# COURSE PLAN

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|---|---|---|---|
| **Department :** | Instrumentation and Control Engineering | | |
| **Course Name & code :** | Industrial Automation | ICE 3252 | |
| **Semester & branch :** | VI | Electronics & Instrumentation Engineering | |
| **Name of the faculty :** | Mr. Bipin Krishna & Dr. Bhagya R Navada | | |

| **No of contact hours/week:** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **4** | **0** | **0** | **4** |

## COURSE OUTCOMES (COS)

| **At the end of this course, the student should be able to:** | | **No. of Contact Hours** | **Marks** | **Program Outcomes (POs)** | **PSO** | **BL (Recommended)** |
|---|---|---|---|---|---|---|
| **CO1** | Review the computer based control, PLC architecture and maintenance. | 8 | 16 | 1,2 | 1 | 2,3 |
| **CO2** | Analyse the function blocks of PLC programming. | 6 | 12 | 1,2, 3,6 | 1,2 | 3,4 |
| **CO3** | Develop PLC programmes using different programming methods. | 15 | 30 | 1,2, 3,6 | 1,2 | 3,4,5,6 |
| **CO4** | Comprehend the structure and working of various types of communication protocols used in automation domain. | 10 | 22 | 1,2 | 1 | 2,3,4 |
| **CO5** | Understand the architecture and interface concepts of DCS | 9 | 20 | 1,2 | 2 | 2,3,4 |
| | **Total** | **48** | **100** | | | |

# Assessment Plan

| ***IN – SEMESTER ASSESSMENTS*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No.** | **Assessment Mode** | | **Assessment Method** | **Time Duration** | **Marks** | **Weightage** | **Typology of Questions (Recommended)** | **Schedule** | ****Topics Covered** |
| 1 | **MISAC** | **1** | **Surprise Assignment** | **20 Mins** | **5** | 1 Question × 5M = 5 marks (Minimum 5 questions to be given) | Bloom's taxonomy (B) level of the question should be L3 and above. | Feb 13-17, 2023 | Topics covered during Jan 30th to Feb 11, 2023. |
| | | **2** | **Quiz** | **15 Mins** | **5** | 10 MCQs × ½ = 5 | Bloom's taxonomy (BT) level of the question should be L3 and above. | Feb 27-March 4th , 2023 | Topics covered during Jan 30th to Feb 25, 2023 |
| | | **3** | **In-semester Exam 1** | **20 Mins** | **15** | **Objective:** 5M<br>10 MCQs × ½ = 5 marks<br><br>**Descriptive:** 10 M<br>(2 Questions of 2 marks +2 Questions of 3 marks) | Bloom's taxonomy (BT) level of the question should be L3 and above. | March 10th- 13th 2023 | Topics covered during Jan 30th to March 4th , 2023 |
| | | **4** | **In-semester Exam 2** | **60 Mins** | **15** | **Objective:** 5M<br>10 MCQs × ½ = 5 marks<br><br>**Descriptive:** 10 M<br>(2 Questions of 2 marks +2 Questions of 3 marks) | Bloom's taxonomy (BT) level of the question should be L3 and above. | April 18-20,2023 | Topics covered during March 6th to April 14th , 2023 |
| 2 | **FISAC** | **1** | **Quiz** | **15 Mins** | **5** | 10 MCQs × ½ = 5 | Bloom's taxonomy (BT) level of the question should be L3 and above. | March 27th to April 01, 2023 | Lecture N0. 14-22 |

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|---|---|---|---|---|---|---|---|---|---|
| | | **2** | **Surprise Assignment** | **20 Mins** | **5** | 1 Question × 5M = 5 marks (Minimum 5 questions to be given) | Bloom's taxonomy (BT) level of the question should be L3 and above. | May 2nd to 08th, 2023 | Topics covered in the guest lecture. |
| ***END – SEMESTER ASSESSMENT*** | | | | | | | | | |
| 1 | **Regular/Make–Up Exam** | | | 180 Mins | 50 | Answer all 5 full questions of 10 marks each. Each question can have 3 parts of 2/3/4/5/6 marks. | Bloom's taxonomy (BT) level of the question should be L3 and above. | 17th week of the semester | Comprehensive examination covering full syllabus. |

*****  Individual faculty will be entering the topics***

****** Individual faculty must identify the assessment method from table 3 and fill in the details.***

***NOTE: Information provided in the table is as per the In-semester assessment plan and schedule of V and VII semester B. Tech provided from Academic Section.***

**Flexible In-semester Assessment Component (FISAC):**

i) The FISAC 1 & FISAC 2 may be any of the types given in Table 1. However, tne two components should be of different type.

ii) The type of assessment should be informed to the students well in advance.

iii) Syllabus for the last component of In-semester Assessment (ISAC) i.e. FISAC 2 should cover the topics mentioned for self-study if any / topics which are not covered till MISAC 4: In-Semester Exam 2.

