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).

B.E. MECHATRONICS ENGINEERING
REGULATIONS – 2021
AUTONOMOUS SYLLABUS
CHOICE BASED CREDIT SYSTEM
VII & VIII SEMESTER CURRICULUM & SYLLABI

VISION:

To make the Department of Mechatronics Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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 willhave the ability to

POs	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 anddesign 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 memberor 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 andwrite 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 inthe broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: Graduates will be able to apply their knowledge in sensors, drives, actuators, controls, mechanical design and modern software & hardware tools to design & develop cost effective Mechatronics systems.

PSO2: 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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REGULATIONS - 2021

CHOICE BASED CREDIT SYSTEM
B.E. MECHATRONICS ENGINEERING
VII & VIII SEMESTER CURRICULUM & SYLLABI

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MT2401	Design of Mechatronics System	PC	3	3	0	0	3
2	GE2401	Universal Human Values and Ethics	HS	2	2	0	0	2
3		Management Elective	HS	3	3	0	0	3
4		Open Elective - II*	OE	3	3	0	0	3
5		Open Elective - III*	OE	3	3	0	0	3
6		Open Elective - IV*	OE	3	3	0	0	3
PRACTICAL								
7	MT2402	Computer Aided Design and Manufacturing Laboratory	PC	3	0	0	3	1
			TOTAL	**20**	**17**	**0**	**3**	**18**

* Course from the Curriculum of other UG programmes

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1	MT2451	Project Work	EM	20	0	0	20	10
			TOTAL	**20**	**0**	**0**	**20**	**10**

MANAGEMENT ELECTIVE

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	GE2491	Principles of Management	HS	3	3	0	0	3
2	GE2492	Total Quality Management	HS	3	3	0	0	3

OPEN ELECTIVES OFFERED TO OTHER DEPARTMENT

OPEN ELECTIVE II

(Offered to AI & DS, BT, CIVIL, CSE, ECE, EEE, MECH)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OMT701	Introduction to PLC Programming	OE	3	3	0	0	3

OPEN ELECTIVE III

(Offered to AI & DS, BT, CIVIL, CSE, ECE, EEE, MECH)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OMT702	Low Cost Automation	OE	3	3	0	0	3

OPEN ELECTIVE IV

(Offered to AI & DS, BT, CIVIL, CSE, ECE, EEE, MECH)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OMT703	Sensors and Actuators	OE	3	3	0	0	3

Course Code	Course Name	L	T	P	C
MT2401	DESIGN OF MECHATRONICS SYSTEM	3	0	0	3

Category: Professional Core Course

a. Preamble

This course is designed to cover the basics of Mechatronics design, including system modeling, Engineering System principles, and Real-Time Interfacing. It emphasizes practical learning through case studies to help students grasp the concepts of Mechatronics system design effectively.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the basics and key elements of Mechatronics design process	K2
CO2	Explain the foundational concepts underlying basic system modeling	K2
CO3	Instruct on the concepts of Engineering System and guide understanding of system dynamics and responses.	K2
CO4	Explain the concepts of Real Time Interfacing and Data acquisition	K2
CO5	Outline the design processes and methodologies evident in Mechatronics system case studies.	K2

c. Course Syllabus **Total: 45 Periods**

INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM **9**

Key elements - Mechatronics design process - design parameters - mechatronics and traditional design - Advanced approaches in mechatronics design - Introduction to industrial design, modelling, simulation and analysis - Ergonomics and safety.

BASIC SYSTEM MODELLING **9**

Introduction - model categories - model development - Simulation using software - verification and validation - Mathematical modelling: Basic system modelling - mechanical electrical, fluid and thermal.

MECHATRONIC SYSTEM MODELLING **9**

Engineering systems: Rotational - translational, electro-mechanical, pneumatic, mechanical, hydraulic-mechanical, micro electro mechanical system - Dynamic responses of system: first order, second order system - Performance measures

REAL TIME INTERFACING **9**

Introduction - Selection of interfacing standards- elements of data acquisition and control systems - Overview of I/O process - general purpose I/O cards and its installation - TIA/EIA serial interface standards (RS232/422/485) - General Purpose Interface Bus (IEEE 488) - Data conversion process –Application software - Man machine interface.

CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM **9**

Timed switch - Windscreen-wiper motion- Bathroom scales- A pick-and-place robot- Car park barriers - Digital camera - Automotive control systems.

d. Activities

Students shall be given exposure to various mechatronics design concepts and case studies in the college premises.

e. Learning Resources

Text Books

1. Devdas Shetty, Richard A. Kolk, *Mechatronics System Design*, 2nd Edition, Cengage Learning, 2011.
2. Bolton W, *Mechatronics*, Pearson Education, 2019.

Reference Books

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, First Indian print, 2010.
3. De Silva, *Mechatronics: A Foundation Course*, Taylor & Francis, Indian Reprint, 2013.
4. Georg pelz, *Mechatronic Systems: Modeling and Simulation with HDL's*, John wiley and sons Ltd, 2003.

Course Code	Course Name	L	T	P	C
GE2401	UNIVERSAL HUMAN VALUES AND ETHICS	2	0	0	2

Category: Science and Humanities

a. Preamble

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Describe the essential complementarily between 'VALUES' and 'SKILLS' for ensuring happiness and prosperity.	K2
CO2	Explore Human being as the Co-existence of the Self and the Body	K3
CO3	Develop holistic perspective towards value-based living in a natural way.	K3
CO4	Explain the interconnectedness of the four orders of Nature and existence.	K2
CO5	Comprehend the ethics of human values, Humanistic education and constitution, strategies of value-based life and profession.	K2

c. Course Syllabus **Total : 30 Periods**

INTRODUCTION TO VALUE EDUCATION **6**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations

HARMONY IN THE HUMAN BEING **6**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

HARMONY IN THE FAMILY AND SOCIETY **6**

Harmony in the Family - the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

HARMONY IN THE NATURE/EXISTENCE **6**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS **6**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

d. Activities

Practice Sessions - Introduction to Value Education

1 Sharing about Oneself

2 Exploring Human Consciousness

3 Exploring Natural Acceptance

Practice Sessions – Harmony in the Human Being

4 Exploring the difference of Needs of Self and Body

5 Exploring Sources of Imagination in the Self

6 Exploring Harmony of Self with the Body

Practice Sessions – Harmony in the Family and Society

7 Exploring the Feeling of Trust

8 Exploring the Feeling of Respect

9 Exploring Systems to fulfil Human Goal

Practice Sessions – Harmony in the Nature (Existence)

10 Exploring the Four Orders of Nature

11 Exploring Co-existence in Existence

Practice Sessions – Implications of the Holistic Understanding – a Look at Professional Ethics

12 Exploring Ethical Human Conduct

13 Exploring Humanistic Models in Education

14 Exploring Steps of Transition towards Universal Human Order

e. Learning Resources

https://fdp-si.aicte-india.org/UHV-II_Lectures_PPTs.php

https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php

Text Books

1. R R Gaur, R Asthana, G P Bagaria., *The Textbook A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019.
2. R R Gaur, R Asthana, G P Bagaria., *The Teacher's Manual A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi,2019.

Reference Books

1. EkParichaya, A Nagaraj., *JeevanVidya*, JeevanVidyaPrakashan, Amarkantak, 1999.
2. A.N. Tripathi ., *Human Values,* New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi ., *The Story of My Experiments with Truth*. 2009.
4. J C Kumarappa., *Economy of Permanence.*2017.
5. Maulana Abdul Kalam Azad., *India Wins Freedom.*1988.

Course Code	Course Name	L	T	P	C
MT2402	COMPUTER AIDED DESIGN AND MANUFACTURING LABORATORY	0	0	3	1

Category: Professional Core Course

a. Preamble

This course promotes the students to get familiarize with part modelling and assembly of machine components. It also explores solution to real time problems using Finite element method. Also, this course makes the students to generate G codes and M codes for various tool path simulations.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Utilize CAD software tools to construct detailed three-dimensional models of engineering components	K3
CO2	Construct different load scenarios to experiment with the effects on stress distribution within the structures.	K3
CO3	Experiment with varying temperature gradients and thermal loads to analyze their effects on different structural materials.	K3
CO4	Make use of CAM software functionalities to model and simulate tool paths for various machining tasks	K3
CO5	Develop plans to create CNC programs that optimize machining processes and meet component specifications.	K3

c. Course Syllabus **Total : 45 Periods**

1. Modelling and assembly of the mechanical components using any CAD package.
2. Structural analysis using FEA software – any analysis package.
3. Beam deflection analysis using FEA software – any analysis package.
4. Thermal Analysis using FEA software – any analysis package.
5. Modelling and tool path simulation – turning using any CAM package.
6. Modelling and tool path simulation – milling using any CAM package.
7. NC code generation for milling using any CAM package.
8. NC code generation for turning using any CAM package.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Desktop	30
2.	Solid modelling, analysis and simulation software packages	30

