleration at any point

CO3 Design cam profile for specified follower motions

CO4 Demonstrate the basic concepts of toothed gearing and the kinematics of gear trains

CO5 Compute the frictional forces in various power transmission systems such as Clutches and Brakes

TEXT BOOKS

1. Rattan, S.S, 2014, *Theory of Machines*,4thEdition, Tata McGraw-Hill.
2. F.B.Sayyad, 2011, *Kinematics of Machinery*. MacMillan Publichers Pvt Ltd., Tech-max Educational resources.
3. Uicker J.J., 2014, Pennock G.R and Shigley, J.E., *Theory of Machines and Mechanisms*,4th Edition, Oxford University Press.

REFERENCES

1. Khurmi, R.S., 2005, *Theory of Machines*,14 Edition, S Chand Publications.
2. Allen S.Hall Jr., 1961, *Kinematics and Linkage design*, Prentice Hall.
3. Thomas Bevan, 2005, *Theory of Machines*, 3rd Edition, CBS Publishers and Distributors.
4. Robert L. Norton, 2009, *Kinematics and Dynamics of Machinery*, Tata McGraw-Hill

MT1401	MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the basic concepts of sand-casting technique and special casting technique.
- To know the principles, equipment's of different welding techniques.
- To understand the basic concepts and working of Traditional machining process.
- To know the basic concepts and working of Non-traditional machining process.
- To understand the working principles of different types of Metal forming and Plastic manufacturing methods.

UNIT I METAL CASTING PROCESSES 9

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding - melting furnaces: Blast and Cupola Furnaces;

Special moulding processes – CO_2 moulding, Shell moulding, Investment moulding, Permanent mould casting, Pressure die-casting, Centrifugal casting, Continuous casting – Stir casting – Casting defects.

UNIT II METAL JOINING PROCESSES 9

Classification of Welding processes- Principles of Oxy-acetylene gas welding - A.C metal arc welding, Resistance welding, Submerged arc welding, Tungsten inert gas welding, Metal inert gas welding - Plasma arc welding - Thermit welding- Electron beam welding- Laser beam welding- Friction welding and friction stir welding -Soldering and brazing- Defects in welding.

UNIT III CONVENTIONAL MACHINING PROCESSES 9

General principles, working and operations of: Lathe, Shaper, Planer, Milling machines, Drilling machine - Gear generation methods - Broaching machines – Cylindrical grinding, Surface grinding, Centreless grinding and Internal grinding – Introduction to CNC Machining.

UNIT IV UNCONVENTIONAL MACHINING PROCESSES 9

General principles, working and applications of: Water jet machining, Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining, Laser beam machining, Chemo-mechanical polishing,

Magneto rheological finishing. Comparison of Conventional & Unconventional machining processes.

UNIT V **METAL FORMING AND MANUFACTURING OF PLASTIC COMPONENTS** **9**

Principles and applications: Forging, Rolling, Extrusion, Wire drawing, Spinning, HERF Process - Powder metallurgy

Types of plastics – Moulding of Thermoplastics – Injection moulding– Blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Processing of Thermosets –Compression moulding – Transfer moulding – Bonding of Thermoplastics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO 1 Identify and Select suitable casting process for a specific component

CO 2 Explain the working principles and applications of different arc welding processes, special welding process and defects associated with it

CO 3 Select the suitable process for manufacturing of components using suitable conventional machining

CO 4 Select the suitable process for manufacturing of components using suitable unconventional machining

CO 5 Understand various metal forming process and manufacturing methods of plastic components

TEXT BOOKS

1. Hajra Choudhary. S.K and Hajra Choudhary. A.K., 2010, *Elements of Workshop Technology*, volume I and II, Media Promoters and Publishers Private Limited, Mumbai.
2. Kalpakjian. S, 2018, *Manufacturing Engineering and Technology*, 7th Edition, Pearson Education India Edition.

REFERENCES

1. *H.M.T. Production Technology – Handbook*, Tata McGraw-Hill, 2000.
2. Roy A. Lindberg, 2006, *Processes and Materials of Manufacture*, PHI / Pearson education.
3. Black J.T and Ronald A. Kosher, 2017, *Degarmos Materials and Processes, in Manufacturing* 12th Edition, Wiley Publishers.

4. Sharma, P.C., 2006, *A Text book of production Technology*, S.Chand and Co. Ltd.
5. Adithan. M and Gupta. A.B., 2006, *Manufacturing Technology*, New Age.

