CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
INSTRUMENTATION
AND
CONTROL ENGINEERING

SUBJECT STUDY SCHEME
(4th SEMESTER: INSTRUMENTATION AND CONTROL ENGINEERING)

Course code	Subjects	Time in Hours				Credits		
		Theory	Tutorial	Practical	Total	Theory	Practical	Total
ES401	Electrical Machines	3	--	--	3	3	--	3
ES402	Electrical Machines Lab	--	--	2	2	--	1	1
ICPC401	Installation and Maintenance of Industrial Equipment's	--	--	4	4	--	2	2
ICPC402	Bio-Medical Instrumentation	3	--	--	3	3	--	3
ICPC403	Bio-Medical Instrumentation Lab	--	--	2	2	--	1	1
ICPC404	Process Instrumentation	3	--	--	3	3	--	3
ICPC405	Process Instrumentation Lab	--	--	2	2	--	1	1
ICPC406	Microcontroller and Embedded systems	2	1	--	3	3	--	3
ICPC407	Microcontroller and Embedded systems Lab	--	--	2	2	--	1	1
	Multidisciplinary Elective MOOC	2	--	--	2	2	--	2
MP409	Minor project	--	--	4	4	--	2	2
	UNIVERSAL HUMAN VALUES / Indian Constitution / Employability skills (Mandatory course)	--	--	1	1	--	--	--
	Total	**13**	**1**	**17**	**31**	**14**	**8**	**22**

Prior learning/Extra learning/Online learning will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby Clubs e.g. Photography etc., Seminars, Declamation Contests, Educational Field Visits, NCC, NSS, Cultural Activities and Self-study etc.

Relevant MOOC courses (8 – 12 weeks)

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ES401	**COURSE TITLE: ELECTRICAL MACHINES**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

COURSE CONTENT

1. Transformers

1.1 Principle of operation and constructional details of single phase transformer
1.2 Voltage Regulation of a transformer (No Derivation)
1.3 Losses in a transformer
1.4 Efficiency, condition for maximum efficiency and all day efficiency
1.5 CTs and PTs (Current transformer and potential transformer)
1.6 CVT (Constant Voltage Transformer)

2. Introduction to Rotating Electrical Machines

2.1 E.M.F induced in a coil rotating in a magnetic field.
2.2 Definition of motor and generator
2.3 Basic principle of a generator and a motor
2.4 Torque due to alignment of two magnetic fields and the concept of Torque angle
2.5 Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction)

3. DC Machines

3.1 Principle of working of DC motors and DC generator, their constructional details
3.2 Function of the Commutator for motoring and generating action
3.3 Factors determining the speed of a DC motor
3.4 Different types of excitation
3.5 Starting of DC motors and starters

4. AC Motors

4.1. Revolving magnetic field produced by poly phase supply
4.1. Construction and working principle of single phase induction motor
4.1. Brief introduction about three phase induction motors, its principle of operation
4.1. Construction, Working Principle and applications of Single phase Synchronous Motor
4.1. Brief introduction about three phase Synchronous motors, its principle of operation

5. Single Phase Fractional Kilowatt Motors

5.1. Concept of micro-motors
5.2. Servo- motors: AC and DC Servo Motors
5.3. Stepper Motor: Working Principle and application

COURSE OUTCOMES

After undergoing the subject, student will be able to:

- Describe star delta 3-phase connections
- Explain phase, line voltages and current relationships in 3-phase power supply.
- Demonstrate the concept of single phase transformers
- Measure the power and power factor in 3 phase load
- Determine the efficiency of a single phase transformer
- Apply the working principle of rotating electrical machines.
- Demonstrate the working of DC, AC and single phase fractional kilowatt motors.
  CO8: Connect and run a DC shunt motor with supply through a 3 point starter.

INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory without much seeking assistance of the factory staff.

