Faculty of Engineering and Technology

Radha Govind University

Chandausi, Sambhal (U.P.)

Evaluation Scheme & Syllabus for

Department of Electronics & Communication Engg.

DIPLOMA -ELECTRONICS & COMMUNICATION ENGINEERING

II Year (III & IV Semester)

(Effective from session _____)

DIPLOMA -ELECTRONICS & COMMUNICATION ENGINEERING

STUDY AND EVALUATION SCHEME

2nd Year, 3RD 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	
DECE 301	ELECTRONIC DEVICES AND CIRCUITS	3	-	-	3	30	-	30	70	-	70	100
DECE 302	DIGITAL ELECTRONICS	3	-	-	3	30	-	30	70	-	70	100
DECE 303	LINEAR INTEGRATE CIRCUIT	2	-	2	3	30	-	30	70	-	70	100
DECE 304	ELECTRIC CIRCUIT AND NETWORK	2	-	2	3	30	-	30	70	-	70	100
DECE 305	OPEN ELECTIVE-I	2	-	-	2	30	-	30	70	-	70	100
DECE 306	ELECTRONIC DEVICES AND CIRCUITS LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 307	DIGITAL ELECTRONICS LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 308	LINEAR INTEGRATE CIRCUIT LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 309	ELECTRIC CIRCUIT AND NETWORK 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.

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

2. Fundamentals of Innovation and Design Thinking

DIPLOMA -ELECTRONICS & COMMUNICATION 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	
DECE 401	MIRCOPROCESSOR AND ITS APPLICATION	3	-	-	3	30	-	30	70	-	70	100
DECE 402	PRINCIPLES OF ELECTRONICS COMMUNICATION	3	-	-	3	30	-	30	70	-	70	100
DECE 403	NETWORK & SIGNAL SYSTEM	3	-	-	3	30	-	30	70	-	70	100
DECE 404	PROGRAMMING IN C	1	-	4	3	30	-	30	70	-	70	100
DECE 405	OPEN ELECTIVE-II	2	-	-	2	30	-	30	70	-	70	100
DECE 406	MIRCOPROCESSOR AND ITS APPLICATION LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 407	PRINCIPLES OF ELECTRONICS COMMUNICATION LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 408	NETWORK & SIGNAL SYSTEM LAB	-	-	4	2	-	25	25	-	25	25	50
DECE 409	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.

(DECE 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.

DECE 301

ELECTRONIC DEVICES AND CIRCUITS

L	T	P
3	-	-

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.

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. Introduction to advance non-planer devices like FinFET, GAA.	(9 Periods)
4th	**AMPLIFIERS AND OSCILLATORS** Single Stage Transistor Amplifier: Analysis of Single Stage CE, CB	(11 Periods)

	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.	
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.

DECE 302 DIGITAL ELECTRONICS

COURSE OBJECTIVES

L	T	P
3	-	-

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.

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.

DECE -303 LINEAR INTEGRATE CIRCUIT

COURSE OBJECTIVES

L	T	P
2	-	2

The fundamentals of operational amplifiers and their linear and non-linear applications are covered in this course. Applications for operational amplifiers include signal conditioning circuits, medical electronics, and instrumentation. An operational amplifier is essential to the functionality of many different electrical circuits. Students who take this course will gain the skills necessary to maintain linear electronic circuits based on integrated circuits.

COURSE OUTCOMES(CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course results by gaining various learning outcomes in the cognitive, psychomotor, and affective domains. The ability for students to:

CO1 • Illustrate the fabrications process of the various IC by the semiconductor industry.

CO2 • Compare the electrical parameters of ideal and practical OP-AMP

CO3 • Design and implement various electronic circuits using OP-AMP

CO4 • Construct and test various voltage regulator using IC.

CO5 • Illustration of various timer ICs.

CONTENT

UNIT 1- OPERATIONAL AMPLIFIERS (6 Periods)

Symbol, pin diagram, ratings of IC 741, Electrical properties, transfer characteristics & parameters of ideal OP AMP, DC and AC performance characteristics, slew rate, Open and closed loop configurations, Block diagram & operating principle, OP-AMP with positive and negative feedback.

UNIT 2- APPLICATIONS OF OPERATIONAL AMPLIFIERS (4 Periods)

Open loop configuration–Inverting, Non-inverting, Close loop configuration –Inverting, non-inverting, Differential amplifier, unity gain amplifier, Inverting & non-inverting configuration of Adders (summing, scaling, averaging amplifier), Subtractor, Integrator & Differentiator.

