DEPARTMENT OF TECHNICAL EDUCATION (DIPLOMA SECTOR)
UTTAR PRADESH

CURRICULUM FOR DIPLOMA PROGRAMME
IN
INSTRUMENTATION AND CONTROL ENGINEERING
(3rd to 4th Semester)

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Semester System
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(EFFECTIVE FROM YEAR 2025-26)

Prepared By:

INSTITUTE OF RESEARCH, DEVELOPMENT & TRAINING, U.P., KANPUR

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THIRD SEMESTER

FOURTH SEMESTER

PREFACE

An important issue generally debated amongst the planners and educators 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 has 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. In order 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 being taken by the State Board of Technical Education, UP to revise the existing curricula of 42 diploma programmes as per the needs of the industry and making them NEP-2020/AICTE compliant, are laudable.

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 outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Director
Institute of Research Development & Training

ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following Persons

1. Sh. Narendra Bhooshan, IAS, Additional Chief Secretary, Department of Technical Education, Govt. of UP, for his exemplary vision & approach.

2. Sh. Avinash Krishna Singh, IAS, Secretary, Directorate General, Department of Technical Education, Govt. of U.P.

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

4. All the participants from industries, Polytechnics and other technical institutions for their professional inputs during curriculum workshops.

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

6. In the last but not least would like to thanks management of the industries who spare not only their precious time but also allowed the visit of their industries to the team making the curriculum

(Shyam Lal)
Textbook Officer/Course Coordinator
IRDT Kanpur

1 SALIENT FEATURES

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1)	Name of the Programme	:	Diploma in Instrumentation and Control Engineering
2)	Duration of the Programme	:	Three years (Six Semesters)
3)	Entry Qualification	:	Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4)	Pattern of the Programme	:	Semester Pattern
5)	NSQF Level	:	Level - 5
6)	Ratio between theory and Practical	:	40: 60 (Approx.)

7) Industrial Training

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.

8) Ecology and Environment

As per Govt. of India directives a subject on Environmental Science has been incorporated in the curriculum.

9) Entrepreneurship and Start-ups

A full subject Entrepreneurship & Start-ups has been incorporated in the curriculum.

10) Student Centred Activities

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 of co–curricular activities such as expert lectures, self-study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS, library and other cultural activities.

11) Project work

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

2- PROGRAM OUTCOMES (POs)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing
Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

3. EMPLOYMENT OPPORTUNITIES

1) Tele-Communication Engineering and related Departments.
2) Railways.
3) Defence Services, Para-military Forces.
4) Civil Aviation.
5) Defence Research and Development Organizations.
6) Electricity Boards and Corporations etc.
7) Research and Development Deptt.
8) Maintenance Deptt.
9) Communication Industry.
10) PCB Design and Fabrication Industry.
11) Consumer Electronics Industry.
12) Computer Assembling and Computer Peripheral Industry.
13) Semi-Conductor Devices Manufacturing Industry.
14) Maintenance of Instrumentation and Control in process Industries.
15) Internet Service Providers.
16) Public Sector Undertakings (like BHEL, BEL, HAL, IOCL, HPCL, ISRO etc).
17) D.T.H component Fabrication Industry.
18) Mobile Phone Assembly Industries.
19) Medical Electronics Equipment Industry.
20) EPBX/ Telephone Exchange Manufacturing Industries.
21) Automobile Industry.
22) Automation and Control Industry (viz bottling plant, cement plant, automobile units, escalators etc.)
23) Sales and Services of Electronic Gadgets from Small Scale Industries.
24) Call Centres.
25) CSIR

4. LEARNING OUTCOMES

Sr.	Learning Outcomes
After undergoing this programme, students will be able to:	
1.	To enable Communicate effectively in English.
2.	Apply basic principles of Mathematics to solve engineering problems
3.	Apply basic principles of Physics and Chemistry to solve engineering problems
4.	Prepare computerized reports, presentations using IT tools and computer application software
5.	Prepare and interpret Engineering Drawings
6.	Use cutting tools, equipment and tooling for fabrication of jobs by following safe practices at workplace
7.	Use appropriate instruments to measure various engineering parameters.
8.	Measure and computing parameters related to basic electrical engineering
9.	Use appropriate procedures for preventing environmental pollution and energy conservation
10.	Assemble, test and troubleshooting of electronic circuits consisting of passive and active components by applying appropriate soldering, testing and measurement techniques at workplaces.
11.	Understand principles of communication engineering.
12.	Understand basic principles of digital electronics and design combinationaland sequential circuits.
13.	Write basic program using C /C++
14.	Apply principles of various networks, filters and transmission lines and its associated parameters
15.	Use various power-controlled devices in industrial applications
16.	Use microprocessor and microcontroller-based system using assembly level language programming
17.	Carryout trouble shooting of different basic consumer electronic products like TV, Audio system and mobile.
18.	Use optical fiber engineering for communication systems
19.	Use different digital communication systems
20.	Program microcontroller for Embedded Systems Applications using C /C++
21.	Understand Microwave and radar engineering
22.	Understand basic concepts of control systems
23.	Understand Embedded systems and its applications
24	Work with various active and passive microwave devices.
25	Use biomedical instruments
26	Apply acquired knowledge and skill in solving a live problem or Industrial project
27	Use modern communication system
28	Understand the fundamental of Machine Learning and AI and their practical application .Familiarize with key framework and guidelines governing AI deployment

5- ABSTRACT OF CURRICULUM AREAS

HUMANITIES & SOCIAL SCIENCES COURSES [HS]	
	• Communication Skills in English
	• Sports and Yoga
	• Entrepreneurship and Start-ups
BASIC SCIENCES COURSE [BS]	
	• Mathematics
	• Applied Physics
	• Applied Chemistry
ENGINEERING SCIENCE COURSES [ES]	
	• Engineering Graphics
	• Engineering Workshop Practice
	• Introduction to IT Systems
	• Fundamentals of Electrical & Electronics Engineering
	• Engineering Mechanics
PROGRAM CORE COURSES [PC]	
	• ELECTRONICS DEVICES AND CIRCUITS
	• TRANSDUCERS AND APPLICATIONS
	• PRINCIPLE OF DIGITAL ELECTRONICS
	• PROGRAMMING IN C
	• ELECTRONIC DEVICES AND CIRCUITS
	• TRANSDUCERS AND APPLICATIONS
	• MICROPROCESSOR AND APPLICATIONS
	• PROCESS INSTRUMENTATION
	• ELECTRONIC INSRUMENTATION AND MEASUREMENT
	• INDUSTRIAL CONTROL
	• MICROPROCESSOR AND APPLICATIONS
	• PROCESS INSTRUMENTATION

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

- Summer Internship – I (3-4 weeks) after IInd Sem
- Summer Internship – II (4-6 weeks) after IVth Sem
- Major Project(In-House) / Internship / Industrial Training

AUDIT COURSES [AU]

- Environmental Science
- Essence of Indian Knowledge and Tradition
- Indian Constitution

6-STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN INSTRUMENTATION AND CONTROL ENGINEERING

THIRD SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Electronics Devices And Its Circuits	Program Core (Theory)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.2	Transducers And Applications	Program Core (Theory)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.3	Principle of Digital Electronics	Program Core (Practicum)	01	-	04	3	40	-	40	60	3	-	-	60	100
3.4	Programming In C	Program Core (Practicum)	01	-	04	3	-	60	60	-	-	40	3	40	100
3.5	Electronic Devices And Circuits (Lab)	Program Core (Practical)	-	-	04	2	-	60	60	-	-	40	3	40	100
3.6	Transducers And Applications (Lab)	Program Core (Practical)	-	-	04	2	-	60	60	-	-	40	3	40	100
3.7	(Q) Open Elective -1 OR	Open Elective	2	-	-	2	50*	-	-	-	-	-	-	-	-
	Advanced Skill Certification	Certification Course Open Elective	-	-	-		-	-	-	-	-	-	-	-	NA
3.8	Summer Internship** (4) Weeks		-	-	-	2	-	50	50	-	-	-	-	-	50
#Student Centered Activities			-	-	10	-	-	50	50	-	-	-	-	-	50
Total			**10**		**26**	**20**	**120**	**280**	**400**	**180**	**-**	**120**	**-**	**300**	**700**

(Q) - It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

Advance Skill Development:-

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

** Students will present a seminar on their summer internship along with certificate, project and report.

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.

4th SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	Microprocessor And Applications	Program Core (Theory)	03	-		3	40		40	60	3	-	-	60	100
4.2	Process Instrumentation	Program Core (Theory)	03	-	-	3	40		40	60	3	-	-	60	100
4.3	Electronic Instrumentation And Measurement	Program Core (Practicum)	02	-	02	3	40		40	60	3	-	-	60	100
4.4	Industrial Control	Program Core (Practicum)	02	-	02	3	-	60	60	-	-	40	3	40	100
4.5	Microprocessor And Applications (Lab)	Practical	-	-	06	3	-	60	60	-	-	40	3	40	100
4.6	Process Instrumentation	Practical	-	-	06	3	-	60	60	-	-	40	3	40	100
4.7	(Q) Open Elective -2	Open Elective	02	-	-	2	50*	-	-	-	-	-	-	-	-
	Advance Skill Certification	Open Elective-2*	-	-	-		-	-	-	-	-	-	-	-	-
4.8	(Q) Essence Of Indian Knowledge And Tradition	Audit Course	02	-	-	-	50*	-	-	-	-	-	-	-	-
#Student Centered Activities			-	-	06	-	-	50	50	-	-	-	-	-	50
Total			**14**		**22**	**20**	**120**	**230**	**350**	**180**	**-**	**120**	**-**	**300**	**650**

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.

(Q) - It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

Advance Skill Development:-

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

OPEN ELECTIVE-1

SR.NO.	(Q) THEORY COURSES NAME
1.	PRODUCT DESIGN AND DEVELOPMENT
2.	FUNDAMENTALS OF INNOVATION AND DESIGN THINKING
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATION-AL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

OPEN ELECTIVE -2

SR.NO.	(Q) THEORY COURSES NAME
1.	ELECTRIC VEHICLE
2.	INDUSTRIAL ROBOTICS
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATION-AL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

3.1	ELECTRONICS DEVICES AND CIRCUITS (Theory)	L T P
		3 - -

1. COURSE OBJECTIVES

This course will enable students to develop the skills required to use basic electronic devices in various electronic circuits. Through the study of this course the students will understand the construction, working, characteristics and applications of various types of semiconductor devices such as Diodes and transistors, which are basic building block of amplifier, oscillator, switching circuit, wave shaping circuit and power supply. The knowledge of this core subject is essential for comprehending the courses that will be introduced later in the diploma program as well as developing requisite skills for effective functioning in the industry.

2. COURSE OUTCOMES(CO):

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following COURSE OUTCOMES.

Students will be able to

CO1 Explain the working of different semiconductor devices.
CO2 Measure and calculate various parameters of different semiconductor devices.
CO3 Conclude VI characteristics of various semiconductor devices.
CO4 Explain the working of different type of amplifier and design a specific operating frequency of an oscillator.
CO5 Compare SCR, DIAC, TRIAC and IGBT

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	3	-	2	2	-	-	*	*
CO3	3	2	-	3	3	-	-	*	*
CO4	3	3	3	-	-	-	-	*	*
CO5	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.

4. CONTENTS

UNIT 1- Semiconductor Diodes Circuit and Applications (06 Periods)

Definition, Extrinsic/Intrinsic, N-type & p-type, P-N junction diode forward & reverse bias characteristics. Different types of diodes, Diode (P-N Junction) as rectifier, Half wave rectifier, full wave rectifier. Construction & Working Principle of Positive, Negative, and Biased Clippers - Construction & Working Principle of Positive and Negative Clampers

UNIT 2- Bipolar Junction Transistor: (11 Periods)

PNP and NPN transistor- Operation and characteristics. CB, CE and CC configurations: working, characteristics and their comparison. Concept of leakage current, effect of temperature on leakage current, standard notation for current and voltage polarity. Transistor Biasing, Transistor as an amplifier in CE configuration, DC load line.

UNIT 3- Unipolar Junction and Field Effect Transistor (9 Periods)

Junction Field Effect Transistor: Construction, operation, characteristics and Biasing.

