Faculty of Engineering and Technology

Radha Govind University

Chandausi, Sambhal (U.P.)

Evaluation Scheme & Syllabus for

Department of Electronics & Comm. Engg.

DIPLOMA –ELECTRONICS & COMM. ENGG.

III Year (5th & 6th Semester)

(Effective from session _____)

DIPLOMA - ELECTRONICS & COMM. ENGG. STUDY AND EVALUATION SCHEME

3rd Year, 5th 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 501	**Optical Fiber Communication**	4	-	-	**4**	30	-	30	70	-	70	100
DECE 502	**Program Elective –I**	3	-	-	**3**	30	-	30	70	-	70	100
DECE 503	**Electronic System Design And Embedded System**	2	-	2	**3**	30	-	30	70	-	70	100
DECE 504	**Program Elective –II**	1	-	4	**3**	30	-	30	70	-	70	100
DECE 505	**Open Elective –iii** a) AI & ML b) Internet of Things **c)** Industrial Automation & MES	2	-	-	**2**	30	-	30	70	-	70	100
DECE 506	**Optical Fiber Communication lab**	-	-	**6**	**3**	-	25	25	-	25	25	50
DECE 507	**Electronic System Design And Embedded System Lab**	-	-	**4**	**2**	-	25	25	-	25	25	50
DECE 508	**Program Elective –II Lab**	-	-	**4**	**2**	-	25	25	-	25	25	50
DECE 509	**Summer Internship (4-6 Weeks)**	-	-	-	**2**	-	-	-	-	50	50	50
Total					**24**	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.

Note: -1 Students will present a seminar/viva on their summer internship along with certificate, project and report.

2. Students will submit the certificate.

DECE 502 Program Elective-I	DECE 504 Program Elective-II
1. Control System PLC 2. Microwave & Radar 3. Digital Communication system	1. Mechatronics 2. Signal And Image Processing

DIPLOMA - ELECTRONICS & COMM. ENGG. STUDY AND EVALUATION SCHEME

3rd Year, 6th 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 601	**Program Elective-III** a) Managerial Economics b) Finance Fundamentals c) Cyber Security d) Data Science	3	-	-	**3**	30	-	30	70	-	70	100
DECE 602	Entrepreneurship And Start- Up*	2	-	-	**2**	30	-	30	70	-	70	100
DECE 603	**Program Elective-IV** a) Mobile & Wireless Communication b) VLSI Using VHDL c) Power Electronics Devices	2	-	3	**3**	30	-	30	70	-	70	100
DECE 604	**Project Works**	4	-	**16**	**12**	-	240	240	-	160	160	400
Total					20	90	240	**330**	210	160	**370**	**700**

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

Note: "Entrepreneurship and Start-up" course is also mandatory in Industrial internship/training mode.

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DECE-501

OPTICAL FIBER COMMUNICATION

1. COURSE OBJECTIVES

Fiber optic technology is rapidly expanding due to lower costs compared to copper, improved transmission quality, and reduced maintenance expenses. As the most economical and efficient medium for wired communication, fiber also supports video transmission, further enhancing its appeal. This course will enable students to understand and apply the principles of optical communication systems

2. COURSE OUTCOMES (CO):

Students will be able to

CO1• Interpret the functions of the various components of optical fiber communication system.

CO2• Measure the key parameters of optical fiber cables.

CO3• Analyze and evaluate losses in optical fiber communication system.

CO4• Compare and differentiate various optical sources used in optical communication.

CO5• Identify and integrate optical components to design solutions for real-world optical communication problems.

CONTENTS

UNIT 1-INTRODUCTION (8 Periods)

Various wired communication mediums – copper wire and optical fiber cable Electromagnetic spectrum, optical band and its range, Optical windows. General Block diagram of optical Fiber communication system. Advantages, disadvantages and application of Fiber Optic communication.

UNIT 2- OPTICAL FIBER (12 Periods)

Nature of light, its properties, Definition and concept of Reflection, refraction dispersion, diffraction, absorption, Total internal reflection (TIR) and scattering of light ray. Propagation of light in optical fiber, Ray model, Theoretical approach to Wave model, Snell's law, definition and concept of Critical angle, numerical aperture, acceptance angle and acceptance cone - (Numerical on above concepts).

UNIT 3- FIBER MATERIALS, CONNECTORS, COUPLER, SPLICER AND LOSSES

(12 periods)

Fiber materials, Structure of fiber, Dimension of fiber. Optical fiber classification based on Modes and index profile, Modes of light propagation in fiber. Optical fiber connections: joints and Couplers-Fiber alignment and joint loss, fiber splicing techniques (Mechanical, fusion). fiber connectors, Losses and signal degradation in optical fiber.

UNIT 4- OPTICAL SOURCES AND DETECTORS (12 Periods)

Optical sources: LED, LASER, construction and working, Characteristics, specifications & Comparison. Optical detectors: PIN diode, Avalanche photo diode- construction, working, Characteristics, specifications & Comparison.

UNIT 5- OPTICAL AMPLIFIERS AND ITS TYPE (12 Periods)

Optical Amplifiers: Types of optical amplifiers, semiconductor & fiber optical amplifiers, principle of operation of SOA, types of SOA. EDFA, Raman amplifiers. Comparison of SOA, EDFA and Raman Amplifiers.

INSTRUCTIONAL STRATEGY

This subject gives the complete knowledge of optical fiber communication techniques. The teacher should make the students aware about the historical development, optical sources and optical fiber system in addition to applications of optical fiber in communication system. Since this subject deals with theory and practical, the theory should be reinforced by visit to sites and industries like BSNL having optical fiber installations in addition to practical work in the laboratory.

TEXT BOOKS/REFERENCE BOOKS

1. Fiber Optic Communication Keiser, Gerd McGraw Hill New Delhi.

2. Optical Fiber communications principles & Practices Senior, John M. Pearson Education Ltd., New Delhi.

3. Govind P. Agrawal, “Fiber Optic Communication Systems”, John Wiley, 3rd Edition, 2004.

OPTICAL FIBER COMMUNICATION LAB

LIST OF EXPERIMENTS

1. To identify and use various components and tools used in optical fiber communication.
2. To view and draw the structure of an optical fiber and cable.
3. To observe the Total Internal Reflection (TIR) and Light transmission.
4. To calculate NA of given optical fiber.
5. To set up fiber optic analog link.
6. To set up fiber optic digital link.
7. Identify various layers & parts of an optical fiber cable.
8. Measure bending losses of the given fiber optic cable.
9. Plot the characteristics of optical source & detector.
10. To connect a fiber with connector at both ends.
11. To observe and measure the splice or connector loss.
12. To splice the available optical fiber.
13. To measure attenuation in optical fiber .
14. To do power budgeting of an optical fiber link.
15. To determine the position of fault in optical fiber link.

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DECE 502
PROGRAM ELECTIVE-1
(Control System & PLC)

COURSE OBJECTIVES

The course on Control Systems & PLC aims to provide students with a solid understanding of control system principles, including open-loop and closed-loop systems, feedback, and stability analysis. Students will learn to model and analyse control systems, apply control techniques like PID, and implement PLC programming for industrial automation. The course covers PLC hardware, software, and programming languages (Ladder Logic, Function Block Diagram), with a focus on real-world applications in process control. Hands-on experience in designing, implementing, and troubleshooting PLC-based systems prepares students to solve automation problems and integrate control systems into complex industrial setups.

COURSE OUTCOMES(CO)

The course is designed to equip students with the knowledge and skills to understand, analyze, and implement control systems and PLC-based automation. The theory will be delivered to help students achieve outcomes across cognitive, psychomotor, and affective domains. Students will be able to

CO1• Illustrate the concept of open loop and close loop control system.

CO2• Analyse dynamic systems and evaluate their stability using standard methods.

CO3• Explain parameters of first-order and second-order control systems and perform time domain analysis.

CO4• Interpret and compare different types of controllers used in control systems

CO5• Understand the fundamentals of PLCs, including programming concepts and instruction sets for automation.

COURSE CONTENTS

UNIT 1- INTRODUCTION TO CONTROL SYSTEM (09 Periods)

Open loop Control System and Close App Control System - block diagram and its elements, properties and application (with example) and Comparison between open and close loop Control System, Block diagram of feedback Control System and its elements, Definition and Explanation of the following Control System - Linear and Non-linear System, Continuous and Discrete System, Static and dynamic System

UNIT 2- TRANSFER FUNCTION (06 Periods)

Definition of Transfer function and its use in Control System, Transfer function of the following: Open loop and Close Loop System, Simple RC low pass and High

pass filter, Characteristic Equation, Pole-Zero Concept of Transfer Function, Initial value and final value theorem.

