MSME TECHNOLOGY CENTRE, KANPUR

(GOVT. OF INDIA)

Syllabus for Diploma Course

(FOR II AND III YEAR)

Mechatronics and Industrial Automation

(UNDER AFFILIATION OF BOARD OF TECHNICAL EDUCATION, UTTAR PRADESH)

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

CURRICULUM OF DIPLOMA IN MECHATRONICS AND INDUSTRIAL AUTOMATION

MSME TECHNOLOGY CENTRE, KANPUR

w.e.f. 2026-27

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PREFACE

An important issue generally debated amongst the planners and educator's world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization have created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and opens economy in the last few decades. To cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives are being taken by the State Board of Technical Education, UP to revise the existing curricula as per the needs of the industry and make NSQF compliant.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove out dated and redundant courses, develop innovative methods of course offering and thereby infuse the much-needed dynamism in the system.

F.R. Khan
Director
Institute of Research Development & Training

1. ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following persons:

1. Sh. Narendra Kumar Bhushan, IAS Additional Chief Secretary, Technical Education Govt. of U.P. for his exemplary vision & approach.

2. Sh. F. R. Khan Director I.R.D.T. Kanpur continually motivating, guiding and taking keen interest in the review of the curriculum.

3. All the participants from Polytechnics and other technical institutions for their professional input during curriculum workshops.

4. CDC Officer and others concerning staff of IRDT for their support and assistance in conducting curriculum workshops.

(Mohd Nadeem)
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Curriculum In-charge
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2. SALIENT FEATURES

1. Name of the Programme	Diploma in Mechatronics & Industrial Automation.
2. Duration of the Programme	➢ Three years (Six Semesters)
3. Entry Qualification	➢ Matriculation or equivalent NEP-2020/NSQF Level 5 as Prescribed by State Board of Technical Education, U.P.
4. Pattern of the Programme	➢ Semester System
5. Ratio between theory and Practice	➢ 40% (Theory) / 60% (Practical)

1) <u>Industrial Training/Internship:</u>

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation.Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) <u>Audit & Pathways</u>:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge & Tradition, Indian Constitution, Entrepreneurship & Startup, subjects on Environmental Studies have been incorporated in the curriculum.

3) <u>Student Centered Activities</u>:

A provision of 4-8 hrs. per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise co– curricular activities such as expert lectures, classroom seminars, games, hobby club like photography, painting, singing etc. declamation contests, field visits, NCC, NSS and other cultural activities, etc.

4) <u>Project work:</u>

Micro/Mini/Major project work has been included in the curriculum to enable the student to get familiarized with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

3. EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN MECHATRONICS & INDUSTRIAL AUTOMATION

Keeping present scenario in view following employment opportunities are visualized in different sectors of employment for diploma holders in Mechatronics & Industrial Automation.

1. MANUFACTURING INDUSTRY

Mechatronics & industrial automation diploma holder will be able to execute following activities:

- Industrial robot manufacturing and integration companies
- Automated production system design firms
- Smart factory and Industry 4.0
- Steel plants and fabrication units
- Hydraulic and pneumatic system-controlled machines
- Material handling cranes and conveyors
- Car, bike, and commercial vehicle production plants
- Robotic welding, painting, and assembly lines
- CNC machine manufacturing and operation
- Lathe, milling, and grinding machine automation
- Tool handling and automated machining systems
- Food, beverage, and packaged goods production
- Bottling plants, filling machines, and packaging lines
- Conveyor-based automated sorting and packing
- Use of PLC and Microcontrollers.

2. GOVERNMENT DEPARTMENTS SUCH AS RAILWAYS, DEFENSE MANUFACTURING, POWER GENERATION & DISTRIBUTION SECTOR, OIL & GAS GOVERNMENT INDUSTRIES, SPACE & RESEARCH ORGANIZATIONS, WATER TREATMENT & MUNICIPAL AUTOMATION, TELECOMMUNICATIONS & ELECTRONICS SECTOR AND OTHER BOARDS AND CORPORATIONS

The Mechatronics & industrial automation diploma holder will be able to execute following type of activities in above mentioned Government Departments:

- Operate pump automation systems in water treatment plants
- Monitor electrical distribution systems in public utilities
- Support automation systems in smart city and municipal projects
- Assist in installation of PLC panels, motors, sensors, drives, and automation equipment
- Support commissioning of industrial machines and control systems
- Check wiring connections, I/O modules, and field devices Inventory Management
- Operate PLC, SCADA, and HMI-based industrial systems
- Monitor automated production and utility systems
- Observe process parameters and maintain smooth system operation
- Programming of PLC
- Perform preventive maintenance of electrical and automation equipment
- Troubleshoot faults in PLC systems, relays, contactors, and sensors
- Replace defective components and restore system operation
- Handle industrial sensors, transducers, and measuring instruments
- Test and calibrate field instruments and control devices
- Maintain signal transmission systems used in automation

- Assist in control panel wiring and assembly
- Read electrical drawings and automation schematics
- Inspect MCC panels, relay circuits, and protection systems
- Support SCADA monitoring systems used in utilities and industries
- Assist in industrial communication and networking setup

3. SELF-EMPLOYMENT

Following type of self-employment opportunities are available to the diploma holder in Mechatronics & Industrial Automation:

- PLC & Industrial Automation Service Center
- Control Panel Manufacturing & Wiring
- Electrical & Industrial Maintenance Contractor
- CNC & Machine Maintenance Services
- Robotics & Automation Training Center
- Sensor & Instrumentation Service Business
- Solar Automation & Renewable Energy Services
- Micro controller-based systems for different applications

4. (A) PROGRAM OUTCOMES (POS) for Diploma in Mechatronics & Industrial Automation

PO1: Basic and Discipline-Specific Knowledge
Apply knowledge of basic mathematics, science, engineering fundamentals, and the specialization of Mechatronics & industrial automation to solve well-defined engineering problems.

PO2: Problem Analysis
Identify, analyze, and solve well-defined engineering problems related to Electrical and electric vehicle systems using codified standard methods.

PO3: Design/Development of Solutions
Design solutions for well-defined technical problems and assist in designing systems, components, or processes for electrical and electric vehicle applications that meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing
Apply modern engineering tools and appropriate techniques to conduct standard tests and measurements on electrical and electric vehicle systems.

PO5: Engineering Practices for Society, Sustainability, and Environment
Apply appropriate technology in the context of society, sustainability, environment, and ethical engineering practices.

PO6: Project Management and Communication
Use engineering management principles as an individual, a team member, or a leader to manage projects and communicate effectively about well-defined engineering activities.

PO7: Life-long Learning
Analyze individual learning needs and engage in continuous professional development to adapt to technological changes in the electrical and electric vehicle industry.

4. (B) LEARNING OUTCOMES OF THE PROGRAM

After undergoing this program, students will be able to:	
1.	Analyze robotic applications in manufacturing and automation industries.
2.	Understand robot construction, drives, and control systems.
3.	Interface PLCs with industrial communication systems.
4.	Monitor and control processes using SCADA software.
5.	Maintain hydraulic and pneumatic systems safely.
6.	Understand hydraulic and pneumatic system components.
7.	Perform automated machining operations.
8.	Understand fundamental mechanical engineering principles and concepts.
9.	Understand basic electrical circuits and components & Analyze AC/DC circuits and electrical measurements.
10.	Understand analog and digital electronic devices and circuits & Design and troubleshoot electronic systems.
11.	Understand precision measurement techniques and standards & Use measuring instruments accurately.
12.	Troubleshoot various electrical faults.
13.	Develop programming skills using C and C++ & Understand object-oriented

	programming concepts.
14.	Apply principles of mini hydro plants, fuel cells, thermoelectric power, geothermal, and tidal energy systems.
15.	Create 2D and 3D engineering drawings using AutoCAD.
16.	Gain practical skills in machining, fitting, welding, and fabrication.
17.	Understand principles of analog and digital communication systems.
18.	Apply appropriate procedures for environmental protection and energy conservation.
19.	Operate and maintain indoor and outdoor substations.
20.	Understand properties and behavior of engineering materials..
21.	Understand IoT architecture and communication protocols.
22.	Understand measurement principles and instrumentation systems.
23.	Understand open-loop and closed-loop control systems & Analyze system stability and performance.
24.	Plan and execute tasks/projects effectively as a team member or leader.
25.	Integrate mechanical, electrical, and electronic systems.
26.	Understand architecture and operation of microprocessors and microcontrollers.
27.	Understand the history, principles, and key interpretations of the Indian Constitution.
28.	Demonstrate awareness and take precautions regarding various types of disasters.
29.	Understand power electronic devices and industrial circuits.
30.	Understand embedded hardware and software concepts & Develop embedded applications using microcontrollers.
31.	Apply cumulative knowledge and skills to solve real-world problems or industry-based projects.
32.	Plan and execute minor projects related to Mechatronics & Industrial Automation Technology.

5. ABSTRACT OF CURRICULUM AREAS

PROGRAM CORE COURSES

- MECHANICAL ENGINEERING SCIENCE
- ELECTRICAL ENGINEERING SCIENCE
- ANALOG & DIGITAL APPLIED ELECTRONICS
- ENGINEERING METROLOGY
- COMPUTER PROGRAMING-C , C++, UNIX
- AUTO CAD
- WORK SHOP PRACTICE
- COMMUNICATION SYSTEM & ITS APPLICATION
- MATERIAL TECHNOLOGY
- INTERNET OF THINGS & ITS APPLICATION
- MEASURING SYSTEM
- CONTROL SYSTEM ITS APPLICATION
- MECHATRONICS SYSTEM
- PLC LAB
- CAM & CNC LAB PRACTICE
- MICROPROCESSOR & MICROCONTROLLER
- INDUSTRIAL ELECTRONICS & ITS APPLICATION
- EMBEDDED SYSTEM & ITS APPLICATION
- CNC TECHNOLOGY
- HYDRAULICS AND PNEUMATICS
- INDUSTRIAL AUTOMATION
- ROBOTICS & ITS APPLICATION

PROGRAM ELECTIVE COURSES

- PROGRAM ELECTIVE - 1
  1. COMPUTER PROGRAMMING – MS ACCESS, VB NETWORK
  2. SENSORS AND TRANSDUCER
- PROGRAM ELECTIVE – 2
  1. QUALITY MANAGEMENT
  2. MECHANICS OF MATERIAL
- PROGRAM ELECTIVE-3
  1. DIGITAL SIGNAL PROCESSING
  2. AUTOMATION AND CONTROL

- ADVANCE SKILL DEVELOPMENT (Open Elective-1)
- ADVANCE SKILL DEVELOPMENT (Open Elective-2)
- ADVANCE SKILL DEVELOPMENT (Open Elective-3)

- SUMMER INTERNSHIP** (4 WEEKS)
- SUMMER INTERNSHIP** (6 WEEKS)

PROJECT WORK, SEMINAR & INTERNSHIP IN INDUSTRY

- INTERNSHIP / IN-HOUSE PROJECT

AUDIT COURSES

- ESSENCE OF INDIAN KNOWLEDGE AND TRADITION
- INDIAN CONSTITUTION

6. STUDY AND EVALUATION SCHEME FOR MECHATRONICS & INDUSTRIAL AUTOMATION

MSME TECHNOLOGY CENTRE, KANPUR															
SCHEME FOR DIPLOMA IN MECHATRONICS & INDUSTRIAL AUTOMATION															
THIRD SEMESTER															
	SUBJECTS	COURSE TITLE & CATEGORY	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks
			Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	MECHANICAL ENGINEERING SCIENCE	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
3.2	ELECTRICAL ENGINEERING SCIENCE	PROGRAMME CORE (THEORY/PRACTICAL)	2	0	4	4	40	60	100	60	3	40	3	40	**200**
3.3	ANALOG & DIGITAL APPLIED ELECTRONICS	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
3.4	ENGINEERING METROLOGY	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
3.5	COMPUTER PROGRAMING-C , C++, UNIX	PROGRAMME CORE (PRACTICUM)	1	0	2	2	-	60	60	-	-	40	3	40	**100**
3.6	PROGRAMME ELECTIVE 1 1. Computer Programming – MS Access, VB Network 2. Sensors And Transducer	PROGRAMME CORE (THEORY)	2	-	-	2	40	-	40	60	3	-	-	60	**100**
3.7	AUTO CAD	PROGRAMME CORE (PRACTICAL)	0	0	4	2	-	60	60	-	-	40	3	40	**100**
3.8	WORK SHOP PRACTICE	PROGRAMME CORE (PRACTICAL)	0	0	4	2	-	60	60	-	-	40	3	40	**100**
3.9	SUMMER INTERNSHIP (IV WEEK)		-	-	-	2	50	-	50	-	-	-	-	-	**50**
#Student Centred Activities (SCA)			-	-	11	-	-	50	50	-	-	-	-	-	**50**
Total			**11**	**0**	**25**	**20**	**250**	**290**	**540**	**300**	**15**	**160**	**12**	**460**	**1000**

NOTE: -

MSME TECHNOLOGY CENTRE, KANPUR **Email:- info@msmetckanpur.org**

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

1. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.
2. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
3. Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

MSME TECHNOLOGY CENTRE, KANPUR

SCHEME FOR DIPLOMA IN MECHATRONICS &INDUSTRIAL AUTOMATION

FOURTH SEMESTER

	SUBJECTS	COURSE TITLE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	COMMUNICATION SYSTEM & ITS APPLICATION	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
4.2	MATERIAL TECHNOLOGY	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
4.3	INTERNET OF THINGS & ITS APPLICATION	PROGRAMME CORE (PRACTICUM)	1	0	2	2	-	60	60	-	-	40	3	40	**100**
4.4	MEASURING SYSTEM	PROGRAMME CORE (PRACTICUM)	2	0	2	3	-	60	60	-	-	40	3	40	**100**
4.5	CONTROL SYSTEM ITS APPLICATION	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
4.6	MECHATRONICS SYSTEM	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
4.7	PROGRAMME ELECTIVE 2 1. Quality Management 2. Mechanics Of Material	CORE PROGRAMME (THEORY)	1	0	0	1	40	-	40	60	3	-	-	60	**100**
4.8	ADVANCED SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-1 (THEORY)	2	-	-	2	50*	-	50*	-	-	-	-	-	**N/A**
4.9	PLC LAB	CORE PROGRAMME (PRACTICAL)	0	0	4	2	-	60	60			40	3	40	**100**
4.10	CAM & CNC LAB PRACTICE	CORE PROGRAMME (PRACTICAL)	0	0	4	2	-	90	90	-	-	60	3	60	**150**
4.11	(Q) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	AUDIT COURSE	2	0	0	0	50*	-	50*						**N/A**
#Student Centred Activities (SCA)			-	-	8	-	-	50	50	-	-	-	-	-	**50**
Total			**16**	**0**	**20**	**20**	**200**	**320**	**520**	**300**	**15**	**180**	**12**	**480**	**1000**

NOTE –

1. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.
2. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
3. Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

MSME TECHNOLOGY CENTRE, KANPUR

SCHEME FOR DIPLOMA IN MECHATRONICS &INDUSTRIAL AUTOMATION

FIFTH SEMESTER

	SUBJECTS	COURSE TITLE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	MICROPROCESSOR & MICROCONTROLLER	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
5.2	INDUSTRIAL ELECTRONICS & ITS APPLICATION	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
5.3	EMBEDDED SYSTEM & ITS APPLICATION	PROGRAMME CORE (THEORY/PRACTICAL)	2	0	4	4	40	30	70	60	3	20	3	80	**150**
5.4	CNC TECHNOLOGY	PROGRAMME CORE (THEORY/PRACTICAL)	2	0	2	3	40	60	100	60	3	40	3	100	**200**
5.5	HYDRAULICS AND PNEUMATICS	PROGRAMME CORE (THEORY/PRACTICAL)	2	0	2	3	40	60	100	60	3	40	3	100	**200**
5.6	ADVANCED SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-2 (THEORY)	2	-	-	2	50*	-	50*	-	-	-	-	-	**N/A**
5.7	PROGRAMME ELECTIVE -3 1. Digital Signal Processing 2. Automation And Control	CORE PROGRAMME (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
5.8	(Q) INDIAN CONSTITUTION	AUDIT COURSE	2	-	-		50*	-	50*	-	-	-	-	-	**N/A**
5.9	SUMMER INTERNSHIP (VI WEEK)					2		60	60			40	3	40	**100**
#Student Centred Activities (SCA)			-	-	12	-	-	50	50	-	-	-	-	-	**50**
Total			**16**		**20**	**20**	**240**	**260**	**500**	**360**	**18**	**140**	**12**	**500**	**1000**

NOTE –

1. (Q) - It is compulsory to appear & to pass in examination, but marks will not be included for division and percentage of obtained marks.
2. Students will submit the certificate.

3. ** Students will present a seminar/viva on their summer internship along with certificate, project and report.
4. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

MSME TECHNOLOGY CENTRE, KANPUR

SCHEME FOR DIPLOMA IN MECHATRONICS & INDUSTRIAL AUTOMATION

SIXTH SEMESTER

	SUBJECTS	COURSE TITLE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	INDUSTRIAL AUTOMATION	PROGRAMME CORE (THEORY/PRACTICAL)	1	0	2	2	40	60	100	60	3	40	3	100	**200**
6.2	ENTREPRENEURSHIP & START UPS*	PROGRAMME CORE (THEORY)	2	0	0	2	40	-	40	60	3	-	-	60	**100**
6.3	ROBOTICS & ITS APPLICATION	PROGRAMME CORE (THEORY/PRACTICAL)	1	0	2	2	40	60	100	60	3	40	3	100	**200**
6.4	IN- HOUSE- PROJECT		4	0	16	12	-	270	270	-	-	180	3	180	**450**
6.5	ADVANCED SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-3 (THEORY)	2	-	-	2	50*	-	50*	-	-	-	-	-	**N/A**
#Student Centred Activities (SCA)			-	-	6	-	-	50	50	-	-	-	-	-	**50**
Total			**10**	**0**	**26**	**20**	**120**	**440**	**560**	**180**	**9**	**260**	**9**	**440**	**1000**

NOTE: -

1. # Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.
2. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
3. Advance skill development mention at 6.4 in the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs. (Offline/Online).

OPEN ELECTIVE-1

Sr. No.	(Q) THEORY COURSES NAME
1.	ENGINEERING ECONOMICS & ACCOUNTANCY (Course offered by Polytechnic Institute)
2.	DISASTER MANAGEMENT (Course offered by Polytechnic Institute)

OPEN ELECTIVE-2

Sr. No.	(Q) THEORY COURSES NAME
1.	ECONOMIC POLICIES IN INDIA (Course offered by Polytechnic Institute)
2.	PROJECT MANAGEMENT (Course offered by Polytechnic Institute)

OPEN ELECTIVE-3

Sr. No.	(Q) THEORY COURSES NAME
1.	ARTIFICIAL INTELLIGENCE (Course offered by Polytechnic Institute)
2.	RENEWABLE ENERGY TECHNOLOGIES (Course offered by Polytechnic Institute)

PROGRAME ELECTIVE-1

Sr. No.	SUBJECT NAME
1.	COMPUTER PROGRAMMING – MS ACCESS, VB NETWORK
2.	SENSORS AND TRANSDUCER

PROGRAME ELECTIVE-2

Sr. No.	SUBJECT NAME
1.	QUALITY MANAGEMENT
2.	MECHANICS OF MATERIAL

PROGRAME ELECTIVE-3

Sr. No.	SUBJECT NAME
1.	DIGITAL SIGNAL PROCESSING
2.	AUTOMATION AND CONTROL

7. DETAILED CONTENTS OF VARIOUS SUBJETS

THEORY	3.1 MECHANICAL ENGINEERING SCIENCE	L	T	P
		2	-	-

COURSE OBJECTIVE

The objective of this course is to provide students with a fundamental understanding of mechanical engineering concepts, engineering materials, machine elements, manufacturing processes, and conventional as well as non-conventional machining techniques. The course aims to develop analytical, technical, and practical skills required for the selection, operation, and application of mechanical systems and manufacturing technologies while emphasizing engineering ethics, quality, and safety practices.

COURSE OUTCOMES (COS)

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

CO1: Explain the history, evolution, and basic principles of mechanical engineering including force, motion, work, energy, power, units, dimensions, and professional ethics.

CO2 : Analyze stress-strain behavior and evaluate the mechanical properties of materials under different loading conditions such as tension, compression, bending, torsion, and shear.

CO3 : Identify and select appropriate machine elements such as gears, bearings, shafts, couplings, and fasteners for engineering applications while considering safety and quality requirements.

CO4 : Describe and compare various manufacturing processes including casting, forming, machining, joining, CNC machining, additive manufacturing, and smart manufacturing systems.

CO5 : Demonstrate understanding of conventional machining operations using lathe, milling, and grinding machines along with their accessories, attachments, and applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	1	2	2	2	*	*
CO2	3	3	2	2	1	1	2	*	*
CO3	3	3	3	2	2	1	2	*	*
CO4	3	2	2	3	2	1	2	*	*
CO5	2	2	2	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Engineering (04 Periods)

History and evolution of mechanical engineering, Basic mechanical engineering principles (force, motion, energy, work, power), Units and dimensions, SI system, Ethics and professionalism in engineering.

UNIT 2 Mechanics of Materials and Structures (05 Periods)

Stress and strain, types of stresses (tensile, compressive, shear), Elasticity and plasticity, Mechanical properties of materials (strength, toughness, hardness), Introduction to bending, torsion, and axial loading, Simple structural analysis and design concepts.

UNIT 3 Machine Elements (03 Periods)

Gears, bearings, shafts, fasteners, couplings, Selection of machine components, Quality control and safety in mechanical engineering.

UNIT 4 Manufacturing Processes (04 Periods)

Casting, forming, machining & joining processes, CNC and additive manufacturing, overview of smart manufacturing.

UNIT 5 Machine Process (12 Periods)

Conventional machines and machining processes :types of lathe, lathe accessories & attachments and lathe operation, types of milling, milling accessories & attachments and milling operation, types of surface grinding, surface grinding accessories & attachments and surface grinding operation, types of cylindrical grinding, cylindrical grinding accessories & attachments and cylindrical grinding operation.

Non-conventional machines and machining process: EDM machines, types of electrode materials and EDM process, WEDM machines and machining operations. Wire materials and coatings.
Types of additive machine and machining processes (polymer and metal)

INSTRUCTIONAL STRATEGY

Instructional strategies in Materials Engineering are teaching methods used to help students understand the structure, properties, processing, and applications of engineering materials. Because the subject combines theory, experimentation, and industrial applications, effective teaching should include both conceptual and practical approaches.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Attendance
4. Sessional Test

RECOMMENDED BOOKS:

1. Wickert, J., & Lewis, K. (2016). An Introduction to Mechanical Engineering. Cengage Learning.
2. Rajput, R. K., (2017). Fundamentals of Mechanical Engineering, Laxmi Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	4	14
II	5	18
III	3	11
IV	4	14
V	12	43
Total	**28**	**100%**

MSME TECHNOLOGY CENTRE, KANPUR **Email:- info@msmetckanpur.org**

(THEORY/PRACTICAL)	3.2 ELECTRICAL ENGINEERING SCIENCE	L	T	P
		2	-	4

COURSE OBJECTIVE:

The objective of this course is to provide students with fundamental knowledge of electrical circuits, AC/DC circuit analysis, electrical measuring instruments, transformers, and rotating electrical machines. The course aims to develop analytical skills for solving electrical engineering problems and understanding the operation, characteristics, and applications of electrical devices and machines used in engineering systems.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Understand and apply basic electrical laws and network theorems such as Ohm's Law, KCL, KVL, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer, Millman's theorem, and Star-Delta transformation for the analysis of DC circuits.

