Faculty of Engineering and Technology

Radha Govind University, Chandausi, Sambhal (U.P.)

Evaluation Scheme & Syllabus for

Department of Electronics Engg.

DIPLOMA -ELECTRONICS & INSTRUMENTATION ENGINEERING

II Year (III Semester & IV Semester)

(Effective from session _____)

DIPLOMA -ELECTRONICS & INSTRUMENTATION ENGINEERING

STUDY AND EVALUATION SCHEME

2nd Year, 3th Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DEIE 301	ELECTRONIC DEVICES AND CIRCUITS	3	-	-	3	30	-	30	70	-	70	100
DEIE 302	DIGITAL ELECTRONICS	3	-	-	3	30	-	30	70	-	70	100
DEIE 303	TRANSDUCERS AND APPLICATIONS	3	-	-	3	30	-	30	70	-	70	100
DEIE 304	PROGRAMMING IN C	1	-	4	3	30	-	30	70	-	70	100
DEIE 305	OPEN ELECTIVE-I	2	-	-	2	30	-	30	70	-	70	100
DEIE 306	ELECTRONIC DEVICES AND CIRCUITS LAB	-	-	4	2	-	25	25	-	25	25	50
DEIE 307	DIGITAL ELECTRONICS LAB	-	-	4	2	-	25	25	-	25	25	50
DEIE 308	TRANSDUCERS AND APPLICATIONS LAB	-	-	4	2	-	25	25	-	25	25	50
DEIE 309	PROGRAMMING IN C LAB	-	-	4	2	-	25	25	-	25	25	50
Total					**22**	150	100	**250**	350	100	**450**	**700**

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

(DEIE 305) Open Elective-I :- 1. Product Design & Development.

2. Fundamentals of Innovation and Design Thinking

DIPLOMA -ELECTRONICS & INSTRUMENTATION ENGINEERING

STUDY AND EVALUATION SCHEME

2nd Year, 4th Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DEIE 401	MIRCOPROCESSOR AND ITS APPLICATION	**3**	**-**	-	**3**	30	-	30	70	-	70	100
DEIE 402	PROCESS INTRUMENTATION	**3**	**-**	-	**3**	30	-	30	70	-	70	100
DEIE 403	Electronic Instrumentation And Measurement	**3**	**-**	-	**3**	30	-	30	70	-	70	100
DEIE 404	INDUSTRIAL CONTROL	**1**	**-**	4	**3**	30	-	30	70	-	70	100
DEIE 405	OPEN ELECTIVE -II	**2**	**-**	-	**2**	30	-	30	70	-	70	100
DEIE 406	MIRCOPROCESSOR AND ITS APPLICATION LAB	**-**	**-**	**4**	**2**	-	25	25	-	25	25	50
DEIE 407	PROCESS INTRUMENTATION LAB	**-**	**-**	**4**	**2**	-	25	25	-	25	25	50
DEIE 408	Electronic Instrumentation And Measurement LAB	**-**	**-**	**4**	**2**	-	25	25	-	25	25	50
DEIE 409	INDUSTRIAL CONTROL LAB	**-**	**-**	**4**	**2**	-	25	25	-	25	25	50
Total					**22**	150	100	**250**	350	100	**450**	**700**

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

(DEIE 405) Open Elective-II :- 1. ELECTRIC VEHICLE

2. INDUSTRIAL ROBOTICS

Industrial training (Summer Internship) of 4-6 weeks duration to be organized after 4th semester exam.

DEIE 301 ELECTRONIC DEVICES AND CIRCUITS

COURSE OBJECTIVES

L	T	P
3	-	-

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.

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 Students will be able to

CO1 • Explain the working of different semiconductor devices.

CO2 • Measure and calculate various parameters of different semiconductor devices.

CO3 • Analyze and interpret the V-I characteristics of various semiconductor devices.

CO4 • Explain the working of different type of amplifiers and design oscillators for specified operating frequencies.

CO5 • Compare the characteristics and applications of SCR, DIAC, TRIAC, and IGBT

COURSE CONTENT

Units	Topics	No. of Lectures
1st	**SEMICONDUCTOR DIODES CIRCUIT AND APPLICATIONS** 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	(06 Periods)
2nd	**BIPOLAR JUNCTION TRANSISTOR** 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.	(11 Periods)
3rd	**UNIPOLAR JUNCTION AND FIELD EFFECT TRANSISTOR** 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.	(9 Periods)

	Introduction to advance non-planer devices like FinFET, GAA.	
4th	**AMPLIFIERS AND OSCILLATORS** 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.	(11 Periods)
5th	**SCR, DIAC, TRIAC and IGBT** Construction, working and characteristics, SCR as a Switch, DIAC as bidirectional switch, Comparison of SCR, DIAC, TRIAC, MOSFET and IGBT.	(05 Periods)

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.

