Final

# DIPLOMA CURRICULUM OF APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING (AEIE) (THIRD YEAR) (5th Semester)

**(To be implemented from 2026-27)**

***Prepared by;***

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## PROGRAMMETITLE: APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING

### SEMESTER - V

| SL. No | Category of Course | Code No | Course Title | Study Scheme | | | | Evaluation Scheme | | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Pre-requisite | Contact Hours/ week | | | Theory | | Practical | | | |
| | | | | | L | T | P | End Exam | Progressive Assessment | End Exam | Progressive Assessment | | |
| 1 | Programme Core | AEIEPC301 TH: 1 | Industrial Instrumentation and Control | | 3 | 0 | 0 | 70 | 30 | - | - | 100 | 3 |
| 2 | | AEIEPC303 TH: 2 | Microprocessor and Its Interfacing | | 3 | 0 | 0 | 70 | 30 | - | - | 100 | 3 |
| 3 | | AEIEPC305 PR:1 | Industrial Instrumentation and Control Lab | | 0 | 0 | 4 | - | - | 15 | 35 | 50 | 2 |
| 4 | | AEIEPC307 PR:2 | Microprocessor and Microcontroller Lab | | 0 | 0 | 4 | - | - | 15 | 35 | 50 | 2 |
| 5 | Programme Elective | AEIEPE301 (Any one) TH: 3 | (A)Fundamentals of Power Electronics<br>(B)Biomedical Instrumentation<br>(C) IoT and its Applications | | 3 | 0 | 0 | 70 | 30 | - | - | 100 | 3 |
| 6 | | AEIEPE303 (Any one) TH: 4 | (A)Analytical Instrumentation<br>(B) Power Plant Instrumentation<br>(C). PLC programming and Automation | | 3 | 0 | 0 | 70 | 30 | - | - | 100 | 3 |
| 7 | | AEIEPE305 (Any one) PR:3 | (A) Fundamentals of Power Electronics Lab<br>(B)PLC programming and Automation Lab<br>(C)IoT and its Applications Lab | | 0 | 0 | 4 | - | - | 15 | 35 | 50 | 2 |
| 8 | Open Elective | Open Elective - I OE301 (Any one) TH: 5 | (A)Universal Human Values<br>(B)Leadership & Management Skills<br>(C) Professional Skills | | 3 | 0 | 0 | 70 | 30 | - | - | 100 | 3 |
| 9 | Summer Internship | SI301 | SUMMER INTERNSHIP II* | | 0 | 0 | 0 | - | | 15 | 35 | 50 | 2 |
| 10 | Major Project | PR301 PR:4 | MAJOR PROJECT | | 0 | 0 | 4 | - | | 15 | 35 | 50 | 2 |
| **TOTAL** | | | | | **15** | | **16** | **350** | **150** | **75** | **175** | **750** | **25** |

*3-4-weeks Internship after 4th Semester

***The best of 2 IA conducted in a subject out of 20 marks to be considered. Assignment/ quiz etc. of 10 marks to be treated as part of IA. Besides this, Monthly Test to be conducted for each subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester. Club/Innovation/ Idea Tinkering Activities etc. shall be encouraged to be performed by students beyond the above stipulated hours.**

**Annexure - I**

OE 301 /302/304 Open Electives (Any three)

**Bundle I**

(A) Soft Computing Techniques
(B) Artificial Intelligence
(C) Artificial Intelligence & Machine Learning
(D) Internet of Things
(E) Web Designing and Multimedia Technology
(F) Virtual Reality
(G) Data Analytics

**Bundle II**

(A) Project Management
(B) Product Design
(C) Operations Research
(D) Mechatronics
(E) Robotics
(F) Industrial Robots
(G) 3-D Printing
(H) Industry 4.0

**Bundle III**

(A) Economic Policies in India
(B) Engineering Economics & Accountancy
(C) Cyber Security Laws, Standards and IPR
(D) Introduction to E-Governance
(E) Disaster Management
(F) Sustainable Development

**Bundle IV**

(A) Universal Human Values
(B) Leadership and Management Skills
(C) Professional Skills
(D) Foreign language Skills (any one language: German, Japanese, French …)

# SEMESTER - V COURSES

# TH: 1- INDUSTRIAL INSTRUMENTATION AND CONTROL

| L | T | P | | Course Code: AEIEPC301 | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

This subject will give the detail knowledge to the student about different types of process control system and modern process instrumentation used in industries for implementing Automation. Student can know about various controller and control system to monitor various process parameter.

## LEARNING OUTCOMES:

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

- Explain the concept of Industrial Process & Control Systems.
- Describe various control actions.
- Explain the working principle of different types of controllers.
- Analyse the characteristics of processes
- Explain the final control element.

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I.** | **Introduction to Industrial Process & Control Systems:**<br>1.1 Concept of Industrial process<br>1.2 Classification of process variables<br>1.3 Concept of open loop and closed loop control system.<br>1.4 Difference between manual and automatic control systems.<br>1.5 Different elements in automatic close loop control systems.<br>1.6 Differential pressure transmitters and its applications<br>1.7 Block diagram representation of control system, block diagram algebra. Concept of transfer function of process.<br>1.8 Simple problem | **8** |
| **II.** | **Various Control Actions:**<br>3.1 Different type of control action.<br>3.2 Principle of ON/OFF control action.<br>3.3 Principle of proportional control action.<br>3.4 Principle of integral control action.<br>3.5 Principle of Derivative control action. | **8** |

| | | |
|---|---|---|
| | 3.6 Principle of composite control action [ P+I, P+D,P+I+D) .<br>3.7 Principle of floating control.<br>3.8 Comparison of various control actions. | |
| **III** | **Controllers:**<br>4.1 Definition of Controllers.<br>4.2 Classification of controller (Pneumatic, Hydraulic, Electrical and Electronic control system).<br>4.3 Flapper Nozzle system, Pneumatic Relay, Pneumatic ON/OFF.<br>4.4 Three mode (PID Pneumatic controller).<br>4.5 Hydraulic Control system with Examples.<br>4.6 Hydraulic proportional, integral and Derivative controller.<br>4.7 Advantages and Disadvantage of Pneumatic and Hydraulic control system..<br>4.8 Electronic controller with example.<br>4.9 Realization of various control mode action using OP-AMP – ON/OFF ,Proportional ,integral, Two mode and three mode using OP-AMP.)<br>4.10 Comparison of Pneumatic and Hydraulic and Electronic controller.<br>4.11 Tuning of controller: Concept, need of tuning, methods of tuning | **12** |
| **IV** | **Characteristics of Process Control:**<br>5.1 Dynamic elements in control loop (negative feedback, Dead time ,capacitive characteristics of real process).<br>5.2 Analysis of self-operating proportional controller for Flow level.<br>5.3 Explain the idea about proportional band, delay, dead time process, Transfer function, Bandwidth , Gain and Offset error of process control.<br>5.4 Explain the characteristics of pneumatic PID Controller and its application. | **9** |
| **V** | **Final Control Element:**<br>5.1 Different types of On Off and regulating Control Valve<br>5.2 Different parts of a Globe valve<br>5.3 Valve actuator<br>5.4 Explain briefly the working principle and use of I/P converter, positioned, Air Filter Regulator, Purge Regulator (constant DP regulator)<br>5.5 Idea on Control valve Characteristics, CV selection & sizing , cavitation, flashing, rangeability<br>5.6 Specification of Control Valve<br>5.7 Installation of Control valve with manifolds. | **8** |