UNIT 3- TIME DOMAIN ANALYSIS AND STABILITY THEORY

(10 Periods)

Time response of first order system with unit step input, Time response of second order system with unit step input, Basic idea of delay time, rise time, setting time, steady state error, max overshoot, damping ratio (No Derivation), Over damped, under damped, critically damped, un damped system (basic idea only) and Pole-zero representation, Nature of transit response, Damping ratio (No Derivation), Basic concept of stability analysis by Routh Hurwitz Criterion

UNIT 4- BASIC CONTROLLERS (07 Periods)

Introduction to controllers, need of controller, Type of controller (Basic idea and Mathematical expression only): (a) On-off controller b) Proportional controller c) PD controller d) PI controller e) PID controller

UNIT 5- INTRODUCTION TO PLC AND INSTRUCTION SET (10 Periods)

Concept of PLC, building block of PLC, function of various blocks, limitation of relays, advantage of PLC over electromagnetic relays, different programming languages, PLC manufacturer, working of PLC, basic operation and principles of PLC, architectural details. Basic instructions like latch, master control self-holding relays, timer instruction like retentive timers, resetting of timers, counter instructions like up counter, resetting of counters.

INSTRUCTIONAL STRATEGY

The teacher should lay stress on the concept of control systems and its time response analysis, stability of the system and different types of controllers. The students must know what PLC is and learn its instruction set.

TEXT BOOKS/REFERENCE BOOKS:

1 Modern Control Engineering, K. Ogata, PHI Publications.

2 Control System Engineering I.J. Nagrath and M. Gopal, New Age International Publishers.

3 Linear Control Systems, B.S. Manke, Khanna Publishers.

4 Introduction to PLCs, Gary Dunning, Tata McGraw Hill.

5 Control System (With MATLAB Programs), Sonveer Singh and Sanjay Agrwal, I. K. International.

DECE 502
PROGRAM ELECTIVE-1
(Microwave & Radar)

COURSE OBJECTIVES

Microwave communication forms the backbone of terrestrial communication and is fundamental to mobile communication systems. Microwave links and RADAR systems are extensively used to provide reliable communication in remote regions and to perform specialized applications. This course is designed to enhance the technical skills of diploma engineers in the operation, maintenance, and troubleshooting of microwave and RADAR based telecommunication systems.

COURSE OUTCOMES (CO):

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

CO1• Understand the fundamentals of microwave engineering and select appropriate microwave devices based on specific applications.

CO2• Utilize active and passive microwave components and devices effectively.

CO3• Understand the principles and operation of waveguides.

CO4• Interpret RADAR based systems for range detection and other specified application

CO5• Analyze various satellite technologies, including different types of satellites, their missions, and areas of application.

CONTENTS

UNIT 1-FUNDAMENTALS OF MICROWAVE COMMUNICATION

(04 Periods)

History, Microwave frequency spectrum, band designations and applications of microwave in various fields, Simple block diagram of microwave transmitter, receiver and microwave link repeater. Types of propagation- Ground wave, Sky Wave and Space Wave. Introduction to Transmission Lines, their types and applications.

UNIT 2-INTRODUCTION TO MICROWAVE DEVICES (14 Periods)

Microwave Passive Devices: Directional Coupler, Power Divider, Attenuator, Resonator Microwave vacuum tube devices: Construction working, specifications

and applications of two cavity Klystron amplifier, Reflex Klystron, Magnetron and Helix TWT. Compare the performance of Klystron, Magnetron and TWT. Microwave semiconductor devices: Construction, working, specifications, characteristics and applications of Gunn diode. IMPATT diode. Tunnel diode, PIN diode

UNIT 3- WAVE GUIDES (08periods)

Types of Waveguides, and Propagation of waves in rectangular and circular waveguides and their applications. Advantages and disadvantages of rectangular and circular wave guides. Modes of wave guide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation). Impossibility of TEM mode in a wave guide. Comparison of wave guide with Transmission line and comparison of rectangular waveguide with circular waveguide.

UNIT 4-RADAR SYSTEMS (08 Periods)

Introduction to RADAR Fundamentals: Basic block diagram of RADAR system, RADAR performance factors: RADAR range equation, factors influencing range, effect of noise.

Types of RADAR Systems: Basic pulse RADAR system: Block diagram and description, applications.

Doppler Effect, CW Doppler RADAR: Block diagram, operation and application.

FM CW RADAR: Block diagram. Operation and application

MTI: Block diagram, operation concept of blind speed, application.

Automatic target detection RADAR, SONAR system: Working principle and applications.

UNIT 5-SATELLITE COMMUNICATION (08 Periods)

Introduction. Advantages & disadvantages of satellite system. Frequency bands, uplink & downlink frequencies. Kepler's First Law. Kepler's Second Law. Kepler 's Third Law. Definitions of Terms for Earth-Orbiting Satellites. Orbital Elements. Apogee and Perigee Heights. Orbit Perturbations, Effects of a non-spherical earth. Atmospheric drag. Satellite angles, satellite repeaters. Station keeping. attitude

control. satellite positioning. LEO, MEO, GEO satellite overview. Satellite communication system. Transponders. Crosslink, Satellite frequency allocation and frequency reuse. Block diagram of satellite earth station.

INSTRUCTIONAL STRATEGY

Microwave and radar engineering are very important subject and requires both theoretical as well as practical exposure. The teaching should be supplemented by visits to the microwave stations and using suitable audio-visual aids.

TEXT BOOKS/REFERNCE BOOKS

1. RADAR systems and radio aids to navigation Sen, A. K. and Bhattacharya, A. B. Mercury Learning information. PVT. LTD. New Delhi, 2017.

2. Microwave Engineering, Das, Annapurna and Das, S. K. Mc Graw Hill, New Delhi (3rd edition)

3. Microwave Engineering, Gupta, Sanjeev, Khanna publication 2015 New Delhi

4. Microwave and RADAR Engineering, Gautam, A. K., S.K. Kataria Publication New Delhi.

5. Microwave and RADAR Engineering, Kulkarni, M. Umesh Publications, New Delhi, 2009.

DECE 502
PROGRAM ELECTIVE-1
(Digital Communication system)

COURSE OBJECTIVES

Communication technologies have undergone radical advancements, primarily due to the convergence of computing and communication systems. Digital communication offers greater flexibility in data processing compared to analog communication. This course enables students to understand the facts, concepts, and working principles of digital communication systems. It introduces fundamental aspects of digital information theory, including information rate and channel capacity. The course also provides insight into digital modulation techniques, channel coding and error control methods, multiple access schemes, and spread spectrum modulation. The knowledge gained through this course equips students to apply digital communication principles effectively in modern communication systems.

COURSE OUTCOMES (CO):

At the end of this course, students will be able:

CO1• Explain the basic statistical concepts involved in communication theory.

CO2• Demonstrate and apply the fundamental concepts of digital communication systems.

CO3• Design basic system blocks or equipment related to digital modulation schemes.

CO4• Analyze the performance parameters of digital communication systems.

CO5• Apply the principles of information theory to digital communication systems.

CONTENTS

UNIT 1-INTRODUCTION TO DIGITAL COMMUNICATION (06 Periods)

Overview of digital communication systems, Analog vs. digital communication, Elements of digital communication systems, Basics of information theory, entropy, relationship between information theory and communication systems.

UNIT 2-MODULATION TECHNIQUES (10 Periods)

Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM). Pulse Code Modulation, Basic concept of sampling theorem, quantization, coding and Shannon's theorem, Types of PCM system and its application (Basic idea only) Basic idea of: Amplitude Shift Keying (ASK) modulation and demodulation technique, Frequency Shift Keying (FSK) modulation and demodulation technique, Phase Shift

Keying (PSK) modulation and demodulation technique, Quadrature Amplitude Modulation (QAM) modulation and demodulation technique

UNIT 3-ERROR CONTROL CODING (08 Periods)

Introduction to channel coding, Basics of code theory, Error detection and correction codes,

Block codes and Convolution codes, Introduction to error detection and correction technique.

UNIT 4-MULTIPLEXING AND MULTIPLE ACCESS TECHNIQUES (08 Periods)

Frequency division Multiplexing (FDM), Time division Multiplexing (TDM), Code division Multiplexing (CDM), Basics of orthogonal frequency division Multiplexing (OFDM) Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiple Access (OFDMA)

UNIT 5- DIGITAL TRANSMISSION FUNDAMENTALS AND PERFORMANCE ANALYSIS (10 Periods)

Line coding techniques (NRZ, RZ, Manchester), Baseband and pass band transmission, Signal-to-noise ratio (SNR) and bit error rate (BER), Channel capacity, Shanon-Hartley theorem, Link budget analysis, Brief idea of interference and noise in digital communication systems.

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. Modern Digital and Analog Communication Systems, Lathi, B.P. and Ding, Z

2. Communication Systems, Haykin, S

3. Digital & Analog Communication Systems By K.S. Shanmugam, John Wiley

4. E-books/e-tools to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

DECE 503

Electronic System Design And Embedded System

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COURSE OBJECTIVES

This course enables students to understand the fundamentals of electronic system design and apply these principles to develop complete electronic systems. Students will identify and select appropriate sensors and actuators for interfacing with real-world environments. The course introduces modern embedded systems, including operating system concepts and realtime system design, enabling students to analyze embedded system requirements and design real-time solutions. Starting with the 8051 microcontroller and its instruction set, the course further covers the Arduino platform, emphasizing programming the Arduino Uno to develop real-time embedded applications.