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

ELECTRONIC DEVICES AND CIRCUITS LAB

LIST OF EXPERIMENTS

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode , find the cut in voltage.

2. Plot the V-I Characteristic of Zener Diode.

3. Plot the V-I Characteristic of Photo Diode.

4. Plot the V-I Characteristic of Light emitting Diode.

5. Simulate half wave, full wave and bridge rectifier using simulation tool like P Spice/ Orcad / Multisim.

6. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.

7. Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results.

8. Plot input and output characteristics of transistor in CB /CE/CC configuration.

9. Build and test voltage divider biased type amplifier & measure voltage at different points on the circuit and observe waveforms.

10. Obtain the characteristics of DIAC and TRIAC 3

11. Obtain frequency response of Single stage RC/RL -coupled amplifier.

12. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers

13. Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

14. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers

15. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

DEIE 302 DIGITAL ELECTRONICS

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.

L	T	P
3	-	-

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 number system to other.

CO2 • Formulate Boolean expressions to model given logical situations..

CO3 • Simplify Boolean expressions using K-map.

CO4 • Design and implement combinational circuits and Sequential logic circuits

CO5 • Classify memory devices based on their working principles, modes of access, and physical characteristics.

COURSE CONTENT

UNIT 1 – NUMBER SYSTEMS & BOOLEAN ALGEBRA (08 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

UNIT 2 – LOGIC GATES (08 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).

UNIT 3 – COMBINATIONAL LOGIC CIRCUITS (08 Periods)

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

UNIT 4 – SEQUENTIAL LOGIC CIRCUITS (10 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

UNIT 5 – MEMORY DEVICES (08 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.

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.

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); International 2 Revised edition ISBN: 978-0071167963

3. Digital Electronics – an introduction to theory and practice William H. Gothmann Prentice Hall India Learning Private Limited; 2 edition ISBN: 978-8120303485

4. Fundamentals of Logic Design Charles H. Roth Jr. Jaico Publishing House; First edition ISBN: 978-8172247744

DIGITAL ELECTRONICS LAB

LIST OF EXPERIMENTS

1. Verification of Demerger's Theorems.

2. To verify the truth tables for all logic Gates– NOT,OR,AND,NAND,NOR, X-OR, X-NOR Gates.

3. Realization of Logic Gates using universal Gates.

4. Design and verification of the truth tables of Half and Full Adder circuits.

5. Design and verification of the truth tables of Half and Full Substrata circuits.

6. Design and verification of the truth tables of 4 to 1 Multiplexer (74150) and 1 to 4 De-Multiplexer (74154) circuits.

7. To convert a given octal input to the binary output and to study the LED display using 7447 7 segment decoder.

8. Construct and test the performance of parity generator.

9. Design and test of an S-R flip-flop using NOR/NAND gates.

10. Design and test of an J-K flip-flop using NOR/NAND gates.

11. Design and test of an T flip-flop using NOR/NAND gates.

12. Construct and test the performance of Decade counter.

13. Design a Programmable Up-Down Counter with a 7 Segment Display.

14. Design of 4-bit shift register.

15. 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.

DEIE 303 TRANSDUCERS AND APPLICATIONS

COURSE OBJECTIVE

L	T	P
3	-	-

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.

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.

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.

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

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.

TRANSDUCERS AND APPLICATIONS (LAB)