Course Code	Course Name	L	T	P	C
GE2491	PRINCIPLES OF MANAGEMENT	3	0	0	3

Category: Management courses

a. Preamble

This course introduces fundamental principles of management, emphasizing their universal applicability in diverse organizations. It covers core managerial functions, explores organizational structures, and provides insights into effective global leadership qualities and skills.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Discuss the trends and challenges of management in global scenario, the different types of organization and its effectiveness.	K2
CO2	Describe the strategies and policies which are involved in process planning and decision making.	K2
CO3	Illustrate the structure, purpose, selection and recruitment process in organizations.	K2
CO4	Elucidate the various motivational theories and processes of management including its functions.	K2
CO5	Explain the process and control techniques for budgeting and inventory management.	K2

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management - Nature, Scope and Functions of Management - Evolution of Management – Contributions of FW Taylor (14 principles of Management), Henri Fayol, Elton Mayo, Roethilisberger, H.A.Simon and P.F Drucker- Management theories - Science or Art - Manager Vs Entrepreneur- types of managers managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Current trends and issues in Management.

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.

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.

DIRECTING **9**

Directing meaning - importance - principles of directing - Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - 14 types and theories of leadership - Communication - Process of communication, types of communication and its uses - Barrier in communication - Effective Communication - Communication and IT.

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 - Inventory Management - PERT, CPM - Application - Control and performance - Direct and preventive control.

d. Activities

Students shall be given exposure to various concepts of delegation of authority, centralization, and decentralization within the college premises.

e. Learning Resources

Text Books

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, Tata McGraw Hill,2020.
2. Stephen P. Robbins and Mary Coulter, *Management*, Prentice Hall (India)Pvt. Ltd,2019.

Reference Books

1. Robert Kreitner and Mamata Mohapatra, *Management*, Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, *Fundamentals of Management*, Pearson Education, 7th Edition,2016.
3. Tripathy PC and Reddy PN, *Principles of Management*, Tata McGraw Hill, 2021.

Course Code	Course Name	L	T	P	C
GE2492	TOTAL QUALITY MANAGEMENT	3	0	0	3

Category: Professional Core Course

a. Preamble

Quality is the mantra for success or even for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in worldclass competition. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach. At the end of the course the students are expected to recognize the quality issues in an organization and analyze the ways to solve those using TQM techniques, and demonstrate skills in using modern TQM tools.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Describe the concepts of TQM for an enterprise.	K2
CO2	Comprehend the TQM principles and its implementation.	K2
CO3	Discuss the various traditional and new TQM tools.	K2
CO4	Examine the fundamental concepts of QFD and TPM with applications.	K3
CO5	Apply QMS and EMS in business organization.	K3

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION **9**

Concept of Quality and Quality Management - Determinants of quality of a product & Service - Reliability - Definition of TQM - Basic concepts of TQM - TQM Framework - Barriers to TQM - Benefits of TQM - Gurus of TQM (Brief Introduction) - Quality statements - vision, mission, and policy.

TQM PRINCIPLES **9**

Continuous Improvement Process - Deming Philosophy - Juran Trilogy - PDSA cycle - Kaizen - Concepts of Quality circle - Japanese 5S principles and 8D methodology.

TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability - Bench marking: Reasons for benchmarking, Benchmarking process, Understanding Current Performance, Planning, Pitfalls and Criticisms of Benchmarking - FMEA: Intent, Documentation, Stages: Design FMEA and Process FMEA.

TQM TOOLS & TECHNIQUES II **9**

Quality circles - Quality Function Deployment: QFD Team - Benefits of QFD - Voice of the customers - Organization of Information - House of Quality - QFD Process - Taguchi quality loss function - TPM: Concepts, improvement needs - Performance measures - Cost of Quality.

QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEM **9**

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards - Sector Specific Standards: AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements - Implementation - Documentation - Internal Audits - Registration - ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001 - Benefits of EMS.

d. Activities

Students shall be exposed to learn the knowledge and skills necessary to drive organizational excellence through the implementation of effective quality management strategies.

e. Learning Resources

Text Books

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, *Total Quality Management*, Revised 3rd Edition, Pearson Education Asia, 2013.
2. Suganthi L & Anand Samuel, *Total Quality Management*, Prentice Hall Publications, 2004.

Reference Books

1. Kiran.D.R, *Total Quality Management: Key concepts and case studies*, Butterworth – Heinemann Limited, 2016.
2. Shridhara Bhat K, *Total Quality Management: Text and Cases*, Himalaya Publishing House India, 2nd Edition, 2016.

Course Code	Course Name	L	T	P	C
MT2451	PROJECT WORK	0	0	20	10

Category: Employability Enhancement Course

a. Preamble

This course focuses on developing the skills necessary to formulate real-world problems and project goals, identifying project tasks using established procedures, learning new tools and techniques, and understanding product validation and cost-effectiveness analysis. Additionally, it provides guidance on preparing reports for oral demonstrations, enhancing students' project management and communication abilities.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Identify specific problems prevailing in the society or industry in the field of Mechatronics Engineering& allied areas.	K3
CO2	Utilize effective research methodologies and information retrieval techniques to conduct a thorough literature survey addressing the identified problem	K3
CO3	Integrate various systems into one Mechatronics product.	K4
CO4	Develop an appropriate solution for the identified problem using modern tool or methodology.	K3
CO5	Impart communication and presentation skills through effective documentation and delivery.	K3

Total : 300 Periods

c. Course Instruction

Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a Mechatronics project. However, special considerations can be given for interdisciplinary measurement and computer-based simulation projects. This exception should be recorded and approved by the department committee. Management related projects will not be allowed. The interdisciplinary projects will carry more weightage. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

Course Code	Course Name	L	T	P	C
OMT701	INTRODUCTION TO PLC PROGRAMMING	3	0	0	3

Category: Open Elective Course

a. Preamble

This course promotes the students to understand the basic PLC terminologies, digital principles, PLC architecture and operation. This course also enables the students to familiarize the different programming language of PLC and develop PLC logic for simple applications using ladder logic.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the basic requirement of a PLC input/output devices and architecture.	K2
CO2	Make use of basic Instruction Sets used for ladder Logic and Function Block Programming.	K3
CO3	Choose Timer/Counter, Arithmetic and Logic Instructions for Ladder Logic and Function Block programming	K3
CO4	Interpret the Concepts of Communication protocols used for PLC/SCADA	K2
CO5	Develop Ladder logic for a specific application on real world problems.	K3

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO PLC **9**

Introduction to PLC - Principles of operation - PLC Architecture and specifications - Different Manufactures of PLC - PLC hardware components Analog & digital I/O modules, Special I/O Modules - Addressing component of I/O -CPU & memory module of PLC.

PLC INSTRUCTIONS **9**

PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions - PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung) - Configuration of Sensors, Switches, Solid State Relays-Interlock examples - Timers, Counters, Examples.

PLC PROGRAMMING **9**

Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions

SCADA AND COMMUNICATION PROTOCOLS OF PLC **9**

SCADA: Hardware and software, Remote terminal units, Master Station and Communication architectures Communication Protocol - Modbus, HART, Profibus - Communication facilities.

CASE STUDIES **9**

Stepper Motor Control- Automatic bottle filling - CNC Machine Control - conveyor control for simple material handling systems - Interlocking applications using Siemens PLC.

d. Activities

Students shall be exposed to the basics of PLC programming in the college premises.

e. Learning Resources

Text Books

1. Frank Petruzzula, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication

Reference Books

1. MadhuchanndMitra and Samerjit Sengupta, Programmable Logic Controllers Industrial Automation an Introduction, Penram International Publishing Pvt. Ltd
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles and Applications, Pearson publication