UNIT 3- SPECIAL PURPOSE OPERATIONAL AMPLIFIERS (6 Periods)

Bridge amplifier, instrumentation amplifier with two & three OP AMPS, V-I converters, I-V converters, logarithmic & Antilogarithmic amplifier, Astable, Monostable and Bistable Multivibrator using OP AMP.

UNIT 4- VOLTAGE REGULATOR (6 Periods)

Linear voltage regulator: Block schematic, pin diagrams, features, Specifications, rating and operating principle of IC 723, 78xx, 79xx series, switching regulator: Block schematic, pin diagram, features, specifications, ratings and operating, Principle of switching regulator IC LM 317, LM337 Regulator.

UNIT 5- COMPARATOR AND TIMERS (6 Periods)

Op-Amp as comparator, Study of Op-amp peak to peak detector, phase detector circuit, voltage level detector circuit, Schmitt trigger using op-amp, Study of timer IC – 555, Block diagram, operating principle, pin diagram, Features of IC-555, IC-555 as Astable, Monostable, bi-stable & Schmitt Trigger, Sample and hold circuit, Phase Locked Loop Principle & block diagram of PLL, Transfer characteristics, lock range & capture range.

INSTRUCTIONAL STRATEGY

This subject being of fundamental importance for diploma holders in electronics engineering and related fields, emphasis on conceptual understanding may be given by taking the help of charts. Sufficient exercises may have given to the students in single stage and multi-stage amplifier circuits in addition to simple exercises in fabricating and testing of various simple DC circuits. The students may be encouraged to perform some additional practical exercises apart from the list provided.

TEXT BOOKS/REFERENCE BOOKS:

1. Design with operational amplifiers and analog integrated circuits, 3rd Edition Sergio Franco Tata McGraw-Hill, 2007

2. Linear Integrated Circuits, D.Roy Choudhry, Shail Jain New Age International Pvt. Ltd

3. System design using Integrated Circuits. B.S.Sonde New Age Pub, 2nd Edition, 2001

4. Analysis and Design of Analog Integrated Circuits Gray and Meyer Wiley International, 2005.

LINEAR INTEGRATE CIRCUIT LAB

Name of Experiment

1. To Interpret the parameters of given Op-Amplifier from data sheet.

2. To test performance of OP_AMP as an inverting & Non inverting amplifier and observe input/output waveforms. To test performance of OP_AMP as unity gain amplifier.

3. To design and test performance of OP_AMP as an Adder and Subtractor

4. To test performance of OP_AMP as an Integrator & Differentiator

5. To test performance of OP_AMP Instrumentation Amplifier calculate gain & frequency response

6. To build & test Astable multivibrator using IC 741 for different values of R and C.

7. To build/test Monostable multivibrator using IC 741 for different values of R and C.

8. To build & test fixed/variable voltage regulator using LM723 & plot line/ load regulation characteristics

9. To build & test variable voltage regulator using LM317 & measure the dropout voltage & plot line/ load regulation characteristics.

10. To build & test variable voltage regulator using LM337 & measure the dropout voltage & plot line/ load regulation characteristics.

11. To build & test voltage regulator using 78xx and 79xx and measure the dropout voltage & plot line/ load regulation characteristics..

12. To build Op-Amp as voltage Regulator- IC 723.

13. Various applications of Timer IC555.

DECE 304 ELECTRIC CIRCUIT AND NETWORK

COURSE OBJECTIVES

L	T	P
02	-	02

The study of networks, filters and transmission lines provides a foundation for understanding of line communication, audio and video communication, and microwave communication systems. In particular, the study of networks builds upon the principles of A.C. theory and introduces student to the parameters and characteristics of various network configurations, including filters. Furthermore, the study of transmission lines is essential, as their behaviour and analogies are extensively used in the analysis of plane electromagnetic wave propagation in bounded media.

COURSE COUTCOMES (CO):

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

CO1 • Illustrate the concepts and characteristics of different networks.

CO2 • Outline the Two networks and analyse their parameters.

CO3 • Examine the principles and operation of attenuators

CO4 • Examine the principles, characteristics, and applications of filters.

CO5 • Examine the concept of Transmission Lines

CONTENT

UNIT 1- BASIC ELECTRICAL CIRCUITS& THEOREM

(06 Periods)

Node and Mesh analysis, Superposition Theorem, Thevenin Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.