COURSE OUTCOMES

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

CO1• Understand the fundamentals of electronic system design and the role of sensors and actuators.

CO2• Explain the key concepts of 8051 and Arduino microcontrollers and their architectures.

CO3• Analyze circuit and system requirements for embedded applications.

CO4• Apply learned concepts to interface devices and develop real-time applications.

CO5• Develop a comprehensive theoretical and practical understanding of 8051/Arduinobased embedded systems.

CONTENT

UNIT 1- BASICS OF ELECTRONIC SYSTEMS DESIGN (05 Periods)

Definition, Purpose and Scope; System Architecture for Electronic Product Designs; Breakdown of an Electronic System Design; Requirements; Electromagnetic Interference in Electronic Systems and Its Impact; Concept of Grounding and Its Significance, PCB designing principals, Etching process, Types of etching.

UNIT 2- SENSORS AND ACTUATORS (06 Periods)

Sensor: Definition: Sensor Characteristics - Sensitivity, Linearity, Range, Resolution, Accuracy, Repeatability, and Hysteresis. Types of Sensors: Temperature Sensor, Ultrasonic Sensor, Gas

Sensor, Level Sensor, Ph Sensor, Flow Sensor, Humidity Sensor, Proximity Sensor, Pressure Sensor, etc.

Actuator: Definition: Actuator Principles and Classification, Energy Source-Based Actuators (i.e., Pneumatic Actuator, Hydraulic Actuator, Electric Actuator, Thermal Actuator, Magnetic Actuator, and Piezoelectric Actuator). Classification of Actuators by Motion: Linear, Rotary, and Semi-Rotary.

UNIT 3 - EMBEDDED SYSTEM (06 Periods)

Embedded system architecture Types of Architecture of Embedded Processors: Von Neumann, Harvard, Super Harvard, RISC, CISC, DSP, Multi core processor, factors affecting embedded systems, Types of embedded O.S: Non real time O.S, Real time O.S, Mobile O.S.

UNIT 4- 8051 MICROCONTROLLER (6 Periods)

Introduction to 8051 Pin Diagram and Description, Memory Organization, Special Function Registers, Addressing Modes, Interrupts, Timers, Serial Communication. Difference between the C language and Embedded C language,

UNIT 5 COMMUNICATION WITH ARDUINO UNO (05 Periods)

Arduino Uno specifications including power ratings, digital and analog peripherals. Arduino Uno Ports, Pins, Digital and Analog Peripherals, Familiarizing with the Arduino IDE, Arduino I/O functions, Arduino Interrupts, Serial Peripheral Interface and Communication and their programming.

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/REFERNCE BOOKS

1. John F. Wakerly,Digital Design: Principles and Practices, 5th edition, Pearson Publications, 2018

2. Charles Kitchin and Lew Counts, A Designer's Guide to Instrumentation Amplifiers,3rd edition, Analog Devices, 2006.

3. Eamon Nash, Errors and Error Budget Analysis in Instrumentation Amplifier Applications, 3rd edition, Analog Devices, 2006

4. Lyla B. Das, Embedded systems: An Integrated Approach, 1st edition, Pearson Education, 2013

5. Steve Furbe, ARM System on chip Architecture, 2nd Edition,Pearson Education, 2015.

Electronic System Design And Embedded System Lab

Name of Experiment

1 Familiarization with different types of PCB'S Materials and their key specifications.(Bakellite,FR4 etc)

2 Schematic creation and PCB Layout for simple circuits using open source software

3. Creating a PCB that is fully prepared for component installation with PCB grounding techniques.

4. Identifying various types of sensors and analyzing their specifications through datasheets

5. Identifying various types of actuators and analyzing their specifications through datasheets

6. Familiarization with different types of microcontrollers and their specifications and IC packages (ESP8266/32, Arduino Classic, MKR, Nano and Mega family, Raspberry pi).

7. Template for embedded C program for 8051 (using reg.51)

8. Write a program to load a number into Accumulator

9. Write a program to load three numbers into Accumulator and send them to port 1

10. Write a program to explain different logical operations.

11. Write a program for LED blinking with 1s delay

12. Write a program for handling two LEDs blinking alternatively with a delay of 2s

13. Write a program to read digital states of a push button and print in IDE serial monitor

14. Write a program to send a message using serial communication.

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DECE 504 PROGRAM ELECTIVE-II

(MECHATRONICS)

COURSE OBJECTIVES

Mechatronics is a rapidly evolving interdisciplinary field that integrates mechanical, electrical, electronics, computer, and control engineering. This fusion enables the design and development of advanced, reliable, and cost-effective electro-mechanical systems. With increasing industrial automation and smart manufacturing, mechatronic systems are being widely adopted across various sectors. Consequently, there is a growing demand for diploma engineers who are skilled in installing, operating, and maintaining these integrated systems in real-world industrial applications.

COURSE OUTCOMES (CO):

Students will be able to

CO1• Illustrate various types of mechatronics systems and explain their architecture.

CO2• Select and apply appropriate sensors and transducers used in mechatronics systems.

CO3• Explain and demonstrate the functioning of various components used in different mechatronic systems.

CO4• Install, operates, and maintains CNC machines.

CO5• Interface PLC with SCADA systems for specific industrial applications.

CONTENT

UNIT 1 INTRODUCTION (03 Periods)

Introduction to Mechatronics: Mechatronics; Importance of Mechatronics; Systems: Measurement systems; Control systems and their types; Closed-loop control System; Automatic water level controller; Sequential controllers-washing machine Mechatronics system architecture: Sensors, signal conditioners, PLC/Embedded controllers, pneumatic, hydraulic and electrical actuators. Introduction to Real Time Mechatronics System.

UNIT 2 SENSORS & SWITCHES (03 Periods)

Sensors: Principle of operation and application of each. Proximity, Motion Sensors, Pressure sensor, High and low temperature measurement sensors, Light Sensors, Selection of Sensors. Switches: Principle, working and applications of-Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type).

UNIT 3 -ELECTRICAL & MECHANICAL SYSTEM (03 Periods)

Electric actuators, Stepper motor, servo motors, DC motor, DC brushless motors, AC motor (Only diagram). Relays Principle of operation and application, latching, triggering, Types of

relays- solid state. Hydraulic systems: Physical components of hydraulic systems Pneumatic systems: Air compressors, filters and regulators.

UNIT 4- SIGNAL CONDITIONERS (03 Periods)

Need of isolators, filters, amplifiers, fluid amplifiers, and optical amplifiers mechatronics systems. Computer Aided Control Systems: CNC Machines: various blocks of CNC machine, advantages of CNC, Part programming of CNC machines, G codes and M codes, small application programs, CNC based machine example.

UNIT 5- INTRODUCTION TO SCADA AND PLC (02 Periods)

SCADA: Data acquisition system, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Applications, Interfacing of PLC to SCADA. Case studies of mechatronics systems: A Microcontroller based pick-and-place robot, Microcontroller based antilock brake system.

INSTRUCTIONAL STRATEGY

The instructional strategy for Mechatronics includes a blend of classroom teaching, hands-on laboratory sessions, industry-relevant projects, and the use of multimedia tools. Emphasis is placed on collaborative learning, simulation software, real-world applications, and continuous assessment to develop practical skills, interdisciplinary knowledge, and problem-solving abilities essential for modern industries.

PROGRAM ELECTIVE-II

(MECHATRONICS) LAB

List of Experiment

1. Familiarize students with measurement systems and control systems, including the working principle of closed-loop control systems.

2 Design and implement an automatic water level controller system, which uses sensors to control the water flow into a tank.

3. Implement a sequential control system, such as a washing machine controller, using a microcontroller or PLC

4. Study the integration of sensors, signal conditioners, actuators, and controllers in a mechatronics system, with a focus on industrial applications.

5. Understand the principle of operation and applications of proximity sensors

6. Study how motion sensors detect and respond to movement.

7. Study the operation and applications of pressure sensors.

8. Study the principle and applications of LDR, photodiodes, and phototransistors.

9. To understand the working principle and applications of electric actuators

10. To understand the working principle and applications of stepper motors, Servo motor, DC motors, DC brushless motors.

11. To understand the principle of operation and applications of relays (including latching, triggering, and solid-state relays).

12. To understand the function and need for various isolators, filters, amplifiers, and their applications in mechatronics systems.

13. To understand the components, working, and programming of CNC machines and the role of computer-aided control systems in mechatronics.

14 To simulate and troubleshoot common CNC machine operations and errors.

15. To understand the SCADA system, its components, and its role in data acquisition, communication, and supervisory control.

16. To understand the principles of PLC programming, its block diagram, and its application in real-time systems.

17. To explore various microcontroller-based mechatronics systems by designing, simulating, and implementing real-world applications.