CO2: Analyze the behavior and performance of R-L, R-C, and R-L-C AC circuits under sinusoidal excitation using phasor concepts, resonance principles, Q-factor, bandwidth, and time constant calculations.

CO3: Explain the construction, working principles, and applications of electrical measuring instruments including moving coil, moving iron, dynamometer, induction type instruments, wattmeter's, and CRO, and apply them for electrical measurements.

CO4: Understand the construction, operation, equivalent circuit, efficiency, voltage regulation, and applications of single-phase transformers and auto transformers.

CO5: Describe the construction, operating principles, characteristics, and industrial applications of DC machines and three-phase induction motors, including torque-speed characteristics and performance analysis.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	3	2	2	1	1	1	*	*
CO2	3	3	2	2	1	1	1	*	*
CO3	3	2	2	3	1	2	1	*	*
CO4	3	3	2	2	2	1	1	*	*
CO5	3	3	2	2	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT – I Circuit Analysis (06 Periods)

Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of dc circuits.

Practical's:

1) Verification of Ohm's Law
2) Verification of Kirchhoff's Current Law
3) Verification of Kirchhoff's Voltage Law

UNIT – II A.C.Circuits (06 Periods)

R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Practical's:

1) Study of series R-L circuit and measurement of impedance
2) Study of series R-C circuit and measurement of impedance
3) Study of series R-L-C circuit characteristics
4) Measurement of Q-factor and bandwidth of resonant circuit

UNIT III: Basics of Transmission and Distribution (05 Periods)

Single line diagrams with components of the electric supply transmission and distribution systems, Classification of transmission lines: Primary and secondary transmission; standard voltage level, Classification of transmission lines: based on type of voltage, voltage level, length and others Characteristics of high voltage for power transmission. Method of construction of electric supply transmission system – 110 kV, 220 kV, 400 kV. Method of construction of electric supply distribution systems – 220 V, 400V, 11 kV, 33 kV.

Practical's:

1. Study of transmission line

UNIT – IV Transformers (05 Periods)

Construction and Working principles and phasor diagrams of Single-phase Transformer, Emf equation, Equivalent circuit, Regulation and efficiency, and Auto transformer.

Practical's:

1) Determination of equivalent circuit parameters of transformer.
2) Study of constructional details of single-phase transformer.
3) Study of constructional details of single-phase transformer.

UNIT-V Rotating Machines (06 Periods)

Construction and working principles of dc motor and generator and its characteristics Applications of DC machines , Construction and working principles of 3-phase Induction motor, Torque-speed characteristics, and Industrial applications.

Practical's:

1) Study of constructional details of DC motor
2) Study of constructional details of DC generator
3) Speed control of DC shunt motor

INSTRUCTIONAL STRATEGY

Instructional strategies for Electrical Engineering (EE) science focus on bridging abstract mathematical and physical theories with practical engineering applications. Effective strategies emphasize active learning**,** hands-on experimentation**,** and progressive practical training to build foundational knowledge, analytical skills, and engineering judgment.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. P.C. Sen "Principles of Electric Machines and Power Electronics", Wiley Eastern 2003.
2. Vincent DEL TORO "Electrical Engineering Fundamental's Prentice Hall India", Ed 2002.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	6	22
II	6	22
III	5	17
IV	5	17
V	6	22
Total	**28**	**100%**

THEORY	3.3 ANALOG & DIGITAL APPLIED ELECTRONICS	L	T	P
		2	-	-

COURSE OBJECTIVES

1. To develop understanding of basic electronic power supply circuits, rectifiers, filters, voltage regulators, and IC regulators used in electronic systems.
2. To explain the principles and applications of oscillators, operational amplifiers, active filters, IC 555 timer, and PLL circuits in analog electronics.
3. To build foundational knowledge of number systems, binary arithmetic, digital codes, and their conversions used in digital electronics.
4. To familiarize students with logic gates, Boolean algebra, Karnaugh maps, combinational logic circuits, and digital circuit simplification techniques.
5. To introduce sequential logic circuits including flip-flops, shift registers, and counters for digital system applications.

COURSE OUTCOMES:

CO1 : Explain the working and analyze the performance of rectifiers, filters, voltage regulators, and IC regulator circuits used in DC power supplies.

CO2 : Understand and apply the concepts of oscillators, operational amplifiers, active filters, IC 555 timer, and PLL circuits in electronic applications.

CO3 : Perform number system conversions, binary arithmetic operations, and apply digital codes such as ASCII and Gray code in problem solving.

CO4 : Analyze and design digital logic circuits using logic gates, Boolean algebra, K-maps, multiplexers, decoders, encoders, adders, and subtractors.

CO5 : Explain the operation and applications of flip-flops, shift registers, and counters in sequential digital systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	3	2	3	2	1	1	*	*
CO2	3	3	3	3	2	1	1	*	*
CO3	3	2	1	3	1	1	1	*	*
CO4	3	3	3	3	2	2	1	*	*
CO5	3	3	3	3	2	2	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Power Supplies: (04 Periods)

Circuit arrangement and operation of:- Half wave rectifier, Full wave rectifier ,Bridge rectifier.
Filter:- Necessity of filters , L type and Pi type filters.
Voltage Regulators: Zener diode regulator, Series voltage regulator
IC Voltage Regulators: IC 723,IC 78XX and 79XX.

UNIT 2 Oscillators And Linear Integrated Circuits: (08 Periods)

Principle of Sine Wave Oscillator - Use of positive feedback. Barkhausen's Criteria for sustained oscillation. Crystal oscillator with Circuit arrangement, Differential Amplifier, Block diagram of operational amplifier, Op-Amp used as: Inverting amplifier, Non-inverting amplifier, Subtractor ,Differentiator, Integrator ,Schmitt trigger. Hartley and RC Phase shift Oscillators using OP-AMP , Advantage of active filters over passive filters, Low pass, high pass, band pass and band stop filters Circuit arrangement and operation. IC 555: Circuit arrangement, Operation as monostable, bistable and astable mode. Phase Lock Loop (PLL).

UNIT 3 Number system and codes (05 Periods)

Number system: Binary, Octal, Decimal, and Hexadecimal, Conversion: Binary-Decimal, Decimal-Binary. 1's and 2's complement of binary number, Binary arithmetic: Addition, Subtraction & Multiplication, short note on ASCII & Gray code ,Conversion: Binary-Gray, Gray-Binary.

UNIT 4 Logic gates (07 Periods)

Study the symbol, truth table, and logic expression for the following logic gates AND, OR, NOT, NOR, NAND, EX-OR, and EX-NOR, Realization of logic gates using NAND & NOR, Define: propagation delay, power dissipation, DE Morgan's theorem, SOP & POS Boolean expressions, K-map, Simplification of Boolean expression using: k-map, and Boolean algebra, adder, subtractor, multiplexer (4:1), DE multiplexer (1:4), encoder, decoder.

UNIT 5 Flip-Flops (04 Periods)

Define flip-flop, SR flip-flop, D flip-flop, T flip-flop, and JK flip-flop, Introduction of shift registers and counter, Basic of A/D & D/A Converter.

INSTRUCTIONAL STRATEGY

Instructional strategies for Analog and Digital Applied Electronics focus on moving away from purely theoretical, teacher-cantered lectures towards student-centered, project-based learning (PBL)**.** Modern pedagogy emphasizes "learning by doing" to build practical skills, addressing the complexity of analog circuits and the necessity of digital logic in modern systems.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Attendance
4. Sessional Test

RECOMMENDED BOOKS:

1. Millman, J., & Halkias, C. (2011). Electronic Devices and Circuits. McGraw-Hill Education.
2. Kalsi, H. S. (2018). Electronics and Communication Engineering. McGraw-Hill Education.
3. Gupta, R. P. (2014). Electronics Devices and Circuits. S. K. Kataria & Sons.
4. Mano, M. M., & Ciletti, M. D. (2017). Digital Design (6th ed.). Pearson Education.
5. Sedra, A. S., & Smith, K. C. (2020). Microelectronic Circuits (8th ed.). Oxford University Press.
6. Gayakwad, R. A. (2015). Op-Amps and Linear Integrated Circuits (5th ed.). Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	4	14
II	8	28
III	5	18
IV	7	25
V	4	15
Total	**28**	**100%**

THEORY	3.4 ENGINEERING METROLOGY	L	T	P
		2	-	-

COURSE OBJECTIVE

To provide students with fundamental and advanced knowledge of engineering metrology and quality control techniques used in manufacturing industries. The course aims to develop the ability to understand measurement systems, operate precision measuring instruments, evaluate surface and form characteristics, and apply modern metrology tools for ensuring product quality and accuracy in engineering applications.

COURSE OUTCOMES (COS)

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

CO1: Explain the fundamentals of engineering metrology, concepts of quality, inspection methods, standards, measurement systems, and measurement errors used in manufacturing industries.

CO2 : Demonstrate the working principles and applications of precision measuring instruments such as Vernier calipers, micrometers, dial gauges, comparators, slip gauges, height gauges, and bevel protractors.

CO3 : Analyze surface finish and form errors using appropriate measurement techniques and instruments for assessing engineering components.

CO4 : Understand and apply advanced metrology instruments such as optical comparators, tool maker's microscopes, and Coordinate Measuring Machines (CMM) for precision inspection and quality control.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	2	1	1	1	*	*
CO2	3	2	1	3	1	1	1	*	*
CO3	2	3	2	3	1	1	1	*	*
CO4	3	3	2	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Engineering Metrology Basics (07 Periods)

Importance of quality in manufacturing , Concepts of Quality, Inspection vs Quality Control vs QA ,Types of inspection (incoming, in-process, final), Quality costs & economics ,Measurement systems, SI units, standards ,Errors in measurement & calibration, Linear measurement tools – Steel rule, Vernier calliper (theory), Micrometer (theory).

UNIT 2 Precision Measuring Instruments (07 Periods)

Dial gauges & comparators, Slip gauges & wringing practice, Height gauge & surface plate, Bevel protractor & angle measurement, Practical session on all instruments.

UNIT 3 Surface & Form Measurement (07 Periods)

Surface roughness concepts, Surface roughness measurement tools, Form errors (roundness, flatness, straightness), Measurement of form errors.

UNIT 4 Advanced Metrology Instruments (07 Periods)

Optical comparators , Tool maker's microscope , Introduction to CMM (Coordinate Measuring Machine)

INSTRUCTIONAL STRATEGY

Engineering Metrology is the science of measurement used in manufacturing and engineering processes. The instructional strategy for this subject should combine theoretical understanding, practical laboratory skills, industrial applications, and problem-solving techniques to help students develop precision measurement competencies.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Attendance
4. Sessional Test

RECOMMENDED BOOKS:

1. Jain, R. K. (2016). Engineering Metrology. Khanna Publishers.
2. Mahajan, K. C. (2019). Engineering Metrology and Measurements. Dhanpat Rai Publications.
3. Beckwith, T. G., Marangoni, R. D., & Lienhard, J. H. (2014). Mechanical Measurements. Pearson Education.
4. Gupta, I. C. (2018). Engineering Metrology. Dhanpat Rai Publications.
5. Doebelin, E. O., & Manik, D. N. (2011). Measurement Systems: Application and Design. McGraw-Hill Education.
6. Khurmi, R. S., & Gupta, J. K. (2019*).* A Textbook of Mechanical Measurements and Metrology. S. Chand Publishing.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	7	25
II	7	25
III	7	25
IV	7	25
Total	**28**	**100%**

PRACTICUM	3.5 COMPUTER PROGRAMING-C , C++, UNIX	L	T	P
		1	-	2

COURSE OBJECTIVE

- To introduce students to the fundamentals of problem solving, algorithm design, and program development techniques.
- To develop programming skills using the C programming language for solving engineering problems.
- To familiarize students with data handling concepts such as arrays, pointers, structures, strings, and file management in C.
- To provide knowledge of different programming approaches, computer languages, and language translators.
- To enable students to apply software tools and applications relevant to Electronics Engineering.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Understand the steps involved in program development, design algorithms and flowcharts, and explain different programming languages and translators.

CO2: Apply the fundamentals of C programming including variables, data types, operators, input/output functions, and control structures to develop simple programs.

CO3: Identify and use software applications and computational tools related to Electronics Engineering for technical problem solving.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	2	1	-	1	2	*	*
CO2	3	3	2	2	-	1	2	*	*
CO3	2	3	2	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Algorithm and Program Development (03 Periods)

Steps in development of a program, Flow-charts, algorithm development, Approaches Towards Programming, Introduction to various computer languages high level language(HLL), machine language (ML) and Assembly Language, Introduction to Translators: Assembler, Compiler, Interpreter.

PRACTICALS :

1. Programing exercise on executing a C Programs.
2. Programing exercise on editing a C program.
3. Programing exercise on defining variables and assigning values to variables.
4. Programing exercise on arithmetic and relation operators.

UNIT 2 Fundamentals of C Programming (09 Periods)

Overview of C: History of 'C', Features and Characteristics, Structure of C, Header Files.

I/O statements : Input output statements, Assignment statements, Variables, Constants, Data Types Operators & Expressions with their precedence, Standard Formatted and Unformatted I/O Functions.

Control Structures : Decision and Loop Statements: if-else, while, do- while, for loops, breaks, switch statements.

Functions: Introduction to Functions, Function declaration and definition, parameter passing- Call by Value-Call by Reference, storage class Specifies, Local and Global Variables, standard library functions, Recursion.

Arrays: Introduction to Array, Array Declaration and Initialization, Single and multi- dimensional Arrays, character arrays.

Pointers: Introduction to Pointers, Declaration and Initialization, Address Operators & Pointers to various data types, pointers in parameters passing, pointers to function.

Structures: Declaration & Definition of a structure, pointer to structure, union and array of structure, Self-Referential Structures.

Strings: String processing, functions and standard library function.

Data files : File handling and manipulation, file reading and writing, Binary and ASCII files, file records using standard function type mouse.

PRACTICALS :

1. Programing exercise on formatting input using print.
2. Programing exercise on formatting output using scan.
3. Programing exercise on simple IF statement.
4. Programing exercise on IF… ELSE statement.
5. Programing exercise on SWITCH statement.
6. Programing exercise on GOTO statement.
7. Programing exercise on DO-WHILE statement.
8. Programing exercise on FOR statement.
9. Programing exercise on one dimensional arrays.
10. Programing exercise on two dimensional arrays.

UNIT 3 Software Applications in Electronics Engineering (02 Periods)

Computer application overview through various applications software related to Electronics Engineering branch.

PRACTICALS :

1. Demonstration of Application Software such as ARDUINO, PLC, MATLAB etc.

INSTRUCTIONAL STRATEGY

C, C++, and UNIX are fundamental technologies in computer science and software development. Teaching these subjects effectively requires a structured instructional strategy that combines

theory, practical exercises, demonstrations, and project-based learning. The aim is to develop programming skills, logical thinking, and system-level understanding among learners.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. Rajaraman, V. (2015). *Fundamentals of Computers*. PHI Learning.
2. Balagurusamy, E. (2019). Programming in ANSI C. McGraw Hill Education.
3. Kanetkar, Y. (2020). Let Us C. BPB Publications.
4. Gottfried, B. S. (2018). Programming with C. Schaum's Outline Series, McGraw Hill.
5. Sedha, R. S. (2018). *Computer Applications in Electronics*. S. Chand Publishing.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	3	21
II	9	64
III	2	15
Total	**14**	**100%**

THEORY	3.6.1 COMPUTER PROGRAMMING – MS Access, VB Network (PE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE

The objective of this course is to provide students with knowledge and practical skills in database programming and application development using MS Access, Visual Basic, and Visual Basic .NET technologies. The course aims to develop the ability to design databases, create forms and reports, implement programming logic, manage data connectivity, and build desktop and web-based applications using modern programming concepts and tools.

COURSE OUTCOMES (COS)

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

CO1: Design and manage relational databases using MS Access by creating tables, relationships, queries, forms, reports, macros, and modules.

CO2: Develop Windows-based applications using Visual Basic by utilizing controls, forms, arrays, procedures, functions, menus, and decision-making structures.

CO3: Build and integrate Visual Basic .NET applications using object-oriented features and modern programming capabilities within the .NET environment.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	2	2	2	3	1	1	1	*	*
CO2	2	3	2	3	1	1	1	*	*
CO3	3	3	3	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Database Programming Using Ms Access (08 Periods)

Overview of Developing Tables and Relationships, Overview of Creating Queries, Overview of Creating Forms and Reports, Creating Macros and Modules , Using Modules and Visual Basic for Applications, Advance Database Design Techniques.

UNIT 2 Programming In Visual Basic (10 Periods)

Introduction of Visual Basic, Visual Basic Environment , Controls in Visual Basic, Windows Common Controls, Windows Common Dialog Controls, Data Types and Operators , Variables and constants , Forms, Arrays and Control Arrays, Decisions and Conditions, Looping Structures , Sub

Procedures and Functions, Menu Editor-Menus, Popup Menus, Standard Code Modules, Data Access Objects , Reporting and Exporting Data, Open Database Connectivity.

UNIT 3 **Visual Basic .Net Concepts** **(10 Periods)**

Introduction to .NET Framework, Role of .NET in Web Development, Overview of .NET Components, New Object capabilities in Visual Basic , Web Interface in Visual Basic , Modern Language Capabilities added t Visual Basic .NET, Fitting Visual Basic into the .NET Frame Work.

INSTRUCTIONAL STRATEGIES

Effective instructional strategies for MS Access and VB.NET programming emphasize a hands-on, project-based approach combining database design principles with event-driven coding. Key methods include using Visual Studio for GUI development, implementing DAO/ADO for data access, and scaffolding exercises from simple forms to complex SQL-based applications.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Attendance
4. Sessional Test

RECOMMENDED BOOKS:

1. Viescas, J. L. (2016). Microsoft Access 2016 Bible. Wiley.
2. Lambert, J. (2015). Microsoft Access 2013 Step by Step. Microsoft Press.
3. Halvorson, M. (2010). Microsoft Visual Basic 2010 Step by Step. Microsoft Press.
4. Harvey, G. M. (2005). Visual Basic 6: The Complete Reference. McGraw-Hill Education.
5. Jones, R. (2011). Beginning Visual Basic .NET. Apress.
6. Petroutsos, E. (2013). Mastering Visual Basic .NET. Sybex.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	8	28
II	10	36
III	10	36
Total	**28**	**100%**

THEORY	3.6.2 SENSORS AND TRANSDUCERS (PE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE

Sensors and transducers are essential devices used to detect physical parameters such as temperature, pressure, light, or motion. They convert these physical quantities into electrical signals, enabling accurate measurement, monitoring, and control in various applications, including industrial automation, healthcare, robotics, and environmental monitoring, enhancing system efficiency and reliability.

COURSE OUTCOMES (COS)

At the end of the subject, the students will be able to:

CO1: Explain principles of sensors and transducers.

CO2: Classify sensors based on types and applications.

CO3: Analyze sensor characteristics and signal conditioning.

CO4: Select sensors for mechatronic systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	1	-	-	-	-	1	*	*
CO2	2	3	-	2	-	-	1	*	*
CO3	2	2	3	2	-	-	1	*	*
CO4	2	2	2	2	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT I: Identify different types of resistive transducers: (7 Periods)

Introduction to Transducers, Resistive transducers: Define transducer and Sensor; classification of transducers as active-passive, analog-digital, unidirectional - bidirectional, mechanical – electrical, primary - secondary transducers; Resistive Transducers: Basic principle of resistive transducers; Working of linear potentiometer, loading effect; Basic principle of strain gauge, different types, derivation of equation for gauge factor, Construction and working of Light dependant resistor (LDR), Resistance temperature detector (RTD) and Thermistor; Displacement measurement using potentiometer; Weight measurement using strain gauge;

UNIT II: Different types of inductive, capacitive and piezo electric transducers: **(7 Periods)**

Inductive, Capacitive and Piezo electric transducers: Basic principle of inductive transducer; Classification of inductive transducers; Construction and working of Linear Variable Differential Transformer (LVDT); pressure measurement using LVDT ; basic principle of Eddy current transducers; Illustrate basic principle of capacitive transducer; Working of different types of capacitive transducers (variable area, variable distance, variable dielectric type); Level measurement using capacitive transducer; Basic principle of piezo electric transducer; Equation for voltage sensitivity and charge sensitivity of the piezo electric transducer; Equivalent circuit of piezo electric transducer; Pressure measurement using piezo electric transducer.

UNIT III: Different types of photo electric transducers, radiation detectors, ultrasonic detectors, Hall effect transducers: (7 Periods)

Photoelectric, Ultrasonic and Hall Effect Transducers: Illustrate photoelectric transducers Working principle of photo conductive -photo diode, photo transistor- transducers. Working principle of photo emissive -photo multiplier tube- transducers, Working principle of solar cell and photo voltaic cell. Working Principle of Ultra Sonic transducer. Construction and working principle of Hall effect transducer. Application of Ultrasonic transducer for level measurement, Hall Effect Transducers for current measurement.

UNIT IV: The concepts of transmitters, smart sensors, smart transmitters and basic idea about industrial transmitters: **(7 Periods)**

Transmitters, Smart Sensors, Smart Transmitters, Nano Sensors: Concept of standard electrical (4-20mA system) transmission; Smart sensors- basic block diagram. Smart Transmitters- basic block diagram: Nano sensor basics with example- Industrial transmitters-Direct mount and remote seal type transmitters- Capacitive type differential pressure transmitters.

INSTRUCTIONAL STRATEGY

- Presentation / Seminars by students on any recent technological developments based on the course.
- Periodic class /online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.
- Student may view video lectures from NPTEL and submit assignments on required topics.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. J.B.Gupta, “Electrical and Electronic Measurements and instrumentation”, Kataria Pulishers
2. B. C. Nakra, K. K. Chaudhry, “Instrumentation, Measurement And Analysis”, Tata McGraw-Hill Publishers
3. R.K. JAIN, “Mechanical and Industrial Measurements”, Khanna Publishers.
4. Krishna Kant, “Computer-Based Industrial Control”, PHI

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	7	25
II	7	25
III	7	25
IV	7	25
Total	**28**	**100%**

MSME TECHNOLOGY CENTRE, KANPUR **Email:- info@msmetckanpur.org**

PRACTICAL	3.7 AUTO CAD	L	T	P
		-	-	4

COURSE OBJECTIVE:

To develop proficiency in Computer-Aided Design (CAD) using AutoCAD software for creating, modifying, annotating, dimensioning, and plotting 2D and 3D engineering drawings. The course aims to equip students with practical skills in drafting standards, mechanical drawing preparation, parametric modeling, and professional drawing documentation used in engineering and industrial applications.