UNIT 2- TWO PORT NETWORK (05 Periods)

Two Port Network: Open Circuit Impedance Parameters, Short Circuit Admittance

Parameters, Transmission Parameters Hybrid Parameters.

Overview of T network, π network, Ladder network; Lattice network

UNIT 3- ATTENUATOR (06 Periods)

Units of attenuation (Decibels and Nepers): General characteristics of attenuators - Analysis and design of simple attenuator of following types; Symmetrical T and π type, L type.

UNIT 4- FILTER (06 Periods)

Brief idea of the use of filter networks in different communication systems, concept of low pass, high pass, band pass and band stop filters. Active Filters Basic concept of active filters and their comparison with passive filters.

UNIT 5- TRANSMISSION LINE (05 Periods)

Transmission Lines, their types and applications, Distributed constants, T and π representation of transmission line section, Concept of reflection and standing waves, definition of reflection coefficient, SWR &VSWR and their relation (no derivation), Concept of transmission lines at high frequencies.

INSTRUCTIONAL STRATEGY

Stress should be laid on problems in networks/ filler and transmission lines. Practical must be carried out after completion of topic to gain a good know how on the subject students should be given home assignments on various topics, stress on making own circuit models to calculate input/output impedance, characteristic impedance, losses etc. should be carried out by the students.

TEXT BOOKS/REFERENCE BOOKS:

1. Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication, New Delhi

2. Networks and Systems by Ashfaq Husain, Khanna Publishing House

3. Network Analysis by Soni and Gupta; Dhanpat Rai and Co. Publication, New Delhi

4. Network Filters and Transmission Line by Yash Pal; Ishan Publications, Ambala City

5. Electrical and Electronics Measuring instrumentation, A.K Sawhney; Dhanpat Rai and Co. Publication, New Delhi

6. Rahul Wadhwa, Network, Filters & Transmission Lines, Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-112-0

ELECTRIC CIRCUIT AND NETWORK LAB

Name of Experiment

1. Verify voltage and current using Node analysis in a DC resistive circuit.

2. Verify voltage and current using Mesh analysis in a DC resistive circuit.

3. Verification of electrical circuit using Thevenin's theorem.

4. Verification of electrical circuit using Norton's theorem.

5. Verification of electrical circuit using Maximum Power Transfer theorem.

6. Use Superposition theorem to determine current/voltage in a linear circuit with

Multiple sources.

7. Determine Z-parameters of a two-port network.

8. To determine the Y parameters of a Two-port network

9. Determine transmission line parameters A, B, C, and D of a two-port network.

10. To determine Hybrid parameters of a Two-port network.

11. To design and verify a symmetrical T-type attenuator for a given attenuation and characteristic impedance.

12. To design and verify a symmetrical π-type attenuator for a specified dB loss and characteristic impedance.

13. To study the frequency response of a Low Pass Filter and observe the cut-off frequency.

14. To study the frequency response of a High Pass filter and observe the cut-off frequency

15. To study the frequency response of a Band Pass filter and observe the cut-off frequency

16. To study the frequency response of a Band Stop filter and observe the cut-off frequency

17. To construct and test a Band Pass Filter and study its center frequency and bandwidth.

18. To observe reflections due to impedance mismatch in transmission lines.

DECE-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.

DECE 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.

DECE 402

PRINCIPLES OF ELECTRONICS COMMUNICATION

L	T	P
3	-	3

COURSE OBJECTIVES

The rapid advancements in communication engineering necessitates a thorough understanding of its fundamental principles. This course aims to equip students with comprehensive knowledge of filters, modulation-demodulation and antenna which will prepare students to analyse, troubleshoot and adapt to the advancements in the field of communication technologies.

COURSE OUTCOMES

The theory should be taught in a manner that enables students to achieve learning outcomes across cognitive, psychomotor and affective domains, demonstrating the following course outcomes:

CO1• Understand the basic principles and components of communication systems.

CO2• Analyze communication channel performance considering bandwidth, noise, and signal distortion.

CO3• Design a basic communication system.

CO4• Select appropriate modulation techniques for specific applications based on performance criteria.