MOSFET: Construction, operation, Characteristics.

CMOS: Construction, operation and Characteristics

Comparison of JEET, MOSFET and Bipolar Transistor.

Introduction to advance non-planer devices like FinFET, GAA.

UNIT 4–Amplifiers and Oscillators (11 Periods)

Single Stage Transistor Amplifier: Analysis of Single Stage CE, CB and CC amplifier.

Multistage Amplifiers: Need of multistage amplifier, gain of multistage amplifier, RC coupled, and transformer coupled, direct coupled Amplifier, their frequency response and bandwidth. Large Signal Amplifier: Difference between voltage and power amplifiers - Importance of impedance matching in amplifiers - Class A, Class B, Class AB, and Class C amplifiers, Push-pull amplifier.

Feedback Amplifiers: Properties of negative Feedback, impact of feedback on different parameters, Basic Feedback Amplifier Topologies.

Basic Principles, different types of Oscillator-LC, RC and crystal oscillator.

UNIT 5- SCR, DIAC, TRIAC and IGBT (05 Periods)

Construction, working and characteristics, SCR as a Switch, DIAC as bidirectional switch, Comparison of SCR, DIAC, TRIAC, MOSFET and IGBT.

5. TEXT BOOKS/REFERENCE BOOKS:

1. Analog Circuits A.K. Maini Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173-584)
2. Electronic Devices and Circuits. Salivahanan and N. Suresh Kumar McGraw Hill Education; Fourth edition (1 July 2017) ISBN: 978-9339219505
3. Electronics Devices and circuit theory Boyestad & Nashelsky Pearson Education India; 11 edition (2015) ISBN: 978-9332542600

4. Electronic Principles Albert Malvino & David Bates Tata McGraw Hill Publication 2010 ISBN: 978-0070634244

5. Rahul Wadhwa, Electronics Devices & Circuits, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-74-3

6. Electronics Devices & Circuits Jacob Millman McGraw Hill Education;4 editions (2015) ISBN: 978-9339219543

7. INSTRUCTIONAL STRATEGY

Electronic Components & Devices being a fundamental subject, it needs to be handled very carefully and in a manner such that students develop clear understanding of the related concepts and principles. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self-study and problem-solving abilities amongst them.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	6	14
2	11	25
3	09	21
4	11	25
5	5	14
Total	**42**	**100**

3.2	TRANSDUCERS & APPLICATION (Theory)	L T P
		3 - -

1. COURSE OBJECTIVE

The course is intended to develop the basic understanding as well as the competency to use, installed and test various transducers and sensors used for measuring non-electrical quantities like displacement, temperature, pressure, flow, level, pH, conductivity, density, velocity, viscosity and such others. The student is required to be familiar with the construction working principle and mounting procedure of different types of transducers including smart sensors. Transducers are used in almost every industry and also in everyday life.

2. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following COURSE OUTCOMES.

Students should be able to:

CO1: Identify different types of sensors and transducers and their applications in the field of instrumentation and control.

CO2: The students will be able to select appropriate transducers relating to a process and will also get the relevant technical know how about the conditioning of a signal from a transducer for the purpose of control.

CO3: Use of specific transducer and signal conditioning equipment in specifications. Idea of different sensors and transducers for given application

CO4: Understand Variable resistance, variable inductance type and capacitive type transducer, Optical transducers. Understand the conductivity analyser and vibration & noise measurement.

CO5: Outline various application of PH analyser. Differentiate between different types of smart sensors. Identify various optical transducer

3- 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 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO 2
CO1	3	2	-	3	-	-	-	*	*
CO2	3	-	-	3	-	-	-	*	*
CO3	3	2	-	3	-	-	-	*	*
CO4	3	-	-	3	1	-	-	*	*
CO5	3	3	-	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.

4- COURSE CONTENTS

UNIT-I : INTRODUCTION (6 Periods)

Definition of transducer, Classification of transducers, mechanical devices as primary detectors. Electrical transducer: Advantages, classification of electrical transducer, active and passive, analog and digital, Electrical phenomena used in transducers. Smart sensors with definition and block diagram, and their role in industry.

UNIT-II : RESISTIVE, INDUCTIVE AND CAPACITIVE TRANSDUCER (12 Periods)

VARIABLE RESISTANCE TRANSDUCER- Principle of variable resistance transducers. Potentiometers – Principle of working, construction, Linearity and sensitivity, Types, advantages and Disadvantage of potentiometers, its applications. Strain Gauges – Theory of strain gauges, gauge factor, Types of strain gauges, Material for strain gauges. Temperature compensation in strain gauge, load cell applications. Hot wire anemometer, Application of different types of Variable Resistance Transducer in Industries.

VARIABLE INDUCTANCE TYPE TRANSDUCERS- Principle of variable inductive transducers by variation of self-inductance, mutual Inductance and eddy current. Different types of transducers, working on above principle. LVDT: Construction, theory, linearly and sensitivity advantage, disadvantage and uses. Electromagnetic pickup, Rotary Variable Differential Transformer (RVDT).

CAPACITIVE TRANSDUCERS- Principle of capacitive transducers, Concept of Capacitive transducers using change in distance between plates, area & dielectric constant. Differential arrangement for improving sensitivity, application of capacitive transducers, Level measurement with calibration using suitable formula, Condenser Microphone, Implementation of different types of Variable Capacitive Transducer in Industries.

UNIT-III : OPTICAL TRANSDUCERS (6 Periods)

Theory of photo emission, classification, of photo electric devices, vacuum photo tube, Gas photo tube, Photo multiplier tube, photo conductive cell, photo diode, photo transistor , Opto-coupler and their applications, Optical Fiber sensors.

UNIT-IV: PIEZOELECTRIC TRANSDUCERS, VIBRATION AND NOISE MEASUREMENT (8 Periods)

Theory of piezoelectric effect, example of piezoelectric crystal, their mode of operation and properties, equivalent circuit of piezoelectric transducers and their applications, use as Ultrasonic Transducer. Measurement of vibration–using seismic accelerometer, potentiometric type and LVDT type, Piezo electric type accelerometer, Seismic Pick-up.

UNIT-V : VISCOSITY MEASUREMENT AND CHEMICAL SENSORS (10 Periods)

VISCOSITY MEASUREMENT- Definition of viscosity, measurement of viscosity by capillary type and rotational type cone and plate viscometer, two float viscometer, Rheometers and their applications.

CHEMICAL SENSORS- Standards, working principle, types, materials, and design criterion. pH Sensor: Definition and need of pH measurement, buffer solution, reference and standard electrodes

for pH measurement. Hydrogen calomel and Glass electrode pH-meter-direct reading type and indirect reading type, uses of pH analyser in Industries.

5- REFERENCE BOOKS

1. Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
2. Kalsi, H. S. Electronic Instrumentation Tata McGraw Hill, 3rd or later Edition
3. Transducers by Peter Norton
4. Industrial Instrumentation & control by S.K. Singh

6. INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

7. MEANS OF ASSESSMENT

- Class test/quizzes
- Home assignments
- Attendance
- Sessional Test
- Practical Tasks
- Presentation/Seminar

8. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	6	15
2.	12	30
3.	6	15
4.	8	20
5.	10	20
Total	**42**	**100**

3.3	PRINCIPLE OF DIGITAL ELECTRONICS (Practicum)	L T P
		2 - 2

1. COURSE OBJECTIVES

Digital electronics plays significant role in revolution of Electronics industries. The major focus of the course is to expose students to design process of combinational and sequential logic circuits. This course gives profile to work in hardware industries, process industries. It gives strong foundation to all modern electronics devices and digital systems.

2. COURSE OUTCOMES(CO):

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1•Convert numbers from one numbering system to other.
CO2• Deduce Boolean expressions for modelling a situation.
CO3•Simplify Boolean expressions using K-map.
CO4•Design and implement combinational circuits and Sequential circuits
CO5•Classify memories on the basis of working principle, mode of access, physical characteristics etc.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	-	3	-	-	-	*	*
CO4	3	2	3	-	-	-	-	*	*
CO5	3	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.

4. COURSE CONTENTS

UNIT 1 – Number Systems & Boolean Algebra (06 Periods)

Introduction to different number systems – Binary, Octal, Decimal, Hexadecimal. Conversion between the number system, 1's complement and 2's complement, Binary Addition and Subtraction. Special Codes: BCD, Gray Codes, ASCII codes.

Boolean Algebra: Basic Boolean laws, De-Morgan's Theorem, SOP and POS representation

Ex. No.	Name of Experiment	Periods
1.	Verification of Demorgan's Theorems.	1

UNIT 2 – **Logic Gates** **(06 Periods)**

Logic Gates – NOT, AND, OR, NAND, NOR, XOR, XNOR: Symbol, Logical expression and truth table. Implementation of Boolean expressions and Logic Functions using gates; Simplification of Boolean expressions using Karnaugh Maps (up to 4 variables).

Ex. No.	Name of Experiment	Periods
1.	To verify the truth tables for all logic Gates–NOT,OR,AND,NAND,NOR, X-OR, X-NOR Gates.	2
2.	Realization of Logic Gates using universal Gates.	2

UNIT 3 – **Combinational Logic Circuits** **(06 Periods)**

Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX., Demultiplexer – 1 to 2 DEMUX, 1 to 4 DEMUX, Decoder, Encoder. Parity generator and checker.

1.	Design and verification of the truth tables of Half and Full Adder circuits.	2
2.	Design and verification of the truth tables of Half and Full Subtrator circuits.	2
3.	Design and verification of the truth tables of 4 to 1 Multiplexer (74150) and 1 to 4 De-Multiplexer (74154) circuits.	2
4.	To convert a given octal input to the binary output and to study the LED display using 7447 7-segment decoder.	2
5.	Construct and test the performance of parity generator.	2

UNIT 4 – **Sequential Logic Circuits** **(6 Periods)**

Basic Latches using NAND and NOR gates, Triggering and types of triggering

Flip Flops – SR, JK, T, D Flip Flops, JK-MS Flip Flops,

Counters – Definition and types of counters, difference between asynchronous and synchronous counters, logic diagram, truth table and operation of Decade Counter, Johnson Counter and Ring Counter, applications of counters

Registers –: Types of register, Serial in Serial Out, Serial in Parallel Out, Parallel in Serial Out, Parallel in Parallel Out, applications of registers

1.	Design and test of an S-R flip-flop using NOR/NAND gates.	2
2.	Design and test of an J-K flip-flop using NOR/NAND gates.	2
3.	Design and test of an T flip-flop using NOR/NAND gates.	2
4.	Construct and test the performance of Decade counter.	2
5.	Design a Programmable Up-Down Counter with a 7 Segment Display.	2
6.	Design of 4-bit shift register.	2

UNIT 5 – **Memory Devices** **(04 Periods)**

Classification of Memories – RAM Organization, Address Lines and Memory Size, SRAM, DRAM,

Read Only memory – ROM organization, PROM, EPROM, EEPROM, Flash memory.

Data Converters – Introduction: Digital to Analog converters, Analog to Digital Converters.

1.	To conduct an experiment to store a set of data in a RAM using IC 2114 starting from location ……..to location …… and retrieve the same data.	1

5. TEXT BOOKS/REFERENCE BOOKS:

1. Digital principles & Applications Albert Paul Malvino& Donald P. Leach McGraw Hill Education; Eighth edition ISBN: 978-9339203405
2. Digital Electronics Roger L. Tokheim Macmillian McGraw-Hill Education (ISE Editions);
3. International 2 Revised edition ISBN: 978-0071167963
4. Digital Electronics – an introduction to theory and practice William H. Gothmann Prentice Hall India Learning Private Limited; 2 edition ISBN: 978-8120303485
5. Fundamentals of Logic Design Charles H. Roth Jr. Jaico Publishing House; First edition
6. ISBN: 978-8172247744
7. Digital Electronics R. Anand Khanna Publications, New Delhi
8. (Edition 2018) ISBN: 978-93-82609445

5. INSTRUCTIONAL STRATEGY

An effective strategy for digital electronics theory involves clear explanations of concepts like logic gates and Boolean algebra, supported by visual aids and diagrams. Encourage active learning through problem-solving, discussions, and real-world examples.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**06**	**19**
2	**06**	**19**
3	**06**	**19**
4	**16**	**24**
5	**06**	**19**
Total	**28**	**100**

3.4	PROGRAMMING IN C (Practicum)	L T P
		1 - 4

1. COURSE OBJECTIVES

Computers play a vital role in present day life, more so, in the professional life of technician engineers. People working in the field of computer industry, use computers in solving problems more easily and effectively. In order to enable the students, use the computers effectively in problem solving, this course offers the modern programming language C along with exposition to various applications of computers. The knowledge of C language will be reinforced by the practical exercises. This course introduces to the students the Python language. Upon completion of this course, the student will be able to write non trivial Python programs dealing with a wide variety of subject matter domains. Topics include language components, the IDLE/IDE environment, control flow constructs, strings, I/O, collections, classes, modules, and regular expressions.

2. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to.

CO1 • Develop the concepts C programming language and identify a problem and formulate an algorithm for it.

CO2 • Model various control structures and implement them

CO3 • Identify various types of variables.

CO4 • Make use of pointer in an array and structure.

CO5 • Interpret the concepts of Python programming language

3. 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 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO 2
CO1	3	1	3	2	1	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-
CO5	3	1	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.

4. CONTENT

UNIT 1- Introduction (04 Periods)

Brief idea of low level and high level programming languages, steps in development of a Program, Flow charts, Algorithm development, Programme Debugging, Introduction to Python, Basis of C programming, I/O statements, Assign statements, Constants, variables and data types, Operators and Expressions, Standards and Formatted IOS, Data Type Casting

Ex. No.	Name of Experiment	Periods
1	Programming exercises on executing and editing a C program.	4
2	Programming exercises on defining variables and assigning values to variables.	2

UNIT 2- Control Structures (02Periods)

Decision making with IF – statement, IF – Else and Nested IF, While and do-while, FOR loop Break. Continue go to and switch statements

Ex. No.	Name of Experiment	Periods
3	Programming exercises on arithmetic and relational operators.	2
4	Programming exercises on arithmetic expressions and their evaluation	4
5	Programming exercises on formatting input/output using printf and scanf and their return type values.	4

UNIT 3- Functions (04Periods)

Introduction to functions, Global and Local Variables, Function Declaration, Standard functions Parameters and Parameter Passing, Call - by value/reference, Recursion

Ex. No.	Name of Experiment	Periods
6	Programming exercises using if statement.	2
7	Programming exercises using if – Else.	4
8	Programming exercises on switch statement	4
9	Programming exercises on do – while, statement	4

UNIT 4- Arrays **(02Periods)**

Introduction to Arrays, Array Declaration, Length of array, Single and Multidimensional Array, Arrays of characters, Passing an array to function, Pointers to an array

Ex. No.	Name of Experiment	Periods
10	Programming exercises on for – statement.	3
11	Programs on one-dimensional array.	3
12	Programs on two-dimensional array.	4
13	(i) Programs for putting two strings together. (ii) Programs for comparing two strings.	2

UNIT 5- Pointers **(02Periods)**

Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers Single pointer

Introduction to Colab, Programming in Python.

Ex. No.	Name of Experiment	Periods
14	Simple programs using structures	2
15	Simple programs using pointers.	2
16	Simple programs using union.	2
17	Practice basic coding syntax in Python language	4

5. TEXT BOOKS/REFERENCE BOOKS

1. Let Us C, Yashavant Kanetkar
2. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House
3. C Programming Absolute Beginner's Guide, Dean Miller and Greg Perry
4. Rahul Wadhwa, Programming using C, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-84-2
5. Learning Python by Mark Lutz; Pratham Books, Bangalore
5. Foundations of Python Network Programming by John Goerzen and Brandeu Rhodes; A press-e Book distributed by Springer Science and Business Media, New York

6. INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A Converters and other topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the tested in circulation may be given to the students.

3.5	ELECTRONIC DEVICES AND CIRCUITS (PRACTICAL)	L T P
		- - 4

1. COURSE OBJECTIVES

This course will enable students to develop the skills required to use basic electronic devices in various electronic circuits. Through the study of this course the students will understand the construction, working, characteristics and applications of various types of semiconductor devices such as Diodes and transistors, which are basic building block of amplifier, oscillator, switching circuit, wave shaping circuit and power supply. The knowledge of this core subject is essential for comprehending the courses that will be introduced later in the diploma program as well as developing requisite skills for effective functioning in the industry.

2. COURSE OUTCOMES (CO):

The practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1 Explain the working of different semiconductor devices.
CO2 Measure and calculate various parameters of different semiconductor devices.
CO3 Conclude VI characteristics of various semiconductor devices.
CO4 Explain the working of different type of amplifier and design a specific operating frequency of an oscillator.
CO5 Compare SCR, DIAC, TRIAC and IGBT

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	-	*	*
CO3	3	2	-	3	-	-	-	*	*
CO4	3	3	3	-	-	-	-	*	*
CO5	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.

4. LIST OF EXPERIMENTS

Ex. No.	Name of Experiment	Periods
1.	Construct the circuit and plot the VI characteristics of the PN Junction Diode , find the cut in voltage	4
2.	Plot the V-I Characteristic of Zener Diode.	4
3.	Plot the V-I Characteristic of Photo Diode.	4
4.	Plot the V-I Characteristic of Light emitting Diode.	4
5.	Simulate half wave, full wave and bridge rectifier using simulation tool like P Spice/ Orcad/ Multisim.	4
6.	Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.	4
7.	Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.	4
8.	Plot input and output characteristics of transistor in CB /CE/CC configuration.	4
9.	Build and test voltage divider biased type amplifier & measure voltage at different points on the circuit and observe waveforms.	4
10.	Obtain the characteristics of DIAC and TRIAC 3	4
11.	Obtain frequency response of Single stage RC/RL -coupled amplifier.	4
12.	Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers	3
13.	Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.	3
14.	Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers	3
15.	Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.	3

5. INSTRUCTIONAL STRATEGY

Electronic Components & Devices being a fundamental subject, it needs to be handled very carefully and in a manner such that students develop clear understanding of the related concepts and principles. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self-study and problem-solving abilities amongst them.

3.6	TRANSDUCERS AND APPLICATIONS (PRACTICAL)	L T P - - 4

1. COURSE OBJECTIVES

This course will enable students to develop the skills required to use basic transducers in various measurement applications. Through the study of this course the students will understand the construction, working, characteristics and applications of various types of transducer devices such as LVDT, photodiode and phototransistors along with measurement of temperature, pressure, flow, level, pH, conductivity, density, velocity, viscosity etc. The knowledge of this core subject is essential for comprehending the courses that will be introduced later in the diploma program as well as developing requisite skills for effective functioning in the industry.

2. COURSE OUTCOMES (CO):

The practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1□□Explain the working of different transducer devices.
CO2□□Measure and calculate various parameters from different transducer devices.
CO3□□Fabricate an application circuit using given transducers such as thermistors, strain gauge, IC sensors, capacitive transducers.
CO4□□ Measure pH and density of given buffer solutions.
CO5□□Compare LDR, Photodiode, Photo Transistor, Optocoupler.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	-	*	*
CO3	3	2	-	3	-	-	-	*	*
CO4	3	3	3	-	-	-	-	*	*
CO5	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 EXPERIMENTS

Ex. No.	Name of Experiment	Periods
1.	To draw the input output characteristics of linear variable differential transducers and also study its details.	5
2.	To fabricate a circuit using linear variable differential transducer for the measurement of non-electrical quantity.	4
3.	To draw I/O characteristics of the various photo transducers such as LDR, Photodiode, Photo Transistor, Optocoupler	5
4.	Fabricate an application circuit using photo transducers as a switch and as a light intensity meter.	5
5.	To fabricate an application circuit using given temperature transducer like thermistors and IC Sensors.	5
6.	To fabricate an application circuit using capacitive transducers for measurement of level.	5
7.	To draw I/O characteristics of a strain gauge and study working of weighing Machine using strain gauge/ load cell.	5
8.	To measure conductivity of a given solution using conductivity meter and calibrate it.	4
9.	To measure pH of given acidic and alkaline solutions using a pH meter and standardize it, using buffer solutions.	5
10.	To measure density of given solution using simple hydrometer.	4
11.	To measure vibration of motor or compressor system using a vibration meter and piezo-electric sensors.	5
12.	To perform noise measurement using condenser microphone.	4

5. INSTRUCTIONAL STRATEGY

Transducers are fundamental components for designing measurement and instrumentation systems. Students will develop clear understanding of the related concepts and principles of transducers and their applications. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self-study and problem-solving abilities amongst them.

OPEN ELECTIVE -1

3.7(a)	PRODUCT DESIGN & DEVELOPMENT (Theory)	L T P
		2 - -

1. COURSE OBJECTIVES

This course is designed to provide the basic concepts of Product Design and Development (PDD), understanding of various phases of PDD, hands on CAD on various tools used for PDD, Manufacturing Considerations, Detail Design and Engineering, 3D CAD design tool with its different features and applications, concept creation and 3D modelling, part design, generative shape design, assembly design, etc., prototyping of concept models using Additive Manufacturing. This course helps students to convert Ideas into real products.

2. COURSE OUTCOMES(CO):

The subject should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1 • Comply with Industry health and safety guidelines
CO2 • Familiarize with the product design process to design a new product
CO3 • Use CAD software to design a component with solid part model, sheet metal part model and assembly models
CO4 • Develop concept models, Detail Design, Engineering Drawing, GD&T
CO5 • Create 3D printing part using slicing software and 3D CAD modelling

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	2	-	1	-	-
CO2	3	2	3	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-
CO4	3	-	3	-	-	-	-	-	-
CO5	3	-	3	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.

4. CONTENT

UNIT 1- INDUSTRIAL SAFETY PRACTICES (04 Periods)

(i) Types and use of fire extinguishers.
(ii) Safe handling and maintenance of tools and equipment.
(iii) Importance of using proper tools.
(iv) Occupational safety and health (OSH) practices.

UNIT 2- INTRODUCTION TO PRODUCT DESIGN DEVELOPMENT (06 Periods)

(i) Introduction and need for product design.
(ii) Stages of the PDD process and standard industry practices.
(iii) Key elements: market research, customer needs, feasibility, concept design, ergonomics, regulatory aspects, and cost.
(iv) Detailed design: material selection, Design for Assembly (DFA), Design for Manufacturing (DFM) and Design failure mode and effect analysis (DFMEA)
(v) Verification, validation, quality control, packaging.
(vi) Program management and product support.

UNIT 3- **ENGINEERING DRAWING & 3D DESIGN TOOLS** (06 Periods)

(i) Basics of engineering drawings, projections, and views.
(ii) Concept creation, 2D/3D design, and use of design tools.
(iii) Introduction to 3D CAD software and its applications.
(iv) Overview of modules: part, surface, assembly, drawing.
(v) Interface, customization, specification tree, and layout.

UNIT 4- **CONCEPT CREATION & 3D MODELLING** (06 Periods)

(i) Sketcher tools and dimensional constraints.
(ii) Part design (Pad, Pocket, Hole, etc.).
(iii) Surface design (Extrude, Sweep, etc.).
(iv) Assembly design, constraints, exploded views, BOM.
(v) Engineering drawings and GD&T.
(vi) Case studies on modelling different materials.

UNIT 5- **ADDITIVE MANUFACTURING** (06 Periods)

(i) Basics of prototyping and 3D printing.
(ii) Material types and selection based on properties and applications.
(iii) 3D printing process and industrial uses.
(iv) Introduction to slicing software and its functions

5. INSTRUCTIONAL STRATEGY

To effectively deliver the above content, begin with interactive lectures and multimedia presentations to introduce core concepts, supported by real-world case studies. Incorporate demonstrations and guided tutorials, especially for CAD tools, engineering drawing, and additive manufacturing. Encourage collaborative group work and design projects to foster creativity and problem-solving in product development. Practical sessions should follow each theory component, allowing learners to immediately apply their knowledge through lab-based exercises and simulations. Finally, integrate industry guest talks or virtual factory visits to expose students to current practices and trends, making the learning process more engaging and career-relevant.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**4**	**12**
2	**6**	**22**
3	**6**	**22**
4	**6**	**22**
5	**6**	**22**
Total	**28**	**100**

OR

OPEN ELECTIVE -1

3.7 (b)	FUNDAMENTALS OF INNOVATION AND DESIGN THINKING (Theory)	L T P
		2 - -

1. COURSE OBJECTIVES

This course is designed to give a strong understanding of basic concepts of Innovation & Design thinking, to develop many creative ideas through structured brainstorming sessions. The ideas are validated through 3D printing& confirmatory tests. Design thinking is an iterative process that use to understand users & usage patterns, their assumptions, redefine problems and create innovative solutions. It is most useful to tackle problems that are ill-defined or unknown.