**REFERENCES:**


| | |
|---|---|
| **1.** | Transducers and Instrumentation, D. V. S. Murthy, Prentice-Hall |
| **2.** | Principles of Industrial Instrumentation; by D Patranabish; Tata McGraw Hill |
| **3.** | Fundamentals of Instrumentation and Measurement, Edited by Dominique Placko, by ISTE |
| **4.** | Introduction to Measurements and Instrumentation, A. K. Ghosh, Prentice-Hall |
| **5.** | Measurement Systems: Application and Design, E. O. Doebelin, McGraw Hill |
| **6.** | Principle of Measurement Systems, J. P. Bentley, Pearson Education |
| **7.** | Instrumentation for Engineering Measurements, James W. Dally, William F. Riley, Kenneth G. McConnell, John Wiley & Sons |

# TH: 2- MICROPROCESSOR AND ITS INTERFACING

| L | T | P | | Course Code: AEIEPC303 | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

The modern digital systems including computer systems are designed with microprocessor as central processing device connected to memory and I/O devices. This subject introduces the students with basics of microprocessor and microcontroller, architecture and programming of microprocessor and microcontroller, interfacing of microprocessor and microcontroller with memory and various I/O (Input/Output) devices.

## LEARNING OUTCOMES:

After completion of the course the students will be able to

- Demonstrate the various features of microprocessor, memory and I/O devices including concepts of system bus.
- Identify the hardware elements of 8085 microprocessor including architecture and pin functions and programming model including registers, instruction set and addressing modes.
- Select appropriate 8085 and 8051 instructions based on size and functions to write a given assembly language program.
- Design a given interfacing system using concepts of memory and I/O interfacing.

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I** | **Architecture of 8085 Microprocessor**<br>1.1 Functional Block Diagram<br>1.2 Registers, ALU, Bus systems, Timing and control signals,<br>1.3 Machine cycles and timing diagrams. | 7 |
| **II** | **Programming of 8085**<br>2.1 Instruction formats,<br>2.2 Addressing modes,<br>2.3 Instruction set,<br>2.4 Need for Assembly language – Development of Assembly language programmes. | 9 |
| **III** | **Memory Interfacing** | 9 |

| | | |
|---|---|---|
| | 3.1. Interface requirements<br>3.2 Address space partitioning<br>3.3 Buffering of Buses – timing constraints<br>3.4 Memory control signals – Read and write cycles<br>3.5 Interfacing SRAM, EPROM and DRAM sections. | |
| **IV** | **I/O Interfacing**<br>4.1 Memory mapped I/O Scheme – I/O mapped I/O scheme<br>4.2 Input and Output cycles, Simple I/O ports<br>4.3 Programmable peripheral interface (8255).<br>4.5 Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes<br>4.6 Interfacing – Simple keyboards and LED displays. | 10 |
| **V** | **Interrupts and DMA**<br>5.1 Interrupt feature – Need for interrupts – Characteristics of Interrupts – Types of Interrupts – Interrupt structure – Methods of servicing interrupts – Development of Interrupt service subroutines – Multiple interrupt request and their handling<br>5.2 Need for direct memory access – Devices for Handling DMA – Programmable DMA controller 8237. | 10 |

## REFERENCES:


| | |
|---|---|
| 1. | Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997. |
| 2. | Douglas, V.Hall., "Microprocessor and Interfacing Programming and Hardware", 2nd Edition, McGraw Hill |
| 3. | Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987Communication System by V. Chandrasekhar, OXFORD Publication |
| 4. | Microcontroller Hand Book, INTEL, 1984 |

# PR:1- INDUSTRIAL INSTRUMENTATION AND CONTROL LAB

| L | T | P | | |
|---|---|---|---|---|
| 0 | 0 | 4 | | **Course Code: AEIEPC305** |
| **Total Contact Hours** | | | | **Laboratory Assessment** |
| Practical | | : 60Hrs | **Total Marks: 50** | End Term Exam 15 |
| | | | | Progressive Assessment 35 |
| **Pre-Requisite** | | **: NIL** | | |
| | | | | |
| **Credit** | | **2** | | Category of Course: PC |

**RATIONALE:**

The student will be having exposure to controller used on –line system in addition to that they will be able to apply the knowledge of Industrial Instrumentation in actual fields. The Lab focuses on design and implementation of controllers for different processes. Temperature process trainer; Pressure process trainer; Flow process trainer; Level process trainer; Multi process trainer can be used by the students.

**LEARNING OUTCOMES:**

After completion of the Lab the students will be able to

- Demonstrate the performance of Differential Pressure transmitter.
- Demonstrate the performance of level, flow, temperature and Pressure process
- Describe the performance of DC motor speed and position Control systems.
- Explain the characteristics of I to P & P to I Converter
- Construct OPAMP based P. PI, PID controller

**DETAILED COURSE CONTENTS**

| Sl No | List of Experiments |
|---|---|
| I | Study the Performance of Differential Pressure transmitter. |
| II | Study the Performance of ON/OFF, P, PI, PID controller on flow process. |
| III | Study the Performance of ON/OFF, P, PI, PID Controller on pressure process |
| IV | Study the Performance of ON/OFF, P, PI, PID Controller on Level process. |
| V | Study the Performance of ON/OFF, P, PI, PID Controller on Temperature process. |
| VI | Study the Performance of DC motor position control using P-I-D control action |
| VII | Study the Performance of DC motor speed control using P-I-D control action |
| VIII | Study the Performance of I to P Converter & P to I Converter |
| IX | Construct of proportional, proportional + integral and proportional + integral+ derivative controller using OP-AMP |
| X | Study the Performance of Different types of On Off and regulating Control Valve |

# PR:2- MICROPROCESSOR AND MICROCONTROLLER LAB

| L | T | P | | Course Code: AEIEPC307 | |
|---|---|---|---|---|---|
| 0 | 0 | 4 | | | |
| **Total Contact Hours** | | | **Total Marks: 50** | **Laboratory Assessment** | |
| Practical | | : 60Hrs | | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| **Pre-Requisite** | | **: NIL** | | | |
| | | | | | |
| **Credit** | | **2** | | Category of Course: PC | |

**RATIONALE:**

The modern digital systems including computer systems are designed with microprocessor as central processing device connected to memory and I/O devices. This subject introduces the students with basics of microprocessor and microcontroller, architecture and programming of microprocessor and microcontroller, interfacing of microprocessor and microcontroller with memory and various I/O (Input/Output) devices.

**LEARNING OUTCOMES:**

After completion of the Lab the students will be able to

- Execute variety of assembly language programs of Intel 8085 including arithmetic and logical, sorting, searching, and string manipulation operations.
- Execute the assembly language programs for interfacing Intel 8086 with peripheral devices.
- Execute simple programs on 8051 micro-controllers.
- Design a given interfacing system using concepts of memory and I/O interfacing.