CO5• Understand the fundamentals and basic characteristics of antenna.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	INTRODUCTION TO COMMUNICATION ENGINEERING **Introduction to electromagnetic frequency spectrum**- relationship between wavelength and frequency. **Filters:** Definition, types of filters and their frequency response characteristics- LPF, HPF and BPF – applications. **Noise:** Definition, Types of noise and their sources, SNR and noise figure. **Distortion** - Definition, types of distortion, Difference between noise and distortion Concept of fidelity, selectivity and sensitivity. I**ntroduction to modulation-** Need of modulation, Concept of frequency translation.	(4 Periods)
2nd	AMPLITUDE MODULATION Definition of amplitude modulation, Expression for AM and its waveform representation, frequency spectrum and bandwidth of AM wave, relative power distribution in carrier and side bands. Elementary idea of DSB, DSB-SC SSB and VSB modulation. **Principles of AM modulators:** Square Law Modulator, Balanced Modulator **Principles of AM Demodulator:** Diode Detector Circuit, Need and Principles of Super Heterodyne Receiver	(11 Periods)
3rd	ANGLE MODULATION **Frequency Modulation:** Concept of Angle Modulation, Definition of FM modulation, Waveform representation of FM, Expression for FM	(11 Periods)

	and its frequency spectrum, modulation index, maximum frequency deviation and deviation ratio, bandwidth a FM signals, Carzon's rule, Pre-emphasis and De-emphasis, FM modulator and demodulator circuit in brief **Phase Modulation:** Definition, expression for PM and its frequency spectrum, modulation index, PM modulator and demodulator circuit in brief, comparison of FM, PM and AM communication systems	
4th	DIGITAL MODULATION TECHNIQUES **Digital Modulation Techniques-** ASK, FSK, PSK, BPSK modulation and demodulation techniques (only block diagram, operation and waveforms)- Basic concept of OFDM **Pulse modulation techniques:** Generation and detection of PAM PWM and PPM **Pulse Digital modulation techniques:** PCM and DM transmitter and receiver	(10 Periods)
5th	INTRODUCTION TO ANTENNAS Definition of Antenna, Importance and applications of Antenna, **Basic parameters**: radiation pattern, gain, directivity, impedance, polarization	(6 Periods)

INSTRUCTIONAL STRATEGY

An effective strategy will involve a blend of theory and hands-on practice. Start with foundational concepts like signal processing and modulation techniques, followed by practical experiments and simulations. Encourage problem-solving, group discussions, and case studies to reinforce understanding and foster critical thinking.

TEXT BOOKS/ REFERENCE BOOKS

1. Principles of communication systems by Taub Schilling, T.M.H.
2. Fundamentals of communication systems by Proakis & Salehi, Pearson education
3. Communication Systems by Simon Haykin, John Wiley
4. Communication Systems (Analog and Digital) By R.P. Singh, S.D. Sapre, T.M.H.
5. Modern Digital & Analog Communication by B.P. Lathi, Oxford Publications
6. Rahul Wadhwa, Principles of Communication Engineering Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-128-1
7. Digital & Analog Communication Systems by K.S. Shanmugam, John Wiley
8. E-books/e-tools to be used as recommended by AICTE/NITTTR, Chandigarh.

DECE- 403
NETWORK & SIGNAL SYSTEM

COURSE OBJECTIVES

L	T	P
3	-	-

The study of networks, filters and transmission lines provides a foundation for understanding of line communication, audio and video communication, and microwave communication systems. In particular, the study of networks builds upon the principles of A.C. theory and introduces student to the parameters and characteristics of various network configurations, including filters. Furthermore, the study of transmission lines is essential, as their behavior and analogies are extensively used in the analysis of plane electromagnetic wave propagation in bounded media

COURSE OUTCOME:

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

CO1 • Illustrate the concepts and characteristics of different networks.

CO2 • Outline the Two networks and analyses their parameters.

CO3 • Examine the principles and operation of attenuators

CO4 • Examine the principles, characteristics, and applications of filters.

CO5 • Examine the concept of Transmission Lines.

COURSE CONTENT

Units	Topics	No. of Lectures
1st	BASIC ELECTRICAL CIRCUITS& THEOREM Node and Mesh analysis, Superposition Theorem, Thevenin Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.	(6 Periods)
2nd	TWO PORT NETWORK Two Port Network: Open Circuit Impedance Parameters, Short Circuit Admittance Parameters, Transmission Parameters Hybrid Parameters. Overview of T network, π network, Ladder network; Lattice network	(5 Periods)
3rd	ATTENUATOR Units of attenuation (Decibels and Nepers): General characteristics of attenuators - Analysis and design of simple attenuator of following types; Symmetrical T and π type, L type.	(6 Periods)
4th	FILTER Brief idea of the use of filter networks in different communication systems, concept of low pass, high pass, band pass and band stop filters. Active Filters Basic concept of active filters and their comparison with passive filters.	(6 Periods)
5th	TRANSMISSION LINE Transmission Lines, their types and applications, Distributed constants, T and π representation of transmission line section, Concept of reflection and standing waves, definition of reflection coefficient, SWR &VSWR and their relation (no derivation), Concept of transmission lines at high frequencies.	(5 Periods)

INSTRUCTIONAL STRATEGY

Stress should be laid on problems in networks/ filler and transmission lines. Practical must be carried out after completion of topic to gain a good know how on the subject students should be given home assignments on various topics, stress on making own circuit models to calculate input/output impedance, characteristic impedance, losses etc. should be carried out by the students.