LIST OF EXPERIMENTS

1. To draw the input output characteristics of linear variable differential transducers and also study its details.

2. To fabricate a circuit using linear variable differential transducer for the measurement of non-electrical quantity.

3. To draw I/O characteristics of the various photo transducers such as LDR, Photodiode, Photo Transistor, Opto coupler

4. Fabricate an application circuit using photo transducers as a switch and as a light intensity meter.

5. To fabricate an application circuit using given temperature transducer like thermostats and IC Sensors.

6. To fabricate an application circuit using capacitive transducers for measurement of level.

7. To draw I/O characteristics of a strain gauge and study working of weighing Machine using strain gauge/ load cell.

8. To measure conductivity of a given solution using conductivity meter and calibrate it.

9. To measure pH of given acidic and alkaline solutions using a pH meter and standardize it, using buffer solutions.

10. To measure density of given solution using simple hydrometer.

11. To measure vibration of motor or compressor system using a vibration meter and piezo-electric sensors.

12. To perform noise measurement using condenser microphone.

DEIE- 304 PROGRAMMING IN C

COURSE OBJECTIVES

Computers are essential in modern life and play a crucial role in the professional work of technician engineers. Professionals in the computer industry use computers to solve problems more efficiently and effectively. To enable students to use computers for problem-solving, this course introduces the C programming language along with its practical applications. The concepts of C are reinforced through hands-on exercises and programming labs. Additionally, the course introduces Python programming. Upon completion, students will be able to write non-trivial Python programs across diverse domains. Topics include language fundamentals, IDE/IDLE usage, control flow constructs, strings, input/output, collections, classes, modules, and regular expressions.

COURSE OUTCOMES:

Theory and practical sessions should be conducted in a manner that enables students to achieve the following outcomes:

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

CO2 • Apply various control structures (loops and decision-making statements) to implement solutions.

CO3 • Identify and use different data types and variables effectively in C programs.

CO4 • Use pointers with arrays and structures for efficient memory manipulation.

CO5 • Understand and apply basic concepts of Python programming.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	**INTRODUCTION** 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	(4 Periods)
2nd	**CONTROL STRUCTURES** Decision making with IF – statement, IF – Else and Nested IF, While and do-while, FOR loop Break. Continue go to and switch statements	(2 Periods)
3rd	**FUNCTIONS** Introduction to functions, Global and Local Variables, Function Declaration, Standard functions Parameters and Parameter Passing, Call - by value/reference, Recursion	(4 Periods)
4th	**ARRAYS** Introduction to Arrays, Array Declaration, Length of array, Single and Multidimensional Array, Arrays of characters, Passing an array to function, Pointers to an array	(2 Periods)
5th	**POINTERS**	(2 Periods)

	Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers Single pointer, Introduction to Colab, Programming in Python.	

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.

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, Electronic Instruments&Measurement, Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-137-3
5. Learning Python by Mark Lutz; Pratham Books, Bangalore
6. Foundations of Python Network Programming by John Goerzen and Brandeu Rhodes; A press-e Book distributed by Springer Science and Business Media, New York

PROGRAMMING IN C LAB

NAME OF EXPERIMENT

1 Programming exercises on executing and editing a C program.

2 Programming exercises on defining variables and assigning values to variables.

3 Programming exercises on arithmetic and relational operators.

4 Programming exercises on arithmetic expressions and their evaluation

5 Programming exercises on formatting input/output using print and scan and their return type values.

6 Programming exercises using if statement .

7 Programming exercises using if – Else. .

8 Programming exercises on switch statement .

9 Programming exercises on do – while, statement .

10 Programming exercises on for – statement.

11 Programs on one-dimensional array.

12 Programs on two-dimensional array.

13 (i) Programs for putting two strings together.

(ii) Programs for comparing two strings.

14 Simple programs using structures

15 Simple programs using pointers.

16 Simple programs using union.

17 Practice basic coding syntax in Python language.

DEIE-305 OPEN ELECTIVE-I

PRODUCT DESIGN AND DEVELOPMENT

L	T	P
2	-	-

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.

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, safety and environment (HSE) guidelines.

CO2 • Familiarize with the product design process to design a new product.

CO3 • Use CAD software to create solid part models, sheet metal models, and assembly models.

CO4 • Develop concept models, detail design, engineering drawing and GD&T principles.

CO5 • Create 3D printable parts using CAD modeling and slicing software.

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 modeling 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

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 labbased 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.

FUNDAMENTALS OF INNOVATION AND DESIGN THINKING

OPEN ELECTIVE-I

COURSE OBJECTIVES

This course is designed to provide a strong foundation in the basic concepts of innovation and design thinking. Students will develop creative ideas through structured brainstorming sessions and validate them using 3D printing and confirmatory testing. Design thinking is an iterative process that helps in understanding user needs and usage patterns, challenging assumptions, redefining problems, and creating innovative solutions. It is particularly effective for solving problems that are ill-defined or unknown.

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, safety and environmental (HSE) guidelines.

CO2 • Create value by applying problems solving methods and innovation techniques.

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

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

CO5 • Initiate and refine a startup or entrepreneurial venture with basic business planning.

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.

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.