RECOMMENDED BOOKS

1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi
2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi
3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
5) Electrical Engineering by JB Gupta, SK Kataria& Sons, New Delhi
6) Electrical Machines by DR Arora, Ishan Publications, Ambala city
7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi
8) E-books/e-tools/relevant software to be used as recommended by AICTE / HSBTE / NITTTR

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	20
2	10	20
3	12	25
4	10	20
5	08	15
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ES402	**COURSE TITLE: ELECTRICAL MACHINES LAB**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

Demonstrate various instruments use viz Ammeter, Voltmeter, Wattmeter, P.F meter etc for their identification and connecting procedure in a circuit.

1. Familiarization of electrical machines laboratory apparatus.
2. To measure power and power factors in 3 phase load by two wattmeter method.
3. Determination of transformer equivalent circuit from open circuit and short circuit test.
4. Determine regulation and efficiency of single phase transformer by direct loading.
5. To verify Faradays laws of electromagnetic induction.
6. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor
7. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test.
8. To measure power and power factor of a single phase induction motor.
9. To run a synchronous motor with a.c. supply and to measure speed to verify the relation N=120f/p.
10. To make connections of starting and running winding of a single phase capacitor motor and to run it with the help of DOL starter and to measure its speed.
11. To perform speed control of stepper motor.
12. Measurement of speed control of motor with tachometric feedback.

- **Note: - A few experiments will be performed through Electrical Machines Virtual Laboratory hosted by Virtual Labs, an Initiative of the Ministry of Education under the National Mission on Education through ICT.**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ICPC401	**COURSE TITLE:INSTALLATION AND MAINTENANCE OF INDUSTRIAL EQUIPMENT**
SEMESTER: 4th	**CREDITS: 2**
PERIODS PER WEEK: 4 (L: 00,T: 00, P: 04)	

COURSE OBJECTIVE

When the students reach the industries, they will be able to install various instruments, identify the various instrumentation devices, measure the current, voltage and power, solder and desolder the components, identify and remedy the electrical faults, test and wire the instrumentation loop and recognize the use of instrumentation tools. They will also be able to select right instruments and tools for the right work.

SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list for guidance for exercises/practical/experiments

1. Study the process to setup an NABL accredited instruments calibration lab.
2. Wire instrument panel with various accessories as per instrument hook-up diagram
3. Wire the MCB, ELCB to supply electrical power to instrument panel
4. Prepare specifications for instrumentation tools, wires, cables, switches, electronic components for a given application
5. Wire electrical circuit diagram using IEEE standard symbols for one instrument panel application
6. Wire instrumentation loop as per given diagram using ISA standard symbols for one instrument panel application controlling single loop
7. Troubleshoot instrument panel wiring for various parameters and faults
8. To perform the installation of electrical earthing for industrial purpose.
9. Dismantle & assemble recorder to identify it's components
10. Install any one instrument using screw type and hang type instrument
11. Test pressure/flow /level/temperature switch
12. Assemble and demonstrate the working of electromagnet.
13. Assemble and demonstrate the working of solenoid.
14. To calibrate an Ammeter and a voltmeter.
15. To calibrate temperature measuring devices like thermocouple, RTD, thermistor etc.
16. To measure the output of piezoelectric crystal and study its characteristics.
17. To install a Solar PV cell and make its connections.
18. To install 3 phase Star-Delta starter (with automatic switch) of motor.
19. Designing of single layer PCB for a given circuit.
20. Designing of two sides PCB for a given circuit.

Note: Students have to perform at least 15 practical's.

COURSE OUTCOME
After undergoing the subject, the students will be able to:

- Learn NABL process of accreditation and starting an instrumentation calibration lab.
- Assemble various rectifier circuits.
- Troubleshoot instrumentation panel wiring.
- Install any instrument using screw and hange type instruments.
- Select right tools for right work.
- Designing and developing of PCB.
- Develop technical knowledge for different instruments.

INSTRUCTIONAL STRATEGY

Students are required to prepare and submit a laboratory report on instruction/demonstration given by teacher and workshop activities done by students as a part of team work.