**DETAILED COURSE CONTENTS**

| Sl No | List of Experiments on |
|---|---|
| 1. | Introduction to 8085 microprocessor kit and 8051 microcontroller kit |
| 2. | Arithmetic Operations of 8085 microprocessor kit. |
| 3. | Sorting of Array of 8085 microprocessor. |
| 4. | Digital Clock Design using 8085 |
| 5. | Interfacing ADC&DAC to 8085 |
| 6. | Interfacing stepper motor to 8085 |
| 7. | Arithmetic, Logical and Bit Manipulation Instructions of 8051 |
| 8. | Timer/Counters in 8051 |
| 9. | Interrupt Handling in 8051 |
| 10. | UART Operation in 8051 |
| 11. | Interfacing LCD to 8051 |
| 12. | Interfacing Matrix keyboard to 8051 |
| 13. | Program to control the speed and direction of stepper motor |

At least ten (10) experiments to be performed by each student.

# TH: 3(A)- FUNDAMENTALS OF POWER ELECTRONICS

| L | T | P | | Course Code: AEIEPE301(A) | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

Power Electronics is an interdisciplinary area using the thyristor family devices to control the ON and OFF processes of semiconductor switches and principles of control theory. The application area of power electronics can have two-sided development – one as the development of improved performance power semiconductor devices and the other side as development of control circuit of these devices. This course includes power electronic devices, thyristor family devices, turn-on and turn-off methods of thyristor, phase-controlled rectifiers and industrial control circuits including SMPS and UPS.

**LEARNING OUTCOMES:**

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

- Explain the operating principle of power electronic devices
- Select power electronic devices for specific applications
- Describe the turn-on and turn-off methods of thyristor
- Explain the operation and applications of phase-controlled rectifiers.
- Discuss the operating principle of industrial control circuits

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I** | **Power Electronic Devices**<br>1.1 Power electronic devices<br>1.2 Power transistor<br>1.2.1 construction and working principle<br>1.2.2 V-I characteristics and uses<br>1.3 IGBT<br>1.3.1 Construction and working principle<br>1.3.2 V-I characteristics and uses<br>1.4 Concept of single electron transistor (SET) | 10 |
| **II** | **Thyristor**<br>2.1 SCR<br>2.1.1 Construction of SCR<br>2.1.2 Two transistor analogy of SCR<br>2.1.3 Types, working and characteristics | 10 |

| | | |
|---|---|---|
| | 2.1.4 SCR mounting and cooling<br>2.2 Types of Thyristors: LASCR, SCS, GTO, DIAC and TRIAC<br>2.2.1 Symbol and construction<br>2.2.2 Operating principle<br>2.2.3 V-I characteristics<br>2.3 Protection circuits<br>2.3.1 Over-voltage<br>2.3.2 Over-current<br>2.3.3 Snubber circuit<br>2.3.4 Crowbar circuit | |
| **III** | **Turn-on and Turn-off Methods of Thyristors**<br>3.1 SCR Turn-On methods<br>3.1.1 Forward Voltage triggering<br>3.1.2 Gate triggering<br>3.1.3 dv/dt triggering<br>3.1.4 Thermal triggering,<br>3.1.5 Illumination (Light) triggering<br>3.2 Trigger/Firing circuits<br>3.2.1 Resistance and Resistance-Capacitance circuits<br>3.3 SCR triggering using UJT<br>3.4 PUT: Relaxation Oscillator and Synchronized UJT circuit<br>3.5 Pulse transformer and opto-coupler based triggering.<br>3.6 SCR Turn-Off methods:<br>3.6.1 Class A- Series resonant commutation circuit<br>3.6.2 Class B-Shunt Resonant commutation circuit<br>3.6.3 Class C-Complimentary Symmetry commutation circuit<br>3.6.4 Class D-Auxiliary commutation<br>3.6.5 Class E-External pulse commutation<br>3.6.6 Class F-Line or natural commutation | 8 |
| **IV** | **Phase Controlled Rectifiers**<br>4.1 Phase control: firing angle, conduction angle.<br>4.2 Single phase half controlled, full controlled and midpoint controlled rectifier with R and RL load<br>4.2.1 Circuit diagram, working, input- output waveforms, equations for DC output voltage and current and effect of freewheeling diode<br>4.3 Different configurations of bridge controlled rectifiers: Half bridge and Full bridge with R load. | 10 |
| **V** | **Industrial Control Circuits**<br>5.1 Applications: Burglar's alarm system, Battery charger using SCR, Emergency light system, Temperature controller using SCR and; Illumination control/fan speed control TRIAC<br>5.2 SMPS (Basic only)<br>5.3 UPS: Offline and Online. | 7 |

## REFERENCES:


| | |
|---|---|
| 1. | An Introduction to Thyristors and their applications by M. Ramamoorty, East-West Press Pvt. Ltd., New Delhi. |
| 2. | Thyristors: Theory and Applications by Rajendra Kumar Sugandhi and Krishna Kumar Sugandhi, New Age International (P) ltd. Publishers, New Delhi |
| 3. | Fundamentals of Power Electronics by S.K. Bhattacharya, Vikas Publishing House |

| | |
|---|---|
| | Pvt. Ltd. Noida. |
| 4. | Power Electronics and its Applications by Alok Jain, Penram International Publishing (India) Pvt. Ltd, Mumbai |
| 5. | Power Electronics Circuits Devices and Applications by Muhammad Rashid, Pearson Education India, Noida |
| 6. | Power Electronics by M. D Singh and K.B. Khanchandani, Tata McGraw Hill Publishing Co. Ltd, New Delhi. |
| 7. | Industrial Electronics: A Text –Lab Manual by Paul B. Zbar, McGraw Hill Publishing Co. Ltd., New Delhi. |
| 8. | SCR Manual by D.R. Grafham, General Electric Co. |

# TH: 3(B)- BIOMEDICAL INSTRUMENTATION

| L | T | P | | Course Code: AEIEPE301(B) | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

The subject biomedical instrumentation is a very vital subject for the students at the present age, to known about biomedical electronic instrument used for getting the biological information of the human being correctly for investigation. The students will have an exposure to biomedical instrumentation use for medical instruments in actual fields. Biomedical Instrumentation is an application of biomedical engineering, which focuses on the devices and mechanics used to measure, evaluate, and treat biological systems.

### LEARNING OUTCOMES:

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

- Describe different physiological variables of interest in medical-Electronics.
- Describe different bio-electric potentials and electrodes.
- Explain different biomedical instruments such as pacemaker, Defibrillator, Ultrasonography.
- Explain operation & application Medical equipment used in clinical laboratory
- Use different electrical safety measures and standards

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I** | **Introduction to Biomedical Instruments**<br>1.1 Fundamentals & specification of biomedical instrumentation system, physiological system of body. a. Cardiovascular system. b. Respiratory system. c. Nervous system.<br>1.2 Different types of sensors & transducer for biological application.<br>a. Types, b. Properties, c. Characteristics.<br>1.3 Explain sources of bio-electric potential.<br>a. Action potential & its propagation, b. Resting potential & its propagation, c. Bio-electric potential.<br>1.4 Introduction to physiology of cardiac, nervous, muscular systems; | **8** |

| | | |
|---|---|---|
| II | **Electrodes**<br>2.1 Electrode theory,<br>2.2 Different types of electrodes- Hydrogen Calomel, Ag-AgCI, pH, PO2 Pco2 electrodes, selection criteria of electrodes.<br>2.3 ECG measurement and Instrumentation techniques;<br>2.4 Measurement of Cardiac output and Cardiac rate,<br>2.5 Electrocardiography, Cardiac pace-maker<br>2.6 Measurement of Electrical Activities in Muscles, Heart and Brain: Electromyography, Electroencephalograph and their interpretation. | **8** |
| **III** | **Medical equipment**<br>3.1 Plethysmography,<br>3.2 Diathermy,<br>3.3 Defibrillator,<br>3.4 Pace maker,<br>3.5 Blood pressure monitor,<br>3.6 Blood flow monitor,<br>3.7 Endoscope | **10** |
| **IV** | **Instrumentation in clinical laboratory**<br>4.1 Measurement of pH, ESR, oxygen, Hb in blood;<br>4.2 X-ray and Ultrasonography.<br>4.3 Medical Imaging- Ultrasound imaging and IR Imaging.<br>4.4 Basic of X-ray & radioisotope instrumentation.<br>4.5 Instrumentation for diagnostic x-ray & handling of x-ray machine.<br>4.7 Basic concept & operation of digital x-ray machine. | **12** |
| **V** | **Patient safety & electrical safety of Medical equipment**<br>5.1 Application of biomedical engineering & computer application in medical field.<br>5.2 Tele medicine.<br>5.3 Physiological effect of electrical current.<br>5.4 Shock hazard of electrical biomedical equipment. | **7** |