COURSE OUTCOMES (COS)

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

CO1: Understand the AutoCAD environment and apply basic drawing, editing, and precision tools to create accurate 2D engineering drawings.

CO2: Utilize layers, text, dimensions, hatching, blocks, and external references to prepare organized and standardized technical drawings.

CO3: Create layouts, viewports, templates, and plotting setups for professional drawing presentation and documentation.

CO4: Apply advanced AutoCAD features such as parametric constraints, isometric drafting, and advanced drawing tools to improve design efficiency and accuracy.

CO5: Develop and modify 3D models using solid modeling commands and generate engineering components such as shafts, flanges, and couplings following standard drafting practices.

CO6: Prepare complete product drawings incorporating dimensions, annotations, layouts, title blocks, and printing standards suitable for industrial and manufacturing applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	3	-	-	1	*	*
CO2	2	2	2	3	1	1	1	*	*
CO3	2	1	2	3	1	2	1	*	*
CO4	2	3	3	3	-	1	2	*	*
CO5	3	3	3	3	1	1	2	*	*
CO6	2	2	3	2	1	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

LIST OF PRACTICALS

1. Introduction to AutoCAD
2. Basic Drawing Commands (LINE, POLYLINE, CIRCLE, ARC, RECTANGLE, Object Snap (OSNAP), Ortho Mode, Grid & Snap, Dynamic Input)
3. Modify Commands (MOVE, COPY, ROTATE, MIRROR
4. SCALE, STRETCH, TRIM (, EXTEND, OFFSET, FILLET, CHAMFER, ARRAY (Rectangular & Polar, BREAK, JOIN)
5. Precision & Inquiry Tools (DIST, AREA, LIST, Object tracking, Selection methods -Window, Crossing, Lasso)
6. Layers & Properties (Layer creation & management Color, Linetype, Lineweight, Properties palette)
7. Text & Annotation (TEXT, MTEXT, ext styles, Spell check.
8. Dimensioning (DIMLINEAR, DIMALIGNED, DIMRADIUS, DIMDIAMETER, Dimension styles, angular, baseline, continued dimensions, tolerances)
9. Hatching & Gradient (HATCH command, Pattern selection and editing, Gradient fill).
10. Creating blocks (BLOCK command) (WBLOCK, INSERT, Attributes (ATTDEF).
11. External References (XREF) (Attaching XREF, Overlay vs Attach.
12. Layouts & Viewports (Model space vs Paper space, Creating layouts, Viewports setup).
13. Plotting & Printing (Plot command, Page setup, Scale settings, PDF export)
14. Templates & Standards (Creating templates (DWT), CAD standards, Units, layers, dimension styles setup.
15. Advanced Drawing Tools (SPLINE, ELLIPSE, HELIX).
16. Parametric Drawing (Geometric constraints Dimensional constraints)
17. Isometric Drawing **(**Isometric snap Isoplane switching).
18. Introduction to 3D (3D workspace UCS, View controls Basic 3D objects BOX, CYLINDER)
19. 3D Modelling **(**EXTRUDE, REVOLVE, SWEEPUNION, SUBTRACT, INTERSECT).
20. Mechanical Drawing (Shaft, flange, coupling drawing , Dimensioning standards)
21. Preparation of product Drawing using normal and advance features.
22. Dimensioning.
23. Layout of drawing sheet with name plate

PRACTICAL	3.8 WORK SHOP PRACTICE	L	T	P
		-	-	4

COURSE OBJECTIVE:

The objective of this course is to provide students with practical knowledge of CNC machine tools, their construction, operation, programming, and maintenance. The course aims to develop skills in CNC part programming using standard G-codes and M-codes, operating CNC lathes and milling machines with Siemens and Fanuc controls, preparing machining instructions, and implementing preventive maintenance practices for efficient and accurate manufacturing operations.

COURSE OUTCOMES (COS)

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

CO1: Understand the constructional features, working principles, and functional components of CNC lathes, CNC milling machines, automatic tool changers, and pallet systems used in modern manufacturing.

CO2: Apply standard G-codes and M-codes and operate CNC machines using Siemens and Fanuc control systems for machining applications.

CO3: Develop and execute CNC part programs for various turning operations such as facing, plain turning, taper turning, and thread cutting on CNC lathes.

CO4: Develop and execute CNC part programs for milling operations including face milling, drilling cycles, slot milling, circular interpolation, and pocket milling on CNC milling machines.

CO5: Prepare technical documentation such as work instructions and machining procedures for CNC machine operators to ensure safe and efficient production.

CO6: Plan and implement preventive maintenance schedules for CNC machines to enhance machine reliability, productivity, and operational safety.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	2	1	-	1	*	*
CO2	2	2	2	3	-	1	2	*	*
CO3	3	3	3	3	1	1	2	*	*
CO4	3	3	3	3	1	1	2	*	*
CO5	1	1	2	1	1	3	1	*	*
CO6	2	2	1	2	3	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

LIST OF PRACTICALS

1. Study of constructional detail of CNC lathe.
2. Study of constructional detail of CNC milling machine.
3. Study the constructional details and working of Automatic tool changer and Multiple Pallets.
4. Practice of different G code and M code.
5. Practice on Siemens and Fanuc Control.
6. Develop a part Programme for following lathe operations and make the job on CNC lathe.
    - Plain turning and facing operation.
    - Taper turning operation.
    - Thread cutting operation.
7. Develop a part Programme for the following milling operation and make the job on CNC milling
    - Face milling.
    - Centre drill & drilling cycle
    - Slot milling.
    - Circular Interpolation.
    - Pocket milling.
8. Preparation of work instructions for machine operator.
9. Preparation of preventive maintenance schedule for CNC machine.

THEORY	4.1 COMMUNICATION SYSTEM & ITS APPLICATION	L	T	P
		2	-	-

COURSE OBJECTIVE

The objective of this course is to provide students with a fundamental and applied understanding of communication systems, radar technology, mobile communication systems, and transmission media. The course aims to build conceptual clarity of modulation techniques, wireless communication principles, cellular systems, and guided transmission lines, enabling students to analyze and design basic communication systems used in modern engineering applications.

COURSE OUTCOMES (COS)

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

CO1: Students will be able to explain the need for modulation, classify analog and digital modulation techniques, and describe the electromagnetic spectrum and its applications across different frequency bands (VLF to microwave).

CO2: Students will be able to analyze AM, DSB, DSB-SC, SSB, and VSB systems and interpret the working of AM transmitters and receivers, as well as FM transmission and reception techniques.

CO3: Students will be able to understand radar principles, interpret radar block diagrams, derive and apply the radar range equation, and explain CW radar systems and their applications.

CO4: Students will be able to compare and analyze different transmission media such as coaxial cables, twisted pair cables, fiber optic cables, and ribbon cables based on their structure, properties, and applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	1	1	1	2	*	*
CO2	3	3	2	2	1	1	2	*	*
CO3	2	3	2	3	1	1	2	*	*
CO4	2	2	2	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Basic of Communication **(9 Periods)**

Need and types of modulation systems, Analog and digital modulation, Electromagnetic spectrum and its various ranges: VLF, LF, MF, HF, VHF, UHF, microwave etc. Analog Modulation Systems, Block diagram of AM transmitters and AM receivers, DSB, DSB-SC, SSB system, FM transmitters and receivers, Vestigial side band systems.

UNIT 2 Introduction to Radar (5 Periods)

Basics, block diagram, operating frequencies, radar range equation, derivation, applications, CW radar block diagram.

UNIT 3 Mobile Communication & its application (9 Periods)

Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management.

UNIT 4 Communication and Transmission Lines (5 Periods)

Detailed study about Coaxial Cable, Twisted Pair Cables, Fiber Optic Cables, Ribbon Cable.

INSTRUCTIONAL STRATEGY

An Instructional Strategy of Communication System refers to the planned method used to design, deliver, and evaluate communication processes so that information is effectively transmitted, received, and understood. It combines principles of communication theory with teaching/learning methods and system design.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

1. Simon Haykin, “Communication Systems”, Wiley India.
2. B.P. Lathi, “Modern Digital and Analog Communication Systems”, Oxford University Press.
3. Merrill I. Skolnik, “Introduction to Radar Systems”, McGraw Hill.
4. Byron Edde, “Radar Principles”, Wiley India.
5. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, Pearson.
6. Jochen Schiller, “Mobile Communications”, Pearson.
7. John D. Ryder, “Networks, Lines and Fields”, Prentice Hall.Gerd Keiser, “Optical Fiber Communications”, McGraw Hill.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	9	32
II	5	18
III	9	32
IV	5	18
Total	**28**	**100%**

THEORY	4.2 MATERIAL TECHNOLOGY	L	T	P
		2	-	-

COURSE OBJECTIVE

This course aims to:

- Develop fundamental understanding of engineering materials and their classification.
- Introduce physical, mechanical, and chemical properties of metals and non-metals used in engineering applications.
- Provide knowledge of ferrous and non-ferrous materials and their industrial significance.
- Explain phase transformations in steels using phase diagrams and TTT curves.
- Familiarize students with heat treatment processes and surface hardening techniques.
- Introduce polymeric and elastomeric materials and their engineering applications.
- Build awareness of corrosion, its types, and prevention methods in engineering systems.

COURSE OUTCOMES (COS)

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

CO1: Describe ferrous and non-ferrous materials along with alloying elements and their effects.

CO2: Explain different heat treatment processes and their working principles.

CO3: Identify properties and applications of common polymers such as PE, PVC, PS, ABS, etc.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	-	2	-	1	*	*
CO2	3	3	2	2	2	-	1	*	*
CO3	3	2	1	1	3	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Engineering Materials and their Properties (9 Periods)

Introduction, Classification and Application of Engineering materials, ferrous materials like Mild steel, plain carbon steel, low alloy steels, alloy steels, different casting material

Nonferrous metal like aluminum and its alloy copper and its alloy Materials.

Common alloying elements like carbon, chromium, nickel, molybdenum, phosphorus, magnetize vanadium & its property.

Properties of metals

Physical Properties –Structure, Density, Melting point.

Mechanical Properties –Strength, elasticity, ductility, malleability, plasticity, toughness, hardness, hardenability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion
Introduction to Corrosion, types of Corrosion, Corrosion resisting

UNIT 2 Heat Treatment of Steels (10 Periods)

Study of iron carbon diagram

Study of TTT curve.

Introduction to Heat treatment processes such as Annealing, subcritical annealing, Normalizing, Hardening, Tempering (Au tempering & Mar tempering) - Principle, Advantages, limitations and applications.
Surface Hardening - Methods of surface hardening, i) case hardening ii) Flame Hardening, iii) Induction Hardening, iv) Nitriding v) Carburizing
Principle, advantages, limitations and applications

UNIT 3: Non Metallic Materials (9 Periods)

Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses of Thermoplastics, Thermosetting Plastics & Rubbers.
Thermoplastic Plastics – Polyethylene (PE) , Poly propylene (pp), Polystyrene (PS), PVC, characteristics and uses of ABS.
Thermosetting Plastics - Characteristics and uses of polyesters, Epoxies, Melamine & Bakelite.
Rubbers – Neoprene, Butadiene, Buna & Silicones – Properties & applications.

INSTRUCTIONAL STRATEGY

Instructional strategy for **Material Technology** (often taught in engineering, architecture, or applied science programs) should combine theory, hands-on experience, and real-world problem solving. The goal is not just memorization of materials, but understanding how and why materials behave in specific conditions.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

1. Raghavan, “Physical Metallurgy: Principles and Practice”, PHI Learning.
2. V.D. Kodgire, “Material Science and Metallurgy”, Everest Publishing House.
3. U.C. Jindal, “Engineering Materials and Metallurgy”, Pearson India.
4. William D. Callister Jr., “Materials Science and Engineering: An Introduction”, Wiley.
5. Sidney H. Avner, “Introduction to Physical Metallurgy”, McGraw-Hill Education.
6. Donald R. Askeland & Wendelin J. Wright, “The Science and Engineering of Materials”, Cengage Learning.
7. George E. Dieter, “Mechanical Metallurgy”, McGraw-Hill Education.
8. V. Rajendran, “Engineering Materials”, Tata McGraw-Hill.
9. Flinn & Trojan, “Engineering Materials and Their Applications”, Oxford University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	9	32
II	10	36
III	9	32
Total	**28**	**100%**

PRACTICUM	4.3 INTERNET OF THINGS & ITS APPLICATION	L	T	P
		1	-	2

COURSE OBJECTIVES:

The objective of this course is to provide students with a foundational understanding of the Internet of Things (IoT) and its architecture, along with hands-on experience in Arduino-based EMBEDDED SYSTEM & ITS APPLICATION & ITS APPLICATIONs. The course aims to develop skills in programming using C language in Arduino IDE, interfacing various sensors and actuators, and implementing real-time IoT applications. It also focuses on enabling students to understand communication protocols, sensor data acquisition, and basic automation systems for real-world problem solving.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Understand the fundamental concepts of IoT, including its architecture, characteristics, protocols, and real-world applications.

CO2: Develop basic programs using C language in Arduino IDE using variables, data types, loops, functions, and control statements.

CO3: Apply programming concepts to develop simple EMBEDDED SYSTEM & ITS APPLICATION & ITS APPLICATIONs using Arduino for real-time applications

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	1	1	2	*	*
CO2	3	3	2	2	1	1	2	*	*
CO3	3	3	3	3	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Introduction to Internet of Things (IoT) **(2 Periods)**

Applications, architecture, protocols, Characteristics of IoT

PRACTICALS:

1. Study and draw the basic IoT system architecture showing sensing layer, network layer, and application layer.
2. Identify and demonstrate real-world IoT applications (smart home, smart agriculture, smart city) using block diagrams or simulation tools.

UNIT 2 Basics of C language using Arduino IDE (2 Periods)

Understating basics of Arduino IDE, Variables, data type, loops, control statement, function

PRACTICALS:

1. Study the Arduino IDE environment and identify key components (editor, board manager, serial monitor, upload button).
2. Write a program using if statement to check a condition (e.g., turn ON LED if input is HIGH).
3. Write a program using if–else control structure for decision-making (e.g., LED ON/OFF based on button press).

UNIT 3 Practical using Arduino-interfacing sensors (10 Periods)

Interfacing Light Emitting Diode(LED)- Blinking LED, Interfacing Button and LED – LED blinking when button is pressed, Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp. Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11), Interfacing Liquid Crystal Display(LCD) – display data generated by sensor on LCD, Interface Ultrasonic sensor to find the distance from the object, Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value. Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD, Interfacing Relay module to demonstrate Bluetooth based home automation application. (Using Bluetooth and relay).

PRACTICALS:

1. Develop a program to blink an LED using Arduino (basic digital output control).
2. Interface a push button with LED and program LED to glow only when the button is pressed.
3. Interface LDR (Light Dependent Resistor) with LED and observe variation in light intensity.
4. Design an automatic night lamp using LDR, where LED turns ON in darkness and OFF in light.
5. Interface LM35 temperature sensor with Arduino and display temperature readings on Serial Monitor.
6. Interface DHT11 temperature and humidity sensor and display values on Serial Monitor.
7. Interface 16x2 LCD with Arduino and display text messages and sensor data.

INSTRUCTIONAL STRATEGY

The instructional strategy for the Internet of Things (IoT) course focuses on developing both theoretical understanding and practical skills through interactive teaching and hands-on learning.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. Arshdeep Bahga & Vijay Madisetti, “Internet of Things: A Hands-On Approach”, Universities Press.
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, McGraw Hill Education.
3. Olivier Hersent, David Boswarthick & Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Wiley India.
4. Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, Wiley.
5. Michael Margolis, “Arduino Cookbook”, O’Reilly Media.
6. Paul Scherz & Simon Monk, “Practical Electronics for Inventors”, McGraw-Hill Education.
7. Simon Monk, “Programming Arduino: Getting Started with Sketches”, McGraw Hill Education.
8. Simon Monk, “Arduino Projects for the Evil Genius”, McGraw-Hill Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	2	20
II	2	20
III	10	60
Total	**14**	**100%**

PRACTICUM	4.4 MEASURING SYSTEM	L	T	P
		2	-	2

COURSE OBJECTIVES:

The objective of this course is to provide students with fundamental knowledge of measurement systems, transducers, and instrumentation techniques used in engineering applications. The course aims to develop understanding of various methods for measuring displacement, strain, force, torque, pressure, flow, and temperature using electrical and electronic instruments. It also focuses on selecting appropriate measuring devices, understanding their principles of operation, and applying instrumentation techniques for industrial and laboratory measurements.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Understand the importance of measurements, basic measuring systems, display devices, and their advantages and limitations.
CO2: Explain the working principles, construction, and applications of different types of transducers used in measurement systems.
CO3: Analyze and apply various techniques for displacement and strain measurement using potentiometers, LVDT, and strain gauges.
CO4: Measure force, torque, and speed using different measuring instruments, load cells, dynamometers, and strain gauge techniques.
CO5: Understand the principles, construction, and applications of pressure and flow measuring instruments such as Bourdon gauges, flow meters, and pressure pickups.
CO6: Apply temperature measurement techniques using thermocouples, RTDs, thermistors, pyrometers, and temperature recording instruments.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	2	1	1	2	*	*
CO2	3	2	2	3	1	1	2	*	*
CO3	3	3	2	3	1	1	2	*	*
CO4	3	3	2	3	1	2	2	*	*
CO5	3	2	2	3	2	1	2	*	*
CO6	3	3	2	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Measurements (3 Periods)

Importance of measurement, basic measuring systems, advantages and limitations of each measuring systems and display devices.

PRACTICALS :

1. Study of different measuring instruments and measuring systems used in electrical and electronic applications.

UNIT 2 Transducers (4 Periods)

Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type)

PRACTICALS :

1. To measure the level of a liquid using a transducer
2. To measure temperature using a thermo-couple

UNIT 3 Measurement of Displacement and Strain (6 Periods)

Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor, gauge materials and their selections. Use of electrical strain gauges, strain gauge bridges and amplifiers.

PRACTICALS :

1. To study the use of thermistor for temperature measurement
2. Study of variable capacitive transducer
3. Draw the characteristics of a potentiometer
4. To measure linear displacement using LVDT
5. To study the use of electrical strain gauge

UNIT 4 Force and Torque Measurement (6 Periods)

Different types of force measuring devices and their principles, load measurements by using elastic transducers and electrical strain gauges. Load cells, measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.

PRACTICALS :

1. To study weighing machine using load cell
2. To study pH meter.

UNIT 5 Pressure & FLOW Measurement (4 Periods)

Bourdon pressure gauges, electrical pressure pickups and their principle, construction and applications. Use of pressure cells.Basic principles of magnetic, ultrasonic flow meters and laser Doppler.

PRACTICALS :

1. Measurement and plotting the characteristics of photo diodes
2. To assemble and test instrumentation amplifier to find out its gain, input and output impedance

UNIT 6 Measurement of Temperature (5 Periods)

Bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermistors and pyrometer. Temperature recorders.

PRACTICALS :

1. Measurement of flow rate
2. Measurement of pressure using Bourdon Tube

INSTRUCTIONAL STRATEGY

The instructional strategy for the Measuring Systems course is designed to provide students with strong theoretical understanding and practical knowledge of measurement techniques, transducers, and instrumentation systems used in engineering applications.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. A.K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai Publications.
2. E.W. Golding & F.C. Widdis, “Electrical Measurements and Measuring Instruments”, Wheeler Publishing.
3. H.S. Kalsi, “Electronic Instrumentation”, McGraw Hill Education.
4. D.V.S. Murty, “Transducers and Instrumentation”, PHI Learning.
5. A.K. Ghosh, “Introduction to Measurements and Instrumentation”, PHI Learning.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	3	11
II	4	14
III	6	22
IV	6	22
V	4	14
VI	5	17
Total	**28**	**100%**

THEORY	4.5 CONTROL SYSTEM & ITS APPLICATION	L	T	P
		2	-	-

COURSE OBJECTIVES:

The objective of this course is to provide students with fundamental knowledge of control systems, mathematical modeling, transfer functions, Laplace transforms, stability analysis, time response analysis, and frequency response techniques. The course aims to develop the ability to analyze and design control systems used in engineering applications.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:
CO1: Understand the basic concepts of control systems including open-loop and closed-loop systems, multivariable systems, transfer functions, block diagrams, and signal flow graphs.
CO2: Apply Laplace transform methods, transfer function derivation, block diagram reduction techniques, and signal flow graph analysis for control system representation and simplification.
CO3: Analyze transient and steady-state responses of first-order and higher-order systems using standard test signals and evaluate system performance using time response specifications and compensation techniques such as PD, PI, and PID controllers.
CO4: Determine the stability of control systems using concepts of relative stability and Routh-Hurwitz stability criterion.
CO5: Interpret and analyze frequency response characteristics using Polar plots, Bode plots, and phase-log magnitude plots for minimum-phase and all-pass systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	-	-	1	*	*
CO2	3	3	2	2	-	-	1	*	*
CO3	3	3	3	2	1	1	1	*	*
CO4	3	3	2	2	-	-	1	*	*
CO5	3	3	2	3	1	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1 Introduction to Control Systems (5 Periods)

Introduction, Open loop control system, closed loop control system, Development of control systems, Multivariable control system, Advantages of control systems,Transfer functions, Block diagrams and Signal flow graphs.

UNIT 2 Introduction to Laplace transform (7 Periods)

Definition of Laplace transform, Inverse of Laplace transform, Laplace transform theorems, Laplace transform pairs, Transfer function, Procedure for deriving transfer functions

Block diagram algebra: Block diagram of a Single-input closed-loop system, Block diagram reduction of a Two-input linear control system

Signal flow graphs: Signal flow graph of a closed-loop system, Construction of signal flow graph, Mason's Gain formula (only definition and equation)

UNIT 3 Time response of feedback control systems (6 Periods)

Transient response and Time response of control system, Standard test signals : Step signal, Ramp signal, Parabolic signal, Impulse signal

Time response of first-order systems for step-signal, Time response specifications, Performance indices for step response, Compensations in second and higher order systems (PD, PI and PID controller), Lag-Lead Compensation

UNIT 4 Stability – concepts and analysis (5 Periods)

Concept of stability, Relative stability, Conditions for stability, Routh-Hurwitz stability criterion

UNIT 5 Frequency response and analysis (7 Periods)

Introduction, Frequency response specifications, Polar plots , Nyquist Plot, Bode plots : General procedure for constructing Bode plots, All-pass and Minimum-phase systems , Log-magnitude versus phase plots.

INSTRUCTIONAL STRATEGY

The instructional strategy for the Control Systems course is designed to promote conceptual understanding, analytical skills, practical application, and problem-solving ability through a combination of theoretical and activity-based learning methods.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers.
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India.
3. Norman S. Nise, "Control Systems Engineering", Wiley India Publications.
4. Benjamin C. Kuo and Farid Golnaraghi, "Automatic Control Systems", Wiley Publications.
5. J.N. Rai and B. Rai, "Automatic Control Engineering", Khanna Publishers.