PROGRAM ELECTIVE-II

(Signal Image and Processing)

COURSE OBJECTIVES

The Signal and Image Processing course provides students with both foundational and advanced concepts in processing digital signals and images. It covers essential techniques such as filtering, sampling, Fourier transforms, and convolution, enabling students to analyze, transform, and manipulate digital signals effectively. In the image processing module, the course explores methods for enhancement, restoration, compression, segmentation, and feature extraction. Students gain a balanced understanding of theoretical principles and practical implementations using tools such as MATLAB or Python.

COURSE OUTCOMES

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

CO1• Understand different types of signals, including continuous and discrete, odd and even, periodic and aperiodic signals.

CO2• Explain and apply transform techniques for analyzing continuous-time signals and systems.

CO3• Analyze the fundamental concepts underlying digital image processing systems.

CO4• Evaluate methods used for image enhancement and restoration to improve image quality.

CO5• Categorize different image compression strategies and assess techniques for image segmentation and representation.

CONTENT

UNIT 1- BASICS OF SIGNALS AND SYSTEMS (02 Periods)

Step, Ramp, Pulse, Impulse, Real, complex and exponentials _ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals

Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non causal, Stable & Unstable.

UNIT 2 -FOURIER TRANSFORM AND LAPLACE TRANSFORM

(04 Periods)

Fourier Transform: Fourier series for periodic signals – Fourier Transform – properties Laplace Transform: Laplace Transforms and properties - convolution and properties.

UNIT 3- BASICS OF IMAGE PROCESSING (04Periods)

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition, Introduction to image sampling and quantization, Color Image Fundamentals: RGB models.

UNIT 4-IMAGE ENHANCEMENT AND RESTORATION (02 Periods)

Image Enhancement: Spatial Domain: Gray level Transformations-Image negative-contrast stretching - Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial filtering. Image Restoration – introduction to degradation model & Noise models.

UNIT 5- IMAGE SEGMENTATION AND COMPRESSION (02 Periods)

Image Segmentation: Edge detection, Region based segmentation – Region growing – Region splitting and merging

Image Compression: Need for data compression, Huffman, JPEG standard, MPEG.

INSTRUCTIONAL STRATEGY

Engage and motivate students through interactive teaching that builds confidence and connects course concepts to real-world applications. Use demonstrations, simulations, and hands-on activities in a theory-demonstrate-practice-activity approach. Encourage critical analysis by having students assess experiment outcomes and identify errors, ensuring outcome-driven learning and improved employability.

TEXT BOOKS/ REFERENCE BOOKS:

1. A.V. Oppenheim, A.S. willsky and S.H. Nawab, Signals and Systems, 2nd Edition, Prentice-Hall of India, 2015.

2. Rafel C. Gonzalez and Richard E. woods, Digital Image processing, 4th edition, Pearson Inc, 2018.

3. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition, Wiley, 2007.

PROGRAM ELECTIVE-II

(Signal Image and Processing) Lab

List of Experiment

1 Understand various signal types in the time domain.

2 Learn about signal operations such as addition, multiplication, and time-shifting.

3. Transform signals from the time domain into the frequency domain.

4. Explore critical properties of the Fourier Transform such as linearity, time-shifting, frequency-shifting, scaling, and duality.

5. Introduce the Laplace transform as a tool for analyzing continuous time signals and systems, and verify its properties such as linearity, time-shifting.

6. Introduction to Digital Image Processing Environment.

7. Understand image as a matrix and perform fundamental operations.

8. Break down an image into its RGB components.

9. Simulate the process of image capture using virtual sensors.

10. Understand human perception of brightness and contrast.

11. Improve the visual quality of images by suppressing degradation.

12. Understand how reducing intensity levels affects image quality.

13. Understand and apply basic pixel intensity transformations.

14. Perform segmentation by dividing and combining image regions based on uniformity.

15. Demonstrate how compression reduces image size and storage needs.

16. Simulate the core steps of JPEG compression.

17. Understand basic principles behind video compression.

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DECE 505 Open Elective-iii

(AI & ML)

COURSE OBJECTIVE

This course is designed to equip students with essential theoretical and practical skills need for understanding the requirements, collection of data, pre-processing of data, building and deploying machine learning and artificial intelligence solutions to real world applications. Participants will gain hands-on experience with the latest software, enabling them to adopt latest technologies in line with industry requirements and building competency in the Machine Learning and Artificial Intelligence field.

COURSE OUTCOME

• Understand the fundamentals of Machine Learning and AI and their practical applications.

• Understanding of Basic Mathematical Concepts used in AI and ML.

• Understand Data Collection and Data Pre-Processing.

• Understand Basics of AI and Machine Learning

• Develop python programming skills for Machine Learning and AI.

• Understand the role of Supervised, Unsupervised and Deep Learning in real world applications.

• Select appropriate Machine Learning Algorithm for specific applications.

• Implementation of Regression Analysis for Prediction.

• Train a logistic regression model for binary classification.

COURSE CONTENTS

1 Industrial Safety Practices

• Fire Extinguishers & its Types

• Safely handling Tools & Equipment

• Use of proper Tools & Equipment & its maintenance

• OSH & practices to be observed as a precaution

2 Fundamentals required for AI and ML

• Introduction to Artificial Intelligence and Machine Learning

• Need of AI and ML

• Basic Mathematical concepts related to AI and ML

• Data Collection, Data Processing and Cleaning

• Types of Data Sources

o Structured Data

o Unstructured Data

o Semi Structured

o Realtime Data

o Open Data Set

o Data Scraping

• Data Acquisition Techniques

o APIs (Application Programming Interfaces): Collection of from External Sources)

o Web Scrapping

o Surveys and Forms

o Sensor Data

o Database and Data Warehouse

• Data Integration

o Combining Data from Multiple Sources

o Data Merging (Combing Data from different Tables)

o Data Aggregation

• Data Pre-Processing

o Data Cleaning

o Outlier Detection and Removal

o Duplicate Data

3. Programming concepts for AI and ML

o Python Basics

o Python Structure

o NumPy

o Pandas

o Matplotlib and Seaborn

o Scikit-learn

4 Introduction to Supervised Machine Learning

Types of Machine Learning Techniques (Supervised, Unsupervised and Reinforcement Learning)

• Supervised Learning

o Regression

o Classification

o Logistic Regression

o Support Vector Machines

o Decision Tree

o Random Forest

o K – Nearest Neighbors (KNN)

o Use cases of Regression and Classification

Introduction to Unsupervised Learning

• Clustering

o K – Means Clustering

o Hierarchical Clustering

o DBSCAN

• Dimensionality Reduction

• Anomaly Detection

• Use cases of clustering and Dimensional Reduction

• Building Machine Learning Model

• Model Evaluation and Validation

• Machine Learning Model Deployment

5 Deep Learning, Reinforcement Learning and Natural Language Processing

o Fundamentals of Deep Learning

o Convolutional Neural Networks (CNNs)

o Recurrent Neural Networks (RNNs)

o Natural Language Processing

o Reinforcement Learning

o TensorFlow and Kera

Generative AI

o Understanding of Gen AI

o Applications of Gen AI

o Development of Gen AI model

o Integration of Gen AI in Mobile App.

o Deployment

6 Deep Learning Applications

o Computer Vision

o Natural Language Processing

o Speech Recognition

o Model Deployment

7 Ethics and Responsibility in AI and Machine Learning

o Ethics in AI and ML

o Accountability and Responsibility

o Privacy and Data Protection

o Social Impact of AI

o Ethical Guidelines

INSTRUCTIONAL STRATEGY

The teacher should lay stress on the fundamentals of artificial intelligence and Machine Learning. The students must know about scope and future aspects of artificial intelligence and Machine Learning.

OPEN ELECTIVE-III

(Internet of Things) IOT

COURSE OBJECTIVE

This course is designed to develop skills on Internet of things (IOT) using latest software & Hardware. The course helps students to build IOT applications and devices using controller, sensors, actuators, and other electronic components. It also helps candidates to develop competency on latest technologies using IOT in various sectors such as home automation, smart city, agriculture, automotive, manufacturing etc. This course also provides opportunities for starting their own start up by developing novel IOT applications.

COURSE OUTCOMES

• Comply with Industry health and safety guidelines.

• Identify the market needs & customer demand analysis.

• Ability to develop basic circuit design and measurement techniques and calibration according to common engineering standards symbols, unit, schematics.

• Ability to generate ideas for upgrading existing product or creation of new product as per customer requirement.

• Ability to convert Ideas into reality by developing prototype model with the help of microcontrollers and wired or wireless protocols.

COURSE CONTENTS

1 Introduction to Industrial Safety Practices

• Fire Extinguishers & its Types

• Safely handling Tools & Equipment

• Use of proper Tools & Equipment & its maintenance

• OSH & practices to be observed as a precaution

2 Fundamentals of Internet of Things

• Introduction of Internet of Things

• Basics of electricals & electronics components used in IoT

• History of IoT

• Applications, Benefits and Limitations of IoT

• Important components of IoT – Micro Controller, Sensors, actuators, communication protocol, cloud etc

• IoT Architecture – Physical layer, Network layer, Data processing layer, Application layer.