## REFERENCES:


| | |
|---|---|
| 1. | Hand book of biomedical instrumentation – Author- R. S. Khandpur- Publisher- T.M.H. Publication |
| 2. | Biomedical instrumentation & measurement - Author –Lesile Cromewell, Fred J. Weibell, Erich A. Pfeiffer -– Publisher-.P.H.I. |
| 3. | Biomedical instrumentation & measurement – Author- Carr & Brown –Publisher- Pearson Publication. |
| 4. | Medical Instrumentation – Application and Design, Webster J S – |
| 5. | Biomedical Instrumentation, Chatterjee Miller – Cengage Learning |

# TH: 3(C)- IOT AND ITS APPLICATIONS

| L | T | P | Total Marks: 100 | Course Code: AEIEPE301(C) | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

Internet of Things (IoT) is to connect everyday objects to the internet, enabling them to collect, share, and analyze data. This connectivity leads to various applications across industries, improving efficiency, automation, and decision-making. This course gives students necessary knowledge and understanding of IoT techniques that are widely used in various fields.

### LEARNING OUTCOMES:

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

- Describe the fundamentals of IoT
- Define the design considerations and use of IoT.
- Develop ability to use various contemporary IOT communication protocols
- Identify the design consideration of IoT
- Apply the utilities of IoT through case studies

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| I | **FUNDAMENTALS OF IoT**<br>1.1 IoT- Evolution of Internet of Things,<br>1.2 Enabling Technologies,<br>1.3 M2M Communication,<br>1.4 IoT World Forum (IoTWF)<br>1.5 Standardized architecture,<br>1.6 Simplified IoT Architecture,<br>1.7 Core IoT Functional Stack, Fog, Edge and Cloud in IoT,<br>1.8 Functional blocks of an IoT ecosystem,<br>1.9 Sensors, Actuators, Smart Objects and Connecting Smart Objects. | **8** |
| II | **IoT PROTOCOLS-**<br>2.1 IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4,<br>2.2 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN,<br>2.3 Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT. | **8** |

| | | |
|---|---|---|
| **III** | **DESIGN AND DEVELOPMENT**<br>3.1 Design Methodology,<br>3.2 Embedded computing logic,<br>3.3 Microcontroller, System on Chips,<br>3.4 IoT system building blocks<br>3.5 IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details | **10** |
| **IV** | **DATAANALYTICS AND SUPPORTING SERVICES**<br>4.1 Data Analytics: Introduction, Structured Versus Unstructured Data,<br>4.2 Data in Motion versus Data at Rest,<br>4.3 IoT Data Analytics Challenges, Data Acquiring,<br>4.4 Organizing in IoT/M2M,<br>4.5 Supporting Services: Computing Using a Cloud Platform for IoT/M2M<br>4.6 Applications/Services, Everything as a service and Cloud Service Models. | **10** |
| **V** | **CASE STUDIES / INDUSTRIAL APPLICATIONS:**<br>5.1 Creating IoT channels for sending and receiving the data,<br>5.2 Testing, evaluating and decision making on the data.<br>5.3 IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment<br>5.4 Industry 4.0 concepts. | **9** |

## REFERENCES:


| | |
|---|---|
| 1. | IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, |
| 2. | Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press |
| 3. | Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education |

# TH: 4(A)- ANALYTICAL INSTRUMENTATION

| L | T | P | | Course Code: AEIEPE303(A) | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

Analysis of different parameter in Industry is most important to maintain best quality of product. This course is a study of the application, installation, and calibration of numerous types of analytical instrumentation, along with study of continuous and non-continuous online analyzers. This includes oxygen analyzers, pH meters, infrared (IR), ultraviolet (UV), mass spectrometers, fiber optic, conductivity, and Chromatographic analyzers.

### LEARNING OUTCOMES:

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

- Describe the functions, strengths, and limitations of various analytical instruments.
- Describe operation & application of Gas analysers.
- Explain operation & application of liquid analyser.
- Explain operation & application of solid analysers
- Use different sampling system

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I** | **Introduction to Analytical Instrument**<br>1.1 Function of Analyzer and need of it in Industry<br>1.2 Quantitative and Qualitative Analysis<br>1.3 Analyzer Safety measures<br>1.4 Analyzer types | **3** |

| | | |
|---|---|---|
| **II** | **Gas Analyzer**<br>2.1 Spectroscopic techniques- IR absorption spectroscopy,<br>2.2 Single channel & dual channel IR spectrometer,<br>2.3 Different components of IR spectrometer source, detector, monochromator.<br>2.4 Thermal conductivity type.<br>2.5 Paramagnetic oxygen analyzer- Magneto dynamic type, Magnetic wind type.<br>2.6 Zirconia cell for oxygen analysis.<br>2.7 Humidity & moisture measurement. | **12** |
| **III** | **Liquid and Solid Analyzer:**<br>3.1 UV & Visible spectroscopy techniques, sources, detectors, monochromators.<br>3.2 Colorimeter, Lambert-Beer's law, its applications & limitations.<br>3.3 Emission & Fluorescence spectroscopy.<br>3.4 Measurement of pH.<br>3.5 Measurement of conductivity & Salinity.<br>3.6 Measurement of dissolved oxygen.<br>3.7 Solid Analyzer: X-ray analysis: concept only | **12** |
| **IV** | **Special Types of Aalyzers:**<br>4.1 Gas chromatography, Liquid chromatography.<br>4.2 Mass spectrometer<br>4.3 Basic idea of NMR – only schematic diagram and working principles, applications | **10** |
| **V** | **Sampling Systems:**<br>5.1 Gas sampling.<br>5.2 Steam & Water analysis system. | **8** |

## REFERENCES:


| | |
|---|---|
| 1. | Instrumental Methods of Analysis Willard, Merrit, Dean & Settle CBS Pub.Co. |
| 2. | Introduction to Instrumental Analysis, Robert D.Braun, McGraw-Hill, Singapore. |
| 3. | Instrumentation Handbook, B. Liptak Butterworth-Heinmann |
| 4. | Principle of Industrial Instrumentation, D Patranabis TMH |
| 5. | Analysis Instrumentation, R.P.Khare, CBS |

# TH: 4(B)- POWER PLANT INSTRUMENTATION

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 0 | | **Course Code: AEIEPE303(B)** |
| **Total Contact Hours** | | | | **Theory Assessment** |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam 70 |
| | | | | Progressive Assessment 30 |
| **Pre-Requisite** | | **: Nil** | | |
| | | | | |
| **Credit** | | **3** | | Category of Course: PC |

## RATIONALE:

The subject Power Plant Instrumentation is a very vital subject for the students at the present age, to known about basics of Instrumentation used in Power Plant. The course is to give idea to the student about instrumentation scheme of thermal, hydro & nuclear power station. The students will also be able to know about different process of energy used for generation of power.