RECOMMENDED BOOKS

1. Murthy, D. V. S. Transducers and Instrumentation PHI Learning 2011
2. Kalsi, H.S.Measurement Systems Mcgraw hill Publishers 2011
3. Bell, D.A.Electronic Instrumentation and Measurements PHI Learning 2010
4. Carr, Joseph J.Elements of Electronic Instrumentation and Measurements Pearson Education, 2010
5. E-books / e-tools / relevant software to be used as recommended by AICTE / HSBTE / NITTTR.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC402**	**COURSE TITLE: BIO-MEDICAL INSTRUMENTATION**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

Instrumentation has brought a new revolution in the field of medical science. An insight into human body could become possible on account of introduction of various bioinstrumentations and cure of various impossible diseases could become possible.

This course will cover various systems of the human physiology signals of biological origin obtained from these systems, biosensors, transducers, bio-electrodes used to acquire such signals, and amplifiers for measuring bio-potentials.

COURSE CONTENT

1. **Introduction**
   - 1.1 Biomedical instruments biometrics
   - 1.2 Introduction and components of man instrument system, transducers of biomedical applications.
   - 1.3 Physiological Systems
   - 1.4 Introduction of physiological system of human body, cardio vascular system, Respiratory system, nervous system

2. **Bioelectric Signals and Electrodes**
   - 2.1 Study of bio-electric potentials, resting and action potentials.
   - 2.2 Bio-electrodes, electrode- tissue interface, contact impedance,
   - 2.3 Types of electrodes (microelectrodes, skin surface electrodes & needle electrodes)

3. **Diagnostic Instruments**
   - 3.1 Brief study of- Stethoscope, Electro cardiograph (ECG) - Electro encephalograph (EEG)
     Electromyography (EMG)
   - 3.2 Pacemakers, Defibrillators, pulse oxymeter SPO2,
   - 3.3 Electro-magnetic and optical blood flow meter, Glucometer, Spirometer

4. **Imaging system**
   - 4.1 X-ray system, properties of X-ray, X-ray machine
   - 4.2 Computed Tomography (CT) scan, Magnetic resonance imaging (MRI),
   - 4.3 Ultra sonography—properties of ultrasound, basic ultra sound system

5. **Patient care and monitoring**

   - 1.1 Introduction, element of intensive care monitoring
   - 5.2 Bio-telemetry

COURSE OUTCOME

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

- Explain the working of instruments in various department & laboratories of a hospital and there by recognize their limitations.
- Understand fundamental knowledge of Bio-medical instrumentation.
- Develop knowledge in various bio-chemical signal generated by the body and their significance.
- Illustrate the fundamental concept of heart, its internal structure and flow of blood through it.

RECOMMENDED BOOKS

1. R.S.Khandpur, Biomedical Instrumentation Technology and Application,McGraw-HillProfessional,2004
2. Leslie Cromwell,Fred.J.Weibell and Erich.A.Pfeiffer."Biomedical Instrumentation and Measurement,"2nd Edition,PHI2003
3. Fundamental of Biomedical instrumentation byDr.O.N.Pandey

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	4	10
2	10	20
3	08	15
4	12	25
5	08	20
6	06	10
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC403**	**COURSE TITLE: BIO-MEDICAL INSTRUMENTATION lab**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. To operate and familiarization with
   (a) BP Apparatus/Sphygmomanometer
   (b) Electronic BP meter
2. To measure the concentration of blood sugar with Glucometer(Fasting/Random)
3. Measurement of heart rate using Stethoscope.
4. Visit to an Intensive Care Unit (ICU) of a hospital and prepare a detailed report of this visit.
5. Study of various leads for monitoring of Electro cardiogram (ECG).
6. Monitoring of Electrocardiogram (ECG) for bipolar limb leads L1, L2 and L3.
7. Monitoring of Electrocardiogram (ECG) for augmented leads a VL, a VF and a VR.
8. Monitoring of Electrocardiogram (ECG) for chest leads V1-V6.
9. Study of various leads and electrode position for electroencephalogram (EEG).
10. Study of various leads for present in different lobes.
11. Monitoring of Electroencephalogram (EEG) signal for different lobes.
12. To record the electrical parameters of the heart using ECG machine.