3 IoT Microcontrollers and Single board computer

• Introduction to microcontroller

• Different types of microcontrollers, Arduino, Raspberry pi

• Introduction to input, output and PWM, interface of camera to raspberry pi, interface of various sensors to raspberry pi, IOT protocol (HTTP, MQTT, HTTPS) for RPI, Study connection of raspberry pi to cloud

• Important features of microcontroller

• Specification of microcontroller

• Selection of microcontroller based on IoT application.

• Basic programming of microcontroller

• Advanced programming of micro controller

• Debugging of program, Testing of program

4 IoT Sensors

• Introduction of Sensors

• Various types of Sensors and their applications

• Specifications of sensors

• Working principle of important sensors

• Comparison of sensors and relative advantages and limitations

• Selection of sensor based on IOT application.

• Interfacing of sensors with microcontroller to develop IOT application.

• Testing of sensors for IOT application

5 Use of Actuators for IoT applications

• Introduction to actuators

• Various types of actuators

• Working principle of actuator

• Applications of actuators

• Comparison of various actuators and relative advantages and limitations

• Selection of actuator based on IOT application

6 IoT Network Connectivity

• Introduction to IoT network technologies

• Various options for IoT connectivity

• Comparison of various options for IoT connectivity

• Selection of IoT connectivity based on application parameter like Range, Data size, Rate of data transfer, Type of data, Number of devices to be connected etc.

7 Cloud and Application of IoT

• Various options available to store IOT Data

• Comparison of storage options

• Storage on premises and Cloud

• IOT Database

• Selection of database

• Interfacing Database with IOT application

• Requirements for IoT applications

• Selection of sensors and actuators as per IoT application

• IoT dashboard building

• Authentication

• IoT application building as per real world application related to Smart

City, Healthcare, Automotive, Manufacturing.

• IoT based mobile application development

• Use of API in IoT application Building

• Basics of Machine Learning and AI

• Use of Machine Learning and Artificial Intelligence in IoT

• Industrial Use cases

INSTRUCTIONAL STRATEGY

The IoT can be a useful educational tool for students who use technology to solve unsolvable problems to increase their training skills. Students' academic behavior can also be tracked and recorded via wearable technology, which improves their interactive learning environment. IoT for education can help increase student engagement, create student-centered curriculums, and foster immersive language learning. Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities: Seminars, Library/Internet survey, MOOCs, Open source simulation software modules etc on relevant topics.

OPEN ELECTIVE-III

(INDUSTRIAL AUTOMATION & MES)

COURSE OBJECTIVE

This course is designed to provide a comprehensive understanding and hands on experience on Industrial Automation and Manufacturing Execution Systems (MES) to excel in the automation sector across various manufacturing domains. This includes Programmable Logic Controllers (PLC), Supervisory Control and Data Acquisition (SCADA), Human Machine Interfaces (HMI), Variable Frequency Drives (VFD), Manufacturing Execution System (MES), and the integration of these components to create cohesive and efficient systems. Participants will gain hands-on experience with the latest software and hardware tools, enabling them to adopt modern automation techniques in line with industry standards and build competency in the automation sector.

COURSE OUTCOME

• Adhere to industry health and safety standards when working with automation tools.

• Grasp the fundamentals of automation processes and their practical applications.

• Develop skills to program and operate Programmable Logic Controllers (PLCs).

• Select appropriate input and output devices for specific applications.

• Work with various industrial communication protocols.

• Understand the role and features of Human-Machine Interfaces (HMIs) in automation.

• Create dynamic HMI screens and manage alarms and events in HMI systems.

• Design recipes, manage security, and provide authorization in HMI systems.

• Learn about Variable Frequency Drives (VFDs) and their industrial uses.

CONTENTS

• Use of proper Tools & Equipment & its maintenance

• OSH & practices to be observed as a precaution

2 Fundamentals of Industrial Automation

• Introduction to industrial automation

• Need and application of automation

• Benefits of automation

• Types of Industrial automation

• Important Components of Automation

• Discrete, Continuous and Batch Manufacturing

• Open-loop vs. Closed-loop systems

• Introduction to PLC, HMI, VFD, SCADA, MES

• Industrial sensors: types and applications

• Actuators: motors, valves, pneumatics

• Signal conditioning and A/D conversion

• Process variables: temperature, pressure, flow, level

• PID control and its applications

• Control panel components and wiring standards

• Industrial communication protocols

3 Programmable Logic Controller (PLC)

• Introduction to Programmable Logic Controller (PLC)

• Types of PLCs and selection criteria.

• Application and advantages of PLC.

• Important components of PLC

• Numbering systems: binary, hexadecimal, BCD

• PLC memory organization and addressing.

• Explain sink and source concept.

• Interfacing of PLC with field devices.

• PLC communication protocols: Modbus, Profibus, ethernet/IP

• Types of PLC programming

• Ladder logic programming basics.

• Conditional logic: AND, OR, NOT, NAND, NOR XOR, XNOR Gates

• Timers and counters in PLC.

• Explain advance instruction used in PLC.

• Fault handling and troubleshooting in PLCs

• Industrial case study of PLC.

4 Variable Frequency Drive (VFD)

• Introduction to Variable Frequency Drive (VFD)

• Basics of AC motors

• Application of VFD

• Components of a VFD: rectifier, DC bus, inverter

• Types of VFDs: scalar control vs. vector control

• Connections and control mechanism

• VFD parameter configuration and settings

• Study motor protection and overload prevention

• Understand energy efficiency optimization using VFD

• Troubleshooting and fault diagnosis in VFDs

• Regenerative braking and energy recovery in VFD

• Learn Modbus and ethernet communication for VFDs

• Industry applications of VFD in HVAC, pumps, and conveyors

• Case study: VFD implementation for smart energy saving

• Interfacing of VFD with PLC & SCADA.

5 Human Machine Interface

• Introduction to HMI

• Role of HMI in industrial automation

• Components of HMI

• Compare HMI and SCADA

• Communication protocols in HMI

• User interface of HMI software.

• Building basic HMI control animations.

• Alarms and event logging

• Security and user access management

• Multi-screen navigation in HMI systems

• Study trending and historical data logging

• Communication between HMI and PLC

• SCADA-HMI integration

• Troubleshooting common issues in HMI.

• Industrial case study: HMI in production line

6 Supervisory Control and Data Acquisition (SCADA)

• Introduction to Supervisory Control and Data Acquisition (SCADA).

• Application and advantages of SCADA

• Important components of SCADA

• Block diagram of SCADA

• SCADA communication protocols.

• Types of tags and its usage.

• Explore the features of SCADA.

• User interface of SCADA software

• Building basic SCADA screens with animation.

7 Flexible Manufacturing System (FMS)

• Introduction to FMS and its importance in modern manufacturing

• Important Components of FMS, Advantages and Disadvantages of FMS

• Applications of Pneumatics in Manufacturing

• Use of Machine Vision, important components, sorting application

• Pick and Place concept and its important components

8 Overview of Manufacturing Execution Systems (MES)

• Introduction to manufacturing execution systems (MES)

• ISA 88 AND ISA 95

• MES architecture and MES core functionalities.

• Key functions of MES: production scheduling, quality control, tracking.

• MES data flow and communication protocols

• Real-time work order management in MES

• Resource allocation via MES

• MES reporting and dashboards for production insights

• Barcode integration for MES automation

• Exploring MES and industry 4.0: digital twin and smart manufacturing

• Case study: MES implementation in a smart factory.

DECE 509

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SUMMER INTERNSHIP (4-6 WEEK) (INDUSTRIAL TRAINING)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations.

The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details. The teacher along with field supervisors will conduct performance assessment of students. The

components of evaluation will include the following:

Punctuality and regularity 15%

Initiative in learning new things 15%

Presentation and VIVA 15%

Industrial training report 55%

6^{TH} SEMESTER

DECE 601 PROGRAM ELECTIVE-III

(MANAGERIAL ECONOMICS)

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COURSE OBJECTIVES

To provide diploma students with a basic understanding of economic principles and how they are applied in business decision-making. The course aims to develop the ability to analyze and interpret economic data, understand market behavior, and make informed managerial decisions to optimize resources and improve business performance.

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. After completion of the course the student will be able to.

CO1• Understand fundamentals of managerial economics and apply economic principles to business decisions.

CO2• Analyze demand, elasticity, and apply demand forecasting methods.

CO3• Explain production concepts and evaluate cost behavior and cost curves.

CO4• Identify different markets structures and analyze firm behavior under each market.

CONTENTS

UNIT 1- FUNDAMENTALS OF MANAGERIAL ECONOMICS (10 periods)

Nature and scope, meaning, goals and importance of managerial economics in business decision-making, Economic principles, Macroeconomics and Micro economics, Firm, nature and objective.