2. COURSE OUTCOMES(CO):

The subject should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1 • Comply with Industry health and safety guidelines

CO2 • Create value by using problems solving approach and by applying innovation techniques

CO3 • Create innovative products, processes, services, business models etc.

CO4 • Familiarise with 3D CAD modelling software, common Engineering standards, symbols

CO5 • Start their own business | start up | entrepreneurship

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PS O2
CO1	3	-	-	-	2	-	1	-	-
CO2	3	3	-	1	-	-	-	-	-
CO3	3	-	2	1	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-
CO5	3	-	3	-	-	-	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.

4. CONTENT

UNIT 1- **INDUSTRIAL SAFETY PRACTICES** (04 Periods)

(i) Types and use of fire extinguishers.
(ii) Safe handling and maintenance of tools and equipment.
(iii) Importance of using proper tools.
(iv) Occupational safety and health (OSH) practices.

UNIT 2- **INTRODUCTION TO INNOVATION & DESIGN THINKING** (06 Periods)

(i) Definition, types, and necessity of innovation.
(ii) Linear vs non-linear innovation; open vs closed models.
(iii)Design thinking: principles, mindset, and value.
(iv)Risk-reward analysis in innovation.
(v) From innovation to start-up: key steps.
(vi)Scoping and foundational principles of design thinking.

UNIT 3- **DESIGN THINKING TOOLS & IDEA GENERATION** (06 Periods)

(i) Brainstorming techniques and tools.
(ii) Phases of design thinking: Explore, Empathize, Experiment, Engage, Evolve.
(iii)Tools: SCOPES, STEEP, POEMS, SCAMPER.
(iv)Deep user needs analysis (SPICE).
(v) Idea selection, concept development, prototyping.
(vi)Storytelling, co-creation, strategic alignment.
(vii) Case studies.

UNIT 4- **INTRODUCTION TO 3D MODELING & ADDITIVE MANUFACTURING**
(06 Periods)

(i) CAD tools, 3D modeling, product drawing & BOM.
(ii) Prototyping basics and its industrial role.
(iii) Additive vs traditional manufacturing.
(iv) Types of 3D printers, components, working, software (slicing).
(v) Laser cutting basics, process, applications, pros & cons.
(vi) Case studies and latest advancements.

UNIT 5- **START-UP & PROJECTION PLAN** (06 Periods)

(i) Basics of management, leadership, HR, communication, and production.
(ii) Entrepreneurial concepts and forms of business.
(iii)Start-up essentials: planning, research, vision, model, operations.
(iv)Business modeling, market positioning, financial analysis.
(v) Start-up success factors and common failure points.
(vi)Case studies and project work.

5. INSTRUCTIONAL STRATEGY

The teacher should lay stress on Demonstrations & Role Play, Video-Based Learning, **Case Study Analysis:** Discuss successful innovations to highlight theory in practice. He should assign real-world problems for learners to solve using design thinking, organize **Software Tutorials** and Business Plan Workshops.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	12
2	6	22
3	6	22
4	6	22
5	6	22
Total	**28**	**100**

4.1	MICROPROCESSORS AND ITS APPLICATIONS (Theory)	L T P
		3 - -

1. COURSE OBJECTIVES

The course aims to cover the fundamental concepts and evolution of microprocessors, focusing on the 8085 and 8086 architectures, instruction sets, and programming. It includes peripheral interfacing, memory organization, and the development of assembly language skills, along with exploring real-world applications of microprocessor-based systems.

2. COURSE OUTCOMES(CO):

The theory should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1 Explain the architecture, operation, and instruction set of microprocessors.

CO2 Develop assembly language programs for microprocessors.

CO3 Interface microprocessors with memory and peripheral devices.

CO4 Design and implement microprocessor-based systems for real-world applications.

CO5 Compare microprocessors and microcontrollers and understand their role in embedded systems.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	-	-	3	*	*
CO2	3	3	2	2	-	-	2	*	*
CO3	3	2	3	3	2	2	2	*	*
CO4	3	3	3	3	2	3	3	*	*
CO5	2	2	2	3	2	3	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.

4. CONTENTS

UNIT 1: Introduction to Microprocessor (10 periods)

Evolution and History of microprocessors, Introduction to 8-bit, 16-bit, and 32-bit processors,

Architecture and Operation of the 8085 microprocessor, Addressing modes and Bus organization

Architecture and Operation of the 8086 microprocessor, Addressing modes and Bus organization

UNIT 2: 8086 Microprocessor Programming (12 periods)

Instruction set of 8086 microprocessors, Assembly language programming, Stack, Subroutines and Interrupt Handling

UNIT 3: Interfacing with Peripheral Devices (8 periods)

Memory and I/O interfacing,8255 Programmable Peripheral Interface, DC, DAC, and sensor interfacing, Serial and parallel communication

UNIT 4: Microprocessor-Based System Design (6 periods)

Design of microprocessor-based control systems, Industrial applications of microprocessors, Data acquisition and process control, Case studies of real-world applications

UNIT 5: Microcontrollers and Embedded Systems (6 periods)

Introduction to Microcontrollers (8051), Difference between microprocessors and microcontrollers, Role of microcontrollers in embedded systems, Applications of modern microprocessor-based systems

5. TEXT BOOKS/ REFERENCE BOOKS:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, PHI.
2. Douglas V. Hall, Microprocessors and Interfacing: Programming & Hardware, McGraw-Hill.
3. B.B. Dwivedi, Microprocessors & Peripheral Devices, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-77-4
4. Kenneth J. Ayala, The 8051 Microcontroller, Cengage Learning.
5. A.P. Godse & D.A. Godse, *Microprocessor and its Applications*, Technical Publications.
6. Muhammad Ali Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson.

6. INSTRUCTIONAL STRATEGY

The approach involves explaining concepts with real-world examples, hands-on microprocessor programming, and developing microprocessor-based systems. It also encourages self-study and case study discussions to enhance problem-solving skills.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**10**	**24**
2	**12**	**29**
3	**8**	**19**
4	**6**	**14**
5	**6**	**14**
Total	**42**	**100**

4.2	PROCESS INSTRUMENTATION (Theory)	L T P
		3 - -

1. COURSE OBJECTIVES

Precision measurement of process parameters such as pressure, level density, speed, temperature, flow, moisture etc. is very essential for successful running of a process industry. Various telemetric and manual control circuits are to be handled by technicians employed in these industries. Therefore to equip the diploma students in instrumentation and control engineering with the knowledge and skill of principles and circuitry for measurement of these parameters.

2. COURSE OUTCOMES

Students will be able to:

CO1: Enabling the students to acquire knowledge about various Pressure measuring instrument Systems.
CO2: Understanding the concept and working of Level Measurement in instrumentation and control.
CO3: Students will be able to know about measurement technique of Speed and Temperature.
CO4: Enable the student to get familiarized with working of flow measurement systems.
CO5: Describe the basics of Moisture and Density Measurement Systems. Understand the working and installation of Instrumentation system.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	-	-	-	-	-	1	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	2	2	1	-	1	-	-
CO5	3	2	2	2	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.

4. COURSE CONTENT:

UNIT-I INTRODUCTION (4 Periods)

Introduction and definition of the term process instrumentation. Importance of process instrumentation for process industry with example of any typical processes. Block diagram of a general instrumentation system, Elements of an instrument. Importance of Calibration.

UNIT- II PRESSURE AND LEVEL INSTRUMENTATION: (14 Periods)

PRESSURE MEASUREMENT: Definition, Types of pressure, Pressure Elements- Diaphragm, Force Balance, Bellows, Bourden Tube. Pressure Gauges, Differential Pressure Gauges, uses of manometers for differential pressure measurement. Measurement of static and dynamic pressure. Pressure switch and regulators. Importance of Pressure measurement.

Electrical Methods for pressure measurement: Resistive Methods using Strain Gauge, Potentiometer, Capacitive Methods using capacitive transducer. Calibration of Pressure Gauge/Pressure Transducers/Pressure transmitters/Different Pressure Transmitters with Dead weight pressure gauge tester, Digital pressure indicator (Differential pressure and vacuum)

LEVEL MEASUREMENT: Introduction , head, density and specific gravity their relationship, method of measurement: Float method, Magnetic float, Displacer method.

Indirect Method: By pressure gauge, Diaphragm box method, Air trap method, bubbler method, Pneumatic force balance method, Level measurement in a pressurised vessel using differential gauges, Level measurement of corrosive liquid by use of seal, Level measurement by weighing and Level measurement of dry material.

Electrical Methods: Electrical Conductivity method, Capacitance method, Radioactive methods, Ultrasonic method and GWR (Guided Waves Radar).

UNIT-III: TEMPERATURE INSTRUMENTATION (10 Periods)

Definition of temperature, temperature scales, conversion of one temperature units into another, importance of temperature instrumentation. Methods of measurement, industrial liquid thermometer, thermometric liquids and its properties, limitation of glass thermometer. Filled thermometers- Liquids filled, gas filled, vapour filled (construction and working principle of filled thermometers), comparison. Possible sources of errors, ambient temperature effects and its compensation. Mounting method location and selection.

Bi-metallic thermometer, principle, construction, material combination of bi- metallic strip its use for control application. Electrical methods for temperature measurement thermocouple, Seeback effect, Peltier effect, Thompson effect, thermocouple material, protecting tube and temperature range, characteristic curve for thermocouple, measurement of thermocouple e.m.f. by (temp Vs. e.m.f.) voltmeter method and potentiometric method, use of compensating leads. Comparison between

millimeter method and potentiometric method, calibration of Milli voltmeter by potentiometer. Mounting of thermocouple.

Possible sources of errors and reference junction compensation. Resistance Temperature Thermometer (RTD), principle and constructional details, bulbs and wells. Properties of resistance elements, I.C. based Semiconductor thermometer, Ranges and limitations. Radiation pyrometer-Principle, working temperature range. Total radiation pyrometer-construction and working principle, Temperature switch.

UNIT-IV : FLOW AND SPEED MEASUREMENTS (08 Periods)

FLOW MEASUREMENTS**:** Types of flow, Bernoulli's theorem, Differential pressure flow meters-Expression for flow rate in terms of differential pressure. Types of restriction - orifice, nozzle and ventury tube, construction, material used and their comparison. Measurement of differential pressure in flow lines. Variable area meter (Rotameter) construction, working principle and its advantage. Positive displacement meter, Rotating lobe meter, Rotating vane meter, or Nutating disc meter reciprocating piston meter. Electromagnetic flow meter and Ultrasonic flow meter. Mass flow meter solid flow meter by weighting. Flow through open channel:- Weirs and V-notch.

SPEED MEASUREMENTS: Speed measurement, Tachometer (Contact type and non-contact type Details).

UNIT-V: MOISTURE AND DENSITY MEASUREMENT (06 Periods)

MOISTURE MEASUREMENT: Definition, Direct drying and weighing method. Electrical Methods: Conductance method, capacitance method. Use of moisture in process industries. Humidity measurement definition, absolute humidity, relative humidity, percentage humidity, Dew point, DRY & WET Bulb Hygrometer.

DENSITY MEASUREMENT: Definition relationship between density, pressure at the bottom of column of liquid and weight of a given volume, Relative density / Specific gravity. Liquid level method, Displacement method and Hydrometer method.

5- REFERENCE BOOKS

1. Industrial Instrumentation by Donald P Eckman
2. Industrial Instrumentation and Control by S K Singh

6. INSTRUCTIONAL STRATEGY

The subject requires active learning strategies such as problem solving activities, group discussion and laboratory experiments and provide hands on experience with Pressure Gauges, Thermometers, Hygrometers. Students will be able to identify the problems and capable to decide the applications for measurement and control of various physical parameters.