6. M. Gopal, “Control Systems: Principles and Design”, Tata McGraw Hill Education.
7. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education.
8. S. Palani, “Control Systems Engineering”, Tata McGraw Hill Publications.
9. Schaum’s Outline Series, “Feedback and Control Systems”, McGraw Hill Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	5	20
II	7	20
III	6	20
IV	5	20
V	7	20
Total	**28**	**100%**

THEORY	4.6 MECHATRONICS SYSTEM	L	T	P
		2	-	-

COURSE OBJECTIVES:

The objective of this course is to provide students with fundamental knowledge of mechatronic systems, system modeling, sensors, actuators, automation, and robotics. The course aims to develop interdisciplinary skills by integrating mechanical, electrical, electronics, control, and computer engineering concepts for designing and analyzing modern automated systems.

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of mechatronic systems, control systems, microprocessor-based controllers, and various actuation systems used in industrial applications.

CO2: Develop mathematical models of mechanical, electrical, fluid, thermal, and electromechanical systems used in mechatronic system design.

CO3: Identify, analyze, and apply various sensors, transducers, actuators, relays, and motors used in automation and mechatronic applications.

CO4: Understand the concepts of industrial automation, robotics, CNC machines, Industry 4.0, and smart manufacturing systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	2	1	1	-	1	*	*
CO2	3	3	3	2	-	-	1	*	*
CO3	3	3	2	3	1	1	1	*	*
CO4	2	2	3	2	3	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit 1 Introduction: **(7 Periods)**

Definition and Introduction to Mechatronic Systems, Measurement Systems, Control Systems, Microprocessors Based Controllers and Applications

Study of Actuation Systems: Pneumatic and Hydraulic Systems, Mechanical Actuation System, Electrical Actuation Systems.

Unit 2 Modelling for mechatronics system design : **(7 Periods)**

Introduction, System, Mechanical System, Electrical System, Fluid system, Thermal System, Engineering system, Translational mechanical system with spring, damper and mass, Rotational mechanical system with spring, damper and mass , Modeling of electric motor, Chamber filled with fluid, Pneumatic actuator.

UNIT III: Introduction to Sensors, Transducers and Actuators **(7 Periods)**

Principle, working and applications of-Limit switches, proximity switches like inductive ,capacitive and optical (deflecting and through beam type) , Thumb wheel switches magnetic reed switches ,Optical encoders- displacement measurement, rotary, incremental, opto-couplers.

Actuator – solenoids – on-off applications, latching, triggering

Types of relays- solid state

Types of motors – DC motors, DC brushless motors, AC motors, stepper motors , servo motors

UNIT IV: Automation, Robotics and Applications : **(7 Periods)**

Automation: Types (fixed, programmable, flexible) ,Advantages and limitations, Industrial robotics: Components of robot -Types of robots (Cartesian, SCARA, articulated) ,End effectors and sensors in robotics- CNC machines (basic concept), Mechatronics applications: Automated manufacturing systems, Home automation, Automotive systems (ABS, cruise control), Industry 4.0 basics: IoT in automation ,Smart manufacturing (intro only).

INSTRUCTIONAL STRATEGY

The instructional strategy for the Mechatronics Systems course is designed to develop interdisciplinary knowledge and practical skills by integrating concepts of mechanical, electrical, electronics, control, and automation engineering through theory, simulation, experimentation, and application-based learning.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. W. Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson Education.
2. Devdas Shetty and Richard A. Kolk, “Mechatronics System Design”, Cengage Learning Publications.
3. HMT Ltd., “Mechatronics”, Tata McGraw Hill Publications.
4. N. Shanmugam, “Mechatronics”, Anuradha Agencies Publishers.
5. Mahalik N.P., “Mechatronics: Principles, Concepts and Applications”, Tata McGraw Hill Education.
6. Alciatore David G. and Histand Michael B., “Introduction to Mechatronics and Measurement Systems”, McGraw Hill Publications.
7. Dan Necsulescu, “Mechatronics”, Pearson Education.
8. K.P. Ramachandran and G.K. Vijayaraghavan, “Mechatronics: Integrated Mechanical Electronic Systems”, Wiley India Publications.

9. M.D. Singh and J.G. Joshi, “Mechatronics: Principles and Applications”, PHI Learning Publications.
10. Robert H. Bishop, “The Mechatronics Handbook”, CRC Press Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	7	25
II	7	25
III	7	25
IV	7	25
Total	**28**	**100%**

THEORY	4.7.1 QUALITY MANAGEMENT (PE-2)	L	T	P
		1	-	-

COURSE OBJECTIVES:

The objective of this course is to provide diploma students with fundamental knowledge of Total Quality Management (TQM), quality improvement techniques, statistical quality tools, quality standards, and continuous improvement practices used in modern industries. The course aims to develop skills required for quality assurance, process control, customer satisfaction, and industrial productivity in manufacturing and service sectors.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:
CO1: Understand the concepts, principles, and importance of Total Quality Management in industries
CO2: Apply quality control tools and statistical techniques for process improvement and defect reduction.
CO3: Understand quality assurance systems, ISO standards, and quality auditing practices.
CO4: Analyze continuous improvement techniques such as Kaizen, Six Sigma, Lean Manufacturing, and 5S practices.
CO5: Develop awareness of modern industrial quality practices, customer satisfaction, sustainability, and Industry 4.0 quality concepts

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	2	1	1	*	*
CO2	3	3	2	3	1	1	1	*	*
CO3	2	2	2	3	2	2	1	*	*
CO4	2	3	3	2	3	2	2	*	*
CO5	2	2	2	2	3	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Introduction to Total Quality Management (3 Periods)

Concept of Quality, Definitions of Quality, Evolution of Quality Management, Inspection, Quality Control, Quality Assurance, TQM, Principles of TQM, Customer Satisfaction and Customer Focus, Quality Costs, Benefits of TQM, Quality Gurus: Deming, Juran, Crosby, Kaoru Ishikawa

UNIT 2: Quality Control Tools and Techniques (3 Periods)

Seven Basic Quality Tools: Cause and Effect Diagram, Pareto Chart, Histogram, Check Sheet, Scatter Diagram, Control Chart, Flow Chart

Statistical Process Control (SPC), Process Capability, Acceptance Sampling, Introduction to Quality Circles

UNIT 3: Quality Standards and Quality Assurance (3 Periods)

Quality Assurance Concepts, ISO 9001: Quality Management System, ISO 14001: Environmental Management System, Occupational Health and Safety Basics, Documentation in Quality Systems

Quality Audit: Internal Audit, External Audit, Calibration and Maintenance Practices

UNIT 4: Quality Improvement Techniques and Case Studies (3 Periods)

Benchmarking, Root Cause Analysis, Failure Mode and Effect Analysis (FMEA), Quality Circles, Supplier Quality Management, Customer Complaint Handling, Industrial Case Studies

UNIT 5: Modern Quality Management (2 Periods)

ISO 9001:2015 Fundamentals, Documentation and Audits, Lean Manufacturing, Six Sigma Basics, TPM (Total Productive Maintenance), Sustainability and Green Quality Practices.

INSTRUCTIONAL STRATEGY

1. Interactive lectures using chalk-board, PPTs, and multimedia tools.
2. Explanation of TQM concepts with real industrial examples.
3. Discussion on current quality practices in manufacturing and service industries.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. Dale H. Besterfield, “Total Quality Management”, Pearson Education.
2. Subburaj Ramasamy, “Total Quality Management”, Tata McGraw-Hill Education.
3. Kanishka Bedi, “Quality Management”, Oxford University Press.
4. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, Cengage Learning.
5. Poornima M. Charantimath, “Total Quality Management”, Pearson Education.
6. S. Kumar, “Total Quality Management”, Laxmi Publications.
7. Douglas C. Montgomery, “Introduction to Statistical Quality Control”, Wiley India.
8. Amitava Mitra, “Fundamentals of Quality Control and Improvement”, Wiley India.
9. Sunil Sharma, “Total Engineering Quality Management”, Macmillan Publishers.
10. John S. Oakland, “Total Quality Management and Operational Excellence”, Routledge Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	3	20
II	3	20
III	3	20
IV	3	20
V	2	20
Total	**14**	**100%**

THEORY	4.7.2 MECHANICS OF MATERIALS (PE-2)	L	T	P
		1	-	-

COURSE OBJECTIVES:

Mechanics of Materials studies the behavior of solid objects under various forces and loads. It focuses on stress, strain, deformation, and material properties to ensure structural integrity and safety. This field is essential in engineering design, helping predict how materials respond to tension, compression, bending, and torsion in real-world applications.

COURSE OUTCOMES (COS)

At the end of the subject, the students will be able to:

- CO1: Compute stress and strain relationships.
- CO2: Analyze shear force, bending moment, and beam deflections.
- CO3: Determine torsion in shafts and springs.
- CO4: Evaluate column buckling and strain energy.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	3	-	2	-	-	1	*	*
CO2	3	3	-	2	-	-	1	*	*
CO3	3	3	-	2	-	-	1	*	*
CO4	3	3	-	2	-	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional**.**

DETAILED CONTENT

UNIT I Understand the concepts of stress and strain in bars, cylindrical and spherical shell:

(4 Periods)

Simple stress and strain: Concept of rigid body, deformable body, mechanical properties of materials - rigidity, elasticity, plasticity, compressibility, hardness, toughness, stiffness, ductileness, brittleness, malleability, creep and fatigue – definition of stress and strain tensile, compressive, shear, crushing, thermal stresses, & corresponding strains – stress - strain relationship - elastic limit and limit of proportionality, Hook's Law –Problems on Direct Stress & Linear Strain- Stress- Strain curve for Ductile material and Brittle material factor of Safety. stresses in varying section -stresses in composite section - simple problems. Elastic Constants - Lateral Strain, Poisson's ratio, Bulk Modulus, Shear

Modulus, Volumetric Strain - Relation between elastic constants- Problems on elastic constants. Hoop stress-Longitudinal Stress in thin cylindrical & spherical shells subjected to internal pressure. - Problems on thin cylindrical shells.

UNIT II:Apply the concept of bending moment, shear force and deflection in beams: **(4 Periods)**
Beams - Types of beams - cantilever beam- simply supported beam- over hanging beam fixed beam and continuous beam - types of loading - concentrated or point load- uniformly distributed load and uniformly varying load – support reaction calculation. Shear force and bending moment diagrams: Shear force and bending moment diagrams of cantilever beams - point load, uniformly distributed load and combination of point load and uniformly distributed load - simply supported beam - point load- uniformly distributed load and combination of point load and uniformly distributed load - maximum bending moment on the section -point of contra flexure. Bending and deflection of beams: Theory of simple bending – Assumptions – Relationship between bending moment, bending stress and radius of curvature- simple problems – Deflection of beams – slopes and deflection of simply supported beam and cantilever beams subjected to symmetrical point load and uniformly distributed load (No derivations).

UNIT III: Apply basic equations of simple torsion in designing of shafts and helical springs: (3 Periods)
Torsion: Introduction to pure torsion – assumption in theory of pure torsion -Torsion equation - Angle of Twist, Polar Moment of Inertia - Power Transmitted by a shaft, axle of solid and hollow sections subjected to Torsion - Comparison between Solid and Hollow Shafts subjected to pure torsion- simple problems to calculate strength and power transmitted. Spring: Introduction - types of spring - leaf spring - helical springs - closely coiled and open coiled helical spring with round wire – spring index - formulae for deflection stiffness- torque and energy stored (no derivation) -simple problems on closely coiled helical springs subjected to an axial load to find out diameter, stress induced, stiffness and deflection. Columns: Concept of column, modes of failure - Types of columns - Buckling load, crushing load - Slenderness ratio - Factors effecting strength of a column - End restraints - Effective length - Strength of column by Euler and Rankine formula (without derivation) – Simple problems to calculate buckling load.

UNIT IV: Selection of materials and its suitability as per Robotic applications: **(3 Periods)**
Strain Energy-Types of loading-Sudden, Gradual and Impact Load-resilience, proof resilience and modulus of resilience-Equation for strain energy stored in a body when the load is gradually applied and suddenly applied – problems. Robotics /Design Basics/Building Materials – Metal, synthetic materials and composite materials – properties of steel from steel construction – properties of wrought aluminum alloys – Mechanical Properties of stainless steel – Designation of Titanium alloys – structural examination of titanium alloys – case hardening of titanium and alloys- How to build robots using advanced materials – Case study.

INSTRUCTIONAL STRATEGY

- Presentation / Seminars by students on any recent technological developments based on the course.
- Periodic class /online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.
- Student may view video lectures from NPTEL and submit assignments on required topics.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMENDED BOOKS

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. SS Bhavikatti ,Strength of materials –Vikas Publishing House
3. Ramamurtham. S., “Strength of Materials”, 14th Edition, Dhanpat Rai Publications, 2011

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	4	25
II	4	25
III	3	25
IV	3	25
Total	**14**	**100%**

THEORY	4.8.1 ENGINEERING ECONOMICS & ACCOUNTANCY (OE 1)	L	T	P
		2	-	-

COURSE OBJECTIVES:

To acquire knowledge of basic economics to facilitate the process of economic decision making.

- To acquire knowledge on basic financial management aspects.
- To develop the basic skills to analyze financial statements.

COURSE OUTCOMES (CO) :

CO1: Explain the fundamental concepts of managerial economics, firm objectives, and the decision-making process in an engineering context.
CO2: Analyze market dynamics by applying the concepts of demand and supply elasticity and forecasting techniques.
CO3: Apply production functions and cost analysis techniques to optimize resources and estimate short-run and long-run costs.
CO4: Determine appropriate pricing strategies based on market structures (perfect/imperfect competition) and government regulations.
CO5: Interpret financial statements (Balance Sheet, P&L) and evaluate investment risks/returns using Ratio Analysis, NPV, and IRR.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	1	-	-	-	1	2	1	*	*
CO2	2	3	-	1	2	2	1	*	*
CO3	2	3	1	-	1	2	1	*	*
CO4	1	2	-	-	3	2	1	*	*
CO5	2	3	-	2	1	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Introduction **(04 Periods)**

Managerial Economics; Relationship with other disciplines; Firms: Types, objectives and goals; Managerial decisions; Decision analysis.

Unit – II: Demand & Supply Analysis (05 Periods)

Demand; Types of demand; Determinants of demand; Demand function; Demand elasticity; Demand forecasting; Supply; Determinants of supply; Supply function; Supply elasticity.

Unit – III: Production and Cost Analysis (06 Periods)

Production function; Returns to scale; Production optimization; Least cost input; Isoquants; Managerial uses of production function; Cost Concepts; Cost function; Types of Cost; Determinants of cost; Short run and Long run cost curves; Cost Output Decision; Estimation of Cost

Unit – IV: Pricing (05 Periods)

Determinants of Price; Pricing under different objectives and different market structures; Price discrimination; Pricing methods in practice; Role of Government in pricing control.

Unit – V: Financial Accounting (Elementary Treatment) (08 Periods)

Balance sheet and related concepts; Profit & Loss Statement and related concepts; Financial Ratio Analysis; Cash flow analysis; Funds flow analysis; Comparative financial statements; Analysis & Interpretation of financial statements; Investments; Risks and return evaluation of investment decision; Average rate of return; Payback Period; Net Present Value; Internal rate of return

RECOMMENDED BOOKS:

1. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House, New Delhi, 2018
2. McGuigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson Southwestern, 10th Edition, 2005.
3. Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.
4. Samuelson. Paul A and Nordhaus W.D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
5. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	04	17
II	05	20
III	06	20
IV	05	20
V	08	23
Total	**28**	**100**

THEORY	4.8.2 DISASTER MANAGEMENT (OE 1)	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn about various types of natural and man-made disasters.
- To know pre- and post-disaster management for some of the disasters.
- To know about various information and organizations in disaster management in India.
- To get exposed to technological tools and their role in disaster management.

COURSE OUTCOMES(CO):

After completing this course, student will be:

CO1: Acquainted with fundamental concepts of disaster, hazard, vulnerability, risk, and capacity, and explain their inter-relationships.

CO2 : Classify various types of disasters (Geological, Hydro-meteorological, Biological, Man-made) and analyze their causes, trends, and consequences.

CO3 : Apply the Disaster Management Cycle (Pre, During, Post) and global frameworks (Hyogo, IDNDR) to plan for risk assessment and mitigation.

CO4 : Familiarised with institutional and legal mechanism of Disaster Management in India, including the DM Act 2005 and the role of various agencies.

CO5: Able to select scientific tools (GIS, RS, GPS) and engineering practices (structural/non-structural mitigation) for disaster preparedness and safe construction.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	2	-	-	-	3	-	1	*	*
CO2	3	2	-	-	3	-	2	*	*
CO3	1	2	1	-	3	2	2	*	*
CO4	2	-	-	-	3	1	2	*	*
CO5	3	2	1	2	3	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Understanding Disaster (02 Periods)

Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.

Unit – II: Types, Trends, Causes, Consequences and Control of Disasters (05 Periods)

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

Unit - III: Disaster Management Cycle and Framework (08 Periods)

Disaster Management Cycle – Paradigm Shift in Disaster Management. Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness. During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.

Unit – IV: Disaster Management in India (05 Periods)

Disaster Profile of India – Mega Disasters of India and Lessons Learnt. Disaster Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies 457 Open Elective Courses

Unit – V: Applications of Science and Technology for Disaster Management (08 Periods)

Geo-informatics in Disaster Management (RS, GIS, GPS and RS). Disaster Communication System (Early Warning and Its Dissemination). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India

RECOMMENDED BOOKS:

1. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management.
2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi.
3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi.
4. Alexander, David, Natural Disasters, Kluwer Academic London.
5. Ghosh, G. K., Disaster Management, A P H Publishing Corporation.
6. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	02	10
II	05	19
III	08	28
IV	05	19
V	08	24
Total	**28**	**100**

MSME TECHNOLOGY CENTRE, KANPUR **Email:- info@msmetckanpur.org**

PRACTICAL	4.9 PLC LAB	L	T	P
		-	-	4

COURSE OBJECTIVE:

The objective of this course is to provide practical exposure to industrial automation systems, including electrical control circuits, Programmable Logic Controllers (PLCs), and Distributed Control Systems (DCS). The course aims to develop skills in designing, programming, implementing, and troubleshooting automation systems using ladder logic for industrial applications such as conveyor control, water level control, motor control, and process automation.

COURSE OUTCOMES (COS)

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

CO1: Identify and analyze industrial control components and construct simple electrical control circuits used in automation systems.

CO2 : Understand the architecture, operation, and applications of PLC and DCS systems used in industrial process and manufacturing automation.

CO3 : Develop and implement PLC ladder logic programs for basic logical operations, timer functions, and counter-based control applications.

CO4 : Design and execute PLC programs for industrial automation processes such as conveyor systems, water level control, and traffic control systems.

CO5 : Develop PLC-based control programs for servo motor speed control and other motion-control applications used in automated systems.

CO6 : Apply PLC programming and industrial automation principles to analyze, troubleshoot, and improve the performance of automated control systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	2	1	-	1	*	*
CO2	3	2	1	3	1	-	2	*	*
CO3	2	3	3	3	-	1	2	*	*
CO4	2	3	3	3	2	1	2	*	*
CO5	3	3	3	3	1	1	2	*	*
CO6	2	3	2	3	2	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional**.**

Introduction to Programmable Logic Controller

Relays, Switches, Contactors (Construction, Working & Applications).,PLC evolution , hardwire control system compared with PLC system , advantages of PLCs ,criteria for selection of suitable PLC , Block diagram of PLC ,principle of operation , CPU memory organization ,I/O modules , Input types , Logic, Analog pulse train expansion modules , power supplies to PLC , modular PLCs , list of various PLCs available.

Input Modules: Discrete input module , AC input module , DC input module , sinking and sourcing , sensor input , special input modules , Sensors , limit switch, reed switch, photo electric sensor, inductive proximity sensor ,Input Addressing scheme in important commercial PLCs.

Output modules: Discrete output module, TTL output module, Relay output, isolated output module, surge suppression in output, Analog outputs, open collector output. Output Addressing scheme in important commercial PLCs.

LIST OF PRACTICALS

1. Identification of control components and using them in simple electrical control circuits.
2. Practical's of PLCs
3. Demonstration of DCS system in typical pharmaceutical plant/thermal power plant
4. Develop ladder program for logic gates
5. Develop ladder program for conveyor control
6. Develop ladder program for water level control
7. Develop ladder program for servo motor speed control
8. Develop ladder program for Traffic control system.
9. Develop ladder program using Timer circuit
10. Develop ladder program using counter circuit

PRACTICAL	4.10 CAM & CNC LAB PRACTICE	L	T	P
		-	-	4

COURSE OBJECTIVE

The objective of this course is to provide practical knowledge of CNC machine tools, CNC programming, machining operations, and Flexible Manufacturing Systems (FMS). The course aims to develop skills in CNC turning and milling operations, CAM software applications, machine maintenance, and manufacturing documentation to prepare students for modern automated manufacturing environments.

COURSE OUTCOMES (COS)

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

CO1 : Understand the constructional features, working principles, and functional components of CNC lathes, CNC milling machines, automatic tool changers, and pallet systems used in advanced manufacturing.

CO2: Develop and execute CNC part programs for turning operations such as facing, plain turning, taper turning, and circular interpolation to manufacture components accurately.

CO3 : Develop and execute CNC part programs for milling operations including plain milling, slot milling, contouring, and pocket milling using CNC machining centers.

CO4 : Prepare technical documentation such as work instructions and preventive maintenance schedules for efficient operation and maintenance of CNC machines.

CO5 : Understand the structure, operation, and industrial applications of Flexible Manufacturing Systems (FMS) and their role in modern automated production environments.

CO6 : Apply CNC simulation/CAM software for programming, verification, and optimization of turning and milling operations on CNC machine centers.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	2	1	-	1	*	*
CO2	3	3	3	3	1	1	2	*	*
CO3	3	3	3	3	1	1	2	*	*
CO4	2	2	1	2	3	3	1	*	*
CO5	3	2	2	2	2	1	2	*	*
CO6	2	3	3	3	1	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional**.**

LIST OF PRACTICALS

1. Study of constructional detail of CNC lathe.
2. Study of constructional detail of CNC milling machine.
3. Study the constructional details and working of Automatic tool changer and Multiple pallets
4. Develop a part Programme for following lathe operations and make the job on CNC lathe.
   - Plain turning and facing operation.
   - Taper turning operation.
   - Circular interpolation.

5. Develop a part Programme for the following milling operation and make the job on CNC milling
   - Plain milling.
   - Slot milling.
   - Contouring.
   - Pocket milling.
6. Preparation of work instructions for machine operator.
7. Preparation of preventive maintenance schedule for CNC machine.
8. Demonstration through industrial visit for awareness of actual working of FMS in production.
9. Use of software for Turning and Milling operation on CNC Turning and Milling Machine Center.

AUDIT COURSE	4.11 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVE:

To introduce the rich heritage of the Indian Knowledge System, bridging ancient wisdom with modern science and promoting holistic well-being through Yoga and traditional healthcare practices.

COURSE OUTCOMES:

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

CO1: Explain the foundational structures of the Indian Knowledge System, including the Vedas, Upavedas, Vedangas, and Upangas, and discuss their historical significance.

CO2: Relate ancient Indian scientific and technological achievements to modern science and analyze the convergence of science and spirituality.

CO3: Describe the basic principles of Yoga and Holistic Healthcare and evaluate their benefits and potential for integration with modern medicine.