MT1402 MICROPROCESSORS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand fundamental operating concepts behind microprocessors and microcontrollers.
- Emphasis on the hardware features of Microprocessor 8085 and Microcontroller 8051 with their functions
- To apply instructions and addressing modes and write programs using 8085
- Understand commonly used peripheral / interfacing
- To apply instructions and algorithms write programs using 8051.

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Serial Communication – Interrupts- Introduction to Arduino & Raspberry pi.

UNIT IV PERIPHERAL INTERFACING 9

Introduction on Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254,8237,8251, 8279 - A/D and D/A converters.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises-key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Krishna Kant., 2013, *Microprocessor and Microcontrollers*, Eastern Company Edition, Prentice Hall of India, New Delhi.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely., 2007, *The 8051 Micro Controller and Embedded Systems*, PHI Pearson Education, 5th Indian reprint.

REFERENCES

1. N.Senthil Kumar, M.Saravanan, S.Jeevananthan., 2016, *Microprocessors and Microcontrollers*, Oxford.
2. Soumitra Kumar Mandal., 2013, *Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051*,McGraw Hill Edu.
3. Valder – Perez., 2013, *Microcontroller – Fundamentals and Applications with Pic,* Yeesdee Publishers, Tayler & Francis.
4. R.S. Gaonkar., 2013, *Microprocessor Architecture Programming and Application, with 8085*, Wiley Eastern Ltd., New Delhi.

MT1403 SENSORS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the concepts of measurement technology and various transducers, sensors.
- To know about the different motion, proximity, ranging sensors.
- To learn the various sensors used to measure various physical and optical parameters.

- To acquire knowledge on various Pressure, Temperature and advanced sensors.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I INTRODUCTION 9

Basics of Measurement Units and Standards– Classification of sensors –Contact and Non Contact Sensors- Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors —Sensor calibration techniques – Sensor Output Signal Types –Wiring Techniques- specifications and manufacturer of sensors

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC, HEADING AND OPTICAL SENSORS 9

Strain Gage, Load Cell, and Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers - Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors

UNIT IV PRESSURE TEMPERATURE AND ADVANCED SENSORS 9

Pressure –Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

CO1	Outline the various calibration techniques and types of sensors and transducers
CO2	Summarize the various sensors used in the Motion and Ranging applications
CO3	Describe the working principle and characteristics of force, magnetic , heading and optical sensors
CO4	Understand the basic principles of various pressure and temperature, smart sensors
CO5	Ability to implement the DAQ systems with different sensors for real time applications

TEXT BOOKS

1. Ernest O Doebelin., 2009, *Measurement Systems – Applications and Design*, Tata McGraw-Hill.
2. Sawney A K and Puneet Sawney., 2013, *A Course in Mechanical Measurements and Instrumentation and Control*, 12th edition, Dhanpat Rai & Co, New Delhi.

REFERENCES

1. C. Sujatha Dyer, S.A., 2001, *Survey of Instrumentation and Measurement*, John Wiley & Sons, Canada.
2. Hans Kurt Tönshoff (Editor), Ichiro., 2001, *Sensors in Manufacturing Volume 1*, Wiley-VCH April.
3. John Turner and Martyn Hill., 1999, *Instrumentation for Engineers and Scientists*, Oxford Science Publications.
4. Patranabis D., 2011, *Sensors and Transducers*, 2nd Edition, PHI, New Delhi.
5. Richard Zurawski., 2015, *Industrial Communication Technology Handbook* 2nd edition, CRC Press.

MT1411 **MANUFACTURING TECHNOLOGY AND SENSORS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To demonstrate and study about various machines
- To understand the machine capabilities and processes
- To provide knowledge about sensors.
- To provide knowledge about actuators.
- To provide hands on experience to measure different signal using sensor and processing them in required form.

LIST OF EXPERIMENTS

MANUFACTURING TECHNOLOGY LABORATORY (30 Hours)

1. LATHE PRACTICE

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

Estimation of machining time for the above turning processes.

2. DRILLING PRACTICE

a. Drilling
b. Tapping
c. Reaming.

3. MILLING

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

4. PLANNING AND SHAPING

a. Cutting Key Ways.
b. Dovetail machining.

SENSORS LABORATORY (30 Hours)

1. Design and testing of Digital Comparator
2. Design and testing of Voltage to frequency converter and frequency to voltage converter.