### LEARNING OUTCOMES:

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

- Describe an idea about Power plant.
- Describe brief idea about energy requirement & energy storage
- Explain about different types of power plant.
- Explain operation & application about instrumentation used in power plant
- Use Instrumentation for transmission for power

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| **I** | **Introduction:**<br>1.1 Importance of electric power plant.<br>1.2 Definition of power plant.<br>1.3 Types of power plants.<br>1.4 Sources of energy.<br>1.5 Recent development in power generation.<br>1.6 Direct energy conversion system.<br>1.7 Alternative energy system.<br>1.8 Energy scores in India.<br>1.9 Development of electric power in India. | **7** |

| | | |
|---|---|---|
| II | **Steam power plant**<br>2.1 Operation of condensing & non condensing power plants.<br>2.2 Choice of steam, temperature & pressure.<br>2.3 Important features of a modern coal fire steam power plant.<br>2.4 Basic working principle of a thermal power plant.<br>2.5 Different units of a stem power plants.<br>• Boiler unit.<br>• Steam nozzles & turbine.<br>• Condensing unit & function of condenser.<br>• Cooling unit.<br>• E. Cooling ponds & cooling towers. | **10** |
| **III** | **Hydroelectric Power plant**<br>3.1 Definition of Hydroelectric power plant.<br>3.2 Essential features of a water power plant.<br>3.3 Classification of a hydro power plant.<br>3.4 Hydraulic turbines & its operating characteristics.<br>3.5 Selection of water turbine.<br>3.6 Carbine hydro &steam power plant.<br>3.7 Comparison of hydropower station with thermal power station. | **10** |
| **IV** | **Nuclear Power plant:**<br>4.1 General introduction of nuclear physics.<br>4.2 description of nuclear reactor.<br>4.3 Classification of nuclear reactor.<br>4.4 safety uranium.<br>4.5 Methods of enriching uranium.<br>4.6 Nuclear power plant in India.<br>4.7 Features of nuclear power. | **10** |
| **V** | **Power plant instrumentation & Instrumentation for transmission for power**<br>5.1 General classification of instrument.<br>5.2 Temperature, Pressure & Flow measuring instrument.<br>5.3 Analysis of combustion of gases.<br>5.4 Instrumentation schemed used for HVDC. & EHVAC transmission system.<br>5.5 Energy management.<br>• Electronic instrumentation system adopted for energy conservation<br>• Electronic instrumentation scheme used for energy audit<br>5.6 Economics of power plant. | **8** |

## REFERENCES:


| | |
|---|---|
| 1. | Power plant engineering by P.C. Sharma—Publisher- S.K. Kataria &Sons. |
| 2. | Operation & control of inter connected system - Author –L. K. Kircahmeyar—Publisher- John Wiley |
| 3. | Power system stability & control -Author –Anderson & Fouad–Publisher-Galgotia Publication |
| 4. | Instrumentation Engineering hand book By Bela. G. Liptak-Publisher- Butterworth Heinemeni Publication. |

# TH: 4(C)- PLC PROGRAMMING AND AUTOMATION

| L | T | P | | Course Code: AEIEPE303(C) | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: PC | |

## RATIONALE:

This course gives students necessary knowledge and understanding of PLC (Programmable Logic Controller) that are widely used in the industrial field. This course deals with some fundamentals of PLC-based control systems without which factory automation domain cannot exist. This PLC course is designed to equip the novice with no prior PLC programming experience with the basic tools required to create a complete PLC program using ladder logic common to most current platforms. The student will write, enter, and execute application programs using the programmable controllers.

## LEARNING OUTCOMES:

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

- Explain Industrial Automation system.
- Explain the basic concepts of relay logic operation and Programmable Logic Controller.
- State basic PLC terminology and their meanings.
- Apply the concept of ladder logic, its history, and its relationship to programmed PLC instruction.
- Use ladder language programming for real cases.

## DETAILED COURSE CONTENTS

| Unit | Topic/Sub Topic | Allotted Time (Hours) |
|---|---|---|
| I | **Introduction to Industrial Automation**<br><br>1.1 History of industrial automation<br>1.2 Need of automations in industries and example for industrial automation<br>1.3 Control system in Industry<br>1.4 Field Instruments, types and working of field devices<br>1.5 Automation using relays and field devices, Examples for relays and field devices, Logical functions done by relays and field devices<br>1.6 Discrete state process automation system<br>1.6 Continuous state process automation system | 9 |
| II | **PLC details**<br>2.1 Introduction to PLC<br>2.2 History of PLC | 10 |

| | | |
|---|---|---|
| | 2.3 Architecture of PLC- CPU, IO Modules, Power Supply and communications Input and Output Devices, PLC registers.<br>2.4 Role of PLC (Programmable Logic Controller) for process automation system<br>2.5 Operation of Relays, latching of relays, relay logic for sequential operation<br>2.6 Replacing of Relays by PLC for automation system | |
| **III** | **PLC programming**<br>3.1 Types of PLC Models<br>3.2 Introduction about PLC Programming<br>3.3 Types of Programming Languages<br>3.4 Introduction about PLC Programming software- Ladder logic diagram and Structure of program<br>3.5 Procedure for creating ladder diagram<br>3.6 Logical function done by ladder program in software,<br>3.7 PLC scan and execution time | 10 |
| **IV** | **Main Instruction Set**<br>4.1 Latching Instructions<br>4.2 Counter operation<br>4.3 Timer operation and Accuracy<br>4.4 Master Controls<br>4.5 Shift Registers<br>4.6 Moving Data<br>4.7 Math Function<br>4.8 Bit function | 9 |
| **V** | **PLC Applications for automation**<br>5.1 Application of PLC as discrete state controller<br>5.2 Application of PLC as P, PI and PID controller<br>5.3 Application for control of conveyor system<br>5.4 Application for automatic bottle filling system<br>5.5 Application for liquid level control system | 7 |

## REFERENCES:


| | |
|---|---|
| 1. | Mano, M. Morris. Digital logic and computer design. Pearson Education India, |
| 2. | Kamel, Khaled, and Eman Kamel. Programmable logic controllers: Industrial control. McGraw Hill Professional |
| 3. | Handbook, P. L. C. "Practical Guide to Programmable Logic Controllers." AutomationDirect. com |
| 4. | Jack, Hugh. Automating manufacturing systems with PLCs. Lulu. com |
| 5. | Programmable Logic Controller by Vijay R. Jadhav, Khannna Publishers |
| 6. | Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition, by Madhuchhanda Mitra, Samarjt Sengupta |

# PR:3(A)- FUNDAMENTALS OF POWER ELECTRONICS LAB

| L | T | P | Total Marks: 50 | Course Code: AEIEPC305(A) | |
|---|---|---|---|---|---|
| 0 | 0 | 4 | | | |
| **Total Contact Hours** | | | | **Laboratory Assessment** | |
| Practical | | : 60Hrs | | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| **Pre-Requisite** | | **: NIL** | | | |
| | | | | | |
| **Credit** | | **2** | | Category of Course: PC | |

**RATIONALE:**

Power electronics is a fundamental subject for electrical engineering students, focusing on the conversion, control, and regulation of electrical power. This lab introduces students to the basic concepts of power semiconductor devices and their applications in rectifiers, converters, and motor control. The experiments are designed to give hands-on exposure to power electronic circuits and their real-world applications in industries, renewable energy, and automation.