Course Code	Course Name	L	T	P	C
OMT702	LOW COST AUTOMATION	3	0	0	3

Category: Open Elective Course

a. Preamble

This course promotes students to familiarize the basic usage of hydraulic, pneumatic and electronic system for low-cost automation.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the concept of automation in industries.	K2
CO2	Summarize the usage of hydraulic system in automation	K2
CO3	Explain the usage of pneumatic system in automation	K2
CO4	Explain the usage of electronic system in automation	K2
CO5	Summarize the type and configuration of assembly automation	K2

c. Course Syllabus **Total : 45 Periods**

FUNDAMENTAL CONCEPTS OF AUTOMATION **9**

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

AUTOMATION USING HYDRAULIC SYSTEMS **9**

Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, and intensifiers etc. - Selection of hydraulic fluid, practical case studies on hydraulic circuit design - Various valves and their applications.

AUTOMATION USING PNEUMATIC SYSTEMS **9**

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - Pneumatic equipments - selection of components - design calculations - application - fault finding – hydro pneumatic circuits - use of ARM Controller for sequential circuits.

AUTOMATION USING ELECTRONIC SYSTEMS **9**

Introduction - various sensors - transducers - signal processing - servo systems - basic

programming of arduino controllers.

AUTOMATED HANDLING AND STORAGE **9**

Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

d. Activities

Students shall be exposed to the different hydraulic, pneumatic and electronic machine parts in the college premises.

e. Learning Resources

Text Books

1. Anthony Esposito, 2013, Fluid Power with applications, Prentice Hall international.
2. Mikell P Groover, 2016, Automation, Production System and Computer Integrated. Manufacturing, Prentice Hall Publications.

Reference Books

1. Kuo .B.C, 2012, Automatic control systems, Prentice Hall India, New Delhi
2. Mujumdar.S.R, 2006,Pneumatic System, Tata McGraw Hill

Course Code	Course Name	L	T	P	C
OMT703	SENSORS AND ACTUATORS	3	0	0	3

Category: Open Elective Course

a. Preamble

This course promotes students to understand the concepts of measurement technology and to learn the various sensors used to measure various physical parameters. This course also enables the students to learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the processes involved in applying various calibration techniques to different sensor types.	K2
CO2	Summarize the principles of operation involved in variable resistance and inductance sensors.	K2
CO3	Explain the basic principles of force, magnetic and heading sensors.	K2
CO4	Summarize the operation of the actuators and electronic control.	K2
CO5	Illustrate the role of temperature control actuators for vehicles	K2

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO MEASUREMENTS AND SENSORS 9

Units and standards- Calibration methods- Classification of errors- Error analysis- Statistical methods - principle of operation of transducers -Classification of transducers - Selection of transducers - Static characteristics - Dynamic characteristics of transducers for standard test inputs.

VARIABLE RESISTANCE AND INDUCTANCE SENSORS 9

Principle of operation- Constructional details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive transducers: – Principle of operation, construction details, characteristics and applications of LVDT - Variable reluctance transducers- Synchros, Microsyn

VARIABLE CAPACITANCE AND OTHER SPECIAL SENSORS **9**

Variable air gap type, variable area type and variable permittivity type - capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor - Smart transducers- Environmental Monitoring sensors (Water Quality & Air pollution) - Thick & Thin Film sensors (Bio sensor & Chemical Sensor)

ACTUATORS **9**

Pneumatic actuation cylinders, Hydraulic actuation, Electric Actuation- Relay, Solenoid, Thyristors, Triac - Motor Actuators - AC Motor, DC Motor, Stepper Motors - Control Valves Actuators, MEMS valves.

AUTOMATIC TEMPERATURE CONTROL ACTUATORS **9**

Different types of actuators used in automatic temperature control - Fixed and variable displacement temperature control - Semi Automatic controller design for Fixed and variable displacement type air conditioning system.

d. Activities

Students shall be exposed to the different signal conditioning, data acquisition and communication systems in the college premises.

e. Learning Resources

Text Books

1. Ernest O Doebelin, “Measurement Systems - Applications and Design”, Tata McGraw-Hill, 2019.
2. Robert Brandy, “ Automotive Electronics and Computer System”, Prentice Hall,2001

Reference Books

1. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015.
2. Krishna Kant., 2010,*Computer Based Process Control*, Prentice Hall of India.
3. James D Halderman, “ Automotive Electrical and Electronics” , Prentice Hall, USA, 2013