3. Design and testing of sample and hold circuit.
4. Design and testing of Flash type Analog to Digital Converters.
5. Design and testing of instrumentation amplifier using OP-AMP.
6. Displacement measurement using potentiometer and LVDT and plotting the characteristic curves.
7. Study of Characteristics and calibration of strain gauge and Load Cell
8. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics.
9. Temperature Measurement using MultiSIM Live Software
10. Measurement of sound using microphones and sound level meter.
11. Conversation of time domain audio signal into frequency domain signal (FFT).
12. Study of Temperature & Pressure Transmitter

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Utilize different machine tools for manufacturing gears

CO2 Utilize different machine tools for finishing operations.

CO3 Generate appropriate design procedure, suitable for signal conversion to interface with computer.

CO4 Design appropriate circuits by using conventional formulas used in signal conditioning and conversion.

CO5 Generate appropriate design procedure to obtain a required measurement data for temperature, force, humidity, displacement and sound.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Qty.
Lathe	15 No.
Drilling Machine	1 No.
Milling Machine	2 No.
Planning Machine	1 No.
Shaping Machine	2 No.
Digital Signal Oscilloscope	6 No.

Function Generator	5 No.
Breadboard	10 No.
Regulated Power supply	6 No.
LVDT	1 No.
Thermistor	1 No.
Thermocouple	1 No.
RTD	1 No.
Load cell setup	1 No.
4 Channel data acquisition system for strain gauge	1 No.
Sound level meter	1 No.
Computer with LABVIEW/ MATLAB/SCILAB	1 No.
Prony brake dynamometer	1 No.
Hygrometer	1 No.

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MT1412 MICROPROCESSORS AND ITS APPLICATIONS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To focus on the implementation of arithmetic operations using microprocessors
- To focus on the implementation of arithmetic operations using microcontrollers
- To simulate assembly language programs.
- To implement various on-chip and off-chip interfacing and algorithms
- To develop mini projects using processors

LIST OF EXPERIMENTS

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions
    i. Ascending / Descending order, Maximum / Minimum of numbers
    ii. Programs using Rotate instructions.
    iii. Hex / ASCII / BCD code conversions
3. Interface Experiments: with 8085
    i. A/D Interfacing & (ii) D/A Interfacing.
4. Traffic light controller

5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
    i. Conditional jumps, looping ii) Calling subroutines
9. Programming I/O Port 8051
    i. study on interface with A/D & D/A
    ii. study on interface with DC & AC motor
10. Mini project development with processors

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1	Apply the concepts of partial derivatives to find the higher derivatives of multi variable functions.
CO2	Apply the techniques of multi variable calculus to compute the gradients, directional derivative and extreme values
CO3	Test the given system of equation is linearly dependent or independent.
CO4	Apply the concept of eigen values and eigenvectors for Diagonalization of a matrix
CO5	Apply the inner product techniques for finding the orthonormal vector and minimal solution to the system of linear equation

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Description of Equipment	**Quantity required**
8085 Microprocessor Trainer with Power Supply	15nos
8051 Micro Controller Trainer Kit with power supply	15nos
8255 Interface board	5nos
8251 Interface board	5nos
8259 Interface board	5nos
8279 Keyboard / Display Interface board	5nos
8254 timer counter	5nos
ADC and DAC card	5nos
AC & DC motor with Controller	5nos
Traffic Light Control System	5nos

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

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OBJECTIVES

The Course will enable learners to:

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence. Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES

CO1	Understand how the text positions the reader
CO2	Develop critical thinking while reading a text
CO3	Develop a descriptive paragraph
CO4	Make use of sentence structures effectively when creating an essay
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCES

1. Davis, Jason & Rhonda LIss. *Effective Academic Writing (Level 3)* Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. *Enriching Speaking and Writing Skills*. Second Edition. 2012, Orient Black swan:Hyderabad.
3. Withrow, Jeans and et al. *Inspired to Write. Readings and Tasks to develop writing skills*. 2004, Cambridge University Press: Cambridge.
4. Goatly, Andrew. *Critical Reading and Writing*, 2000, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, *The Professional Writing Guide: Knowing Well and Knowing Why*, 2004,Business & Professional Publishing: Australia.

WEB RESOURCES

1. http://learnenglishteens.britishcouncil.org/skills/reading
2. https://learnenglish.britishcouncil.org/skills/reading
3. https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
4. https://linguapress.com/advanced.html