Note: Experiment No. 5 to 11 will be done through Virtual Biomedical Instrumentation Lab hosted by Virtual Labs, an Initiative of the Ministry of Education under the National Mission on Education through ICT.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC404**	**COURSE TITLE: PROCESS INSTRUMENTATION**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

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

COURSE CONTENT

1. **Measurement of Flow**

   Construction and working principle of measurement with orifices, venture meter, nozzle, pitot tube, ultrasonic, vortex flow meters, turbine flow meters, electromagnetic flow meters and rotameter.

2. **Measurement of Level**
   Construction, working principle and application of float, visual, purge, resistance probes, capacitance probes, ultrasonic.

3. **Measurement of Temperature**
   Concept of temperatures measurement devices, Constructional details, working principle and application of temperature sensors-thermocouple, RTDs, bimetallic, thermistors, radiation pyrometers.

4. **Measurement of Pressure**
   Concept of absolute, gauge and differential pressure. Construction, working principle and application of pressure sensors-Bourden tube, bellows, diaphragm, capsules, manometers, pirani gauge, dead weight tester.

5. **Measurement of density, pH, humidity, moisture and viscosity**.

COURSE OUTCOME

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

- Enabling the students to acquire knowledge about various Pressure measuring instruments.
- Understanding the concept and working of Level Measurement in instrumentation and control.
- Enable the student to get familiarized with working of flow measurement systems.

- Enable the student to get familiarized with working of temperature measurement systems.
- Describe the basics of Moisture and Density Measurement Systems.
- Understand the working and installation of Instrumentation system.

RECOMMENDED BOOKS

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

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	12	25
2	08	15
3	10	20
4	10	20
5	08	20
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC405**	**COURSE TITLE: PROCESS INSTRUMENTATION LAB**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. To measure pressure by various methods
   a) Pressure Gauge(Bourdon, Bellowand diaphragm type)
   b) Digital Pressure Indicator
   c) Vacuum pressure by any available vacuum gauge and compare.
2. To measure record pressure offline by graphic recorder and electronic pressure Recorder.
3. To measure level of a tank by
   a) Sight glass tube and flood method.
   b) Capacitive level detector
   c) resistive level detector.
4. To calibrate a pressure gauge using load weight tester and standard pressure Calibration.
5. To study the construction and operation of level limit switch and make an application circuit using
   level limit switch.
6. To measure speed of motor by
   a) Mechanical tachometer
   b) Optical tachometer
   c) Inductive reluctance type tachometer
7. To measure temperature of a furnace/object by various methods.
   a) Thermometer
   b) Thermocouple
   c) Pyrometer (Total radiation and optical pyrometer)
   d) RTD
   e) I.R. temperature sensor (Semiconductor type)
8. To record level/temperature using universal electronic meter.
9. To measure flow in a pipeline using
   a) Orifice meter
   b) Venturimeter
   c) Rota meter
   d) Electromagnetic flow meter
   e) Ultrasonic flow meter
10. To measure flow of air using anemometer.
11. To measure density of solution using hydrometer.
12. To measure moisture using Electronic moisture meter.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC406**	**COURSE TITLE: MICROCONTROLLER AND EMBEDDED SYSTEMS**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 02,T: 01, P: 00)	

COURSE OBJECTIVE

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in Instrumentation Industries. The microcontroller is an area of specialization & microcontroller is the heart of the programmable devices. Students of Instrumentation and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry.

COURSE CONTENT

1. Introduction
- 1.1 Difference between microprocessor and microcontroller.
- 1.2 Microcontroller and their applications.
- 1.3 Microcontroller for embedded system.
- 1.4 Overview of the 8051 family

2. 8051 Architecture
- 2.1 Block Diagram and Pin Diagram of 8051 microcontroller.
- 2.2 The 8051 Oscillator & clock.
- 2.3 Program Counter and Data Pointer.
- 2.4 A & B CPU registers.
- 2.5 Flag and the program status word (PSW).
- 2.6 Internal Memory.
- 2.7 The stack and stack pointer.
- 2.8 Input/output ports.
- 2.9 Counters and timers.
- 2.10 Serial Data input/output.
- 2.11 Interrupts.