7. MEANS OF ASSESSMENT –

- Class tests
- Home assignment
- Attendance
- Sessional test

8. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	14	30
3	10	25
4	08	20
5	06	15
Total	42	100

4.3	ELECTRONIC INSTRUMENTATION AND MEASUREMENT (Practicum)	L T P
		2 - 2

4.a.i.1. COURSE OBJECTIVES

Instrumentation is an emerging field used in data detection, acquisition, analysis and control in industrial applications. Analog and digital instruments are mainly used to determine different process parameters. These instruments present the desired information in visual indication either in analog or digital form. The course builds on students' knowledge of basic measuring tools, covering the principles, concepts, and techniques of analog and digital electronic measurement methods for accurate process parameter determination.

4.a.i.2. COURSE OUTCOMES

The theory should be taught should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following COURSE OUTCOMES.

Students will be able to

CO1• Measure various electrical parameters with accuracy, precision, resolution.

CO2• Measure relevant parameters using AC and DC bridges.

CO3•Make use of electronic instruments for lifelong measurements.

CO4• Make use of front panel controls of DSO/CRO for appropriate measurements.

CO5•Select appropriate passive or active transducers for measurement of physical phenomenon.

4.a.i.3. 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 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO 2
CO1	3	2	-	3	-	-	-	*	*
CO2	3	2	-	3	-	-	-	*	*
CO3	3	2	-	3	-	-	2	*	*
CO4	3	-	-	3	-	-	-	*	*
CO5	3	3	-	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.

4. CONTENT

UNIT 1- Basics of Measurements (04 Periods)

Measurement, Method of measurements, Types of instruments, Accuracy & Precision, Sensitivity, Resolution, Types of Errors, Sources of errors, Loading effect

UNIT 2- AC and DC and Bridges (04 Periods)

DC Bridges –Wheatstone and Kelvin Double Bridge (Only comparative study)

AC Bridges - Maxwell's Bridge, Hay's Bridge, Anderson Bridge, De-Sauty's Bridge (Only comparative study)

Ex. No.	Name of Experiment	Periods
1.	Determine the value of unknown resistance using Wheatstone bridge.	2
2.	Measure Low resistance by Kelvin's Double Bridge.	2
3.	Measure unknown inductance using following bridges (a) Anderson's Bridge (b) Maxwell's Bridge.	2

UNIT 3- Measuring Instruments (07 Periods)

Permanent Magnet Moving Coil Instruments (PMMC), Moving Iron Type Instruments (MI), Electro Dynamo Type Instruments, Single Phase Energy Meter, Applications of DC Potentiometer and AC Potentiometers, Various types of Electronic Instruments.

Ex. No.	Name of Experiment	Periods
4.	List various standard sources & measuring UNITs. Measure DC & AC voltages, current using ammeter and voltmeter.	2
5.	Test diodes and transistors using analog and digital Multimeter.	2
6.	Study the working of Q-meter and measure Q of coils.	2

UNIT 4- Oscilloscopes (07 Periods)

Cathode ray tube: probe structure (1:1,10:1), construction, operation, screens, Graticules vertical deflection system, Horizontal deflection system, Delay line, Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method), Oscilloscope probe: Structure of 1:1 and 10:1probe, Multiple Trace CRO, Digital storage oscilloscope (DSO).

Ex. No.	Name of Experiment	Periods
7.	Operate front panel controls of DSO/CRO to observe various waveforms.	2
8.	Measure time, voltage, frequency, phase difference of input signals using DSO/CRO.	2

9.	Demonstrate features of digital storage oscilloscope.	2
10.	Experiment with front panel controls of various signal generators and observe output Waveform.	2

UNIT 5- Transducers (06 Periods)

Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor, LVDT, Strain Gauge Load Cell, Piezoelectric Transducers.

Ex. No.	Name of Experiment	Periods
11.	Measure strain/stress using strain gauge measurement.	2
12.	Measure displacement using LVDT.	2
13.	Measure temperature using thermistor and thermocouple.	2
14.	Using a piezo resistive sensor to measure pressure variations/Using a piezoelectric sensor to measure sound vibrations.	2

5. TEXT BOOKS/ REFERENCE BOOKS

1. Electrical & Electronic Measurement & Instruments A.K. Sawhney, Dhanpat Rai & Sons, India
2. Electronic Instrument and Measurement Technique W.D. Cooper Prentice Hall International, India.
3. Electronic Measurement & Instrumentation J.G. Joshi Khanna Publishing House, Delhi
4. Measurement systems application and design E.O. Doebelin and D. N. Manik, Tata Mcgraw-Hill
5. Electronic Measurements and Instrumentation Oliver and Cage, Tata Mcgraw-Hill.
6. Rahul Wadhwa, Electronic Instruments&Measurement, Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-137-3
7. Basic Electrical Measurement M.B. Stout Prentice hall of India, India
8. Electronic Instrumentation H. S. Kalsi ,Tata Mcgraw-Hill

6. INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

7 . SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	15
2	4	25
3	7	25
4	7	25
5	6	20
Total	28	100

4.4	INDUSTRIAL CONTROL (Practicum)	L T P
		2 - 2

1. COURSE OBJECTIVES

Electrical energy is the main source of energy for running nearly all type of industries. The machines are mainly driven by the electrical energy. Therefore the control of electrical power is of utmost importance in these machines. The objective of this paper is to familiarize the student with response of simple first order and second order systems, input, output relationships, components and devices used in control systems, thyristors and their application in heating, welding and motor control.

2. COURSE OUTCOMES

Students will be able to

CO1: Demonstrate an understanding of fundamentals of Control System.

CO2: Ability to analyze the response of first and second order system with different basic input signals.

CO3: Uses of Laplace Transform in control system analysis and analyze the stability of control system using Routh-Hurwitz criterion.

CO4: Understand the construction and working of various power electronic devices, Acquire knowledge of power converter like rectifier, Inverter, Cycloconverter etc.

CO5: Understand basic concept of electric drive and motor speed control using power electronic devices.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	-	-		-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	2	2	2	-	**2**	-	-
CO4	3	-	-	2	-	-	-	-	-
CO5	3	-	2	2	2	-	**2**	-	-

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

4. COURSE CONTENTS

UNIT-I : INTRODUCTION TO CONTROL SYSTEM (06 Periods)

Need of automatic control, classification of control systems- Open loop and closed loop system with block diagram, basic element, and applications. Other types of control systems- Linear and Nonlinear system, Single input - Single output (SISO) system and Multi Input - Multi-output (MIMO) system, Static and dynamic systems, Continuous and discrete systems, Analog and digital system and Stable and Unstable systems.

UNIT-II : INPUT OUTPUT RELATIONSHIP OF CONTROL SYSTEMS (05 Periods)

Concept of Laplace & inverse Laplace transform, Laplace and inverse Laplace transform of some useful functions, Initial and Final value theorems, Concept of transfer function and transfer function of close loop control system, transfer function of cascade and parallel system, Block diagram representation of control system & simplification techniques.

UNIT-III: SYSTEM EXCITATION AND RESPONSE OF CLOSE LOOP SYSTEMS. (05 Periods)

Step, ramp, pulse, exponential and sinusoidal type of inputs with examples, Response of first order and second order systems with examples, Response due to forcing function, response to impulse, step and ramp inputs, Definitions of over shoot, under shoot, rise time and damping ratio, damping coefficient, settling time and peak time, Stability Analysis using Pole-Zero plot, Routh-Hurwitz criterion.

Ex. No.	Name of Experiment	Periods
1.	To plot the time response of a first order electrical system.	2
2.	To plot time response of second order electrical system and find out transfer function of a LCR circuit.	2

UNIT-IV: THYRISTORS AND THEIR APPLICATIONS (07 Periods)

Name, symbol and typical application of members of Thyristor family. SCR, DIAC and TRIAC: Basic structures, operations, V-I characteristics, ratings, Triggering methods and circuits, Turn off methods and circuits. UJT: Operation, V-I characteristics, relaxation oscillator and its use for triggering of thyristors. Half Wave Full Wave Rectifiers: Half wave and full wave (Including Bridge) single phase and three phase controlled rectifiers using SCRs, circuit diagram, working principle and applications. Principle and operation of invertor circuit, basic series and parallel inverter circuits. Operation of choppers and Cycloconverters with their applications. Uninterruptible power supply (UPS), SMPS: block diagram and brief description.

Ex. No.	Name of Experiment	Periods
1.	To draw the characteristic curves of S.C.R., Diac and Triac.	3
2.	To study a power rectifier using SCR and draw input and output wave forms.	3
3.	To study a single phase inverter. Circuit using S.C.R. and draw input and output wave forms.	3
4.	To fabricate a S. C. R. chopper circuit, test it and determine duty cycle.	3
5.	To Fabricate a circuit for illumination control of Light Source using SCR.	3

UNIT-V: SOLID STATE MOTOR CONTROL (05 Periods)

Application of phase controlled rectifiers in illumination and temperature control. A.C. and D. C. motor speed control. Plugging, Dynamic & Regenerative Braking. Introduction to Electric Drives.

COMPONENTS AND DEVICES USED IN CONTROL SYSTEMS: Brief description, working of potentiometer, self-balancing potentiometers, Servo motors, Eddy current clutches, Relays and contactors, Timing relays, Saturable core reactor and its use as magnetic amplifier.

HIGH FREQUENCY HEATING AND WELDING: Concept of- induction heating, dielectric heating, resistance welding. Heating processes and electronic control of resistance welding and its applications in industry.

Ex. No.	Name of Experiment	Periods
1.	To study the effect of variation in firing angle on a C.R.O. and to plot the wave shapes.	3
2.	To fabricate the Traic Diac motor speed control circuit and draw input output (Speed)	3
3.	To Fabricate a circuit for temperature control of a heating element using Thyristors.	3

5. REFERENCE BOOKS

1. Linear Control Systems by B S Manke, Khanna Publishers
2. Power Electronics: Circuit Divecs and Application by M.H.Rashid,PHI publication
3. Power Electronics by P.S.Bimbhra Khanna publication
4. Elements of Electric Drives by J B Gupta by Katson Publication
5. Industrial Electronics and control By S.K.Bhattacharya& S Chattarji

6. INSTRUCTIONAL STRATEGY

The teacher should use examples to explain the working concept of different types of control systems, applications of thyristors, software tools, etc.

7. MEANS OF ASSESSMENT

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

4.5	MICROPROCESSORS AND ITS APPLICATIONS (PRACTICAL)	L T P
		- - 6

1. COURSE OBJECTIVES

The course aims to familiarize students with microprocessor hardware and software, provide hands-on experience in assembly language programming, and develop skills in interfacing microprocessors with peripheral devices. It focuses on microprocessor-based system design and enhances analytical, design, and implementation skills through laboratory experiments

2. COURSE OUTCOMES(CO):

CO1 Write and execute basic assembly language programs using 8085/8086.
CO2 Develop programs involving arithmetic, logical, and control instructions.
CO3 Interface microprocessors with input/output devices.
CO4 Design and simulate microprocessor-based solutions to simple problems.
CO5 Document and analyse practical experiments effectively

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	2	3	-	-	2	*	*
CO2	3	3	2	3	-	-	2	*	*
CO3	3	3	3	3	2	-	2	*	*
CO4	3	3	3	3	2	2	3	*	*
CO5	2	2	2	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.