**LEARNING OUTCOMES:**

After completion of the Lab the students will be able to

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

- Explain the working and characteristics of power semiconductor devices.
- Implement basic rectifier and converter circuits.
- Analyze the performance of different power electronic circuits.
- Develop skills to troubleshoot and test power electronic circuits.
- Apply power electronics in simple industrial and renewable energy applications.

**DETAILED COURSE CONTENTS**

| Sl No | List of Experiments on |
|---|---|
| 1. | Study of V-I characteristics of SCR, DIAC, TRIAC, and MOSFET |
| 2. | Experiment on R and RC triggering circuits for SCR |
| 3. | Implementation and analysis of a single-phase half-wave-controlled rectifier using R load. |
| 4. | Implementation and analysis of a single-phase full-wave rectifier using R-load. |
| 5. | Study of DC-DC converters (Buck and Boost converter) |
| 6. | Experiment on single-phase inverter (square wave output) |
| 7. | Study of AC voltage controllers using TRIAC |
| 8. | Speed control of DC motors using chopper circuits |
| 9. | Speed control of AC motors using TRIAC-based controller |
| 10. | Study of battery charging circuits using SCR |

**REFERENCES**


| | |
|---|---|
| 1. | Power Electronics: Circuits, Devices & Applications – Muhammad H. Rashid |
| 2. | Power Electronics – P.S. Bimbhra |

# PR:3(B)- PLC PROGRAMMING AND AUTOMATION LAB

| L | T | P | Total Marks: 50 | Course Code: AEIEPC305(B) | |
|---|---|---|---|---|---|
| 0 | 0 | 4 | | | |
| **Total Contact Hours** | | | | **Laboratory Assessment** | |
| Practical | | : 60Hrs | | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| **Pre-Requisite** | | **: NIL** | | | |
| | | | | | |
| **Credit** | | **2** | | Category of Course: PC | |

**RATIONALE:**

A PLC programming and automation lab provides a practical, hands-on learning environment for understanding and applying PLC programming techniques. This lab is essential for students and professionals seeking to develop expertise in industrial automation, allowing them to manipulate real-world automation systems and develop their problem-solving skills in a safe, controlled environment.

**LEARNING OUTCOMES:**

After completion of the Lab the students will be able to

- Develop equivalent ladder Diagram of logic gates.
- Use relay as a switch and latching system.
- Use timers, counters and registers for PLC operation.
- Develop ladder diagrams for motor control applications.
- Develop a ladder diagram for level control.

**DETAILED COURSE CONTENTS**

| Sl No | List of Experiments on |
|---|---|
| 1. | Develop equivalent ladder Diagram of NOT Gate, AND Gate, OR Gate, NAND Gate NOR Gate and XOR Gate. |
| 2. | Use relay as a switch and latching system. |
| 3. | Utilize timers (on-delay, off-delay), counters, and registers for working with push buttons, switches, and other input devices. |
| 4. | Design a 4:1 multiplexer using ladder logic. Assume the inputs are connected to I-1, I-2, I-3 & I-4; Control signals are connected to I-5 and I-6 and output terminal is O-1. |
| 5. | Develop a ladder diagram to fulfil the following conditions<br>When START switch is ON, the motor is ON. When STOP switch is ON, the motor is OFF. When motor is ON, the green light is ON. When motor is OFF, the red light is ON . |
| 6. | Draw a ladder diagram for blinking indicator lights. When start switch is ON two lights will be flashed alternatively every 5 seconds. |
| 7. | Develop a ladder diagram to fulfil the following conditions.<br>When start switch is ON, the motor is ON.<br>When Stop switch is ON, the motor is OFF.<br>When motor is ON, the green light is ON<br>When motor is OFF, the red light is ON. |

| | |
|---|---|
| 8. | Draw a ladder diagram for a two-motor system having the following conditions. |

| | |
|---|---|
| | Start PB starts motor 1<br>After 10 Seconds motors 2 is ON.<br>Stopping the switch stops motor 1 and 15 seconds later stops motor 2. |
| 9. | Develop a ladder diagram for level control of liquid in a tank using low and high level switch. |
| 10. | Develop Ladder diagram for PID Controller for speed control of DC motor. |

# PR:3(C)- IoT AND ITS APPLICATIONS LAB

| L | T | P | Total Marks: 50 | Course Code: AEIEPC305(C) | |
|---|---|---|---|---|---|
| 0 | 0 | 4 | | | |
| **Total Contact Hours** | | | | **Laboratory Assessment** | |
| Practical | | : 60Hrs | | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| **Pre-Requisite** | | **: NIL** | | | |
| | | | | | |
| **Credit** | | **2** | | Category of Course: PC | |

**RATIONALE:**

The course, IoT and its applications lab focuses on hands-on IoT concepts such as sensing, actuation and communication. This Course focuses on Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help students to develop skills and experiences. This Course focuses on real world applications of IoT.

**LEARNING OUTCOMES:**

After completion of the Lab the students will be able to

- Design some IOT based prototypes.
- Use embedded OS used for IoT application.
- Develop knowledge of IoT hardware and software.
- Develop knowledge of IoT sensors and actuators.
- Implement some real world IoT applications.

**DETAILED COURSE CONTENTS**

| Sl No | List of Experiments on |
|---|---|
| 1. | Draw the circuit for the basic setup required to connect an Arduino Uno to the internet. |
| 2. | Connect an Arduino Uno to Wi-Fi using the ESP8266 module |
| 3. | Use ThingSpeak IoT Platform for sending and receiving sensor data |
| 4. | Read temperature and humidity sensor data using a DHT11 sensor and send it to a cloud platform |
| 5. | Use the Arduino Uno to monitor soil moisture levels and send alerts via email |
| 6. | Create a simple IoT dashboard to visualize data collected from various sensors connected to Arduino Uno |
| 7. | Integrate Arduino Uno with a mobile app for remote control of devices |
| 8. | Use a relay module with Arduino Uno to control home appliances remotely |
| 9. | Create a smart irrigation system using Arduino Uno and moisture sensors |

**OPEN ELECTIVE I**

# TH: 5(A)- UNIVERSAL HUMAN VALUES

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 0 | | **Course Code: OE 301A** |
| **Total Contact Hours** | | | | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam 70 |
| | | | | Progressive Assessment 30 |
| **Pre-Requisite** | | **: Nil** | | |
| **Credit** | | **3** | | Category of Course: OE |

**RATIONALE:**

The Universal Human Values (UHV) course aims to help diploma students develop a strong ethical foundation, nurturing responsible individuals who contribute positively to society. In an era driven by rapid technological advancements, it is crucial for students not only to gain technical expertise but also to cultivate values that promote harmony, respect, and sustainability.