UNIT 2- DEMAND ANALYSIS AND FORECASTING (10 periods)

Theory of demand, factors influencing demand, and elasticity of demand, Demand Forecasting, Methods and techniques for forecasting demand.

UNIT 3- PRODUCTION AND COST ANALYSIS (12 periods)

Production, Production Function, Relationship between inputs and outputs, Production Analysis, Short-run and long-run production analysis, Law of Variable Proportions, Output behavior when one input varies and others are constant. Cost Analysis, Fixed cost, variable cost, total cost, marginal cost, average cost, Cost Curves.

UNIT 4- MARKET STRUCTURES (10 Periods)

Market Structures, Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly.

TEXT BOOKS/REFERENCE BOOKS

1. "Managerial Economics" by Dominick Salvatore
2. "Managerial Economics: Theory and Practice" by Thomas J. Webster
3. "Managerial Economics" by D. N. Dwivedi
4. "Managerial Economics and Financial Analysis" by Dr. N. Appa Rao & Dr. P. Vijay Kumar

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.

PROGRAM ELECTIVE-III

(FINANCE FUNDAMENTALS)

COURSE OBJECTIVES

The objective of this course is to enable the student to identify different ways to save money for future, understand various techniques to raise capital, get acquainted with the essential terminologies used in finance language, get exposed to banking, credit, investments, assets, different types of budgeting, instill the concept of costing and its impact on profitability. It also encompasses study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

COURSE OUTCOMES(CO):

Students will be able to:

CO1: Manage financial resources effectively to achieve personal goals.

CO2: Ensure that the business has enough money to meet its obligations and that it can recover in the future.

CO3: Exhibit financial literacy through the usage of different terminologies appropriate to the context.

CO4: Differentiate different types of budgeting and allocate the resources.

CO5: Apply the idea of marginal costing in decision making.

CONTENTS

Assets – Current Assets – Fictitious Assets – Liabilities – Long-term Liabilities – Current Liabilities – Internal Liabilities – External Liabilities – Share holders fund: Equity Share capital, Preference Share Capital, Reserve & Surplus – Borrowings: Debentures, Bank Loan, Other Loan – Depreciation – Reserve Vs Provision.

UNIT-4 BUDGETING **(08 Periods)**

Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales Budget – Production budget – Cash Budget – Flexible budgets. (With Problems)

UNIT-5 MARGINAL COSTING **(10 Periods)**

Marginal Costing – Meaning – Marginal Costing Vs Absorption Costing – Concepts of Variable Cost, Fixed Cost and Contribution – PV Ratio – Break Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (With Problems).

TEXT BOOKS/REFERENCE BOOKS

1. S. K. Sharma, Fundamentals of Financial Management, Sultan Chand & sons, New Delhi, 2024

2. L. Natarajan, Banking Theory, Law & Practice, 1st edition, Margham Publications, 2019

3. T.S. Reddy and Dr. Y. Hariprasad Reddy, Management Accounting, 1st edition, Margham Publications, 2005

4. T.S. Reddy and Dr. Y. Hariprasad Reddy, Cost Accounting, 1st edition, Margham Publications, 2012

5.Web resource: https://archive.nptel.ac.in/courses/110/107/110107144/

INSTRUCTIONAL STRATEGY

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. The teacher should actively engage students to boost their learning confidence, incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts, utilize demonstrations and plan interactive student activities for an engaging learning experience. The teacher employs a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.

PROGRAM ELECTIVE-III

(Cyber Security)

COURSE OBJECTIVES

• Introduce the fundamentals of cyber security, threats, and ethical practices.

• Explain the basic principles of cryptography and data encryption techniques.

• Describe network vulnerabilities and methods to protect network infrastructures.

• Provide knowledge about web application vulnerabilities and security techniques.

• Develop understanding of security policies, audits, and ethical hacking practices.

COURSE OUTCOMES(CO):

CO1: Identify and describe cyber threats, attacks, and security principles.

CO2: Understand and apply cryptographic techniques for securing communication.

CO3: Analyze network vulnerabilities and implement network security measures.

CO4: Detect web application vulnerabilities and apply security best practices.

CO5: Explain cyber security management practices, laws, and ethical hacking concepts.

CONTENTS

UNIT 1 – INTRODUCTION TO CYBER SECURITY (07 Periods)

Definition and Importance of Cyber Security, Cyber Threats and Attacks: Malware, Phishing, Ransomware, Social Engineering, Denial of Service (DoS) , Cyber Security Principles: Confidentiality, Integrity, Availability, Authentication, Non-repudiation Cyber Security in Electronics and IoT: Security concerns in embedded systems, smart devices, and industrial control systems Cyber Laws and Ethics: Overview of IT Act (2000), Data Protection Laws, Ethical Hacking.

UNIT 2 – CRYPTOGRAPHY AND ENCRYPTION (10 Periods)

Introduction to Cryptography: Basics of encryption and decryption, Types of Cryptographic Algorithms: Symmetric (AES, DES), Asymmetric (RSA, ECC), Hash functions (MD5, SHA), Public Key Infrastructure (PKI): Digital signatures, Certificates, Trust models, Applications of Cryptography: SSL/TLS, Secure Email, VPNs, Blockchain Cryptography in IoT and Embedded Systems: Key exchange protocols, securing communication between IoT devices

UNIT 3 – NETWORK SECURITY (07 Periods)

Introduction to Network Security: Concepts of firewalls, intrusion detection and prevention systems (IDS/IPS), Network Security Protocols: IPsec, SSL/TLS, HTTPS, SSH VPNs and Proxies: Understanding Virtual Private Networks and Proxy Servers for secure communication Securing Wireless Networks: Wireless security standards (WPA, WPA2, WPA3), threats to wireless networks

UNIT 4 – WEB AND APPLICATION SECURITY (09 Periods)

Web Application Vulnerabilities: XSS (Cross-Site Scripting), SQL Injection, CSRF (Cross Site Request Forgery) Web Security Measures: Web Application Firewalls (WAFs), Secure Coding Practices, Input validation Secure HTTP (HTTPS): SSL/TLS in securing web traffic Mobile and IoT Application Security: Securing mobile applications, secure communication in

IoT.

UNIT 5 – CYBER SECURITY MANAGEMENT AND ETHICAL HACKING

(09 Periods)

Cyber Security Policies and Risk Management: Establishing security policies, risk assessment, and mitigation strategies Security Audits: Understanding how to conduct a security audit, common audit frameworks Ethical and Legal Issues: Legal aspects of hacking, cyber security compliance, and international regulations.

TEXT BOOKS/REFERENCE BOOKS

1. Cyber Security Essentials by Charles J. Brooks

2. Principles of Information Security by Michael E. Whitman and Herbert J. Mattord

3. Network Security Essentials by William Stallings

4. Introduction to Modern Cryptography by Jonathan Katz and Yehuda Lindell

5. Ethical Hacking and Penetration Testing Guide by Rafay Baloch

6. Cyber Security and Cyber Laws by S. B. S. K. Sharma (Indian Author)

7. Cyber Security: Understanding Cyber Crimes, Computer Forensics, and Legal Perspectives by Nishith Chhapparia (Indian Author).

PROGRAM ELECTIVE-III

(Data Science)

COURSE OBJECTIVES:-

• Learn the basics of Data Science and its use in electronics.

• Gain skills in collecting, cleaning, and analyzing data.

• Use Python with tools like NumPy and Pandas.

• Understand basic machine learning and how it applies to electronics.

• Apply data science in areas like IoT, automation, and signal processing.

COURSE OUTCOMES (CO):-

CO1• Understand the basic concepts of Data Science, its scope, and its applications in the field of electronics.

CO2• Identify and handle different types of data and perform basic data visualization and statistical analysis.

CO3• Write Python programs for data processing using NumPy and Pandas with a focus on electronics datasets.

CO4• Apply basic machine learning techniques to solve problems related to electronics systems.

CO5• Analyze real-world data science applications in IoT and electronics and develop a mini capstone project.

CONTENTS

UNIT 1 – INTRODUCTION TO DATA SCIENCE (08 Periods)

What is Data Science? Evolution and Importance, Data Science vs. Data Analytics vs. Machine Learning, Applications in Electronics: IoT, Automation, Signal Processing Overview of Data Science Workflow

UNIT 2 – DATA HANDLING AND VISUALIZATION (08 Periods)

Types of Data: Structured, Unstructured, Time-Series, Data Collection Methods (from sensors, logs, APIs), Data Cleaning Techniques, Introduction to Excel and CSVs, Visualization with Matplotlib / Seaborne / Excel, Basics of Statistics (mean, median, mode, std. dev.)