3. Addressing Modes & Instructions
- 3.1 Instructions set of 8051.
  - 3.1.1 Arithmetic instructions.
  - 3.1.2 Loops and jump instructions.
  - 3.1.3 Call instructions.
  - 3.1.4 Push and Pop Instructions.
- 3.2 Addressing modes of 8051**.**

4. Introduction to Embedded System
- 4.1 Definition of embedded system.
- 4.2 Embedded operating system, RTOS.
- 4.3 Embedded hardware units and devices in a system.

4.4 Design parameters of an embedded system and its importance.
4.5 Applications of embedded system.

5. Advanced Microcontroller

5.1 Only brief general architecture of AVR, PIC and ARM microcontroller
5.2 Introduction to Arduino IDE
5.3 Applications of advanced microcontroller in the Instrumentation and Control field

COURSE OUTCOME
After completion of the subject, the learner should be able to:

- Understand the application of microcontrollers in industries.
- Understand the working of microcontrollers.
- Familiar with the instruction set and addressing modes of microcontroller
- Understand basic knowledge of embedded systems.
- Explain the architecture of advanced microcontrollers.

INSTRUCTIONAL STRATEGY

Instruction should be given to students to get familiar with the microcontrollers in the class room so that they can develop the concept of controllers. Programming should be done by taking simple examples like interfacing of switch, LCD and relay, keypad etc.

RECOMMENDED BOOKS:-

1. Fundamentals of Microprocessor and Microcontroller by B. Ram, DhanpatRai Publications.
2. Microcontroller: Architecture, Programming & Applications by Ayala, Kenneth J., Penram
3. Microcontroller and Embedded Systems using Assembly And C by Muhammad Ali Mazidi, Rolin Mckinlay, Janice Gillespie Mazidi: Pearson
4. PIC Microcontroller and Embedded Systems : Using assembly and C by Muhammad Ali Mazidi, Rolin Mckinlay, Danny Causey; Pearson
5. The 8051 microcontroller by K.J. Ayala, Penram International.
6. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
7. E-books/e-tools/relevant software to be used as recommended by AICTE / HSBTE / NITTTR.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	**Time Allotted (Hours)**	**Marks Allotted (%)**
1	06	10
2	14	30
3	10	20
4	10	20
5	08	20
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC407**	**COURSE TITLE: MICROCONTROLLER AND EMBEDDED SYSTEMS LAB**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 0,T: 0, P: 2)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. Familiarization with Micro-controller Kit and its different sections.
2. Familiarization with Assembly Language Programming (PC Based).
3. Program to add two hexadecimal numbers.
4. Program to add two decimal numbers.
5. Program to check whether number is odd or even.
7. Programming to interface switches and LEDs.
8. Programming and interface of Seven Segment and LCD.
9. Programming to interface Keypad.
11. Programming for A/D converter, result on LCD.
12. Programming for D/A converter, result on LCD.
13. Programming and interfacing of RELAY and Buzzer.
15. Programming and interfacing of Stepper Motor**.**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: OE401	**COURSE TITLE: MULTIDISCIPLINARY ELECTIVE (Preferably through MOOCs from Swayam / NPTEL)**
SEMESTER: 4th	**CREDITS: 2**
PERIODS PER WEEK: 2 (L: 2,T: 0, P: 0)	

• Introduction to Internet of Things, Introduction to Robotics, • Introduction to Embedded System Design, • Fundamentals of Artificial Intelligence, • Digital Image Processing, • Introduction to Machine Learning • IOT and Smart systems, • Introduction to Artificial Intelligence, • Fundamentals of Mechatronics,	• Fundamentals of Artificial Intelligence, • The Joy of Computing Using Python, • Cloud Computing, • Introduction to Industry 4.0 and Industrial Internet of Things, • Object Oriented System Development using UML, Java and Patterns, • Mobile Application Development using Android, • Linux system administration, • Big Data Computing

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: SI/PR401	**COURSE TITLE: MINOR PROJECT**
SEMESTER: 4th	**CREDITS: 2**
PERIODS PER WEEK: 4 (L: 0,T: 0, P: 4)	

NOTE: - The project may be identified at the end of 3rd semester

Realizing the great importance of students' exposure to world of work for his professional growth, two spells of industry oriented projects-minor and major have been included in the curriculum. It is necessary that teachers to play a pro -active role in planning and guidance of individual students for optimizing the benefits of the activity in stipulated time.