4. LIST OF EXPERIMENTS

Ex. No.	Name of Experiment	Hours
1.	Introduction to 8085/8086 kit and instruction set	3
2.	Add two 8-bit numbers using 8085	3
3.	Subtract and compare two 8-bit numbers	3
4.	Multiply two 8-bit numbers using repeated addition	3
5.	Divide two 8-bit numbers using 8085	3
6.	Block data transfer using 8085	3

7.	Sorting of an array using 8085	3
8.	To add two hexadecimal & decimal numbers using 8085.	3
9.	To subtract two hexadecimal & decimal numbers using 8085.	3
10.	Interfacing ADC/DAC with 8085	3
11.	To interface ADC & DAC with 8085 & demonstrate generation of square wave.	3
12.	Add two 8-bit numbers using 8086	3
13.	Subtract and compare two 8-bit numbers using 8086	3
14.	Multiply two 8-bit numbers using repeated addition using 8086	3
15.	Divide two 8-bit numbers using 8086	3
16.	Block data transfer using 8086	3
17.	Sorting of an array using 8086	3
18.	Perform various logical operation using 8086	3
19.	Perform universal gate operation using 8086	3
20.	Find 1s' and 2's complement of a number in 8086	3
21.	Program for LED blinking using microprocessor I/O interfacing	3
22.	Stepper motor interfacing using 8255	3
23.	Traffic light control simulation using 8085	3
	REVISION	15

3. INSTRUCTIONAL STRATEGY

Begin with fundamental concepts and progressively advance to more complex ideas. Collaborative problem-solving is encouraged through pair or group learning. Real-time experiments reinforce theory, and documentation and discussion of outcomes are emphasized to deepen understanding and reflection.

4.6	PROCESS INSTRUMENTATION (PRACTICAL)	L T P - - 6

1. COURSE OBJECTIVES

Precision measurement of process parameters such as pressure, level density, speed, temperature, flow, moisture etc. is very essential for successful running of a process industry. Various telemetric and manual control circuits are to be handled by technicians employed in these industries. Therefore to equip the diploma student in instrumentation and control engineering with the knowledge and skill of principles and circuitry for measurement of these parameters will be useful in world of work.

2. COURSE OUTCOMES

Students will be able to:

CO1: Enabling the students to acquire practical knowledge about various Pressure measuring instrument Systems.
CO2: Understanding the concept and working of Level Measurement in instrumentation and control.
CO3: Students will be able to know and realise about the measurement technique of Speed and Temperature.
CO4: Enable the student to get familiarized with practical knowledge of flow measurement systems.
CO5: Describe the basics of Moisture and Density Measurement Systems. Understand the working and installation of Instrumentation system.

3. 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 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO 1	PSO2
CO1	3	-	-	-	-	-	1	-	-
CO2	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-
CO4	3	-	2	2	1	-	1	-	-
CO5	3	2	2	2	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.

4. LIST OF PRACTICALS

Ex. No.	Name of Experiment	Hours
1	To measure pressure by various methods A. Pressure Gauge (Bourdon, Bellow and diaphragm type) B. Digital Pressure Indicator C. Vaccum pressure	10
2	To measure and record pressure of line by graphic recorder and electronic pressure recorder.	4
3	To measure level of a tank by A. Sight glass tube and flood method. B. Capacitive level detector C. resistive level detector.	10
4	To calibrate a pressure gauge using load weight tester and standard pressure calibration.	4
5	To study the construction and operation of level limit switch and make an application circuit using level limit switch.	4
6	To draw the I/o characteristic of electronic pressure transmitter.	4
7	To measure speed of motor by A. Mechanical tachometer B. Optical tachometer C. Inductive reluctance type tachometer	8
8	To measure temperature using various methods. A. Thermometer B. Thermocouple C. Pyrometer (Total radiation and optical pyrometer) D. RTD E. I.R. temperature sensor (Semiconductor type)	12
9	To record level/temperature using universal electronic meter.	4
10	To measure flow in a pipeline using A. Orifice meter B. Venturimeter C. Rotameter D. Electromagnetic flowmeter	12
11	To measure flow of air using anemometer.	4
12	To measure density of solution using electronic density meter and	4

	hydrometer	
13	To measure moisture using Electronic moisture meter.	4

5. INSTRUCTIONAL STRATEGY

The subject requires active learning strategies such as problem solving activities, group discussion and laboratory experiments and provide hands on experience with Pressure Gauges, Thermometers, Hygrometers. Students will be able to identify the problems and apply their knowledge for measurement and control of various physical parameters.

OPEN ELECTIVE-2

4.7 (a)	ELECTRIC VEHICLE (Theory)	L T P
		2 0 0

1. COURSE OBJECTIVES

This course aims to provide a solid foundation in electric vehicle (EV) technology, government policies, and their economic and environmental implications. It explores the different systems and subsystems within electric vehicles and their respective functions. Students will gain insight into the calculations involved in EV design and operation, as well as guidelines for selecting critical components, such as motors, motor controllers, battery packs, battery management systems, charging infrastructure, and regenerative braking. The course also covers essential regulatory standards, safety protocols, electrical wiring harness design, and testing norms for electric vehicles, along with the latest advancements in EV technology.

2. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that

Students will be able to

CO1• Comprehend and adhere to industry health and safety guidelines while working with electric vehicles to mitigate hazards.

CO2• Identify key components of electric vehicles and their functions and apply basic calculations related to EV design and operation.

CO3• Troubleshoot EV component faults

CO4• Apply effective techniques for troubleshooting, repairing, and maintaining electric vehicle systems to minimize potential hazards.

CO5• Design and assemble components for basic electric vehicle systems.

3. 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 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	2	1	-	-	-	-	*	*
CO3	3	2	-	-	-	-	-	*	*
CO4	3	2	2	-	-	-	-	*	*
CO5	3	-	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.

4.CONTENT

UNIT 1- INTRODUCTION TO INDUSTRIAL SAFETY PRACTICES & ELECTRIC VEHICLE (04 Periods)

Fire Extinguishers & its Types, safely handling Tools & Equipment, Use of proper Tools & Equipment & its maintenance, OSH & practices to be observed as a precaution.

Overview electric Vehicle Technologies, India policy regarding electric vehicles, Electric vehicle advantages and limitations, Electric vehicle effects on the economy and environment

UNIT 2- ELECTRIC VEHICLE ARCHITECTURE, MOTORS AND CONTROLLERS (06 Periods)

Types of Electric Vehicles (Overview of electric vehicle technologies like BEV, HEV, PHEV and FCEV.), Basic architecture of electric vehicle drivetrains, Overview of various system and subsystem of Electrical Vehicle and their functions.

Function and operation of electric vehicle motors, Classification of electrical vehicle motors, Types of loads acing on vehicle, Motor specifications, Motor calculation for electric vehicle, Motor selection, Motor controllers and its function, Motor controller selection, Function and operation of a DC-to-DC converter, Basic Wiring harness for EV, Overview of regenerative braking, function & working

UNIT 3- ENERGY STORAGE SYSTEM & CHARGING SYSTEM, ELECTRIC VEHICLE BATTERY MANAGEMENT SYSTEM AND BASIC REGULATORY REQUIREMENTS (08 Periods)

Electric Vehicle Energy Storage & Charging System, Overview of battery pack. (Cell selection, battery connection, battery pack construction), Overview of battery pack sizing, Thermal management, charging system types, Fundamentals of constant voltage and constant current charging, Standards for electric car charging, Connector standards for charging electric vehicles, Calculation for battery recharging and discharge, Pros and Limitations of batteries for electric vehicles, Regenerative Braking Systems.

Introduction to Battery Management System, function of a battery management system (BMS), Block diagram of the battery management system, Thermal control system, cell load distribution, and State of Charge (SOC) and State of Health (SOH) analysis, Difference between high voltage and low voltage system, Maintenance & repairing of electric vehicle system, Basic Regulatory Requirements.

UNIT 4- ELECTRIC VEHICLE CIRCUIT PROTECTION SAFETY, REPAIR AND MAINTENANCE OF EV (06 Periods)

Introduction to electrical wiring harness, Importance of colour coding and labelling on wiring harness, Materials used for wiring harness and its selection criteria, Design consideration in wiring harness, Understand wire gauge and power rating capacity, Types of Electric vehicle Fuses, Electric Vehicle Relays, Selection of relay type, Positioning Fuses and relays in Electric vehicle circuit.

Preventive maintenance of EV, Standard procedure to work on high voltage systems, Diagnosis and fault finding, Schedule servicing of EV, Predictive maintenance of EV.

UNIT 5- ELECTRIC VEHICLE TESTING AND TECHNOLOGY ADVANCEMENT IN ELECTRIC VEHICLE (04 Periods)

Vehicle Performance testing for acceleration, top speed, range, braking, hill climbing, vehicle structure, road handling, weather resistance, etc., Vehicle Durability testing or life expectancy of parts, materials, and components, Safety: battery safety, charging system safety, and occupant safety, Emission standard and its testing, Vehicle Noise standards and its testing, Advancements in electrical vehicle: Autonomous Driving, Battery Technology to improved range, greater efficiency, and faster charging, life span of batteries, Charging Infrastructure (public charging networks, on-the-go charge, development in vehicle overnight charging technology, wireless Charging).

* Case studies and Mini Project should be carried out throughout the semester.

5. TEXT BOOKS/REFERNCE BOOKS

1. **Electric Vehicle Technology Explained**

   Authors: James Larminie, John Lowry
   Publisher: Wiley
2. **Modern Electric Vehicle Technology**

   Author: C.C. Chan, K.T. Chau
   Publisher: Oxford University Press
3. **Electric and Hybrid Vehicles: Design Fundamentals**

   Author: Iqbal Husain
   Publisher: CRC Press
4. **Electric and Hybrid Vehicles: Technologies, Modeling and Control – A Mechatronic Approach**

   Author: Amir Khajepour, M. Saber Fallah, Avesta Goodarzi
   Publisher: Wiley
5. **Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives**

   Author: Chris Mi, M. Abul Masrur, David Wenzhong Gao

Publisher: Wiley

6. **Battery Management Systems for Large Lithium Ion Battery Packs**

   Author: Davide Andrea
   Publisher: Artech House

7. **Electric Vehicles: Prospects and Challenges**

   Editors: Tariq Muneer, Irene Illescas García
   Publisher: Elsevier

8. **Power Electronics for Electric Vehicles and Energy Storage**

   Author: Anup Bhattacharya
   Publisher: Springer

9. **Automotive Power train and Electric Vehicle Systems**

   Author: Alexander G. Arnold
   Publisher: SAE International

10. **The Electric Car: Development and Future of Battery, Hybrid and Fuel-Cell Cars**

    Author: Michael Here ward Westbrook
    Publisher: IET (Institution of Engineering and Technology)

6. INSTRUCTIONAL STRATEGY

Use a blended instructional strategy combining lectures, multimedia, hands-on activities, and case studies to teach electric vehicle concepts. Incorporate project-based learning, real-world demonstrations, and expert talks to deepen understanding. Assess through quizzes, presentations, and practical projects, encouraging exploration of EV technology, environmental impact, and industry trends.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**4**	**15**
2	**6**	**20**
3	**8**	**30**
4	**6**	**20**
5	**4**	**15**
Total	**28**	**100**

OR

OPEN ELECTIVE -2

4.7 (b)	INDUSTRIAL ROBOTICS (Theory)	L T P
		2 0 0

1. COURSE OBJECTIVES

This course aims to equip students with foundational and advanced knowledge of industrial robotics, including robot anatomy, programming, kinematics, and control systems. Students will learn to design, simulate, and operate robotic systems used in manufacturing. Emphasis is placed on automation integration, safety protocols, and real-world applications, preparing learners for careers in robotics engineering, industrial automation, and smart manufacturing environments.

2. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that **Students will be able to**

CO1• Comprehend and adhere to industry health and safety guidelines while working with robots' vehicles to mitigate hazards.

CO2• Differentiate coordinate systems and define the custom or user-defined coordinate frames.

CO3• Develop simple robot programs that incorporate various types of movements along with their respective parameters.

CO4• Integrate robot with different automation components i.e., PLC HMI, conveyor etc.

CO5• Create variety of innovative ideas and develop creative approaches to problem-solving.

3. 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 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	2	-	-	-	-	-	*	*
CO3	3	-	2	1	-	-	-	*	*
CO4	3	-	1	-	-	-	-	*	*
CO5	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.

4. CONTENT

UNIT 1- INTRODUCTION TO INDUSTRIAL SAFETY PRACTICES AND INTRODUCTION TO INDUSTRIAL ROBOTICS (08 Periods)

Fire Extinguishers & its Types, safely handling Tools & Equipment, Use of proper Tools & Equipment & its maintenance, OSH & practices to be observed as a precaution.