UNIT 3 – PYTHON FOR DATA SCIENCE - (08 Periods)

Why Python for Data Science? Basics of Python Programming (variables, loops, functions) ,

Libraries: NumPy, Pandas – Data Manipulation , Reading sensor data from files , Mini

project: Handling electronics-related datasets (e.g., temperature, voltage logs)

UNIT 4 – INTRODUCTION TO MACHINE LEARNING - (08 Periods)

Supervised vs. Unsupervised Learning, Algorithms Overview: Linear Regression, KNN, Decision Trees, Real-world examples in electronics (e.g., fault prediction, pattern detection), Model Training, Testing, and Evaluation .

UNIT 5 – REAL-WORLD APPLICATIONS OF DATA SCIENCE - (10 Periods)

Data Science in IoT & Smart Devices, Signal and Image Data Analysis Basics, Introduction to Big Data Concepts (brief) , Ethics in Data Science and AI , Capstone Project Guidelines.

TEXT BOOKS/REFERENCE BOOKS

1. "Doing Data Science" by Cathy O'Neil & Rachel Schutt

2. "Data Visualization with Python and JavaScript" by Kyran Dale

3. "Python Data Science Handbook" by Jake VanderPlas

4. "Machine Learning for Absolute Beginners" by Oliver Theobald

5. "Data Science for IoT Engineers" by Perry Lea

6. Data Science & Machine Learning by Rashmi Singh

DECE 602

Entrepreneurship And Start-UP

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COURSE OBJECTIVES:

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

COURSE OUTCOMES(CO):

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

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

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

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

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

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

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

COURSE CONTENTS

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

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

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

Discovering ideas and visualizing the business

Activity map

Business Plan (Case Study)

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

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

Unit – IV: Management (06 Periods)

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

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

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

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

Ways of succession

Types of Dissolution

NSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

• Assignments and quiz/class tests

• Mid-term and end-term written tests

• Model/Proto type making.

RECOMMENDED BOOKS:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company – Steve Blank and Bob Dorf, K & S Ranch, ISBN: 978-0984999392

2. Entrepreneurship Development (A New Venture Creation) – Vasant Desai, Himalaya Publishing House

3. Entrepreneurship Development – S.S. Khanka, S. Chand & Company Ltd., New Delhi

4. Entrepreneurship Development – Gupta and Srinivasan, S. Chand & Company Ltd., New Delhi

5. Demand: Creating What People Love Before They Know They Want It – Adrian J. Slywotzky with Karl Weber, Headline Book Publishing, ISBN: 978-0755388974

6. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses – Eric Ries, Penguin UK, ISBN: 978-0670921607

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DECE 603

PROGRAM ELECTIVE-IV

(Mobile & Wireless Communication)

COURSE OBJECTIVES

Wireless and mobile communication technologies, though complex, are expanding at a rapid pace. Mobile communication has largely replaced traditional landline systems, and it is anticipated that mobile communication will become nearly universal in the near future. As the technology continues to evolve rapidly, it is essential for students to understand the functioning, architecture, and operational principles of wireless and mobile communication systems. This course aims to equip students with fundamental knowledge and practical understanding of wireless/mobile communication systems, enabling them to stay updated with current and emerging communication technologies.

COURSE OUTCOMES (CO):

The course is designed to develop students' learning across the cognitive, psychomotor, and affective domains, enabling them to achieve the following outcomes:

CO1• Identify and explain the features, specifications and working principles of cellular mobile communication systems.

CO2• Understand and explain the concepts of wireless signal propagation and its impact on communication performance.

CO3• Interpret the evolution and generations of cellular mobile communication systems.

CO4• Analyze and compare multiple access techniques used in wireless communication, such as FDMA, TDMA, and CDMA.

CO5• Differentiate between various mobile communication systems based on their architecture, standards, and applications.

CONTENT

UNIT 1- WIRELESS COMMUNICATION AND PROPAGATION (06 Periods)

Basics, Advantages of wireless communication, Electromagnetic waves, Frequency Spectrum used, Cellular Network Systems, Link budget, Free-space path loss, Noise figure of receiver, Multipath fading, Shadowing, fading margin, Shadowing margin.

UNIT 2 - OVERVIEW OF CELLULAR SYSTEMS (08 Periods)

Evolution 1G/2G/3G/4G/5G Cellular Concepts – Cell area, Cell site structure, Capacity of cell, Frequency reuse, Co channel and Adjacent Channel Interference, Power Control for reducing Interference, Fundamentals of cellular network planning: Coverage planning, Capacity planning, Cell splitting and sectoring Antenna diversity, wireless channel capacity and MIMO.

UNIT 3 -MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION

(06 Periods)

Introduction to Multiple Access. Frequency Division Multiple Access (FDMA). Time

Division Multiple Access (TDMA), Distinction between TDMA FDD and TDMA TDD, Code

Division Multiple Access (CDMA), WCDMA.

UNIT 4 - MOBILE COMMUNICATION SYSTEMS (8 periods)

Introduction of Global Systems for Mobile Communication (GSM) and its architecture, Introduction of CDMA System, comparison of CDMA and GSM Systems and frequency bands.

Introduction to GPRS and EDGE, Introduction to Architecture and Features of UMTS HSPA (High Speed Packet Access), Features and Architecture of LTE (Long Term Evolution), Vo-LTE (Voice Over Long-Term Evolution).

INSTRUCTIONAL STRATEGY

The teacher should lay stress on the concept of wireless propagation, cellular systems and multiple access techniques. The students must know about Bluetooth and Wi-Fi Technologies, and the various mobile communication system.

PROGRAM ELECTIVE-IV

(VLSI Using VHDL)

COURSE OBJECTIVES

Very Large Scale Integration (VLSI) technology plays a vital role in the design and implementation of modern digital systems. Hardware Description Languages (HDLs) provide a structured and efficient way to model, design, and verify digital hardware. This course aims to introduce students to the fundamentals of VLSI design using HDL, with emphasis on the design and analysis of combinational and sequential digital circuits. The course also focuses on simulation and functional verification of digital systems using the VHDL Hardware Description Language, and provides exposure to programmable logic devices such as CPLDs and FPGAs.

COURSE OUTCOMES

The course is designed so that theory and laboratory components together enable students to achieve the following learning outcomes:

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

CO1• Explain the concepts and operation of NMOS and CMOS logic circuits.

CO2• Describe the stages involved in the VLSI design process.

CO3• Understand and apply various VHDL constructs and statements.

CO4• Develop and simulate VHDL code for combinational and sequential digital circuits.

CO5• Demonstrate familiarity with CPLD and FPGA architectures and their applications.

CONTENT

UNIT 1- **(6 Periods)**

Levels of abstraction in VLSI design, Stages in the VLSI design process: Design Entry, Simulation, Synthesis, Placement, and Routing, Implementation of NOT, AND, OR, NAND, and NOR gates using NMOS, Implementation of NOT, AND, OR, NAND, and NOR gates using CMOS, Design of simple combinational circuits using NMOS, Design of simple combinational circuits using CMOS.

UNIT 2- **(06 Periods)**

Types of HDL, Various modeling techniques, Fundamentals of VHDL language: module,

Data types, Operators: Arithmetic operators, Logical shift operators, Relational operators,

Logical operators, Syntax for Continuous assignment statements, Procedural assignment statements, Timing control, wait statement, Syntax for control statements.

UNIT 3- (06 Periods)

VHDL code for Half Adder and Full Adder, VHDL code for Half Subtractor and Full Subtractor, VHDL code for 4-to-1 Multiplexer, 1-to-4 Demultiplexer, VHDL code for 4-to-2 Encoder, 2-to-4 Decoder..

Unit 4- (6 Periods)

VHDL code for D, JK, and T Flip-flops, VHDL code for 3-bit Shift register, VHDL code for 3-bit up counter, VHDL code for 3-bit down counter, VHDL code for 3-bit up-down counter.

UNIT 5- (04 Periods)

Introduction to PROM, PLA, and PAL – Design of combinational circuits using PROM, PAL, and PLA (up to 3 variables).

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.

PROGRAM ELECTIVE-IV

(POWER ELECTRONICS DEVICES)

COURSE OBJECTIVES

The objective of this course is to introduce students to the fundamental concepts, principles, and applications of power electronics and power semiconductor devices. The course focuses on the working principles, characteristics, and applications of power semiconductor devices such as MOSFETs, IGBTs, and thyristors. It also aims to develop an understanding of the operation, analysis, and applications of power converters, including DC–DC converters (choppers) and inverters, with emphasis on their role in energy conversion systems. The course provides practical exposure through hands-on experiments and simulations involving power electronic circuits. Additionally, students are introduced to the integration of power electronic systems in renewable energy applications such as solar and wind energy, along with associated power quality considerations.

COURSE OUTCOMES (CO):

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

CO1• Explain the fundamental concepts of power electronics and the operating principles of power semiconductor devices such as MOSFETs, IGBTs, and thyristors, along with their real-world applications..

CO2• Analyze the characteristics and performance of power semiconductor devices and apply appropriate devices for specific power electronic applications.

CO3• Design, simulate, and analyze DC–DC power converters (choppers) and evaluate their role in energy conversion systems.