COURSE OUTCOME

After undergoing the subject, students will be able to:

- Apply concepts, principles and practices taught in the classroom in solving field / industrial problems.

GENERAL GUIDELINES

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to correlate concepts, principles and practices taught in the classroom with their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work

Depending upon the interests of the students and location of the organization the student may be asked to visit:

1. Process industries like Petrochemical Units/Fertilizers /Paper etc.
2. Various instrumentation industries.
3. Thermal power stations.
4. Electronics and Microprocessor based control system industries.
5. Medical electronics industries.
6. Repair and maintenance workshops.
7. Pressure measuring systems.
8. Digital display systems.
9. Calibration of different types of indicating instruments, measurement of process variables in industry.
10. Repair of different instruments being used in various laboratories.
11. Case study of process industries using PLC or DCS

LIST OF MINOR PROJECTS

1. LPG leakage detector
2. Smoke detector

3. Mobile detector
4. Street light control
5. Power supply design
6. Clamp switch
7. Fire alarm
5. Metal detector
6. Rain Alarm
7. Fastest finger first
8. A Timer
9. Filters
10. Running Light Control
11. Message Display
12. Digital Alarm Clock
13. PCB Design
14. Temperature Controller
15. Power Supply for Mobile
16. Multiple O/P Power Supply
17. Lab Experimental Trainer Board
18. On-Off Control
19. Use of for controlling speed of motors.

***(This list is only suggestive; however other problems may also be identified depending on local industries*)**

For effective planning and implementation of the above, it is suggested that polytechnics / institutes should:

a) Identify adequate number of industrial/field organizations and seek their approval for deputing students for exposure/visits.
b) Prepare a workbook (which can be used by students) for guiding students to perform definite task during the above mentioned exposure.
c) Identify teachers who would supervise the students' activities and provide guidance on continuous basis during the above project work.

The components of evaluation will include the following:

Unit No.	Component	Weigtage
a)	Punctuality and regularity	10%
b)	Initiative in learning new things	10%
c)	Relationship with others/workers	10%
d)	Project Report/ Technical report	50%
e)	Seminar based on Project	20%

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: AU401	**COURSE TITLE: UNIVERSAL HUMAN VALUES / Indian Constitution / Employability skills (Mandatory course)**
SEMESTER: 4th	**CREDITS: 0**
PERIODS PER WEEK: 1 (L: 0,T: 0, P: 1)	

UNIVERSAL HUMAN VALUES

COURSE OBJECTIVE:

This introductory course input is intended to help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientation input in value education to the young enquiring minds.

COURSE METHODOLOGY

The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.

It is free from any dogma or value prescriptions.

It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.

This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.

This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

COURSE CONTENT

1. Course Introduction –

Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education.

Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities-

the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations: understanding and living in harmony at various levels

2. Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material the Body'
Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensureSanyam and Swasthya
Practice Exercises and Case Studies will be taken up in Practice Sessions.

3. Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding Harmony in the family – the basic unit of human interaction
Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas) and Respect (Samman) as the foundational values of relationship Understanding the meaning of Vishwas; Difference between intention and competence
Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human GoalsVisualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!
Practice Exercises and Case Studies will be taken up in Practice Sessions.

4. Understanding Harmony in the Nature and Existence

Whole existence as Co-existence Understanding the harmony in the Nature Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self- regulation in nature
Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence
Practice Exercises and Case Studies will be taken up in Practice Sessions.

5. Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values

Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order:
At the level of individual: as socially and ecologically responsible engineers, technologists and managers
At the level of society: as mutually enriching institutions and organizations
To inculcate Human Values among Students: The Role of self, Parents and Teachers- Practice Exercises and Case Studies will be taken up in Practice Sessions. Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

Assignments and quiz/class tests, Practical assessment.

Reference Material

The primary resource material for teaching this course consists of
a. The text book (Latest Edition)Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
b. The teacher's manual (Latest Edition)Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 4.
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkanta k. E. F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
8. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in Story of Stuff, http://www.storyofstuff.com