CO4: Analyze case studies to demonstrate the contemporary relevance and practical application of Indian Knowledge Systems in solving modern problems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	1	-	-	-	3	-	2	*	*
CO2	2	2	-	-	2	-	2	*	*
CO3	-	-	-	-	3	2	3	*	*
CO4	1	2	2	-	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

Importance and relevance

1. Introduction to the Vedas
2. Upavedas
3. Vedangas
4. Upangas

Unit – II: Modern Science and Indian Knowledge System (06 Periods)

1. Relevance of Science and Spirituality,
2. Science and Technology in Ancient India,

Unit – III: Yoga and Holistic Healthcare (04 Periods)

1. Basic principles of Yoga
2. Benefits of holistic healthcare practices
3. Integration with modern healthcare

Unit – IV: Case Studies / Assignment (02 Periods)

Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times

ASSESSMENT

Viva -Voce Exam

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	16	50
2.	06	20
3.	04	15
4.	02	15
Total	**28**	**100**

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THEORY	5.1 MICROPROCESSOR & MICROCONTROLLER	L	T	P
		2	-	-

COURSE OBJECTIVE

The course aims to:

1. Understand the architecture, organization, and operation of microprocessors and microcontrollers.
2. Develop knowledge of 8085/8080A instruction sets and assembly language programming.
3. Learn interfacing techniques of memory and peripheral devices with microprocessors.
4. Understand concepts of interrupts, serial communication, timers, and programmable peripheral devices.
5. Study the architecture and applications of 8051 microcontroller in embedded and industrial systems.
6. Develop programming and troubleshooting skills required for industrial automation and embedded applications.

COURSE OUTCOMES (COS)

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

CO1: Explain the architecture, operation, and instruction set of 8085/8080A microprocessors.

CO2: Develop and debug assembly language programs using arithmetic, logical, branching, and data transfer instructions.

CO3: Apply interfacing concepts for memory, I/O devices, interrupts, timers, ADC/DAC, and serial communication using 8085.

CO4: Describe the architecture, organization, and applications of microcontrollers and differentiate between microprocessors and microcontrollers.

CO5: Explain the architecture, memory organization, pin functions, and operational features of the 8051 microcontroller for embedded system applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	1	-	-	1	*	*
CO2	3	3	2	2	-	1	1	*	*
CO3	3	3	3	3	1	1	1	*	*
CO4	3	2	2	2	1	-	1	*	*
CO5	3	2	3	3	1	1	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: introduction of Microprocessor (5 Periods)

Microprocessors Architecture and its operation, Memory Input-Output (I/O), interfacing devices. The 8085/8080A Microprocessors, Instruction classification Instruction format, Example of a simple program, Instruction Timing and operation status, Introduction to 8085/8080A instruction set.

UNIT 2: Basic Instructions of 8085/8080 (3 Periods)

Data transfer Instructions, Arithmetic operation, logic operation, Branch operations, Assembly language programming in 8085; Debugging a program

UNIT 3: Programming with additional Instruction (6 Periods)

looping, counting, indexing, Additional Data transfer and 16bit Basic Interfacing Concept, Interfacing input Keyboard, Memory-mapped I/O, 8085 interrupt, D-A and A-D Convertor, 8255A programmable peripheral Interface, 8253 Programmable interval Timer, Basic concept of Serials I/O, software controlled Asynchronous serial I/O, SID, SOD, Hardware – controller serial I/O using Programmable chips.

UNIT 4: Introduction of Microcontrollers (7 Periods)

Block diagram of microcontroller: CPU, input device, output device, memory and buses common features of Microcontrollers: On-chip Oscillator, program and data memory, I/O Ports, Watchdog-timer reset, SFRs, Timers, Counters, Interrupts, ADC, PWM microprocessor and microcontroller, Hierarchy of microcontrollers Architectures of microcontroller Harvard, Von Neumann RISC and CISC Applications: House hold, Communication, Office equipment and industrial automation

UNIT 5: Blocks of Microcontroller 8051 (7 Periods)

ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports Functions of each pin of 8051 Clock circuit, reset Circuit, phase and state in machine cycle of 8051 Memory organization of 8051: Program and Data Memory Map, External Memory Addressing and Decoding Logic of 8051

INSTRUCTIONAL STRATEGY

The instructional strategy should focus on developing conceptual understanding, programming skills, hardware interfacing ability, and industrial application knowledge in microprocessors and microcontrollers.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Applications with 8085”, Penram International Publishing.
2. A.P. Mathur, “Introduction to Microprocessors”, Tata McGraw-Hill Education.
3. Douglas V. Hall, “Microprocessors and Interfacing: Programming and Hardware”, McGraw-Hill Education.
4. B. Ram, “Fundamentals of Microprocessors and Microcontrollers”, Dhanpat Rai Publications.

5. N. Senthil Kumar, M. Saravanan and S. Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press.
6. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, “The 8051 Microcontroller and embedded system”, Pearson Education.
7. Kenneth J. Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, Cengage Learning.
8. Aditya P. Mathur, “Microprocessors PC Hardware and Interfacing”, PHI Learning.
9. Krishna Kant, “Microprocessors and Microcontrollers: Architecture, Programming and System Design”, PHI Learning.
10. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	5	20
II	3	20
III	6	20
IV	7	20
V	7	20
Total	**28**	**100%**

THEORY	5.2 INDUSTRIAL ELECTRONICS & ITS APPLICATION	L	T	P
		2	-	-

COURSE OBJECTIVE:

The course aims to:

1. Understand the construction, working principles, characteristics, and applications of various power semiconductor devices used in industrial electronics.
2. Develop knowledge of power electronic converters such as rectifiers, inverters, choppers, and cyclo-converters used in industrial drives and power control systems.
3. Study industrial power distribution systems, emergency power supplies, and modern power supply techniques.
4. Interpret and prepare industrial electrical diagrams, wiring layouts, and motor connection schemes used in electrical installations and automation systems.
5. Understand the operation and applications of motor control devices, relays, solenoids, timers, counters, and sequencers used in industrial control circuits.
6. Develop troubleshooting, circuit analysis, and practical control system skills for industrial electrical and automation applications.

COURSE OUTCOMES (COS)

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

CO1: Explain the construction, operation, characteristics, and applications of power semiconductor devices such as SCR, TRIAC, DIAC, MOSFET, IGBT, GTO, MCT, and UJT.

CO2: Analyze and describe the working of power electronic converters including controlled rectifiers, inverters, choppers, and cyclo-converters used in industrial applications.

CO3: Explain industrial power distribution systems, emergency power supplies, UPS systems, batteries, and switch mode power supplies used in industries.

CO4: Interpret and prepare various industrial electrical diagrams such as schematic, wiring, ladder, block, and single-line diagrams along with motor connections.

CO5: Describe the working and applications of pilot devices, motor starters, relays, solenoids, timers, counters, and sequencers used in industrial control systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	2	1	2	1	-	1	*	*
CO2	3	3	3	2	2	1	1	*	*
CO3	3	2	2	2	3	1	1	*	*
CO4	3	2	3	3	1	2	1	*	*
CO5	3	3	2	3	2	2	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Power Semiconductor Devices (6 Periods)

Construction, working, characteristic & applications of:- SCR, TRIAC, DIAC, Power Transistor , MOSFET,GTO , IGBT , MCT ,UJT . Circuit diagram, working and application of:- Controlled Rectifiers (Single phase and 3 phase), Inverter - Series, parallel, bridge types, Chopper – Step down, step up, Cyclo- converters - Single and 3 phase.

UNIT 2: Power And Power Distribution System (6 Periods)

Power Distribution System: Stages in delivery of power to an Industrial user, Power quality, Emergency power supply system: On site alternator & UPS system. Implant distribution: Power control Centre, Motor control Centre. Power sources: Batteries, Linear power supplies ,Switch mode power supply.

UNIT 3: Industrial Electrical Diagrams (4 Periods)

Electrical symbols, Diagrams, Wiring diagram ,Schematic diagram, Block diagram , Single line diagram , Ladder diagram, Motor connection and technology.

UNIT 4: Motor Control Devices And Circuits (6 Periods)

Introduction of Pilot Devices

Manually operated switches: Toggle switch, Slide switch, DIP switch, Rotary switch, Thumb wheel switch, Selector switch, Push button switch, Drum switch.

Mechanically operated switches: Limit switch, Micro switch, Temperature switch, Pressure switch, Float switch, Flow switch.

Manual control devices: Disconnect switch, Manual motor starter, Manual drum switch.

Contractors and motor starters: Contractor, Magnetic motor starter, Solid state contractor.

Unit 5: Magnets, Solenoids, Relays, Timers And Counters (6 Periods)

Introduction of Magnets and electromagnets.

Solenoid: Basic solenoid action, Inline (or ON/OFF) solenoid valve, solenoid specification, Selecting solenoid for a given application, Types of solenoid valves - One example - 3-way 2 position, Application for solenoids.

Relays: Electro mechanical control relays, Solid state relays, Timing relays, Latching relays, Relay logic.

Timer: Introduction, Types, Pneumatic timer, Electromechanical motor driven timer, Solid state electronic timer, Microprocessor (digital) timer, Application of timers, Testing and troubleshooting the timer.

Counters: Introduction and Timer Modes, Mechanical counter, Electro mechanical counter, Solid state counters, Programmable timer/counter.

Sequencers: Introduction, Programmable sequencers.

INSTRUCTIONAL STRATEGY

An **instructional strategy** in industrial electronics refers to the teaching methods and learning activities used to help students acquire knowledge, technical skills, problem-solving abilities, and practical competencies related to electronic systems used in industries.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education.
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers.
3. Muhammad H. Rashid, “Power Electronics Handbook”, Academic Press.
4. V. K. Mehta & Rohit Mehta, “Principles of Power Electronics”, S. Chand Publishing.
5. R. K. Rajput, “Power Electronics”, Laxmi Publications.
6. J. B. Gupta, “industrial electronics and Control”, S. K. Kataria & Sons.
7. W. Bolton, “Industrial Control and Instrumentation”, Newnes (Elsevier).
8. Frank D. Petruzella, “industrial electronics ”, McGraw-Hill Education.
9. G. K. Mithal, “Industrial and Power Electronics”, Khanna Publishers.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	6	20
II	6	20
III	4	20
IV	6	20
V	6	20
Total	**28**	**100%**

THEOTY/PRACTICAL	5.3 EMBEDDED SYSTEM & ITS APPLICATION	L	T	P
		2	-	4

COURSE OBJECTIVES:

After completing this course, students will be able to:

1. Understand the fundamentals, architecture, and applications of embedded system used in various industrial and consumer applications.
2. Explain the architecture and programming concepts of 8051 microcontroller and develop simple assembly language programs.
3. Interface peripheral devices such as LEDs, displays, keyboards, sensors, ADCs, and DACs with microcontrollers.
4. Understand timers, interrupts, serial communication, and communication protocols used in embedded system .
5. Describe the concepts of RTOS, embedded software development tools, multitasking, and debugging techniques.
6. Design and analyze basic embedded system applications used in industrial automation, IoT, and real-time control systems.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the basic concepts, characteristics, classifications, and applications of embedded system.

CO2: Describe the architecture of 8051 microcontroller and develop assembly language programs using various instructions and addressing modes.

CO3: Interface input/output devices, displays, sensors, ADCs, and DACs with microcontroller-based embedded system.

CO4: Apply timers, counters, interrupts, UART, SPI, and I2C communication protocols in EMBEDDED SYSTEM applications.

CO5: Understand RTOS concepts, embedded software development process, multitasking, scheduling, and debugging tools.

CO6: Design simple embedded system applications and analyze real-time industrial and IoT-based embedded system.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	-	1	-	2	*	*
CO2	3	3	2	2	-	-	2	*	*
CO3	3	3	3	3	1	1	2	*	*
CO4	3	3	3	3	1	1	2	*	*

CO5	2	2	2	3	1	2	3	*	*
CO6	3	3	3	3	2	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Introduction To Embedded System (5 Periods)

Definition of embedded system &, differences between general-purpose computer and embedded system, characteristics of embedded system, classification: standalone, real-time, networked, mobile embedded system, overview of embedded system design flow.

applications in: consumer electronics, industrial automation, automotive systems, medical electronics overview of embedded system design flow.

PRACTICALS:

1. Identification and Study of Components Used in EMBEDDED SYSTEM Trainer Kits.
2. Simulation and Overview of EMBEDDED SYSTEM Design Flow using Software Tools.

UNIT 2: 8051 Microcontroller Architecture And Programming (6 Periods)

Introduction to microcontrollers vs microprocessors , 8051 architecture block diagram, Pin diagram and functions, Special Function Registers (SFRs), Memory organization, Addressing modes, Instruction set overview.

Assembly language programming: Data transfer instructions, Arithmetic and logical operations, Branching instructions.

Simple programs: LED blinking, Delay generation, Counter applications

PRACTICALS:

1. Write and Execute Programs for Arithmetic Operations using 8051 Microcontroller.
2. Write and Execute Programs for Logical Operations using 8051 Microcontroller.
3. Write a Program for LED Blinking using 8051 Microcontroller.

UNIT 3: Peripheral Interfacing (3 Periods)

I/O port programming, LED and switch interfacing, Seven segment display interfacing, LCD interfacing (16x2), Keyboard matrix interfacing, ADC and DAC basics and interfacing, Sensor interfacing (temperature, LDR, etc.).

PRACTICALS:

1. Interfacing of Seven Segment Display with 8051 Microcontroller.
2. Interfacing of 16×2 LCD Display with 8051 Microcontroller.
3. Study and Interfacing of ADC & DAC with 8051 Microcontroller.

UNIT 4: Timers, Interrupts And Communication (5 Periods)

Timers and counters in microcontrollers, Modes of operation, Interrupt structure and types, Introduction to SPI and I2C protocols, Applications of communication systems.

Serial communication: UART basics, RS232 standard.

PRACTICALS:

1. Programming and Operation of Timers in 8051 Microcontroller.
2. Programming and Operation of Counters in 8051 Microcontroller.

UNIT 5: Real Time Operating System (Rtos) And Embedded Software (4 Periods)

Introduction to RTOS, Tasks, scheduling, multitasking, Kernel and system calls, Interrupt handling in RTOS, Embedded software development process, Cross-compilation and debugging tools, Basics of IDEs used in embedded system.

PRACTICALS:

1. Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM.
2. Write a program to find the square of a number (1 to 10) using a look-up table.
3. Write a program to find the largest or smallest number in an array of 32 numbers.

UNIT 6: Embedded System Design And Applications (5 Periods)

embedded system design cycle, Hardware-software co-design concept, Power supply design considerations, Introduction to IoT-based embedded system.

Case studies: Washing machine controller, Traffic light controller, Home automation system, Industrial motor control system.

PRACTICALS:

1. Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.
2. Interface a simple Switch and display its status through Relay, Buzzer and LED

INSTRUCTIONAL STRATEGY

The instructional strategy for embedded system focuses on developing theoretical understanding, programming skills, hardware interfacing ability, problem-solving skills, and practical application knowledge through classroom teaching, laboratory work, simulations, and project-based learning.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. Kenneth J. Ayala, “The 8051 Microcontroller”, Cengage Learning.
2. David E. Simon, “An Embedded Software Primer”, Pearson Education.
3. Shibu K. V., “Introduction to embedded system”, McGraw Hill Education.
4. Steve Heath, “EMBEDDED SYSTEM Design”, Newnes Publications.
5. Michael J. Pont, “Embedded C”, Pearson Education.
6. Peatman John B., “Design with Microcontrollers”, McGraw Hill Education.
7. Lyla B. Das, “EMBEDDED SYSTEM: An Integrated Approach”, Pearson Education.
8. Craig Hollabaugh, “Embedded Linux: Hardware, Software and Interfacing”, Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	5	20
II	6	20
III	3	15
IV	5	15
V	4	15
VI	5	15
Total	**28**	**100%**

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THEOTY/PRACTICAL	5.4 CNC TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVES:

After completing this course, students will be able to:

1. Understand the fundamentals, construction, working principles, and applications of NC, CNC, and DNC machines used in modern manufacturing industries.
2. Explain the components, control systems, tooling arrangements, and safety features of CNC machines.
3. Understand the operation of actuators, transducers, sensors, encoders, and axis drive systems used in CNC machine control.
4. Develop CNC part programs using standard programming formats, canned cycles, subroutines, and compensation techniques.
5. Identify and troubleshoot common mechanical, electrical, pneumatic, and electronic faults in CNC machines using diagnostic tools.
6. Develop practical knowledge of CNC machining systems for industrial automation and precision manufacturing applications.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concepts, advantages, applications, and constructional features of NC, CNC, and DNC systems.

CO2: Understand the working principles and applications of actuators, transducers, sensors, encoders, and axis drive systems used in CNC machines.

CO3: Develop CNC part programs using programming formats, canned cycles, subroutines, tool offsets, and compensation techniques.

CO4: Apply CNC machine technology and diagnostic techniques for efficient manufacturing and industrial automation applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	1	-	2	*	*
CO2	3	3	2	3	1	-	2	*	*
CO3	3	3	3	3	1	1	2	*	*
CO4	3	3	3	3	2	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit 1: Introduction (12 Periods)

Introduction to NC, CNC and DNC, their advantages, disadvantages and applications, Machine Control Unit, input devices, serial communication and Ethernet techniques , Selection of components to be machined on CNC machines, Problem with conventional NC, New Development in NC, Axis identification, PLC control and its components, Construction and Tooling, Design features, specification of CNC machines, Use of sideways, balls, rollers and coatings Motor and lead screw, swarf removal, Safety and guarding devices, Various cutting tools for CNC machines, Concept of CNC tool holder, different pallet systems and automatic tool changer system, Management of a tool room.

PRACTICALS:

1. Study of constructional detail of CNC lathe.
2. Study of constructional detail of CNC milling machine.

UNIT 2: System Devices (6 Periods)

Control System Open Loop and Closed Loop System, Concept of Actuators, Transducers and Sensors, Tachometer, LVDT, Opto-interrupters, Potentiometers for linear and angular position encoder and decoder and axis drives.

PRACTICALS:

1. Study the constructional details and working of Automatic tool changer and multiple pallets.

UNIT 3: Part Programming (5 Periods)

Introduction to Part programming, Basic concepts of part programming, NC words, part programming formats, simple programming for rational components, Part programming using canned cycles, subroutines and do loops, Tool off sets, cutter radius compensation and tool wear compensation.

PRACTICALS:

1. Develop a part Programme for following lathe operations and make the job on CNC lathe.
2. Plain turning and facing operation.
3. Taper turning operation.

UNIT 4: Problems in CNC Machines (5 Periods)

Common problems in CNC machines related to mechanical, electrical and pneumatic and Electronic components, Study of common problems and remedies, Use of on-time fault finding diagnosis tools in CNC machines.

PRACTICALS:

1. Circular interpolation.

INSTRUCTIONAL STRATEGY

Computer Numerical Control (CNC) technology is widely used in modern manufacturing industries for precision machining and automated production. An effective instructional strategy for CNC technology focuses on developing learners' theoretical understanding, practical skills, problem-solving abilities, and industry readiness.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw-Hill.
2. P. Radhakrishnan, "Computer Numerical Control Machines", New Age International Publishers.
3. I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers.
4. D. Patranabis, "Sensors and Transducers", PHI Learning.
5. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall.
6. Peter Smid, "CNC Programming Handbook", Industrial Press Inc.
7. Rao, Kundra & Tiwari, "Computer Aided Manufacturing", Tata McGraw-Hill.
8. Keith Mobley, "Maintenance Engineering Handbook", McGraw-Hill.
9. Ralph D. Nims, "Troubleshooting and Repairing CNC Machines", Industrial Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	12	40
II	6	20
III	5	20
IV	5	20
Total	**28**	**100%**

THEOTY/PRACTICAL	5.5 HYDRAULICS AND PNEUMATICS	L	T	P
		2	-	2

COURSE OBJECTIVES:

After completing this course, students will be able to:

1. Understand the fundamentals, construction, working principles, and applications of NC, CNC, and DNC machines used in modern manufacturing industries.
2. Explain the components, control systems, tooling arrangements, and safety features of CNC machines.
3. Understand the operation of actuators, transducers, sensors, encoders, and axis drive systems used in CNC machine control.
4. Develop CNC part programs using standard programming formats, canned cycles, subroutines, and compensation techniques.
5. Identify and troubleshoot common mechanical, electrical, pneumatic, and electronic faults in CNC machines using diagnostic tools.
6. Develop practical knowledge of CNC machining systems for industrial automation and precision manufacturing applications.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concepts, advantages, applications, and constructional features of NC, CNC, and DNC systems.

CO2: Understand the working principles and applications of actuators, transducers, sensors, encoders, and axis drive systems used in CNC machines.

CO3: Develop CNC part programs using programming formats, canned cycles, subroutines, tool offsets, and compensation techniques.

CO4: Apply CNC machine technology and diagnostic techniques for efficient manufacturing and industrial automation applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	1	-	2	*	*
CO2	3	3	2	3	1	-	2	*	*
CO3	3	3	3	3	1	1	2	*	*
CO4	3	3	3	3	2	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Introduction (12 Periods)

Need, scope and importance of hydraulic and pneumatic, Hydrostatic and hydrodynamic definitions, properties of fluid, Pascal's law, Continuity equation and Bernoulli's equation. Advantages and limitations of hydraulic and pneumatic systems.

Hydraulic Elements: Hydraulic Pipes- Type, materials, designations, pressure ratings and selection criteria, Piping Layout, Concept, rules/norms, Hydraulic Pump- Type, construction, working applications and selection criteria. Power pack, Control Valves- Type, designation, symbols, working and applications, Hydraulic Actuators- Type, working and applications, Other Elements such as filters, manifold, receivers, coolers and connecters.

PRACTICALS:

1. Study and demonstration of various hydraulic devices/elements.

UNIT 2: Fundamentals of Pneumatics (4 Periods)

Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications.

PRACTICALS:

1. Study and demonstration of various pneumatic devices/elements.

UNIT 3: Pneumatic Elements (4 Periods)

Pipes- Type, designations, applications and properties, Air Compressor- Type (Reciprocating and rotary), working and selection criteria, Pneumatic Cylinders- Type, symbol, cushion, assemblies, mounting and installation, Air Motors- Type, working and applications, Pneumatic Valves- Type, symbols, working, applications and selection criteria, Other elements - Air receivers, filters, pressure regulator, lubricator.

PRACTICALS:

1. Operate, pneumatic circuit based on simple systems requirements (at least 3)

UNIT 4: Hydraulic and Pneumatic Circuits (4 Periods)

Concept, Meaning and ISO symbols, Basic hydraulic and pneumatic Circuits-Type, circuit diagrams, Rules/ Norms for designing hydraulic and pneumatic circuits.