**LEARNING OUTCOMES:**

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

- Identify fundamental human aspirations such as happiness and prosperity.
- Differentiate between the self and the body and understand their respective needs.
- Practice self-reflection to improve decision-making, emotional balance, and personal growth.
- Develop respectful and trustworthy relationships within family, friends, and society.
- Explain the role of values like trust, respect, and love in building strong social bonds.
- Promote cooperation and harmony within communities through ethical practices.

**DETAILED COURSE CONTENT:**

| Unit No. | Topic/Sub-Topic | Allotted Time (Hours) |
|---|---|---|
| I | **Introduction to Value Education and Human Values -** Concept and Need for Value Education - Understanding the importance of value education in personal and professional life, Differentiating between values and skills.<br>Basic Human Aspirations - Exploring fundamental human aspirations: happiness and prosperity, Methods to achieve these aspirations through right understanding and relationships. | 8 |
| II | **Harmony in the Human Being -** Understanding the Self - Differentiating between the 'Self' (I) and the Body, Understanding the needs of the Self and the Body, Harmony of the Self with the Body - Ensuring the harmony of 'I' with the Body,<br>Practices for mental and physical well-being. | 8 |
| III | **Harmony in the Family and Society -** Family as the Basic Unit of Society - Understanding values in human relationships, Trust and respect as the foundational values in relationships, Harmony in Society - The concept of an undivided society,<br>Universal human order and world family. | 8 |

| | | |
|---|---|---|
| IV | **Harmony in Nature and Existence -** Interconnectedness in Nature -Understanding the four orders of nature: material, plant, animal, and human, Mutual fulfillment among these orders, Co-existence in Existence - Holistic perception of harmony in existence, Role of human beings in maintaining environmental balance. | 8 |
| V | **Professional Ethics -** Ethical Human Conduct - Integrating values into professional life, Concept of professional ethics and accountability, Case Studies in Professional Ethics - Analyzing real-life scenarios to understand ethical dilemmas, Developing solutions based on universal human values. | 8 |
| VI | **Personal Development and Social Responsibility -** Self-Reflection and Self-Exploration - Techniques for self-assessment and personal growth, Setting personal goals aligned with universal values, Social Responsibility - Understanding one's role in society, Participating in community service and social initiatives. | 5 |

**REFERENCES:**


| | |
|---|---|
| 1. | R. R. Gaur, R. Asthana, G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. |
| 2. | R. R. Gaur, R. Asthana, G. P. Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. |
| 3. | A. Nagraj, JeevanVidya: EkParichaya, Amarkantak, 1999. |
| 4. | A. N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004. |
| 5. | Moral Thinking: An Introduction To Values And Ethics, Vineet Sahu, IIT Kanpur: https://onlinecourses.nptel.ac.in/noc23_hs89/preview |

# TH: 5(B)- LEADERSHIP AND MANAGEMENT SKILLS

| L | T | P | | Course Code: OE 301B | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: OE | |

**RATIONALE:**

This course/subject on Leadership and Management Skills for students undergoing Diploma programmes is an exploration in leading and managing people, majorly in education based on sound and acceptable principles and theories for effective leadership. The leadership skills will enable them to take initiative, guide team efforts, motivate peers, and ensure effective collaboration. They'll learn how to delegate tasks, resolve conflicts, and foster a positive team environment. The management skills will help them in organizing tasks, setting timelines, and ensuring efficient workflow within a team.

It is expected that the students will be able to handle projects with better project outcomes and a earn a more productive learning experience. This will benefit their academic journey, future careers, and overall professional development:

**LEARNING OUTCOMES:**

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

- Explain the principles of management
- Collaborate across cultures for effective team work
- Communicate with people for a positive work culture
- Demonstrate personal dispositions, skills & abilities of a leader
- Undertake the process of change management
- Design training for staff development
- Adapt suitable leadership style for improved work efficiency.

**DETAILED COURSE CONTENT:**

| Unit No. | Topic/Sub-Topic | Allotted Time (Hours) |
|---|---|---|
| I | **Leadership & Management, concept, principles.**<br><br>• Definition of leadership, management<br>• Leadership theories<br>• Leadership characteristics<br>• Principles of management<br>• Managerial functions<br>• Leader v/s Manager, Leader/Manager traits and character<br>• Leadership Styles | 10 |
| II | **Human Resource Management in Organizations**<br><br>• Human Resource Management: Meaning, Nature, Objectives, Scope<br>• Job & Job analysis.<br>• Staff Development: Need and Objectives of Staff Development, Approaches<br>• Training & development<br>• Organizational Development: Components of OD process.<br>• Learning organization | 10 |
| III | **Personal disposition, skills & abilities of leaders**<br><br>• Self-awareness<br>• Leadership characteristics, traits<br>• Leadership skills & abilities<br>• Emotional intelligence & its components, importance in leadership<br>• Communication skills for effective leadership, barriers to effective communication, Active Listening, Mindful listening.<br>• Leading & Mentorship – Influencing & mentoring | 09 |
| IV | **Leader's role in Motivating, Inspiring and Transformative leadership, nurturing team-work**<br><br>• Goal setting & leadership<br>• Transformative Leadership, vision & envisioning<br>• Motivational role of leader in people management<br>• Group & team<br>• Team dynamics<br>• Conflict management, strategies in managing conflicts | 08 |
| V | **Change Management & Leadership**<br><br>• Models of change<br>• Forces driving change<br>• Change Management – process, goal, importance<br>• The process of change happening in an organization<br>• Key aspects of leadership in change management – responsibilities of a change leader. | 08 |

**SUGGESTED ACTIVITIES:**

- Group/individual presentation on the basic principles of leadership and management, Discussion on readings - Individual or group presentation of assigned topics in class on leadership and management principles and theories.
- Activities on Envisioning, Goal setting
- ACTION PLAN to be prepared

**REFERENCES:**


| | |
|---|---|
| **1.** | Theories of Educational Leadership and Management (3rd ed.), by Bush, Tony (2003). SAGE Publications, Ltd. |
| **2.** | The inspiring leader: unlocking the secrets of how extraordinary leaders motivate. By Zenger, John, Joseph Folkman, and Scott Edinger (2009). New York: McGraw Hill Press. |
| 3. | Knowing yourself. On becoming a leader: the leadership classic. By Bennis, Warren (2009). New York: Basic Books. |
| 4. | Leading Change. By P. Kotter, Harvard Business, 2012. |
| 5. | The Fifth Discipline. By Peter M. Senge, Crwon Currency, 2006. |
| **6.** | The Leadership Sutra: An Indian Approach to Power. By Devdutt Pattanaik, – Penguin Random House, 2017. |
| **7.** | Leadership and Management. By Dr. A. Chandra Mohan. Himalaya Publishing House, 2010. |

# TH: 5(C)- PROFESSIONAL SKILLS

| L | T | P | | Course Code: OE 301C | |
|---|---|---|---|---|---|
| 3 | 0 | 0 | | | |
| **Total Contact Hours** | | | | **Theory Assessment** | |
| Theory | | : 45Hrs | **Total Marks: 100** | End Term Exam | 70 |
| | | | | Progressive Assessment | 30 |
| **Pre-Requisite** | | **: Nil** | | | |
| | | | | | |
| **Credit** | | **3** | | Category of Course: OE | |

**RATIONALE:**

The term, "Professional skills" carries significant weight in the job market and career development. This open elective course explores various types of professional skills, their significance, and how they can be cultivated and harnessed for career progression. By understanding the landscape of professional skills, student can better position himself or herself for success in the competitive job market. It is crucial to continuously update and adapt the professional skills to stay ahead in a rapidly changing work environment. By investing in professional development, one can enhance employability and open doors to new opportunities.