DEIE 401
MIRCOPROCESSOR AND ITS APPLICATION

L	T	P
3	-	-

COURSE OBJECTIVES

The course provides a strong foundation in microprocessor concepts and evolution, with emphasis on 8085 and 8086 architectures. It covers instruction sets, assembly language programming, memory organization, and peripheral interfacing. Students will also develop practical skills through programming and explore real-world applications of microprocess or based systems

COURSE OUTCOMES

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.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	**INTRODUCTION TO MICROPROCESSOR** 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.	**10 Periods**
2nd	**8086 MICROPROCESSOR PROGRAMMING** Instruction set of 8086 microprocessors, Assembly language programming, Stack, Subroutines and Interrupt Handling.	**12 Periods**
3rd	**INTERFACING WITH PERIPHERAL DEVICES** Memory and I/O interfacing,8255 Programmable Peripheral Interface, DC, DAC, and sensor interfacing, Serial and parallel communication.	**8 Periods**
4th	**MICROPROCESSOR-BASED SYSTEM DESIGN** Design of microprocessor-based control systems, Industrial applications of microprocessors, Data acquisition and process control, Case studies of real-world applications.	**6 Periods**
5th	**MICROCONTROLLERS AND EMBEDDED SYSTEMS** Introduction to Microcontrollers (8051), Difference between microprocessors and microcontrollers, Role of microcontrollers in embedded systems, Applications of modern microprocessor-based systems.	**6 Periods**
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.

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. Kenneth J. Ayala, The 8051 Microcontroller, Cengage Learning.
4. B.B. Dwivedi, Microprocessors & Peripheral Devices, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-77-4
5. A.P. Godse & D.A. Godse, Microprocessor and its Applications, Technical Publications.6. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson.

DEIE 402

PROCESS INTRUMENTATION

L	T	P
3	-	3

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.

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.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	INTRODUCTION 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.	**(4 Periods)**
2nd	PRESSURE AND LEVEL INSTRUMENTATION: 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).	**(14 Periods)**

3rd	TEMPERATURE INSTRUMENTATION 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 pyrometerPrinciple, working temperature range. Total radiation pyrometer-construction and working principle, Temperature switch.	**(10 Periods)**
4th	FLOW AND SPEED MEASUREMENTS 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).	**(08 Periods)**
5th	MOISTURE AND DENSITY MEASUREMENT 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.	**(06 Periods)**

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.

TEXT BOOKS/ REFERENCE BOOKS

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

DEIE- 403
Electronic Instrumentation And Measurement

L	T	P
3	-	-

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.

COURSE OUTCOME:

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.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	Basics of Measurements Measurement, Method of measurements, Types of instruments, Accuracy & Precision, Sensitivity, Resolution, Types of Errors, Sources of errors, Loading effect	(4 Periods)
2nd	C and DC and Bridges 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)	(4 Periods)
3rd	Measuring Instruments 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	(7 Periods)
4th	Oscilloscopes 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).	(7 Periods)
5th	Transducers Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor, LVDT,	(6 Periods)

	Strain Gauge Load Cell, Piezoelectric Transducers.	

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

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 McgrawHill
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

DEIE- 404 INDUSTRIAL CONTROL

L	T	P
1	-	4

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.

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.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	INTRODUCTION TO CONTROL SYSTEM 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.	(6 Periods)
2nd	INPUT OUTPUT RELATIONSHIP OF CONTROL SYSTEMS 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.	(5 Periods)
3rd	SYSTEM EXCITATION AND RESPONSE OF CLOSE LOOP SYSTEMS. 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.	(5 Periods)
4th	THYRISTORS AND THEIR APPLICATIONS 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	(7 Periods)

	power supply (UPS), SMPS: block diagram and brief description.	
5th	SOLID STATE MOTOR CONTROL 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.	(5 Periods)

INSTRUCTIONAL STRATEGY

INSTRUCTIONAL STRATEGY

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

TEXT BOOKS/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

DEIE 405 OPEN ELECTIVE-II
ELECTRIC VEHICLES

L	T	P
2	-	-

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.

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• Diagnose and troubleshoot faults in EV components using systematic testing methods.

CO4• Apply effective techniques for troubleshooting, repairing, and maintaining electric vehicle systems to ensure safety and reliability.

CO5• Design and assemble components for basic electric vehicle systems, integrating appropriate safety and performance considerations.