PRACTICALS:

1. Operate hydraulic circuits based on simple system requirement. (at least 3)
2. Visit to a related industry.

INSTRUCTIONAL STRATEGY

Hydraulics and Pneumatics are essential subjects in mechanical, industrial, and automation engineering. Effective instructional strategies help learners understand fluid power principles, system components, circuit design, operation, maintenance, and industrial applications through theory and practical exposure.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. S. R. Majumdar, "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw-Hill.
2. S. R. Majumdar, "Pneumatic Systems: Principles and Maintenance", Tata McGraw-Hill.
3. Anthony Esposito, "Fluid Power with Applications", Pearson Education.
4. Andrew Parr, "Hydraulics and Pneumatics: A Technician's and Engineer's Guide", Elsevier.
5. Jagadeesha T., "Hydraulics and Pneumatics", I.K. International Publishing House Pvt. Ltd.
6. Dr. Ilango S. and Soundararajan V., "Introduction to Hydraulics and Pneumatics", PHI Learning Pvt. Ltd.
7. Pippenger and Hicks, "Industrial Hydraulics", McGraw-Hill Education.
8. Srinivasan R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints Pvt. Ltd.
9. Peter Rohner, "Fluid Power Logic Circuit Design", Macmillan Education.
10. John Watton, "Fundamentals of Fluid Power Control", Cambridge University Press.
11. Bolton W., "Pneumatic and Hydraulic Systems", Butterworth-Heinemann.
12. D. A. Pease and John J. Pippenger, "Basic Fluid Power", Prentice Hall.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	12	30
II	4	20
III	8	30
IV	4	20
Total	**28**	**100%**

THEORY	5.6.1 ECONOMIC POLICIES IN INDIA (OE 2)	L	T	P
		2	-	-

COURSE OBJECTIVES:

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

COURSE OUTCOMES(CO):

CO1: Explain the basic features of the Indian economy, including demographic trends, and analyze major economic problems like poverty, unemployment, and inflation.

CO2: Discuss the role of the agricultural sector, the impact of land reforms and the Green Revolution, and evaluate current agricultural policies.

CO3: Describe the industrial development pattern, the significance of small-scale industries, and the growth of the service sector in India.

CO4: Analyze the framework of economic planning (Planning Commission vs. NITI Aayog), and the impact of Monetary, Fiscal, and LPG policies.

CO5: Interpret India's external sector performance, including foreign trade composition, Balance of Payments, and the impact of Globalization and WTO.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	1	2	-	-	2	1	2	*	*
CO2	1	2	-	-	2	1	1	*	*
CO3	1	1	-	-	2	2	2	*	*
CO4	1	2	-	-	3	3	2	*	*
CO5	1	2	-	-	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

Unit – 1: Basic features and problems of Indian Economy: (08 Periods)

Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Un employment, Inflation, income inequality, Black money in India.

Unit – 2: Sectorial composition of Indian Economy: (05 Periods)

Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

(04 Periods)

Unit – 3: Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

Unit – 4: Economic Policies: (06 Periods)

Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India.

Unit – 5: External sector in India: (05 Periods)

India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

RECOMMENDED BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	23
2	05	20
3	04	17
4	06	20
5	05	20
Total	**28**	**100**

THEORY	5.6.2 PROJECT MANAGEMENT (OE 2)	L	T	P
		2	-	-

COURSE OBJECTIV

The aim of this course is to help the students to develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the fundamental concepts of project management, including the project life cycle and priorities, and construct a Work Breakdown Structure (WBS) for a given project.

CO2: Apply the capital budgeting process to generate and screen project ideas and analyze market feasibility using demand forecasting techniques.

CO3: Estimate project costs, working capital requirements, and prepare projected financial statements including Cash Flow and Break-Even analysis.

CO4: Evaluate the financial viability of projects using discounting (NPV, IRR) and non-discounting (Payback, ARR) capital budgeting techniques and social cost-benefit analysis.

CO5: Develop project schedules using Network Planning techniques (CPM/PERT) to analyze time-cost trade-offs and determine the least cost duration.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	2	1	1	-	-	3	1	*	*
CO2	2	2	-	-	1	3	2	*	*
CO3	2	2	-	-	-	3	1	*	*
CO4	2	2	-	-	2	3	2	*	*
CO5	2	3	1	2	-	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

UNIT-I: Concept of a project: **(04 Periods)**

Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time) project priority matrix- work break down structure.

UNIT-II: Capital budgeting process: (06 Periods)

Planning- Analysis-Selection-Financing-Implementation-Review.

Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

UNIT-III: Financial estimates and projections: (06 Periods)

Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability , projected cash flow statement and balance sheet. Break even analysis.

UNIT-IV: Basic techniques in capital budgeting: **(06 Periods)**

Non discounting and discounting methods- payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return.

Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**

UNIT-V: Project administration: **(06 Periods)**

Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress,

time-cost trade off.

Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management software.

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial and start- up qualities in the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term written tests
- Model/Proto type making.

RECOMMENDED BOOKS:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill
3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
4. Project Management – Gopala krishnan – Mcmillan India Ltd.
5. Project Management-Harry-Maylor-Peason Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	04	18
II	06	22
III	06	20
IV	06	20
V	06	20
Total	**28**	**100**

MSME TECHNOLOGY CENTRE, KANPUR **Email:- info@msmetckanpur.org**

THEORY	5.7.1 DIGITAL SIGNAL PROCESSING (PE-3)	L	T	P
		2	-	-

COURSE OBJECTIVES:

The objective of this course is to provide students with a strong foundation in Digital Signal Processing (DSP), including the representation and analysis of signals and systems in both time and frequency domains. The course aims to develop understanding of discrete-time signals, linear time-invariant systems, sampling and quantization techniques, Z-transform, Fourier transform, DFT, and their practical applications in digital communication and signal analysis.

COURSE OUTCOMES(CO):

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

CO1: Explain the concepts of signals, systems, and signal processing, and compare digital signal processing with analog signal processing. Classify different types of signals and understand frequency representation in continuous-time and discrete-time domains.

CO2: Describe and classify discrete-time signals and systems, perform signal manipulations, analyze LTI systems using convolution, and study recursive and non-recursive systems represented by difference equations.

CO3: Apply Z-transform techniques for the analysis of discrete-time LTI systems, determine poles and zeros, evaluate system behavior, and compute inverse Z-transform using different methods.

CO4: Analyze discrete-time signals in the frequency domain using Fourier Transform and Discrete Fourier Transform (DFT), evaluate DFT properties, and perform circular convolution and spectral analysis.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	-	-	1	*	*
CO2	3	3	2	2	-	1	1	*	*
CO3	3	3	2	2	-	1	2	*	*
CO4	3	3	2	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

UNIT 1: INTRODUCTION (8 Periods)

Discuss Signals, Systems & Signal processing. Explain basic element of a digital signal processing system. Compare the advantages of digital signal processing over analog signal processing.

Classify signals : Multi channel & Multi dimensional signals, Continuous time verses discrete time, Continuous valued verses discrete valued signals, Deterministic Versus Random Signals, Discuss the concept of frequency in continuous time & discrete time signals, Continuous-time sinusoidal signals, Discrete-time sinusoidal signals. Harmonically related complex exponential, Discuss Analog to Digital & Digital to Analog conversion & explain the following. Sampling of Analog signal. The sampling theorem. Quantization of continuous- amplitude signals. Quantization of sinusoidal signals. Coding of quantized sample. Digital to analog conversion. Quantization of sinusoidal signals. Analysis of digital systems signals vs. discrete time signals systems.

UNIT 2: Discrete time signals & systems. (8 Periods)

State and explain discrete time signals. Discuss some elementary discrete time signals. Classify discrete time signal. Discuss simple manipulation of discrete time signal. Discuss discrete time system.

Describe input-output of system. Draw block diagram of discrete time system. Classification of discrete time system. Discuss inter connection of discrete time system. Analysis of discrete time linear time-invariant system. Discuss different technique for the analysis of linear system. Discuss the resolution of a discrete time signal into impulse. Discuss the response of LTI system to arbitrary I/Ps using convolution theorem. Explain the properties of convolution & interconnection of LTI system.

Study systems with finite duration and infinite duration impulse response. Discuss discrete time system described by difference equation. Explain recursive & non-recursive discrete time system. The impulse response of linear time invariant recursive

UNIT 3: The z-transform & its application to the analysis of LTI system. (6 Periods)

Discuss Z-transform & its application to LTI system. State & explain direct Z-transform. State & explain inverse Z-transform. Discuss various properties of Z-transform. Discuss rational Z-transform. Explain poles & zeros. Determine pole location time domain behavior for casual signals.

Describe the system function of a linear time invariant system. Discuss inverse Z-transform. Determine inverse Z transform by partial fraction expansion.

UNIT 4: Fourier transform: its applications properties (6 Periods)

Discuss discrete fourier transform. Determine frequency domain sampling and reconstruction of discrete time signals. State & explain discrete Fourier transformation (DFT).Compute DFT as a linear transformation. Relate DFT to other transforms. Discuss the property of the DFT. Discuss periodicity, linearity & symmetry property. Explain multiplication of two DFT & circular convolution.

INSTRUCTIONAL STRATEGY

The instructional strategy for the Digital Signal Processing course is designed to promote conceptual understanding, analytical ability, practical implementation skills, and problem-solving capability through a combination of theoretical and application-oriented teaching methods.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson Education.
2. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing", Pearson Education.
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya, "Digital Signal Processing", McGraw Hill Education.
4. P. Ramesh Babu, "Digital Signal Processing", Scitech Publications.
5. Monson H. Hayes, "Digital Signal Processing", Schaum's Outline Series, McGraw Hill.
6. Andreas Antoniou, "Digital Signal Processing: Signals, Systems and Filters", Tata McGraw Hill.
7. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", Pearson Education.
8. Sanjit K. Mitra, "Digital Signal Processing: A Computer-Based Approach", McGraw Hill Education.
9. B. P. Lathi, "Principles of Linear Systems and Signals", Oxford University Press.
10. Simon Haykin and Barry Van Veen, "Signals and Systems", Wiley India Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	8	25
II	8	25
III	6	25
IV	6	25
Total	**28**	**100%**

THEORY	5.7.2 AUTOMATION & CONTROL (PE-3)	L	T	P
		2	-	-

COURSE OBJECTIVE:

Automation and Control is the field focused on using technology to operate processes and systems with minimal human intervention. It involves sensors, controllers, and actuators to monitor and regulate machines and industrial operations. This enhances efficiency, accuracy, and safety across various industries, including manufacturing, energy, transportation, and building management systems.

COURSE OUTCOMES (COS)

At the end of the subject, the students will be able to:

CO1: Identify industrial automation components.

CO2: Explain power semiconductor devices.

CO3: Develop PLC ladder programs for applications.

CO4: Analyze control strategies.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	2	-	-	1	*	*
CO2	3	3	-	2	-	-	1	*	*
CO3	2	2	3	3	-	-	1	*	*
CO4	2	2	3	2	-	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional**.**

DETAILED CONTENT

UNIT I: Understand the concept of Industrial Automation and its applications: (7 Periods)

Automation - need for automation - advantages and disadvantages of automation – ten strategies for automation - types of automation - fixed, programmable, flexible and integrated automation – advantages and disadvantages - basic elements of an automated system – levels of automation - future challenges of automation.

UNIT II: Illustrate the structure and operation of Power Semiconductor Devices(7 Periods)

SCR - structure - characteristics - working principle – applications - two transistor analogy – turn on/triggering methods - gate triggering methods - 'R' triggering - RC triggering - UJT triggering - commutation techniques - forced commutation circuits (class A to E) DIAC, TRIAC- structure - working principle – characteristics – applications.

UNIT III: Explain the working of Controlled Rectifiers and Inverters: (7 Periods)

Single phase converters - half wave - full wave midpoint and bridge - working principle with R, RL

loads - Basic inverter circuit - working principle - series and parallel inverter circuits - working principle – single phase dual converters - working principle - applications.

UNIT IV: Develop PLC ladder program for an application: (7 Periods)

PLC - architecture - advantages - applications - ladder logic - ladder diagram instruction sets - bit instructions - timer/counter instructions - compare instructions - move instructions - math instructions - program control instructions - ladder programs – logic gates - staircase lamp – conveyor control – water level control – servo motor speed control.

INSTRUCTIONAL STRATEGY

- Presentation / Seminars by students on any recent technological developments based on the course.
- Periodic class /online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.
- Student may view video lectures from NPTEL and submit assignments on required topics.
-

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests
2. Sessional test
3. Viva-voce

RECOMMENDED BOOKS:

1. Industrial automation and mechatronics - A.K.Gupta, S.K.Arora
2. INDUSTRIAL ELECTRONICS & ITS APPLICATION and Control - S K Bhattacharya, S Chatterjee
3. Programmable logic controllers - Frank D Petruzella.
4. INDUSTRIAL ELECTRONICS & ITS APPLICATION and Control - Biswanath Paul - PHI
5. Power Electronics - P S Bimbhra
6. Introduction to Programmable Logic Controllers - Gary Dunning - 3rd Edition - Delmar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted
1	7	25
2	7	25
3	7	25
4	7	25
Total	28	**100%**

THEORY	5.8 INDIAN CONSTITUTION (AUDIT COURSE)	L	T	P
		2	-	-

COURSE OBJECTIVES:

To provide a comprehensive understanding of the Indian Constitution's history and philosophy, and to familiarize them with the administrative structure, powers, and functions of the Union, State, and Local governments, along with the Judiciary and Election Commission.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the making of the Indian Constitution, interpret the Preamble, and discuss the significance of Fundamental Rights and Duties.

CO2: Describe the structure of the Union Executive, detailing the powers and roles of the President, Prime Minister, and Council of Ministers.

CO3: Distinguish between the functions of the Lok Sabha and Rajya Sabha and explain the jurisdiction and structure of the Supreme Court.

CO4: Discuss the administrative framework of State Governments, focusing on the roles of the Governor, Chief Minister, and State Secretariat.

CO5: Outline the hierarchy and functions of Local Administration, including District Administration, Municipal Corporations, and Zila Panchayats.

CO6: Examine the structure of the Election Commission of India and its critical role in conducting free and fair elections.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	-	-	-	-	3	1	3	*	*
CO2	-	-	-	-	2	2	2	*	*
CO3	-	-	-	-	3	1	2	*	*
CO4	-	-	-	-	2	2	2	*	*
CO5	-	-	-	-	3	2	2	*	*
CO6	-	-	-	-	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

Unit – I: The Constitution – Introduction **(06 Periods)**

The History of the Making of the Indian Constitution
Preamble and the Basic Structure, and its interpretation
Fundamental Rights and Duties and their interpretation

Unit – II: Union Government **(06 Periods)**

Structure of the Indian Union Government
President – Election, Role and Power
Prime Minister and Council of Ministers

Unit – III: Indian Legislature & Judiciary **(06 Periods)**

Composition of Lok Sabha and Rajya Sabha
Powers & Functions of Lok Sabha and Rajya Sabha
Structure of Supreme Court including Appointment of Judges
Powers & Functions of Supreme Court

Unit – IV: State Government **(03 Periods)**

Governor – Role and Power
Chief Minister and Council of Ministers State Secretariat

Unit – V: Local Administration **(04 Periods)**

District Administration
Municipal Corporation
Zila Panchayat

Unit – VI: Election Commission **(03 Periods)**

Structure of Election Commission of India
Role and Function of Election Commission

INSTRUCTIONAL STRATEGY

Teach the Indian Constitution through interactive methods like case studies, debates, and role-plays to engage students. Use visuals and simplified texts to explain key features like fundamental rights and duties. Encourage discussions on amendments and landmark judgments. Incorporate quizzes and group projects to foster critical thinking and civic awareness.

MEANS OF ASSESSMENT

- Class test/quizzes
- Home assignments
- Attendance
- Sessional Test

RECOMMENDED BOOKS:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition
4. Our Constitution Subhash Chand Kashyap NBT New Delhi.

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/
5. https://ncert.nic.in/textbook.php

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	06	21
II	06	21
III	06	21
IV	03	11
V	04	15
VI	03	11
Total	**28**	**100**

THEORY/PRACTICAL	6.1 INDUSTRIAL AUTOMATION	L	T	P
		1	-	2

COURSE OBJECTIVES:

Students will be able to:

1. Understand concepts of industrial automation and control systems.
2. Identify automation components used in industries.
3. Develop basic PLC programs and automation logic.
4. Understand sensors, actuators, drives, and industrial communication systems.
5. Analyze SCADA, HMI, and Industry 4.0 concepts.
6. Apply automation principles in manufacturing and process industries.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concepts, types, hierarchy, importance, and industrial applications of automation systems along with safety practices and smart manufacturing concepts.

CO2: Develop simple PLC programs using Ladder Diagram (LD) and Functional Block Diagram (FBD) programming methods.

CO3: Implement PLC-based industrial applications such as motor control systems, lift systems, and process automation using suitable programming techniques.

CO4: Explain SCADA, HMI, industrial communication protocols, cloud monitoring, and cybersecurity concepts used in modern industrial automation systems.

CO5: Explain the evolution of industries from Industry 1.0 to Industry 4.0 and identify key technologies used in modern automation systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	2	1	2	*	*
CO2	3	3	2	2	1	1	2	*	*
CO3	3	3	2	3	1	1	2	*	*
CO4	3	3	3	3	1	2	2	*	*
CO5	3	2	2	3	2	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Introduction to Industrial Automation (3 Periods)

Definition and scope of automation

Types of automation: Fixed automation, Programmable automation, Flexible automation

Industrial automation hierarchy, Need and importance of automation, Automation in manufacturing industries, Advantages and limitations of automation, Industrial safety practices, Introduction to smart factories and digital manufacturing.

PRACTICALS:

1. Study of industrial automation components.
2. Testing of inductive and capacitive sensors.

UNIT 2: Introduction to Programmable Logic Controller (3 Periods)

Introduction to PLC, PLC architecture and working, Input/output modules.

PLC programming languages: Ladder Diagram (LD), Functional Block Diagram (FBD) basics.

PLC instructions: Timer, Counter, Compare, Sequencing.

PLC wiring and troubleshooting, Industrial PLC applications, Introduction to PLC simulation software

PRACTICALS:

1. PLC Programming for Logic Gates.
1. Basic PLC ladder programming
2. PLC timer and counter applications

UNIT 3: PLC Programming (3 Periods)

Symbols used . relays and logic functions, OR, AND, Comparator ,Programming Devices , programming methods , STL and CSF, FBD and Ladder methods , simple instructions , Programming NC and NO contacts , EXAMINE ON and EXAMINE OFF instructions , online, offline methods, Latch and Unlatch outputs , pulse edge evaluation , timer instructions , on, delay and off, delay timer. Counter instructions, UP / DOWN counters, Timer and Counter applications. Program control, instructions, Data manipulating instructions, Math instructions. Converting simple relay ladder diagram into PLC relay ladder diagram, PID and PWM functions.

Sample PLC implementations for Automatic Star, Delta Starter, floor Lift system.

PRACTICALS:

1. Motor Star, Delta Starter using PLC.
2. Traffic Light Simulation.
3. Tank Level Controller.

UNIT 4: SCADA, HMI and Industrial Communication (3 Periods)

Introduction to SCADA, SCADA architecture, Human Machine Interface (HMI), Data acquisition systems

Industrial communication protocols: Modbus, Profibus, Ethernet/IP, CAN bus

Cloud monitoring concepts, Cyber security basics in automation.

PRACTICALS:

1. SCADA Screen Design for Automated System.
2. Interfacing SCADA with PLC for Industrial Application.
3. PID Controller implementation in PLC.
4. Temperature Monitoring System using SCADA

Unit 5: Industry Evolution & Automation (2 Periods)

Industry evolution (1.0, 2.0, 3.0 & 4.0), Robot applications, CNC and automation integration, Artificial Intelligence in automation, Digital twin, Predictive, Breakdown maintenance, Cyber security in automation.

PRACTICALS:

1. Comparative study of different industrial revolutions.
2. Programming or simulation of robotic arm for pick-and-place application.
3. Study of interfacing PLC with CNC system for automated process control.

INSTRUCTIONAL STRATEGY

Industrial Automation is a multidisciplinary subject involving electrical systems, electronics, control engineering, PLCs, sensors, SCADA, industrial communication, and smart manufacturing technologies. Effective instructional strategies should combine theoretical understanding with practical implementation and industry-oriented learning.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. Frank D. Petruzella, "Programmable Logic Controllers", McGraw-Hill Education.
2. Bolton W., "Programmable Logic Controllers", Newnes Publication.
3. Krishna Kant, "Computer Based Industrial Control", PHI Learning Pvt. Ltd.
4. B. R. Mehta and Y. J. Reddy, "Industrial Process Automation Systems: Design and Implementation", Elsevier.
5. Mikell P. Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Education.
6. Stenerson Jon, "Industrial Automation and Process Control", Prentice Hall.
7. Hugh Jack, "Automating Manufacturing Systems with PLCs", Version 5.0, Open Textbook.
8. Gary Dunning, "Introduction to Programmable Logic Controllers", Cengage Learning.
9. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", PHI Learning.
10. Richard L. Shell and Ernest L. Hall, "Handbook of Industrial Automation", CRC Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	3	20
II	3	20
III	3	20
IV	3	20
V	2	20
Total	**14**	**100%**

THEORY	6.2 ENTREPRENEURSHIP AND START-UPS	L	T	P
		2	-	-

COURSE OBJECTIVES:

To foster an entrepreneurial mind set by equipping students with the skills to identify business opportunities, formulate comprehensive business plans, understand management functions, and navigate the financial and legal landscapes of starting and sustaining a venture.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concept of entrepreneurship, classify business structures, and distinguish between the roles of an entrepreneur and manager.

CO2: Identify feasible business ideas using activity maps and develop a preliminary Business Plan based on case study analysis.

CO3: Analyze market strategies using STP and SWOT analysis, and formulate the Vision, Mission, and Objectives for a start-up.

CO4: Discuss the fundamental functions of management, organizational structures, and the processes of recruitment, selection, and training.

CO5: Select appropriate financing methods (Govt schemes, Venture Capital) and apply Intellectual Property Rights (IPR) concepts to protect business ideas.

CO6: Describe the strategies for business succession, harvesting, and the legal types of dissolution.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	-	-	-	-	2	3	2	*	*
CO2	-	2	2	-	1	3	2	*	*
CO3	-	2	2	-	2	3	2	*	*
CO4	-	-	-	-	1	3	1	*	*
CO5	-	2	-	-	2	3	2	*	*
CO6	-	-	-	-	1	3	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit – I: Introduction to Entrepreneurship and Start – Ups (05 Periods)

Definitions, Classification of Entrepreneur
Traits of an Entrepreneur, Intrapreneurship, Motivation
Types of Business Structures- On the Basis of size and on the basis of ownership
Similarities/differences between entrepreneurs and managers

Unit – II: Business Ideas and their implementation (04 Periods)

Discovering ideas and visualizing the business
Activity map
Business Plan (Case Study)

Unit – III: Ideas to Start-up (08 Periods)

Marketing and Accounting- Definition and Importance.
Market Analysis – STP (Segmentation, Targeting, Positioning)
Competition evaluation and Strategy Development – Vision, Mission, Goal, Objectives.
Risk analysis- SWOT Analysis.

Unit – IV: Management (06 Periods)

Definition Concept and Functions of Management
Company's Organization Structure- Concept and Classification
Recruitment and Selection- Definition, Training and Development- Importance.