**LEARNING OUTCOMES:**

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

- Demonstrate Self-competency and Confidence
- Practice Emotional Competency
- Work in a team work or in collaboration
- Demonstrate problem solving and decision-making skills
- Apply time management strategies and techniques effectively
- Apply professional ethics and integrity in professional and personal life

| UNIT NO. | CONTENT | ALLOTTED TIME (HOURS) |
|---|---|---|
| I<br>Communication Skills: | • Active listening<br>• Verbal and non-verbal communication<br>• Written communication<br>• Presentation skills<br>• Conflict resolution | 08 |
| II<br>Teamwork and Collaboration: | • Building trust within a team<br>• Effective collaboration strategies<br>• Role delegation and responsibility sharing<br>• Conflict resolution within a team | 08 |

| | | |
|---|---|---|
| III<br>Problem-Solving: | • Identifying root causes of issues<br>• Generating solutions and evaluating options | 08 |
| | • Decision-making under pressure<br>• Critical thinking skills<br>• Triple constraint issues | |
| **IV**<br>Time<br>Management: | • Prioritization and task management<br>• Setting realistic deadlines<br>• Effective time planning and organization | 06 |
| **V**<br>Emotional<br>Intelligence: | • Self-awareness and emotional regulation<br>• Empathy and understanding others' emotions<br>• Managing interpersonal relationships<br>• Motivation<br>• Social skills<br>• Emotional Intelligence (EQ)<br>• Stress management | 08 |
| **VI**<br>Professional<br>Ethics and Integrity: | • Workplace ethics and code of conduct<br>• Confidentiality and data privacy<br>• Professional accountability-<br>• Important Considerations: | 07 |

**REFERENCES:**


1. Dr. Vitthal Gore: Professional Skills for 21st Century: A Key to Success: Blue Rose-ACADEMIC
2. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success: PEARSON
3. The essence of Leadership: S. Manikutty: Bloomsbury

# SUMMER INTERNSHIP – II

| L | T | P | Total Marks: 50 | Course Code: SI301 | |
|---|---|---|---|---|---|
| 0 | 0 | 0 | | | |
| Total Contact Hours | | | | Internship Assessment | |
| Internship | | 0 | | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| Pre-Requisite | | : Nil | | | |
| Credit | | 2 | | Category of Course: SI | |

**Duration: 3-4 weeks after 4th Semester**

**RATIONALE:**

The Summer Internship course includes activities for promoting industrial interaction at the diploma level in technical institutes. The main aim is to enhance employability skills of the students passing out from Technical Institutions. It allows students to gain direct experience, which cannot be simulated in the classroom environment. Hence, this course aims to create competent professionals for the industry. The internship experience will augment outcome based learning process and inculcate various attributes in a student in line with the graduate attributes defined by the NBA. Students can also use internships to test their interest in and aptitude for different career areas. This enables students to find out where they might fit best in a professional environment.

**LEARNING OUTCOMES:**

After the completion of this course, the students will be able to

- Integrate theory and practice of current technological developments relevant to the subject area.
- Assess interests and abilities in their field of study for exploring career alternatives
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the job interview process.
- Identify social, economic and administrative considerations that influence the working environment of industrial organizations

**DETAILED COURSE CONTENTS**

**SUGGESTED ACTIVITIES:**

Activity Heads: Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship

During the summer vacation after 4$^{th}$ semester, students are ready for industrial experience. They may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may either choose to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case student want to pursue their family business and do not want to undergo internship, a declaration by the parents to be submitted directly to the TPO.

As per guidelines of AICTE, assessment to be done based on the following major activity heads:

**A. Innovation / IPR / Entrepreneurship**

1. Participation in innovation related completions for eg. Hackathons etc. to be evaluated by Faculty Mentor
2. Development of new product/ Business Plan/ registration of start-up to be evaluated by Program Head.
3. Participation in all the activities of Institute's Innovation Council (ICC) for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc., evaluated by President/ Convener of ICC.
4. Work experience at family business – to be evaluated by TPO

**B. Internship**

1. Internship with Industry/ Govt. / NGO/ PSU/ Any Micro/ Small/ Medium enterprise/ Online Internship to be evaluated by Faculty Mentor/ TPO/ Industry supervisor

# PR:4- MAJOR PROJECT

| L | T | P | | Course Code: PR 301 | |
|---|---|---|---|---|---|
| 0 | 0 | 4 | | | |
| Total Contact Hours | | | | Project Assessment | |
| Project | | 0 | Total Marks: 50 | End Term Exam | 15 |
| | | | | Progressive Assessment | 35 |
| Pre-Requisite | | : Nil | | | |
| | | | | | |
| Credit | | 2 | | Category of Course: Project | |

**Assessment to be done, marks (50) and credit (2) to be carried over to the 6th Semester**

**RATIONALE:**

The project work is a part of teaching learning process. In this course, the role of teachers is a facilitator or coordinator and the students will select the topic, perform design work, place the indent, procure or purchase the material either from departmental store or from the local market. The leadership quality, co-ordination of job and maintaining good communal harmony is an important factor of this type of activity. Project Work is a learning experience, which aims to provide students with the opportunity to synthesize knowledge from various areas of learning, and critically and creatively apply it to real life situations. This process, which enhances student's knowledge and enables them to acquire skills like collaboration, communication and independent learning, prepares them for lifelong learning and the challenges ahead. The success of the project is not the ultimate goal. The group, who is successful in obtaining the good output, should definitely be credited but they must be evaluated for the other components of the activity.

**LEARNING OUTCOMES:**

After the completion of this course, the students will be able to

- Select suitable topic, problem and plan of action
- Apply theory and practices to investigate and solve industry / society related problems
- Maintain good relation among the peer groups
- Demonstrate leadership quality
- Estimate cost involvement
- Develop plan for effective utilization of time

**GUIDELINES FOR MAJOR PROJECT**

- The project work may involve the designing a model or upgrading an existing system. The design is to be implemented into a working model.
- A project work may be carried out by a team of 3 to 5 students with a well-defined role of each student within the team. The group will select a project with approval of team of teachers & the guide.

- Each group must prepare project proposal that includes project title, group members, sponsor details (if any), detailed problem definition, area, abstract, details of existing similar systems if any, scope of the project and software-hardware requirements.
- Major projects should be based on real/ live problems of the Industry/ Govt./ NGO/ MSME/Rural Sector or an innovative idea having the potential of a Start-up. Main objective of the major project is to provide the students with an opportunity to develop a complete project.
- The major project is distributed in two consecutive semesters, students can get ample time to realize a complete project with documentation or transform their ideas of start-ups into reality. The requirement analysis and designing part of the project may be completed in the $5^{th}$ semester.
- A project report including all necessary documents such as Requirement Analysis, Design specifications, Project Plan, Design Modeling, test plan etc. need to be prepared and submitted for progressive assessment.
- For assessment, following components may be considered:
    - Synopsis and Project Title selection
    - Initiative in Performing Project tasks
    - Sense of responsibility and punctuality
    - Outcome of the completed stages of the Project
    - Communication and presentation skills
    - Interpersonal skills
    - Report writing skills
    - Viva voce