COURSE CONTENT

Units	Topics	No. of Lectures
1ST	INTRODUCTION TO INDUSTRIAL SAFETY PRACTICES & ELECTRIC VEHICLE 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	(4 Periods)
2ND	ELECTRIC VEHICLE ARCHITECTURE, MOTORS AND CONTROLLERS 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	(6 Periods)

3RD	ENERGY STORAGE SYSTEM & CHARGING SYSTEM, ELECTRIC VEHICLE BATTERY MANAGEMENT SYSTEM AND BASIC REGULATORY REQUIREMENTS 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.	(6 Periods)
4TH	ELECTRIC VEHICLE CIRCUIT PROTECTION SAFETY, REPAIR AND MAINTENANCE OF EV 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.	(6 Periods)
5TH	ELECTRIC VEHICLE TESTING AND TECHNOLOGY ADVANCEMENT IN ELECTRIC VEHICLE 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).	(4 Periods)

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.

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

[OPEN ELECTIVE-II]

INDUSTRIAL ROBOTICS

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.

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 robotic systems to mitigate hazards.

CO2• Differentiate between coordinate systems and define the custom or user-defined coordinate frames for robotic operations.

CO3• Develop basic robot programs incorporating various motion types and relevant parameters.

CO4• Integrate robot with automation components i.e., PLC HMI, conveyor, and other manufacturing peripherals

CO5• Generate innovative ideas and apply creative problem-solving approaches to develop robotic automation solutions.

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.

DEIE 406

MIRCOPROCESSOR AND ITS APPLICATION LAB

L	T	P
-	-	4

LIST OF PRACTICALS

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

DEIE 407

PROCESS INTRUMENTATION

L	T	P
	-	4

LIST OF PRACTICALS

1. To measure pressure by various methods

A. Pressure Gauge (Bourdon, Bellow and diaphragm type)

B. Digital Pressure Indicator

C. Vaccum pressure

2. To measure and record pressure of line by graphic recorder and electronic pressure recorder.

3. To measure level of a tank by

A. Sight glass tube and flood method.

B. Capacitive level detector

C. resistive level detector

4. To calibrate a pressure gauge using load weight tester and standard pressure calibration.

5. To study the construction and operation of level limit switch and make an application circuit using level limit switch.

6. To draw the I/o characteristic of electronic pressure transmitter.

7. To measure speed of motor by

A. Mechanical tachometer

B. Optical tachometer

C. Inductive reluctance type tachometer

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)

9 . To record level/temperature using universal electronic meter.

10. To measure flow of air using anemometer.

11. To measure flow of air using anemometer.

12. To measure density of solution using electronic density meter and hydrometer

13. To measure moisture using Electronic moisture meter.

DEIE 408

Electronic Instrumentation And Measurement LAB

L	T	P
-	-	4

NAME OF EXPERIMENT

1. Determine the value of unknown resistance using Wheatstone bridge.
2. Measure Low resistance by Kelvin's Double Bridge.
3. Measure unknown inductance using following bridges
   (a) Anderson's Bridge (b) Maxwell's Bridge.
4. List various standard sources & measuring UNITs. Measure DC & AC voltages, current using ammeter and voltmeter.
5. Test diodes and transistors using analog and digital Multimeter.
6. Study the working of Q-meter and measure Q of coils.
7. Operate front panel controls of DSO/CRO to observe various waveforms.
8. Measure time, voltage, frequency, phase difference of input signals using DSO/CRO.
9. Demonstrate features of digital storage oscilloscope.
10. Experiment with front panel controls of various signal generators and observe output Waveform.
11. Measure strain/stress using strain gauge measurement.
12. Measure displacement using LVDT.
13. Measure temperature using thermistor and thermocouple.
14. Using a piezo resistive sensor to measure pressure variations/Using a piezoelectric sensor to measure sound vibrations.

DEIE 409 INDUSTRIAL CONTROL

L	T	P
-	-	4

NAME OF EXPERIMENT

1. To plot the time response of a first order electrical system.
2. To plot time response of second order electrical system and find out transfer function of a LCR circuit
3. To draw the characteristic curves of S.C.R., Diac and Triac.
4. To study a power rectifier using SCR and draw input and output wave forms.
5. To study a single phase inverter. Circuit using S.C.R. and draw input and output wave forms.
6. To fabricate a S. C. R. chopper circuit, test it and determine duty cycle.
7. To Fabricate a circuit for illumination control of Light Source using SCR.
8. To study the effect of variation in firing angle on a C.R.O. and to plot the wave shapes.
9. To fabricate the Traic Diac motor speed control circuit and draw input output (Speed)
10. To Fabricate a circuit for temperature control of a heating element using Thyristors.