Unit – V: Financing and Protection of Ideas (03 Periods)

Financing methods available for Entrepreneurship/ Startups in India (Government Scheme, Banking, NBFCs, SHG and Micro Financing).
Intellectual Property Rights- Overview of - Copyrights, Trademark, Geographical Indicators, Patenting and Licenses
Communication of Ideas to potential investors – Investor Pitch.

Unit – VI: Succession, Dissolution and Harvesting strategy (02 Periods)

Ways of succession
Types of Dissolution

INSTRUCTIONAL STRATEGY

Entrepreneurship and start-ups include use experiential learning, integrate real-world projects, provide mentorship, foster interdisciplinary collaboration, partner with businesses, invite industry professionals for lectures, organize business plan competitions, offer practical consulting opportunities, and help students launch real ventures to build entrepreneurial skills and mindsets.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/Prototype making.

RECOMMENDED BOOKS:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company – Steve Blank and Bob Dorf, K & S Ranch, ISBN: 978-0984999392
2. Entrepreneurship Development (A New Venture Creation) – Vasant Desai, Himalaya Publishing House
3. Entrepreneurship Development – S.S. Khanka, S. Chand & Company Ltd., New Delhi
4. Entrepreneurship Development – Gupta and Srinivasan, S. Chand & Company Ltd., New Delhi
5. Demand: Creating What People Love Before They Know They Want It – Adrian J. Slywotzky with Karl Weber, Headline Book Publishing, ISBN: 978-0755388974
6. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses – Eric Ries, Penguin UK, ISBN: 978-0670921607
7. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business – Clayton M. Christensen, Harvard Business Review Press, ISBN: 978-1422196021

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	05	15
II	04	15
III	08	25
IV	06	20
V	03	10
VI	02	15
Total	**28**	**100**

PRACTICUM	6.3 ROBOTICS & ITS APPLICATION	L	T	P
		1	-	2

COURSE OBJECTIVES:

Students will be able to:

1. Understand the fundamentals and applications of robotics in industries.
2. Identify various robot components, configurations, and drive systems.
3. Understand robot kinematics, sensors, actuators, and control systems.
4. Develop basic robot programming and automation skills.
5. Apply robotics knowledge for industrial automation and smart manufacturing applications.

COURSE OUTCOMES:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the fundamentals of robotics, robot anatomy, classifications, degrees of freedom, workspace analysis, and industrial applications of robots.

CO2: Describe robot elements, end effectors, actuators, drive systems, transmission mechanisms, and select suitable robot drives for industrial applications.

CO3: Analyze the role of robotic sensors and apply basic robot control concepts including feedback systems, PID control, and safety mechanisms in robotic systems.

CO4: Apply basic robot kinematics, motion planning, and programming techniques for industrial robot operations using online/offline programming and simulation tools.

CO5: Explain the concepts of machine vision, artificial intelligence, autonomous robotic systems, and evaluate modern industrial applications and future trends in robotics.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	2	1	1	*	*
CO2	3	2	3	2	1	1	1	*	*
CO3	3	3	2	3	2	1	1	*	*
CO4	3	3	3	3	1	2	2	*	*
CO5	2	2	2	2	3	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

UNIT 1: Introduction to Robotics (3 Periods)

Definition and scope of robotics, History and evolution of robots, Laws of robotics, Need and importance of robotics, Robot anatomy and terminology

Classification of robots: Cartesian robot, Cylindrical robot, Polar robot, SCARA robot, Articulated robot, Collaborative robots (Cobots)

Degrees of freedom (DOF), Robot workspace and resolution, Applications of robots in industries, Advantages and limitations of robotics, Safety standards in robotic systems.

PRACTICALS:

1. Robot system connection and component recognition
2. Robot operation, moving the various axis continuous and intermittent motions.

UNIT 2: Robot Elements and Drives (3 Periods)

Robot structure and joints, End effectors: Mechanical grippers, Vacuum grippers, Magnetic grippers

Robot actuators: Electric drives, Hydraulic drives, Pneumatic drives

Servo motors and stepper motors, Transmission systems: Gear drives, Belt drives, Chain drives, Ball screw mechanisms.

Robot power supply systems, Robot drive selection criteria, Industrial robot examples.

PRACTICALS:

1. Writing program a. homing operation b. recording position
2. Program for operating the gripper
3. Program for pick and place the object
4. Program for stacking the object

UNIT 3: Sensors and Robot Control (2 Periods)

Introduction to robotic sensors.

Internal sensors: Position sensors, Velocity sensors, Encoders.

External sensors: Proximity sensors, Force and torque sensors, Vision sensors, Tactile sensors.

Feedback and closed-loop control.

Robot control systems: Point-to-point control, Continuous path control.

Introduction to PID control, Safety interlocks and emergency systems, Human-robot interaction basics.

PRACTICALS:

1. Measurement of applied force and touch sensing in robotic applications
2. Study of feedback control using motor speed control setup.

UNIT 4: Robot Kinematics and Programming (3 Periods)

Introduction to robot kinematics, Coordinate systems, Forward kinematics basics, Inverse kinematics basics.

Robot motion types: Linear motion, Circular motion, Joint motion.

Robot path planning concepts, Introduction to robot programming, Lead-through programming, Online and offline programming, Programming commands and syntax basics, Simulation software introduction, Industrial robot programming examples.

PRACTICALS:

1. Program for stacking the object
2. Write a Looping program

3. Study about XYZ coordinates
4. Write a Program using XYZ Coordinates
5. Write a program using wait, speed commands

UNIT 5: Machine Vision and Artificial Intelligence in Robotics (3 Periods)

Introduction to machine vision, Vision system components: Camera, Lighting, Image processing unit. Object detection and inspection, Barcode and QR code applications, Artificial Intelligence (AI) basics in robotics, Machine learning concepts, Autonomous mobile robots (AMR), Automated Guided Vehicles (AGV), Collaborative robots (Cobots), Industrial applications of AI-based robotics, Cyber security in robotic systems, Future trends in robotics.

PRACTICALS:

1. Measurement of Robot work envelope
2. Measurement of Robot of motion
3. Measurement of Repeatability

INSTRUCTIONAL STRATEGY

Robotics is an interdisciplinary subject that combines mechanical systems, electrical and electronics engineering, control systems, computer programming, artificial intelligence, and automation technologies. An effective instructional strategy should integrate theoretical concepts with practical implementation, simulation, and industry-oriented learning to prepare diploma students for modern industrial requirements.

MEANS OF ASSESSMENT

1. Class test/quizzes
2. Home assignments
3. Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
4. Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva voce.

RECOMMENDED BOOKS:

1. Mikell P. Groover, “Industrial Robotics: Technology, Programming and Applications”, McGraw-Hill.
2. S. R. Deb, “Robotics Technology and Flexible Automation”, Tata McGraw-Hill.
3. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, “Robotics: Control, Sensing, Vision and Intelligence”, McGraw-Hill.
4. John J. Craig, “Introduction to Robotics: Mechanics and Control”, Pearson Education.
5. R. K. Mittal and I. J. Nagrath, “Robotics and Control”, Tata McGraw-Hill.
6. Saeed B. Niku, “Introduction to Robotics: Analysis, Control and Applications”, Wiley India.
7. Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, “Robotic Engineering”, Prentice Hall.
8. Francis N. Nagy, “Industrial Robotics”, Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
I	3	20
II	3	20
III	2	20
IV	3	20
V	3	20
Total	**14**	**100%**

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PROJECT	6.4 IN-HOUSE- PROJECT	L	P
		4	16

In House Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or accept the given project assignment at least two to three months in advance. The project work identified in collaboration with industry should be preferred. Each teacher is expected to guide the project work of 5–6 students. The project assignments may consist of:

- Programming customer based applications
- Web page designing (Only dynamic)
- Database applications
- Software Development

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Use effectively oral, written and visual communication
- Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Identify, analyze and solve problems creatively through sustainment critical investigation.
- Develop leadership abilities.
- Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

THEORY	6.5.1 ARTIFICIAL INTELLIGENCE (O.E-3)	L	T	P
		2	-	-

COURSE OBJECTIVES
The objectives of this course are to:

1. Introduce students to the fundamental concepts, goals, and applications of Artificial Intelligence.
2. Enable understanding of intelligent agents and their interaction with different environments.
3. Develop basic knowledge of search algorithms and problem-solving techniques used in AI.
4. Familiarize students with fuzzy logic systems and their role in decision-making.
5. Introduce neural network concepts and their applications in intelligent systems.

COURSE OUTCOMES (CO):

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

CO1: Explain the concept, goals, history, and applications of Artificial Intelligence.
CO2: Describe intelligent agents, their types, and properties of environments.
CO3: Apply basic search algorithms and heuristic techniques for problem solving.
CO4: Explain principles and components of fuzzy logic systems.
CO5: Describe the structure and working of neural networks including perceptron and back-propagation.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):
SUGGESTED COURSE ARTICULATION MATRIX (CAM):

Course Outcomes (COs)	PO1 Basics & Discipline Knowledge	PO2 Problem Analysis	PO3 Design & Development	PO4 Tools, Experimentation & Testing	PO5 Socio-Economic/ Environmental	PO6 Project Mgmt & Communication	PO7 Lifelong Learning	PSO 1	PSO 2
CO1	3	1	–	–	–	–	1	*	*
CO2	2	2	–	–	–	–	1	*	*
CO3	2	3	–	–	–	–	1	*	*
CO4	2	2	–	–	–	–	1	*	*
CO5	2	2	1	–	–	–	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

Unit 1 – Introduction to Artificial Intelligence (06 Periods)
• Artificial Intelligence (AI) definition
• Goals of AI
• History of AI
• Applications of AI

Unit 2 – Agents and Environments (06 Periods)
• Agent Terminology, Types of Agents – Simple Reflex Agents, Model Based Reflex Agents, Goal Based Agents

• Nature of Environments, Properties of Environments

Unit 3 – Search Algorithms Terminology (06 Periods)

• Brute Force Search Strategies – Breadth First Search, Depth First Search.

• Heuristic Search Strategies, Local Search Algorithms.

Unit 4 – Fuzzy Logic Systems (05 Periods)

Introduction to Fuzzy Logic and Fuzzy systems,

• Membership functions,

• Fuzzification/Defuzzification

Unit 5 – Neural Networks (05 Periods)

Basic structure of Neural Networks

• Perceptron

• Back-propagation

RECOMMENDED BOOKS

Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial Intelligence use cases Denis Rothman Packt Publishing ISBN – 978-1788990547

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	15
2	06	25
3	06	20
4	05	20
5	05	20
Total	**28**	**100**

THEORY	6.5.2 RENEWABLE ENERGY TECHNOLOGIES (O.E-3)	L	T	P
		2	-	-

COURSE OBJECTIVE

The objectives of this course are to:

- Provide a comprehensive understanding of the **current and future global energy scenario**.
- Introduce students to **renewable and non-conventional energy sources** as alternatives to fossil fuels.
- Enable understanding of **solar, wind, and bio-energy systems** and their working principles.
- Develop the ability to **evaluate suitable renewable energy options** for a given location.
- Familiarize students with **economic, environmental, and sustainability aspects** of renewable energy technologies.

COURSE OUTCOMES (CO):
After successful completion of this course, the students will be able to:

CO1: Explain the global energy scenario, energy resources, and the need for renewable energy with economic and environmental perspectives.
CO2: Describe principles, components, and applications of solar energy systems including solar thermal and solar PV technologies.
CO3: Explain wind energy fundamentals, types of wind energy systems, site selection, and performance aspects.
CO4: Evaluate bio-energy generation methods such as biomass combustion, biogas, biofuels, and cogeneration systems.
CO5: Identify and compare alternative renewable energy sources such as tidal, wave, hydro, geothermal, hydrogen, fuel cells, and hybrid systems for suitable applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

Course Outcomes (COs)	PO1 Basics & Discipline Knowledge	PO2 Problem Analysis	PO3 Design & Development	PO4 Tools, Experimentation & Testing	PO5 Socio-Economic/ Environmental	PO6 Project Mgmt & Communication	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	1	–	–	2	–	2	*	*
CO2	3	2	2	1	1	1	1	*	*
CO3	2	2	2	–	1	1	1	*	*
CO4	2	2	1	1	2	1	1	*	*
CO5	2	3	1	1	3	1	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT

Unit-1: (6 Periods)

Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilization; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit-2: (6 Periods)

Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-3: (5 Periods)

Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance. Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-4: (5 Periods)

Bioenergy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-5: (6 Periods)

Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

INSTRUCTIONAL STRATEGY

1. Teacher should focus on conceptual clarity.
2. An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

RECOMMENDED BOOKS:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press,
   U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey &Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	19
2.	06	24
3.	05	19
4.	05	19
5.	06	19
Total	28	100

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8. GUIDELINES FOR ASSESSMENT OF STUDENT-CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 15 Marks for general behaviour and discipline

(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:

(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 6 Marks

b) 80 - 85% 8 Marks

c) Above 85% 10 Marks

iii. * Even Semester:

25 Marks maximum for the subject of plant maintenance & safety and industrial management that given by the maintenance head of the department.

**Odd Semester:

25 Marks maximum

a) Language Lab Practices / foreign language practices

b) Group Discussion and Personality Development

c) Industrial Visits/Industrial Talks

d) Power Point Presentations and Resume Making

e) Development of Aptitude and Reasoning Skills

f) Participation in the technical Exhibitions, Symposiums, Seminars, Workshops at the Institute /District/State/National Level.

9. RESOURCE REQUIREMENT

A. PHYSICAL RESOURCES

a. Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of classrooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

b. Equipment Requirement:

Following Laboratories are required:

ELECTRICAL ENGINEERING SCIENCE LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1	Transmission Line	• On board 100m transmission line • Facility of loss measurement at every 25m • On board function generator up to 1MHz • On board two 10 turn potentiometer for impedance matching. • Facility for waveform viewing • ON/OFF switch and LED for power indication. • Bare board Tested Glass Epoxy SMOBC PCB is used. • Block Description Screen printed on PCB • All interconnections are made using 2mm banana Patch cords • Supplied with User manual and patch cords • With built-in power supply • Enclosed in a wooden/plastic box	1
2	Transmission Line Training System	Testing panel modules mounted on sturdy aluminium profile flat demo system, consisting of colourful vinyl printed circuit diagram, metering section, power supply section and various high voltage components fixed on sturdy Bakelite sheet, fixed to modular aluminium profile structure table mounted. Size of control panel is L=1020 mm x H=770 mm (fitted on top of table in aluminium profile). Shock proof banana jack terminal (BS-10). Trainers and Machines	1

		should be from ISO Certified.	
3	RLC Resonance Trainer	On board fitted Different Type Resistance. On board fitted Different Type Capacitor. On board fitted Different Type Inductor. Signal Generator (Frequency Ranges: 1KHz, 10KHz, 60KHz) Engraved/ Laser printed block description on Bakelite Sheet. Adequate number of other electronic components. All interconnections are made using 2 mm banana patch cords. Supplied with User manual and patch cords.	1
4	Electricity Lab Trainer	• DC Power Supply : 5V, 200mA • AC Power Supply : 6V, 1A • Relay : 5V • Light Bulbs : 6V • Potentiometers : 25W, 1W, 10kW, 1W • Power Supply : 230V ±10%, 50Hz • Fixed resistance of different values. • Fixed capacitor of different value. • Fixed inductor of different value. • Glass fuse for short circuit protection. • Adequate number of other electronic components. • ON/OFF switch with indication light.	1
5	Three Phase Transformer Lab: Including following products 3 Phase Variac 10A with terminal brought out on the plate 3Φ Resistive Load 3.5KW	(i) Digital AC Voltmeter Micro -controller based, 0 -500V – 2 Nos. (ii) Digital AC Voltmeter Micro -controller based, 0 -50V – 1 No. (iii) Digital AC Voltmeter Micro -controller based, 0 -10A – 2 No. (iv) Digital AC Ammeter Micro -controller based, 0 -2A – 1 Nos. (v) Digital Wattmeter Micro -controller based, 5 Amp, 500V – 2 Nos. (vi) TPN MCB 10 Amp – 01 No. (vii) Indicating Lamps LED type 16 mm dia – 3 Nos. (viii) Insulating banana Jack terminals (BS -10).	1
6	BLDC (Brushless DC) Motor Training System	Machine Type : BLDC Motor Rating : 220W approx. Voltage Rating : 24V Speed : 3000 rpm ± 10% Loading arrangement : Mechanical Brake Drum/Pulley : Aluminum casted Mechanical	1

		Loading : Pronney brake arrangement, C.I.	
7	Single Phase Transformer Lab with AC /DC Load	(i) Digital AC Voltmeter Micro-controller based, 0-500V – 2 Nos. **(ii)** Digital AC Voltmeter Micro-controller based, 0-50V – 1 No. **(iii)** Digital AC Voltmeter Micro-controller based, 0-10A – 2 No. **(iv)** Digital AC Ammeter Micro-controller based, 0-2A – 1 No. **(v)** Digital Wattmeter Micro-controller based, 5 Amp, 500V – 1No. **(vi)** ThreePhaseVariac,6Amp Open type– 1 No. **(vii)** DP MCB 10 Amp – 01 No. **(viii)** Indicating Lamps LED type 16 mm Dia – 1No. **(ix)** Insulating banana Jack terminals (BS- 10).	1
8	Single Phase AC Motor Control Training System	Type : Squirrel Cage Phase : 1 Capacity : 2 HP R.P.M. : 1420 to be displayed on Panel Board using Proximity Sensor fitted on shaft Volts : 220 Starting : DOL Insulation : Class 'B' Connection : All the terminals of stator winding	1
9	Synchronous machine with accessories and it is system	**DC Shunt Motor** -3 HP, 230V, 1500 rpm, Horizontal foot mounted internally fan cooled, with 3 -point starter, class 'B Insulation. **Three Phase Alternator** – 2 KVA, 415V, 50 Hz, Salient pole type (Dove Tail type construction with damper windings), 3 -phase 4 wire screen protected, horizontal foot mounted, fan cooled, separately excited with damper winding.	1
10	Power Measurement using CT & PT	Digital AC Voltmeter Micro-controller based, NABL Certified, 0-500V – 1 No. Digital AC Ammeter Micro-controller based, NABL Certified, 0-5A – 1 No. DP MCB 10 Amp – 1 No.	1

		Current Transformer 10/5 Amp – 1 No. Potential Transformer 440/110V – 1 No. Single Phase Auto Transformer 8 Amp – 01 No. Indicating Lamps LED type 16 mm dia – 1 No.	
11	DC Series Motor Shunt Generator Lab	2 HP, 230V, 1500 rpm, Class 'B' insulation, Series Wound, self-excited, screen protected, horizontal foot mounted, fan cooled.	1
12	DC Shunt Motor Compound Generator Lab	D.C. Shunt Motor – 2 HP, 230V, 1500 rpm, Class 'B' insulation, Shunt Wound, self-excited, screen protected, horizontal foot mounted, fan cooled. D.C. Compound Generator – 1 KW, 230V, 1500 rpm, Class 'B' insulation, Compound Wound, self-excited, screen protected, horizontal foot mounted, fan cooled.	1

COMPUTER PROGRAMING-C, C++, UNIX

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Desktop Computer	Operating System: Windows Processor: Intel i5 RAM: Minimum 8 GB Storage: Minimum 1 TB HDD/SSD Display Resolution: 1024 × 768 or higher	60
2.	Visual Studio Code (VS Code)	Lightweight and fast editor, Syntax highlighting, IntelliSense (code completion), Debugging support, Extensions support, Integrated terminal, Git version control integration, Multi-language programming support	60
3.	C Compiler	Compilation of C programs, Error detection and debugging support, Program execution, Optimization of machine code	60
4.	ARDUINO KIT	Microcontroller ATmega328P Operating Voltage 5V Digital I/O Pins 14 Analog Input Pins 6 Clock Speed 16 MHz Flash Memory 32 KB SRAM 2 KB EEPROM 1 KB	10
5.	MATLAB SOFTWARE	**Toolboxes:** Professionally documented add-ons for specialized workflows, such as Deep Learning, Control Systems, and Signal Processing. **Simulink:** Graphical block-diagram environment integrated with MATLAB for multidomain simulation and Model-Based Design. **AI Integration:** Includes features to accelerate learning and automate workflows	10

AUTO CADD lab

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Desktop Computer	Operating System: Windows Processor: Intel i5 RAM: 8 GB Storage: Minimum 1 TB HDD/SSD	40
2.	Auto CADD Software	Auto CADD version- 16, 18 & 26 (Installed in each computer system)	40

WORKSHOP PRACTICE

S. No.	Name of Equipment	Broad Specifications	Quantity
1	Conventional Milling (vertical)	BFW(VF-2)- 800 x 230 x 400	6
2.	Conventional Milling (Horizontal)	BFW(HF-2)- 800 x 230 x 400	2
3.	Conventional Milling (Universal)	BFW(UF-2)- 800 x 230 x 400	2
4.	Surface Grinding	HMT(451)- 500 x 220 x 180	5
5.	Cylindrical Grinding	HMT (Anubhab-130)- D-130 x 500	3

IOT & IT'S APPLICATION

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Desktop Computer	Operating System: Windows Processor: Intel i5 RAM: Minimum 8 GB Storage: Minimum 1 TB HDD/SSD Display Resolution: 1024 × 768 or higher	60
2.	ARDUINO KIT	Microcontroller ATmega328P Operating Voltage 5V Digital I/O Pins 14 Analog Input Pins 6 Clock Speed 16 MHz Flash Memory 32 KB SRAM 2 KB EEPROM 1 KB	10
3.	LDR (Light Dependent Resistor)	Type Light Sensor Resistance Range Varies with light intensity Operating Voltage 3V–5V	10
4.	LM35 Temperature Sensor	Temperature Range -55°C to 150°C Output Analog Voltage Accuracy ±0.5°C	10
5.	DHT11 Sensor	Humidity Range 20–90% RH Temperature Range 0–50°C Operating Voltage 3V–5V	10
6.	16x2 LCD Display	Display Type Alphanumeric LCD Characters 16 × 2 Operating Voltage 5V Interface Parallel	10
7.	MATLAB SOFTWARE	**Toolboxes:** Professionally documented add-ons for specialized workflows, such as Deep Learning, Control Systems, and Signal Processing. **Simulink:** Graphical block-diagram environment integrated with MATLAB for multidomain simulation and Model-Based Design. **AI Integration:** Includes features to accelerate learning and automate workflows	10