Introduction of Robots and their Importance in Manufacturing and Production, Applications of robots in manufacturing and assembly for which they can be efficiently utilized, Role of robots and automation systems in boosting the safety at dangerous manufacturing tasks, Structure and functions of robot System (Basic Package) and additional Equipment, Major Applications of Robots-Pick and Place, Arc Welding, Ultrasonic welding, Part Transfer, Packing, Palletizing. Type of End of arm tools and differences between them: Handling tools - Pneumatic Gripper, Vacuum Gripper, Hydraulic Gripper, Hydraulic Gripper, and Servo-Electric Gripper. Welding guns – Arc Welding guns, Spot welding guns. Robotic cell and its various components. Cycle time and its importance. Operator job in robotic cell. Safety procedure for Programmer and an Operator.

UNIT 2- JOGGING OF ROBOT (04 Periods)

Turn ON /OFF Steps of Robot, Checking Robotic cell Health, Introduction to Teach pendent and key functions, Industrial robot Coordinate system, Different coordinate systems in Robots, Defining X, Y, Z co-ordinate system, Jogging Robot using Teach pendant in different Modes of coordinate systems: Joint co-ordinate system, rectangular co-ordinate system, and User or object co-ordinate system, Tool co-ordinate system, TCP (Tool centre point definition) i.e., TCP File. , Creating user defined work objects i.e., user coordinate frame File.(Box, circle, triangle work object definition)

UNIT 3- PROGRAMMING OF A OF ROBOT USING TEACH PENDANT (06 Periods)

Robot Program Structure, Different Motion Types used in Programming (PTP, Linear, Circular, Spline): Move J (PTP) , Move L (Linear) , Move C (Circular) , Move S (Spline) ; Different Motion Parameters used in Program Point Recording, Basic Program creation using Motion types and parameters, Path optimization for smooth robot movement and cycle time, Safety instructions to be followed while loading and unloading of parts.

UNIT 4- ROBOT INTEGRATION WITH PLC, HMI AND OTHER EQUIPMENT (06 Periods)

PLC and robot communication and HMI, Conveyor system and its communication with PLC, Methods to create fencing and safety equipment's, Steps to work with two different types of Robots at same project, Tool mounting on Robot Flange, Different connections of grippers (Electric, Pneumatic etc.).

UNIT 5- ROBOT PROGRAMMING WITH ADVANCE LEVEL INSTRUCTIONS (04 Periods)

Loop control instructions, Arithmetic and Logical instructions, Shift instructions, Interfacing End of arm tools to Robot using robot I/O, establishing communication between Robot I/O and PLC

modules, Function Keys in Pendant for Arc welding and Material Handling robot, MIG welding Instructions in Robot, MIG welding Program and how to optimize it, Material Handling Program and how to optimize it.

* Case studies and Mini Project should be carried out throughout the semester.

5. TEXT BOOKS/REFERNCE BOOKS

1. **Modern Robotics: Mechanics, Planning, and Control**
   Authors: Kevin M. Lynch, Frank C. Park
   Publisher: Cambridge University Press
2. **Robot Modelling and Control**
   Authors: Mark W. Spong, Francesco Bullo
   Publisher: Wiley
3. **Springer Handbook of Robotics**
   Editors: Bruno Siciliano, Oussama Khatib
   Publisher: Springer
4. **Robotics for Engineers**
   Author: Yoram Koren
   Publisher: McGraw-Hill
5. **Robotic Engineering: An Integrated Approach**
   Author: Richard D. Klafter, Thomas A. Chmielewski, Michael Negin
   Publisher: Prentice Hall

6. INSTRUCTIONAL STRATEGY

Combine theoretical instruction with hands-on training using robotic arms and simulation software. Use lectures, demonstrations, and lab sessions to teach robot programming, kinematics, and control. Incorporate project-based learning, real-world case studies, and industry visits. Assess through practical tasks, quizzes, and group projects to reinforce industrial robotics applications.

7.SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**8**	**30**
2	**4**	**15**
3	**6**	**20**
4	**6**	**20**
5	**4**	**15**
Total	**28**	**100**

4.8	ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L T P
		2 0 0

COURSE OBJECTIVE:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

LEARNING OUTCOMES:

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

- Importance and relevance
- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

Unit 2: Modern Science and Indian Knowledge System (06 Periods)

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (04 Periods)

- Basic principles of Yoga
- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: 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**

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-

15 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)

10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 06 Marks

b) 80 - 85% 08 Marks

c) Above 85% 10 Marks

25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) 25 - State/National Level participation

b) 20 - Participation in two of above activities

c) 15 - Inter-Polytechnic level participation

9- LAB EQUIPMENT LIST

3.5 : EDC & 3.3 : LIC , 3.4 ECN

Sr. No.	Equipment	Qty Required	Approximate Cost (in Rs) Per unit
1	DSO/Oscilloscope (50 Mhz, 2 channel)	6	30000
2	Function Generator (0-1 MHz)	6	25000
3	Dual Power Supply (+/- 30V)	6	20000
4	Ammeter (0-20 mA)	10	2000
5	Ammeter (0-200 µA)	10	2500
6	Voltmeter	10	1000
7	Bread Board	20	300
8	Transformer (6V-0-6V)	20	500
9	Decade Capacitor Box	10	500
10	Decade Resistor Box	10	500
11	PN Diode IN4007	50	10
12	Zener Diode	50	10
13	Transistor BC 107	50	52
14	FET BFW11	50	45
15	N channel FET (BFW11)	50	40
16	IC 741	50	20
17	IC555	50	20
18	IC566	50	28
19	IC723	50	50
20	IC7805	50	20
21	Probes and Connecting Wire	100	50

3.6 Digital Electronics

Sr. No.	Equipment	Specification	Qty	Approximate Cost (in Rs)
1.	DC regulated multiple output power supply	• 2 output channel • DC output(Multiple output): DC 0 to 30V/2A, DC 0 to +/-15V /1A Tracking, 4.5 to 5.5 /5A • Setting resolution: V 10 mV, I 5mA • Load Regulation : ≤ ± (0.05% +10 mV) • Line Regulation: ≤ ± (0.05% +10 mV) • Ripple and noise: ≤ 1 mVrms • Internal Resistance: ≤ 10 mΩ • Stability: ≤ 2.5 mV at full load • Recovery Time: ≤ 50 ms • Display: Switchable 3 digit seven segment LED for Voltage & Current • Display Accuracy: V : ± (1% + 1 dig-	**06**	**12000**

		it), I : ± (1% + 3 digit) • Protection: Built-in overheat, over voltage protections. • Input Supply: 230 AC ± 10% /50-60 Hz		
2.	**Digital storage Oscilloscope with probe**	• Bandwidth: 100 MHz maximum bandwidth. • No. Of channels: 2 • Maximum memory depth. 1 Mpts • Maximum sample rate: 1 GSa/s • ADC Bits: 8 bits • Waveform math: Add, subtract, multiply, divide, FFT (magnitude and phase), low pass filter • Display: : ≤ 6.5-inch TFT LCD WVGA • Real Time Sample Rate- 1 GSa/s (each channel), 500 MSa /s(Dual Channel), Equivalent Sample rate- 25 GSa/S, Digital filter and waveform Recorder, function- math functions, digital filter, waveform recorder, cursor measurenment-mannual, track and auto measure modes • Connectivity: USB 2.0 (host and device) with waveform analysis software. • External tigger:1 • Avilable trigger type: 6 Standard (Edge, Pulse, Video, Rise/Fall, Setup/Hold, Pattern/State) • Edge trigger slope: Rising, Falling, Rising + Falling • Available Measurements: 22. • Calculated rise time: ≤ 3.5 ns • Time base range: 5 ns/div to 50 s/div 4 cable RG58 C/U 50Ω.	**40000**	**06**
3.	Electronic Digital Multimeter	• TRMS • Auto / Manual Ranging • 19999 Count • LCD with Backlight • Auto Power Off • Capacitance • Frequency • Duty Cycle • Data Hold • MIN / MAX • Diode Test • Audible Continuity	**4000**	

		• DC Voltage. 19.999mv-1000 volt, Accuracy ±(0.5% rdg + 3 dgt) • AC Voltage. 19.999mv-750 volt, Accuracy ±(0.5% rdg + 3 dgt) • AC Response 40Hz ~ 1KHz • DC Current : 199.99 / 1999.9µA / 19.999 / 199.99mA / 1.9999 /10.000A • Accuracy: ± (0.8% rdg + 3 dgt) on 199.99 / 1999.9 µA ± (1.0% rdg + 3dg) • AC current TRMS: : 199.99 / 1999.9µA / 19.999 / 199.99mA /1.9999 / 10.000A • Accuracy ± (0.8% rdg + 3 dgt) on 199.99 / 1999.9 µA ± (1.0% rdg + 3dg) • Resistance: 199.99Ωto 199.99MΩ • Accuracy ± (1% rdg + 3 dgt at 199.99Ω)		
4.	Function Generator	• **Waveforms:** Sine, Square, Ramp, Triangle, Pulse, Noise, DC, Dual tone. • 25 MHz Sine and 10MHz Square waveforms. • Sample rate: 125MSa/s • 8Mpt length Arbitrary Waveform Generator • Channels: 2 • Advanced Waveforms PRBS, RS232, Sequence • Built in Arbitrary Waveforms 160 types of waveforms, including Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, Haver Sine, Lorentz, etc. • Resolution 5 µHz • High frequency stability: ±1 ppm; low phase noise: -105 dBc/Hz; • Built-in high-order harmonic generator (at most 8-order harmonics) • Accuracy ±(1 ppm of the setting value + 10 pHz) • Noise (-3 dB): 100 MHz bandwidth • Ramp Frequency range: 1 uHz to 500 kHz, • Pulse Frequency range: 1 uHz to 10 MHz Pulse width • **Amplitude:** Range 1mVpp to 10 Vpp into 50 Ω, Accuracy (at 1 kHz): ± 2% of setting ± 1 mVpp **UNIT**s: Vpp, Vrms, dBm, Resolution: 0.1mVpp or 4 digits.	**25000**	

		DC offset Range: (peak AC + DC) ± 5 V into 50 Ω • **Trigger Characteristics:** Trigger Input: Level TTL-compatible, Slope Rising or falling (selectable) Pulse Width >100 ns Trigger output: Level TTL compatible, Output impedance 50 Ω, typical Maximum rate 1 MHz • **Modulation feature:** AM, FM, PM, ASK, FSK ,and PWM modulation types Carrier waveform: Sine, Square, Ramp, Arb Modulating Waveform: Sine, Square, Ramp, Noise, Arb • **Operations:** Linear & logarithmic sweeps and burst operation • **Connect:** via USB, GPIB • **Display:** ≤ 4 inch colour touch screen		
5.	Logic probes (TTL and CMOS)	Testing of TTL and CMOS, displaying logic states and pulse presence, catching pulse of 10 ns or pulse train to 50 MHz, input over voltage protection	**1400**	
6.	Digital logic trainer (TTL)	General purpose IC Trainer KIT to accommodate 20 pin ICs and 40 pin IC and all available ICs in ZIF socket (All the Pins of ZIF socket should be available to be connected by patch chords on board switchable Digital inputs and output LEDs on board.-OUTPUT D.C. VOLTAGE : Fixed 5V and 0 - ±18V. OUTPUT CURRENT: 1 Amp. LOAD REGULATION : ± 1% of the highest specified output voltage. (NO LOAD TO FULL LOAD) RIPPLE AND NOISE : less than 2 mV LOGIC INPUTS : Minimum 16 switches for High/Low 07. OUTPUT INDICATORS : 16, 5 mm bright Red LEDs. SEVEN SEGMENT DISPLAY : 4 digit seven segment display with decoder driver. DIGITAL VOLTMETER: Digital DC voltameter range 0 - 20V. BREAD BOARD : Unique solder - less large size, spring loaded breadboard INPUT VOLTAGE : 230V ±10% at 50	**6000**	