CO4• Design, simulate, and implement inverters and DC–DC converters, and explain their control strategies.

CO5• Apply power electronic systems in renewable energy applications such as solar and wind energy systems, and analyze power quality issues associated with these systems.

CONTENT

UNIT -1 INTRODUCTION TO POWER ELECTRONICS AND POWER SEMICONDUCTOR DEVICES (06 Periods)

Introduction to Power Electronics: Definition, Basic concepts and Applications, Power Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-N-channel Enhancement Power MOSFET, Insulated Gate Bipolar Transistor (IGBT)- Symbol, Principle of Working, Voltage Current (V-I) Characteristics, and its applications.

UNIT- 2 THYRISTOR FAMILY DEVICES (06 Periods)

SCR, DIAC, TRIAC, UJT – Symbol, working principle, Characteristics and applications.

UNIT -3 CHOPPERS & CONVERTERS (05 Periods)

Introduction to DC-DC converters (Choppers), Working principle and classification of choppers : Step-up (Boost) Converter, Step-down (Buck) Converter, Buck-Boost Converter, Cuk Converter, Types of Choppers, Applications of Choppers. Single Phase Full Controlled Bridge Converter with R Load and RL load. Introduction to Inverters, Types of inverters, Basic Operation, Control Strategies, Applications.

UNIT -4 INVERTERS (05 Periods)

Introduction to Inverters, Types of inverters, Basic Operation, Control Strategies, Applications. Inverter with Resistive Load, Single Phase Inverter with RL load –Methods to obtain Sine Wave output from an Inverter.

UNIT 5, APPLICATIONS OF POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS (06 Periods)

Solar Power Electronics: Solar cells, solar panels, and the working principle of photovoltaic systems, Power converters in solar systems: DC-DC converters, MPPT (Maximum Power Point Tracking), and solar inverters, Grid integration of solar power, Wind Power Electronics: Wind energy conversion systems and their components, Power electronics for controlling wind turbines and grid integration, Energy Storage Systems: Role of energy storage in renewable energy systems: Batteries, super capacitors, and hybrid systems. Power quality issues in renewable energy and their mitigation using power electronics.

INSTRUCTIONAL STRATEGY

• Involve and Motivate: To increase students' confidence in their ability to learn, teachers should actively involve their students.

• Real-World Relevance: To aid students in comprehending and appreciating course contents, include realistic, real-life examples and engineering applications.

• Interactive Learning: To create an engaging learning environment, use demonstrations and organize interactive student activities.

• Application-Based Learning: To guarantee outcome-driven learning and employability, use a theory-demonstrate-practice-activity approach throughout the course.

• Simulation and Real-World Practice: Perform practical exercises and demonstrations in a simulated setting, moving into real-world situations where practical.

• Promote Critical Analysis: Create an atmosphere where students may objectively evaluate the results of experiments and examine possible causes of inconsistencies.

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DECE 604
PROJECT WORKS

GENERAL OBJECTIVE:

Purpose of the project work is :

(i) To develop abilities of diagnosing problems.

(ii) To develop the abilities to :

(a) Make literature survey.

(b) Design/develop/fabricate/test simple circuits.

(c) Prepare documents for electronic work.

(d) Work as a team.

LIST OF PROJECTS (TO BE ASSESSED INTERNALLY):

The list of projects shown below is indicative of general nature and the complexity work to be entrusted to students. (Teachers can modify this list to shut local needs and constraints keeping the level of complexity as suggested here).

1. To make simple circuit which will demonstrate the use of transistor as a switch. (The student should measure Ic and Vce in this circuit when Ib is varied from zero to maximum value and measures the value of Ib (sat), Ic (sat), Vce (sat) and Hfe (min) for saturation at a given supply voltage and load.
2. To calculate the values and assemble and test simple transistor switching circuit to switch on a
(a) LED.
(b) Relay.
(c) 200/500 ma. lamp. (6v/12v).
3. Make a battery eliminator
4. Make a battery charger.
5. Fabricate (including making PCB) and testing of regulated power supply (series and shunt circuit using zener diode &IC type).
6. Assembly and testing of a two band transistor radio receiver.
7. Fabrication and testing of any ICs of consumer interest, For example.
(a) Fan regulator/Light dimmer.
(b) Timer using IC 555.
(c) Burglar's alarm.
(d) Digital clock.

The list is only suggestive, more items may be included.

LIST OF PROJECTS

NOTE: The list of projects shown below is to be used as a guideline by the BTE(UP) for drawing up the project list for the diploma examination. Expert team formulating the final list may consult this list to ensure that the complexity level is consistent with the guideline set here.

1. AMPLIFIERS:
1.1Simple transistor / FET / IC amplifier to meet the given specifications.
1.2Audio frequency mono/stereo amplifier including usual control facilities (including power amplifier and power supply stages).
2. OSCILLATORS:
2.1Sine wave oscillators of given specifications using transistors/FETs/ICs (tuned oscillators,
phase shift, including Wein's Bridge oscillators).
2.2Multivibrators of different types to produce square wave output signals of given specifications
(Monostable, Bistable and Astable) using transistor FET or IC circuits.
2.3 Simple function generators.
3. POWER SUPPLIES:
3.1Single dual and multiranged low voltage and low power fixed variable D.C. power supplies of different specifications using transistor and regulator ICs.
4. TIMERS AND OPERATIONAL AMPLIFIERS:
4.1 Timers of different types using 555/556 ICs.
4.2Amplifiers, oscillators, active filters, differentiations, integrator, scale changer and other simple circuits using operational modules.
5. DIGITAL CIRCUITS:
5.1 Simple three digit counter.
5.2 24 hour and 12 hour digital clock.
5.3 Electronic multimeter.
5.4 A/D and D/A convertors.
5.5 Interface circuits using Microprocessors.
6. MISCELLANEOUS CIRCUITS:
6.1Fan regulators, motor speed control, phase controlled rectifier and similar circuits using Thyristor/Triac/Diac/UJT and similar PNPN devices.
7. RADIO RECEIVER:
7.1 Simple one or two band AM radio receiver.
7.2 Simple trans receiver.
8. Mobile Phone based devices and Microcontroller based devices.
NOTE:-
1. Depending upon the complexity of the work, the teacher may assign any number of project
work to a group. The group size will also be similarly decided by the teacher, normally between 2 to 4 students per group.
2. The board may request all heads of Electronics Engineering Departments of U.P. Polytechnics
to provide list of
projects. An expert committee may be appointed to screen the project list.
3. The BTE (UP) may adopt the following format for the project report.

FORMAT

A project report (of about 100 typed computer pages) should submitted covering the following points.

1. Basic design procedure for the project circuit.
2. Full block diagram and/or circuits diagram showing the component values.
3. Component layout diagram, including component and copper side details of the PCB used.
4. List of components used showing types voltage/current ratings, tolerance values and other specifications.
5. Details of heat sink used IC and Transistor pin connections and types of packages.
6. Front panel layout and chassis details. (as relevant)
7. Test and measurement procedure.
8. Discussion on the deviation of the results from the given specifications.
9. Estimating and costing with discussion about selection of components from cost point of view.

NOTE: For specialization Digital Electronics and Microprocessors and Radio, Audio Video Engineering, Mobile Communication more project in these subjects should be given by the teachers.

9. AMPLIFIERS:

9.1Simple transistor / FET / IC amplifier to meet the given specifications.

9.2Audio frequency mono/stereo amplifier including usual control facilities (including power amplifier and power supply stages).

10.OSCILLATORS:

10.1Sine wave oscillators of given specifications using transistors/FETs/ICs (tuned oscillators, phase shift, including Wien's Bridge oscillators).

10.2Multivibrators of different types to produce square wave output signals of given specifications
(Monostable, Bitable and Astable) using transistor FET or IC circuits.

10.3Simple function generators.

11.POWER SUPPLIES:

11.1Single dual and multiranged low voltage and low power fixed variable D.C. power supplies of different specifications using transistor and regulator ICs.

12. TIMERS AND OPERATIONAL AMPLIFIERS:

12.1Timers of different types using 555/556 ICs.

12.2Amplifiers, oscillators, active filters, differentiations, integrator, scale changer and other simple circuits using operational modules.

13.DIGITAL CIRCUITS:

13.1Simple three digit counter.
13.224 hour and 12 hour digital clock.
13.3Electronic multimeter.
13.4A/D and D/A convertors.
13.5Interface circuits using Microprocessers.
14.MISCELLANEOUS CIRCUITS:
14.1Fan regulators, motor speed control, phase controlled rectifier and similar circuits using Thyristor/Triac/Diac/UJT and similar PNPN devices.
15.RADIO RECEIVER:
15.1Simple one or two band AM radio receiver.
15.2Simple transreceiver.
16. Mobile Phone based devices and Microcontroller based devices.
NOTE:-
4. Depending upon the complexity of the work, the teacher may assign any number of project work to a group. The group size will also be similarly decided by the teacher, normally between 2 to 4 students per group.
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