MEASURING SYSTEM

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Trainer Board / Breadboard	Type: Electrical & Electronic Measurement Trainer Kit, Input Supply: 230V AC, 50Hz, Output DC Supply: +5V, +12V, Variable DC Output Built-in Components: Resistors, Capacitors, Diodes, Test Points	60
2.	Digital Multimeter	DC Voltage Range: 200mV – 1000V AC Voltage Range: 200V – 750V Current Range: 200µA – 10A Resistance Range: 200Ω – 20M	10
3.	CRO	Bandwidth: 20 MHz or higher Channels: Dual Channel Input Impedance: 1MΩ Time Base: 0.2s/div to 0.5µs/div Vertical Sensitivity: 5mV/div to 5V/div	05
4.	Function Generator	Frequency Range: 1Hz – 1MHz Waveforms: Sine, Square, Triangle Output Amplitude: 0–20V peak-to-peak	05
5.	DC Regulated Power Supply	Input: 230V AC Output: 0–30V DC Variable Current Rating: 0–2A Regulation: Line and Load Regulated	05
6.	Liquid Level Measurement Trainer Board	Input Supply: 230V AC, 50Hz Operating Voltage: 12V DC / 24V DC Sensor Type: Float / Capacitive / Ultrasonic Transducer Measurement Range: 0–100 cm liquid level Output Signal: 0–5V / 4–20mA Display Type: Digital LED/LCD Display Accuracy: ±1% Full Scale Protection: Fuse protection and overload safety	01
7.	Flow Rate Measurement	Pump: ½ HP, 230V AC Rota meter: Range: 0 to 2000 LPH Type: Glass tube or Acrylic body Connection: Vertically placed with back body connection Mounting: Bottom inlet, top outlet Piping: 20mm (¾") CPVC rigid piping 20mm (¾") Flexible piping Water Tap: Inlet and outlet tap – 20mm (¾") Power Supply: 230V, 50Hz AC	01
8.	Optical Transducer	Built in DC Power Supply Transducer-Controlled Switching Study using light as a controlling parameter. Signal Conditioning Circuitry Built-in Power, Current, and DC Amplifiers,	01

		Comparator, Electronic Switch, Buffer Output Circuits Digital Voltmeter, Relay, LED	
9.	Temperature Transducer	Built-in amplification, filtering, and linearization circuits to process raw sensor signals into readable outputs, ensuring accurate and reliable measurements. Built-in DC Power Supply Functional Block Mimics on Board.	01
10	Linear Variable Differential Transformer (LVDT)	On-board Excitation Generator, Amplitude adjustment for Excitation Generator, 20 mm Measurement Range, 4 KHz Excitation Frequency, 4 VPP Excitation Voltage, 10 mV DC/ mm Sensitivity, Full Scale Linear Range, 0.1 V DC or Maximum Displacement Signal conditioner output, 3½ Digit LED with Polarity Indicator Display, 25 mm Micrometre Scale, 0.01 mm Micrometre Least count, 8 nos. Test points.	01
11.	Study of Strain Gauge	DC Power Supplies, 3½ digits LED display, On-board Cantilever arrangement. 4 nos.(350Ω) Strain Gauge, 2.1 Gauge factor, Maximum 500 gm. bearable weight, Stainless Steel Cantilever, 2.5 cm Cantilever width, 0.16 cm Cantilever thickness, 20 cm Cantilever length, +8 V DC Bridge Voltage. Full Bridge configuration, 8 nos. Test points.	01
12.	Study of Load Cell	power supply, LCD display, should have test points to observe input output of each block, it should have maximum weight bearing capacity of 5 kgs, 500 gms of allowed weight, Strain gauge/shear beam type load cell should be provided. Should have tact switch for (Tare and Calibration).	01
13.	Pressure Transducer Explorer	The V-I specification should accommodate a 0 to 5 VDC input and produce a 4 to 20 mA output. A buzzer indicator should operate at 5 V DC. An LED indicator should also require 5 V DC. A digital voltmeter should be used with a measurement range of 0 to 10 V. The system should have 18 test points.	01
14.	10MHz Function Generator with Arbitrary Waveforms, AM, FM, PM, FSK Modulation and Built-in 200MHz Frequency Counter	DDS (Direct Digital Synthesis) Technique Sine, Square, Ramp & Pulse Frequency Resolution 1µHz Rise/Fall time ≤ 25ns Vertical resolution 14 bits Display 4” color LCD	01

PLC LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Desktop Computer	Operating System: Windows Processor: Intel i5 RAM: Minimum 8 GB Storage: Minimum 1 TB HDD/SSD Display Resolution: 1024 × 768 or higher	10
2.	Electrical Control Circuit Trainer Kit	Input Supply: 230V AC, 50Hz, Control Voltage: 24V DC / 230V AC, Built-in Components: Relays, Contactors, Push Buttons, Lamps, Protection: MCB and Fuse Protection, Mounting Type: Modular Panel Type	10
3.	Push Buttons (NO/NC)	Voltage: 24V DC / 230V AC, Built-in Components: Relays, Contactors, Push Buttons	50
4.	Contactors	Voltage: 24V DC / 230V AC, Built-in Components: Relays, Contactors, Push Buttons	20
5.	Relays	Voltage: 24V DC / 230V AC, Built-in Components: Relays, Contactors, Push Buttons	20
6.	DC/AC Power Supply	Voltage: 24V DC / 230V AC, Built-in Components: Relays, Contactors, Push Buttons	10
7.	PLC Trainer Kit	PLC Type: Siemens, Digital Inputs: 8–16, Digital Outputs: 8–16, Analog Inputs: 2–4, Communication: USB/RS232/Ethernet, Operating Voltage: 24V DC, Programming Language: Ladder Logic	06
8.	PLC Programming Software	PLC Type: Siemens, Digital Inputs: 8–16, Digital Outputs: 8–16, Analog Inputs: 2–4, Communication: USB/RS232/Ethernet, Operating Voltage: 24V DC, Programming Language: Ladder Logic	06
9.	Input/output Module	PLC Type: Siemens, Digital Inputs: 8–16, Digital Outputs: 8–16, Analog Inputs: 2–4, Communication: USB/RS232/Ethernet, Operating Voltage: 24V DC, Programming Language: Ladder Logic	06
10.	Push Buttons and Switches	PLC Type: Siemens, Digital Inputs: 8–16, Digital Outputs: 8–16, Analog Inputs: 2–4, Communication: USB/RS232/Ethernet, Operating Voltage: 24V DC, Programming Language: Ladder Logic	60

CNC & CAM PROGRAMING

S. No.	Name of Equipment	Broad Specifications	Quantity
1	CNC CMM	MITUTOYO CRISTA (S 9106)- 900 x 1000 x 800	1
2.	SOFTWARES	MASTERCAM 2019 US 3 AXIS	20
		MASTERCAM 2019 US 5 AXIS	5
		NX CAD/CAM (PERPETUAL)	20
		NX CAD/CAM/CAE (PERPETUAL)	1

EMBEDDED SYSTEM & ITS APPLICATION

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Desktop Computer with embedded "c"	Operating System: Windows Processor: Intel i5 RAM: Minimum 8 GB Storage: Minimum 1 TB HDD/SSD Display Resolution: 1024 × 768 or higher	20
2.	8051 Universal Development Platform	Crystal Frequency: 11.0592 MHz DC Power Supplies: +12V, -12V, +5V & - 5V Programmer: Ready to run programmer will program 8051 devices Interconnection for modules: 2 mm patch cords and FRC cables Online Product Tutorial: Which include Theory, procedure, reference results etc. Power Supply: 110V - 260VAC, 50Hz.	01
3.	PIC Microcontroller Development Board	Size of Breadboard: 175 x 67 x 8 mm Tie points: 1685 On board DC supply: ± 12V and ± 5 V Test points:25 Nos. or more Interconnections: 2 mm patch cords and FRC cables Programmer unit: Ready to run USB programmer will program PIC Devices Power supply: 230VAC, 50 Hz Fuse: 1A OS Support: Windows 7 & 8 (32bit and 64 bit)	01
4.	AVR Development Board	Tie points: 840 Test points: 35 Nos. or more DC power supply: +12 V, -12 V, +5 V & -5 V Programmer unit : Ready to run USB programmer will program ATMEGAS8515 Device	01
5.	ARM7 Development Platform with ZigBee module	MCU: LPC2148 External memory: EEPROM Crystal Frequency: 12 MHz LEDs: 8 Nos. ADC: 14Nos. Internal 10-bit ADC, DAC: 10 Bit internal DAC Interrupts: 2 Nos. or more Variable Supply: 0-3.3 Volt RTC: 32.768KHz, 3.3V Battery PWM: 7 Nos., Sensor: LM35, Display: 16X2 LCD Display Motor Drive: L293D 600mA (5-12V) GPIO's: All GPIO Pins Communication interfaces: USB 2.0 Full speed device control Programmer: USB Interface	01
6.	16-Bit Development Platform	Interrupts: Four External Interrupts on-platform TIMER: Seven Timer compare outputs and Timer clock output GPIO's: Ten	01

		GPIO Ports on Platform Clock Output: Three clock outputs from MCU Philips I2C: One I2C interface (Master/Slave) with Data and Clock bus pulled up to Vcc SPI: A four wire SPI interface (Master/Slave) Programmer: USB port for programming	
7.	LED Interface Module	LED Type: 5mm Red LEDs Number of LEDs: 8 Operating Voltage: 5V DC Current Limiting Resistors: 220Ω Interface Ports: Port 1 / Port 2 of 8051	01
8.	Seven Segment Display Module	Display Type: Common Anode/Common Cathode Digits: 1 Digit / 4 Digit Operating Voltage: 5V DC Interface Method: Direct Port Interface Segment Current: 10–20mA per segment	01
9.	16×2 LCD Module	LCD Type: 16×2 Alphanumeric LCD Operating Voltage: 5V DC Interface Mode: 4-bit / 8-bit Backlight: LED Backlit Controller: HD44780 Compatible	01
10.	ADC Module (ADC0804)	ADC Resolution: 8-bit DAC Resolution: 8-bit Operating Voltage: 5V DC Input Range: 0–5V Analog Output Type: Digital/Analog Conversion Interface: Parallel Interface with 8051	01
11.	DAC Module (DAC0808)	ADC Resolution: 8-bit DAC Resolution: 8-bit Operating Voltage: 5V DC Input Range: 0–5V Analog Output Type: Digital/Analog Conversion Interface: Parallel Interface with 8051	01
12.	LED/Buzzer Interface	Clock Frequency: 11.0592 MHz Operating Voltage: 5V DC	01
13.	Pulse Generator/Switch	Counter Type: Timer/Counter Mode Input Pulse Range: TTL Compatible Operating Voltage: 5V DC Display: LED Output Display	01
14.	LED Display Module	Counter Type: Timer/Counter Mode Input Pulse Range: TTL Compatible Operating Voltage: 5V DC Display: LED Output Display	01

CNC TECHNOLOGY

S. No.	Name of Equipment	Broad Specifications	Quantity
1	CNC VMC (Fanuc Oi MF)	S&T Engineers(VL 550)- 550 x 400 x 450	2
2.	CNC MILLING (Fanuc Oi MF)	S&T Engineers(VL 760)- 760 x 400 x 400	4
3.	CNC MILLING (SEIMENS)	ACE (MCV350L)- 750 x 300 x 400	4
4.	Surface Grinding	ROYAL (RSG450)- 400 x 180 x 335	1
5.	Cylindrical Grinding	GRINDEX (SERBIA) (BSC 700 U PLC)- 300 x CH175 x 700	1

HYDRAULICS AND PNEUMATICS

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Hydraulic Trainer Kit	Working pressure: 40–70 bar, oil reservoir: 20–40 L	01
2.	Hydraulic Pump	Gear/Vane pump, flow rate: 5–20 LPM	01
3.	Hydraulic Cylinder	Double acting, bore: 25–50 mm, stroke: 100–300 mm	01
4.	Direction Control Valve (DCV)	4/3 way valve, manual/solenoid operated	01
5.	Pressure Relief Valve	Adjustable pressure range up to 100 bar	01
6.	Pressure Gauge	Range: 0–100 bar	01
7.	Hydraulic Motor	Speed: 100–1500 RPM	01
8.	Hydraulic Hoses & Fittings	High-pressure hose, 100 bar rating	01
9.	Pneumatic Trainer Kit	Working pressure: 4–8 bar	01
10.	Air Compressor	1–2 HP, tank capacity: 20–50 L	01
11.	FRL Unit (Filter-Regulator-Lubricator)	Pressure range: 0–10 bar	01
12.	Pneumatic Cylinder	Double acting, bore: 20–40 mm	01
13.	Direction Control Valve	3/2 or 5/2 way valve	01
14.	Pneumatic Circuit Trainer	Modular panel with quick connectors	01
15.	Push Button Valves	3/2 way manual valve	01
16.	Roller Lever Valve	Mechanical actuation	01
17.	Solenoid Operated DCV	24V DC coil	01
18.	Hydraulic Circuit Trainer	Pressure rating: 50–70 bar	01
19.	Hydraulic Power Pack	1–2 HP motor, 20–30 L oil tank	01
20.	Safety Helmet	Industrial safety standard	05
21.	Safety Shoes	Steel toe protection	05
22.	Safety Goggles	Impact resistant	05

INDUSTRIAL AUTOMATION LAB

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	PLC Trainer Kit	SIEMENS S7_1200 KIT, 24V DC supply, 8 DI/8 DO, Ethernet/RS485 communication	06
2.	SMPS	Input: 230V AC, Output: 24V DC, 2–5A	01
3.	Relay Module	24V DC coil, 5A/250V AC contacts	01
4.	HMI Panel	7-inch TFT touchscreen, Ethernet support	01
5.	Push Buttons & Indicator Lamps	24V DC operation	06
6.	Inductive Proximity Sensor	Sensing distance: 2–8 mm, 10–30V DC	01
7.	Capacitive Sensor	Sensing distance: 5–15 mm, 10–30V DC	01
8.	Digital Multi meter	AC/DC voltage and continuity measurement	02
9.	Programming Software	Siemens TIA Portal	06
10.	PLC Module	Minimum 14 I/O points	06
11.	Switches & Lamps	24V DC compatible	05
12.	Contactor Set	3 contactors, 230V AC coil	05
13.	Signal Lamps	Red, Yellow, Green LEDs	06
14.	Water Tank Setup	Acrylic tank with level markings	01
15.	Level Sensors	Float/Ultrasonic type	01
16.	Communication Cable	CAT6 Ethernet cable	50
17.	PLC with PID Function	Analog input/output support	01
18.	Temperature Process Trainer	Heater and sensor arrangement	01
19.	RTD/PT100 Sensor	Range: -50°C to 200°C	01
20.	SCADA Software	Real-time trending support	01
21.	Servo Motors	5V/12V servo motors	01
22.	CNC Trainer Machine	2-axis/3-axis CNC trainer	01

ROBOTICS & ITS APPLICATION

S. No.	Name of Equipment	Broad Specifications	Quantity
1.	Industrial Robot Trainer Kit	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC	05
2.	Robotic Arm (4-axis/5-axis/6-axis)	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC, Number of Axes: 4/5/6 Axes	01
3.	Robot Controller Unit	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC, Number of Axes: 4/5/6 Axes,	01
4.	Teach Pendant	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC, Number of Axes: 4/5/6 Axes, Drive Type: Servo Motor Based	01
5.	Servo Motors	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC, Number of Axes: 4/5/6 Axes, Drive Type: Servo Motor Based	01
6.	Servo Drive Controller	Input Supply: 230V AC, 50Hz, Controller Voltage: 24V DC, Number of Axes: 4/5/6 Axes, Drive Type: Servo Motor Based	01
7.	Robotic Gripper Assembly	Gripper Type: Pneumatic/Electrical	01
8.	Pneumatic/Electric Gripper Controller	Operating Pressure: 4–6 bar (Pneumatic), Control Voltage: 24V DC	01
9.	PLC/Robot Controller	Control Voltage: 24V DC	01
10.	Pick and Place Robot Trainer	Degrees of Freedom: 4/5 Axis, Payload Capacity: 250g–1kg, Repeatability: ±0.1 mm	01
11.	Conveyor Setup	Degrees of Freedom: 4/5 Axis, Payload Capacity: 250g–1kg, Repeatability: ±0.1 mm	01
12.	Force Sensor/Load Cell	Sensor Type: Force Sensitive Resistor/Load Cell, Force Range: 0–10N / 0–50N, Output Signal: Analog Voltage	01
13.	Touch Sensor Module	Sensor Type: Force Sensitive Resistor/Load Cell, Force Range: 0–10N / 0–50N, Output Signal: Analog Voltage	01
14.	DC Servo Motor Setup	Motor Type: DC Servo Motor, Speed Range: 0–3000 RPM	01
15.	Tachogenerator/Encoder	Motor Type: DC Servo Motor, Speed Range: 0–3000 RPM	01
16.	PID Controller Unit	Controller Type: PID Controller, Input Voltage: 12V/24V DC	01
17.	Cartesian Robot Trainer	Coordinate Axes: X, Y, Z Linear Axes, Travel Range: 100–300 mm, Position Resolution: 0.1 mm, Motion Type: Linear Motion	01
18.	XYZ Coordinate Demonstration Setup	Coordinate Axes: X, Y, Z Linear Axes, Travel Range: 100–300 mm, Position Resolution: 0.1 mm, Motion Type: Linear Motion	01

19.	Robot Motion Analysis Setup	Motion Tracking: Encoder Based, Speed Measurement: RPM/Linear Speed	01
20.	Encoder Feedback System	Motion Tracking: Encoder Based, Speed Measurement: RPM/Linear Speed	01
21.	Dial Gauge/Digital Indicator	Measurement Device: Dial Gauge/Digital Sensor	01

10. EVALUATION SCHEME GUIDELINES: As Per AICTE ATTACHED (ANNEXURE- 2)

a. Theory Courses:

- Internal Assessment: 40%
- End Semester Examination: 60%
- Passing Criteria: A student must secure a minimum of 40% marks separately in both internal assessment and end semester examination to pass the course.

b. Practical Courses:

- Internal Assessment: 60%
- End Semester Examination: 40%
- Passing Criteria: A student must secure a minimum of 40% marks separately in both internal assessment and end semester examination to pass the course.

c. Summer Internship / Projects / Seminars, etc.:

- Evaluation is based on the following components:
  - Quality of work completed
  - Report preparation and documentation
  - Viva-voce performance
  - Presentation skills

Note:
Internal assessment is conducted based on the student's overall performance, which includes:

- Two best out of three mid-semester tests
- Quizzes and assignments
- Class participation and attendance
- Viva-voce and lab records (for practical subjects)

ANNEXURE- 2

EVALUATION METHODOLOGY

1. EVALUATION METHOD for THEORY

	Internal Assessment (40 marks)				External Assessment (60 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Written Test**	**Written Test**	**Attendance and Assignments**	**Pre – Semester Examination**	**End Semester Examination**
Portion	2 units	2 units	Regularly	All units	All units
Duration1hr	1hr	1hr	-	3hrs	3hrs
Exam Marks	20	20	20	60	60
Converted to	10	10	15	15	60
Tentative Schedule	5^{th} Week	10^{th} Week	Regularly	12^{th} -13^{th} Week	

IA1 and IA2: A written assessment test worth 20 marks should be conducted for two units. The marks earned (20 marks) will be converted to 10 marks. The best of the two assessments will be evaluated for an internal 10-mark assessment.

IA3: Assignments given after the completion of each unit, along with attendance throughout the semester, will be assessed for a total of 15 marks.

IA4: The pre-semester examination should follow the end-semester examination question pattern. The marks should be adjusted to 15 for internal assessment.

2. EVALUATION METHOD for PRACTICAL

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Practical Test and Quiz – Viva Voce**	**Practical Examination**
Portion	50% Practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	3 hrs	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as outlined and retain them for the practical test. The test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be internally evaluated for a total of 20 marks.

IA3: Maintain a practical file for each exercise while ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, and practical test along with a valid certificate (Progress Card). This will be assessed for 20 marks.

IA4: The pre-semester practical examination, quiz, and viva-voce should follow the end-semester practical examination pattern, with marks adjusted to 20 for internal assessment.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted	Marks Allotted (FOR 4.10)
A.	Objective	**5**	**7.5**
B.	Circuit Diagram	**5**	**7.5**
C.	Procedure and Connections	**10**	**15**
D.	Observation Table and Calculation	**10**	**15**
E.	Result and its Discussion, Conclusion	**10**	**15**
F.	Practical Test	**20**	**30**
	Total	**60**	**90**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted	Marks Allotted (FOR 4.10)
A.	Objective	**5**	**7.5**
B.	Circuit Diagram	**5**	**7.5**
C.	Procedure and Connections	**5**	**7.5**
D.	Observation Table and Calculation	**5**	**7.5**
E.	Result and its Discussion, Conclusion	**10**	**15**
F.	Viva-Voce	**10**	**15**
	Total	**40**	**60**

3. EVALUATION METHOD for PRACTICUM (End Exam-Practical)

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Micro Project**	**Practical Examination**
Portion	50% practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	Regularly	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as instructed and retain them for the practical test. The test should be conducted according to the evaluation scheme. The best of the two practical tests will be internally assessed for a total of 20 marks.
IA3: Maintain a practical file for each exercise, ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be evaluated by 20 marks.
IA4: Submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be assessed by both the laboratory supervisor and an internal examiner. This evaluation will contribute 20 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted	Marks Allotted (FOR 5.3)
A	Objective	**5**	**2.5**
B.	Circuit Diagram	**5**	**2.5**
C	Procedure and Connections	**10**	**5**
D	Observation Table and Calculation	**10**	**5**
E.	Result and its Discussion, Conclusion	**10**	**5**
F.	Mini Project	**20**	**10**
	Total	**60**	**30**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted	Marks Allotted (FOR 5.3)
A.	Objective	**5**	**2.5**
B.	Circuit Diagram	**5**	**2.5**
C.	Procedure and Connections	**5**	**2.5**
D.	Observation Table and Calculation	**5**	**2.5**
E.	Result and its Discussion, Conclusion	**10**	**5**
F.	Viva-Voce	**10**	**5**
	Total	**40**	**20**

4. EVALUATION METHOD for <u>PRACTICUM (End Exam-Theory)</u>

	Internal Assessment (40 marks)						External Assessment (60marks)
	IA 1		IA 2		IA 3	IA 4	
Mode	**Written Test**	**Practical Test**	**Written Test**	**Practical Test**	**Attendance and Practical Documentation**	**Pre Semester Examination and Micro Project**	**End Semester Examination**
Portion	2 units	Practical related to the units	2 units	Practical related to the units	All unit	All Practical	All unit
Duration	1hr	3hrs	1hr	3 hrs	3hrs	Regularly	3hrs
Exam Marks	10	20	10	20	60	60	60
	30		30				
Converted to	10		10		15	15	60
Tentative Schedule	5th Week		10th Week		Regularly	12th -13th Week	

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two **UNIT**s. Complete all exercises and experiments as outlined and retain them for the practical test worth 20 marks. The practical test should be conducted in accordance with the evaluation scheme. The total marks earned (30 marks) will be converted to 10 marks. The best of the two assessments will be internally evaluated for a total of 10 marks.

IA3: Attendance and the pre-semester examination should follow the end-semester examination question paper pattern. The marks should be adjusted to 15 for internal assessment.

IA4: Maintain a practical file for each exercise. Submit the required documents for the practical file, quiz/viva-voice, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be assessed for 40 marks. Additionally, submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be evaluated by both the laboratory supervisor and an internal examiner. The total of 60 marks will be converted to 15 marks

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION FOR IA4

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Attendance & Mini Project	**10**
	Total	**40**

11. LIST OF EXPERTS

1. Shri Ajay Bajpai, Joint Director cum Incharge, MSME TC KANPUR.
2. Shri. Pradipta Swain, Consultant, MSME TC KANPUR.
3. Shri. Bhupender Pratap Singh, Teaching Assistant. MSME TC KANPUR.
4. Shri. Akshay Awasthi, Teaching Assistant. MSME TC KANPUR.

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