		Hz A.C. Mains.		
7.	**Miscellaneous loose items.**	• **Different values resistances**. Quarter Watt (1/4) Resistances (Carbon Film):(1K, 1.5K, 2K, 2.2K, 4.7K, 5K,6K, 7K, 8K, 10K, 20K, 50K,100K. and other ranges available.)-100 each; Half Watt (1/2) Resistances(Carbon Film):(1K, 1.5K, 2K, 2.2K, 4.7K, 5K,6K, 7K, 8K, 10K, 20K, 47K,100K and Other Ranges Available)-100 each; 5-Watt Resistances:(1 Ohm(<10%), 2 Ohm (<10%), 5 Ohm(<5%), 10 Ohm, 50 Ohm,100Ohm, 1K, 2.2K, 4.7K, 10K,20K 47K.)-100 each **Bread-board.** • 20 **UNIT** High Quality breadboard • Breadboard Dimension: ≤ 5. cm x 16 cm x 1cm • Points: ≤800 points **Connecting leads (single stand wire).** • 200 meter Single core conductor wire for breadboard with 22-24 American wire gauge (AWG) or 0.20-0.25mm^2 cross section with isolation. **DSO probe.** • Total: 10 **UNIT** • Coaxial cable • Characteristic impedance: 50-52**Ω** • Series: RG58 C/U cable **Single stand Wire cutter**. • Total: 02 **UNIT**. Single stand wire cutter for cutting the wire **Different color and voltage level LEDs Red, Blue, green, yellow)**		
8.	**ICs**	QUAD 2-INPUT NAND GATE 7400 QUAD 2-INPUT NOR GATE 7402 HEX INVERTER 7404 QUAD 2-INPUT AND GATE 7408 DUAL 4-INPUT NAND SCHMITT TRIGGER 7413		

		QUAD 2-INPUT OR GATE 7432 EX-PENDABLE DUAL 2-WIDE 2-INPUT AOI GATE 7450 DUAL 4-INPUT EXPANDER 7460 EDGE - TRIGGERED FLIP-FLOP 7470 DUAL JK M/S FLIP-FLOP 4027 DUAL JK-FLIP-FLOP 7473 4 BIT FULL ADDER 7483 QUAD 2-INPUT EXCLUSIVE OR-GATE 7486 DECADE COUNTER 7490 . DIVIDE-BY-TWELVE COUNTER 7492 4-BIT BINARY RIPPLE COUNTER 7493 4-BIT SHIFT REGISTER 7495 QUAD 3-STATE BUFFER 74126 8-INPUT MULTIPLEXER 74151 1-OF-16 DE-CODER/DEMULTIPLEXER 74154 8-BIT D/A CONVERTER DAC 0808 8-BIT A/D CONVERTER ADC 0808 4 bit synchronous counter 74161 BCD to seven segment display 7447 Priority Encoder 3:8 74148 3:8 Decoder 74138		
9.	Advance Digital Trainer Kit	4bit Adder, 4bit subs tractor, Flip-flops, SISO SIPO PIPO PISO shift registers	**18000**	
10.	Analog and digi-tal ic tester	• Test variety of TTL and CMOS ICs up to 16 pins. • 16x2 Character LCD display • 9V/12V Power Adapter Two Keys for simple operation No training required, automatic operation 20 Pin ZIF socket provided for testing. Built-in self-diagnostic ICs	**38000**	

4.3 ELECTRONIC INSRUMENTATION AND MEASUREMENT (PRACTICUM)

Sr. No.	Equipment	Specifications	Qty Required	Approx. Cost per UNIT
1	Digital Multimeter	Auto / Manual Ranging, LCD with Backlight, Auto Power Off, Capacitance, Frequency, Duty Cycle, Data Hold, MIN / MAX, Diode Test, Audible Continuity, DC Voltage.	4	4000

2	Analog Multimete	Standard DC voltage range settings include 0.5 V, 2.5V, 10V, 50V, 250V, and 1000V. Standard AC voltage settings are 10V, 50V, 250V, and 1000V.with standard DC settings of 2.5, 25, and 250 amperes.	4	1000
3	Maxwell'S Inductance Bridge	Frequency: 1KHz +-3%, amplitude 0-15Vpp.Power: +-5V+-12V & +5V/ 500mA.	2	4500
4	Anderson's Bridge Trainer kit	Frequency: 50Hz,Input Signal: 1Khz , 0-20Vp-p,Null Detector: Digital, Operating Supply Voltage: 220VAC,Power Source: Electricity	2	4500
5	WheatStone Bridge Trainer Kit	Power Supply: 12V DC , Phase: single phase, Interface: NO, Automation Grade: Manual, Capacity: 50Hz, Channels: Dial Box	2	1200
6	Kelvins Double Bridge Trainer	On board oscillator section, On board amplifier section, On board unknown Resistors for conducting the experiment, Block Description Screen printed on glassy epoxy PCB	2	8050
7	LCR-Q METER	Variables Measured: L, C, R & Q. Measurement Modes : Series or parallel equivalent. Measurement: User selectable 100Hz or 1KHz. Frequency Accuracy of : ±0.25%. Measurement Maximum Voltage : 0.285V rms (0.8V p-p) (approx.)	2	LS
8	DSO	Bandwidth: 100 MHz maximum bandwidth. No. Of channels: 2,Maximum memory depth. 1 Mpts, Maximum sample rate: 1 GSa/s, ADC Bits: 8 bits, Waveform math: Add, subtract, multiply, divide, FFT (magnitude and phase), low pass filter, Display: : ≤ 6.5-inch TFT LCD WVGA	2	40000
9	Function Generator	Waveform- sine,Frequency-0 - 15MHz, Type-Digital	2	14000
10	Single Phase Linear Variable Differential Transformer	Power (VA)- DC 24 and RMS 3,Phase-Single Phase, Input Voltage-24 DC, Output Voltage-4-20 MA, Cooling Type-Dry Type/Air Cooled, Oil Cooled.	1	35000
11	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and potentiometer etc		LS	30000

12	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit		LS	250000

4.4 Programming in C

Sr.No.	Equipment	Specifications	Qty.	Price (Approx)
1.	Computer Desktop	I7 8th Generation, 1TB HDD,8GB RAM, Pre-loaded Windows with 5 years Warranty	30	240000
2.	Online UPS	6VA with Battery	02	200000
3.	Switch	24 Port 10/100/1000 (Manageable)	01	50000
4.	Connectors	RJ-45, RJ-11,BNC,SC,ST	LS	10000
5.	Cables	UTP,STP,OFC 25m each	LS	10000
6.	MFP		01	30000
7.	Router		01	40000
8.	Computer Server	Quad core, Intel processor, 32Gb RAM		500000
9.	Modem with Router		01	10000
10.	Hardware kit	For computer assembling and disassembling	08	150000
11.	External HDD	-	04	30000
12.	Internet Connectivity	-	30 Nodes	150000
13.	Computer system demonstration kit	-	01	
14.	Printer Demonstration Kit	-	01	100000
15.	SMPS Demonstration Kit	-	01	20000
16.	Unmanaged Switch	-	04	60000
17.	Hub	-	02	20000
18.	Air conditioner	2 Tones	02	70000
19.	Miscellaneous	Cables, Connectors, Computer Stationary,	LS	30000

		Toner Cartridge, Ink Cartridge		
20.	Python IDE(py charm/ Eclipse with Py Dev/VS code etc.	Freeware	-	-
21.	Ms Office Latest or equivalent FOSS	Office (Freeware		Per year
22.	Compile Turbo C, C++ or equivalent FOSS	-	01	10000
23.	Web Camera, Mike, Speaker	LS	LS	20000

4.5 MICROPROCESSOR AND ITS APPLICATIONS

S. No.	Equipment	Specification	Quantity	Price(Approx.)
1.	Computer with UPS	Intel I5 processor capable to support "C" programming and required Micro-controller Simulator softwares MPLAB X IDE etc.. .	15	40000 (each)
2.	PIC 18 Devel-opment kit	PIC 18 Development kit, With inbuilt power supply, keyboard, LCD displays, ports for interfacing peripheral and memory.	6	10000 (each)
3.	Microcontroller based interfac-ing study cards	Microcontroller based interfacing study cards, Capable to interface LCD, Key-board, ADC, DAC, Sensor, Relay, DC motor, Stepper Motor With PIC 18 De-velopment kit.	6	10000
4.	Miscellaneous Items	20 Stepper motor 50/100RPM , ADC/DAC(0808) trainer board, LCD trainer board, Relay Trainer board, Keyboard 4*4 trainer board, 20Temperature sensor(Mq series), 20 LDR (I2C light sensor),20 Potentiometer,20 LM35 IC etc.		20000

4.6 PRINCIPLES OF ELECTRONICS COMMUNICATION

Sl. No.	Equipment	Specifications	Quantity	Price (approx. for each UNIT)

1	Desktop latest configuration (Intel i3 processor)	8th Generation Minimum processor speed 3.0 GHz RAM 4GB DDR4, Min 6 MB, cache HDD 1TB, Networking Integrated Bluetooth 4.0 and wireless LAN 802.11b/g/n CD/DVD disk drive, USB Keyboard & USB,optical mouse, Monitor 18.5 inches or above, Ports HDMI 01 slot, VGA 01 slot, USB 2.0 minimum 4 slots, USB 3.0 minimum 2 slots, Integrated Intel HD graphics, headphones with mic, Webcam : HD Webcam, OS – Windows 10 professional Or Higher Specifications available	2	40000
2	MATLAB Software	Student Version	2	LS
3	Kit - AM Modulation & Demodulation	Audio Signal Source Type : Sinusoidal Frequency range : 200 Hz to 3.5 KHz Amplitude : 0 – 5 V variable Carrier Source : 1 MHz DC Source/Level Shifter : 0 – 5 V variable Balance Modulator : DSB - AM Transistorized Modulator : DSB - AM Envelope Detector : With adjustable band filter	2	20000
4	Kit - FM Modulation and Demodulation	Audio Signal Source Type Frequency range Amplitude : : : Sinusoidal 0- 3.4 KHz 0 – 5 V variable DC Source/Level Shifter : 0 – 5 V variable Frequency Modulation : Using VCO Frequency Demodulation : Using PLL	2	20000
5	Kit - PAM-PPM-PWM Modulation-Demodulation Techniques	Pulse Modulation Techniques Pulse Amplitude Modulation Pulse Width Modulation Pulse Position Modulation On-board Sampling : 8 KHz, 16 KHz, Frequencies (Pulse) : 32 KHz, 64 KHz On-board Generator Sinewave Squarewave Low Pass Filter : 1 KHz & 2 KHz (Gain adjustable) : 1KHz & 2 KHz th : 4 order BW filter	2	10000
6	Function Generator		3	
7	DSO	Analog Bandwidth (-3 dB) : 70MHz-100MHz, No. of Analog Channels : 2 + EXT, Sampling Mode : Real-time Sampling , including various probes	4	55000

10 - List of Participants / Experts

The following experts participated in various workshop for Developing the Curriculum's Structure and Contents of **Instrumentation and Control Engineering** at I.R.D.T. Kanpur.

1. Shri Manoj Kumar Gopta, HOD, ICE, Government Polytechnic, Rampur
2. Shri Nitin Kumar Sharma, Lecturer ICE, Government Polytechnic, Kanpur
3. Shri Hashim Raja, Lecturer ICE, Government Polytechnic, Rampur
4. Shri Diwjender Pandey, Lecturer ICE, Government Polytechnic, Mainpuri.
5. Shri Ashish Rohila, Lecturer ICE, Government Polytechnic, Pilibhit.
6. Shri Shashank Kumar, Lecturer ICE, MMIT Chandouli.

11 . EVALUATION SCHEME

a. For Theory Courses:

(The weightage of Internal assessment is 40% and for End Semester Exam is 60%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

b. For Practical Courses:

(The weightage of Internal assessment is 60% and for End Semester Exam is 40%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

c. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.

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	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.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**16**	
2	**06**	
3	**04**	
4	**02**	
Total		**100**

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	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 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
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Practical Test	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

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.	Viva-Voce	**10**
	Total	**40**

3. EVALUATION METHOD for PRACTICUM (Practical External)

	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
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Mini Project	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

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.	Viva-Voce	**10**
	Total	**40**

4. EVALUATION METHOD for PRACTICUM (Theory External)

	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 Pre Semester Examination**	**Practical Documentation and Micro Project**	**End Semester Examination**
Portion	2 units	50% Practical	2 units	50% Practical	All units	All Practical	All units
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		10^{th} Week		Regularly	12^{th} -13^{th} 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**