TEXT BOOKS/REFERENCE BOOKS:

1. Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication, New Delhi
2. Rahul Wadhwa, Network, Filters & Transmission Lines, Asian Publishers, Muzaffarnagar. ISBN: 978-93-5502-112-0
3. Networks and Systems by Ashfaq Husain, Khanna Publishing House
4. Network Analysis by Soni and Gupta; Dhanpat Rai and Co. Publication, New Delhi
5. Network Filters and Transmission Line by Yash Pal; Ishan Publications, Ambala City
6. Electrical and Electronics Measuring instrumentation, A.K Sawhney; Dhanpat Rai and Co. Publication, New Delhi

DECE- 404 PROGRAMMING IN C

L	T	P
1	-	4

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** Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers Single pointer, Introduction to Colab, Programming in Python.	(2 Periods)
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

DECE 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

INDUSTRIAL ROBOTICS

(OPEN ELECTIVE-II)

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.

DECE 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

DECE 407

PRINCIPLES OF ELECTRONICS COMMUNICATION LAB

L	T	P
	-	4

LIST OF PRACTICALS

1. Construct and test the performance of LPF,HPF and BPF

2. Construct and test the performance of AM Modulator

3. Construct and test the performance of AM demodulation using envelope detector.

4. (a) To obtain an AM wave from a square law modulator circuit and observe waveforms

(b) To measure the modulation index of the obtained wave form. Observe under modulated, 100%

modulated & over modulated AM

5. Construct and test the performance of FM Modulator

6. Construct and test the performance of FM demodulator

7. To obtain an FM wave and measure the frequency deviation and modulation index for different modulating signals.

8. Test the performance of ASK modulator and demodulator and draw its input and output waveform

9. Test the performance of PSK modulator and demodulator and draw its input and output waveform

10. Test the performance of FSK modulator and demodulator and draw its input and output waveform

11. Construct and test the performance of Sample and Hold Circuit.

12. To observe the sampled signal and compare it with the analog input signal. Note the effect of varying the sampling pulse width and frequency on the sampled output.

13. To observe and note the pulse amplitude modulated signal (PAM) and compare them with the corresponding analog input signal.

14. To observe PPM signal and compare it with the analog input signal.

15. To observe PWM signal and compare it with the analog input signal.

16. Construct and test the performance of Pulse Width Modulator.

DECE 408

NETWORK & SIGNAL SYSTEM LAB

NAME OF EXPERIMENT

L	T	P
-	-	4

1. Verify voltage and current using Node analysis in a DC resistive circuit.
2. Verify voltage and current using Mesh analysis in a DC resistive circuit.
3. Verification of electrical circuit using Thevenin's theorem.
4. Verification of electrical circuit using Norton's theorem.
5. Verification of electrical circuit using Maximum Power Transfer theorem.
6. Use Superposition theorem to determine current/voltage in a linear circuit with multiple sources.
7. Determine Z-parameters of a two-port network.
8. To determine the Y parameters of a Two-port network
9. Determine transmission line parameters A, B, C, and D of a two-port network.
10. To determine Hybrid parameters of a Two-port network.
11. To design and verify a symmetrical T-type attenuator for a given attenuation and characteristic impedance.
12. To design and verify a symmetrical π-type attenuator for a specified dB loss and characteristic impedance.
13. To study the frequency response of a Low Pass Filter and observe the cut-off frequency.
14. To study the frequency response of a High Pass filter and observe the cut-off frequency
15. To study the frequency response of a Band Pass filter and observe the cut-off frequency
16. To study the frequency response of a Band Stop filter and observe the cut-off frequency
17. To construct and test a Band Pass Filter and study its center frequency and bandwidth.
18. To observe reflections due to impedance mismatch in transmission lines.

DECE 409 PROGRAMMING IN C LAB

L	T	P
-	-	4

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.