**Table 1: Flexible In-semester Assessment Component (FISAC)**

| No | Type | Description |
|---|---|---|
| A. | Quiz/MCQs | Same as MISAC 2: Quiz/MCQs |
| B. | Surprise Assignment | Same as MISAC 3: Surprise assignment. |
| C. | Take Home Assignment | *10 questions are to be given to each student.<br>*Questions must be of Blooms Taxonomy Level 3 for first year and Level 4 for higher semesters.<br>*Questions are to be given TWO weeks in advance.<br>*Students have to write the answers to all the questions. |
| D. | Group Assignment | *The students are to be grouped in such a way that there are 3 – 4 students in each group.<br>*Each group is to be given one question.<br>*The questions should be of Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters.<br>*Questions are to be given TWO weeks in advance.<br>*The questions may be in the form of case studies, design, report writing, etc. |
| E. | Seminar | *Students may be given the topics for seminar relevant to the course of study.<br>*Topics are to be given TWO weeks in advance.<br>*Should be of Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters.<br>*Topics should be related to the courses of study.<br>*Topics should be in the field of recent developments in the courses of study.<br>*Students have to collect the data regarding the seminar topic and submit a report.<br>*Students should make a presentation for about TEN minutes using Power Point. |
| F. | Quiz / Assignment based on invited talks | *Faculty have to arrange for the invited talk in the emerging areas in the courses of study.<br>*Quiz / Assignment is to be conducted on the topic of the invited talk.<br>*Questions should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters. |
| G. | Development of Software / Apps | *Faculty has to define the problem statement.<br>*Problem Statements are to be given TWO weeks in advance.<br>*Should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters.<br>*Students have to develop the software / mobile apps using the appropriate software language / platform. |
| H. | Mini Project | *Faculty has to define the problem statement.<br>*Problem Statements are to be given TWO weeks in advance.<br>*Should be at Blooms Taxonomy Level 4 for first year and Level 5 for higher semesters.<br>*Students have to develop prototypes. |

## LESSON PLAN

| L No | TOPICS | Course Outcome Addressed |
|---|---|---|
| 1 | Introduction to the course | |
| 2 | Computers in Process Control: Data loggers, Data Acquisition Systems (DAS) | CO1 |
| 3 | Direct Digital Control (DDC) | CO1 |
| 4 | Supervisory Control and Data Acquisition Systems (SCADA), sampling considerations | CO1 |
| 5 | Programmable Logic Controller (PLC): Definition, overview of PLC systems | CO1 |
| 6 | PLC architecture, power supplies and isolators | CO1 |
| 7 | input/output modules | CO1 |
| 8 | PLC Maintenance: networking of PLC, PLC installation, troubleshooting and maintenance | CO1 |
| 9 | wiring of sensors and output devices to the PLC | CO1 |
| 10 | Ladder logic Programming: General PLC programming procedures | CO3 |
| 11 | Programming on-off inputs/ outputs | CO3 |
| 12 | Auxiliary commands and functions | CO2 |
| 13 | PLC Basic Functions, register basics | CO2 |
| 14 | Timer functions | CO2 |
| 15 | Problems using Timers | CO3 |
| 16 | Problems using Timers | CO3 |
| 17 | Counter Function | CO2 |
| 18 | Problems using counters | CO3 |
| 19 | Problems using counters | CO3 |
| 20 | PLC Intermediate Functions: Arithmetic functions | CO2 |
| 21 | Skip and MCR functions, Number comparison functions | CO2 |
| 22 | Problems using Data move systems | CO3 |
| 23 | Problems with PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions | CO3 |
| 24 | Problems with PLC-PID functions, PLC advanced functions | CO3 |
| 25 | Problems with Analog PLC operatio and matrix functions | CO3 |
| 26 | General programming procedures to construct Instruction List (IL) and problems | CO3 |
| 27 | General programming procedures to construct Structured Text (ST) and problems | CO3 |
| 28 | General programming procedures to construct Sequential Flow Chart (SFC) and problems | CO3 |
| 29 | General programming procedures to construct Functional Block Diagrams (FBD) and problems | CO3 |
| 30 | Problems on alternate programming languages | CO3 |
| 31 | Interface and Backplane Bus Standards for Instrumentation Systems: Communication Hierarchy- Communication System Requirements. - Network Topologies -Protocol - Functions of Various Layers | CO4 |
| 32 | Field bus: Introduction, concept | CO4 |
| 33 | HART protocol: Method of operation, structure, operating conditions and applications. | CO4 |
| 34 | Smart transmitters, smart valves and smart actuators | CO4 |
| 35 | MOD bus: Transmission mode | CO4 |
| 36 | General message form, Data types, Data addressing | CO4 |
| 37 | Cyclic redundancy check calculation | CO4 |
| 38 | Profibus: Communication Profiles, Physical Profiles | CO4 |
| 39 | Application Profiles, Protocol Architecture | CO4 |
| 40 | RS-485 Transmission Technology, IEC 1158-2 Transmission Technology. | CO4 |

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|---|---|---|
| 41 | Distributed Control Systems (DCS): Definition, configuration of DCS | CO5 |
| 42 | Local Control Unit (LCU) architecture | CO5 |
| 43 | LCU languages, LCU – Process interfacing issues | CO5 |
| 44 | Redundancy concept | CO5 |
| 45 | Operator interfaces: Low level and high level operator interfaces- Displays | CO5 |
| 46 | Engineering interfaces – Low level and high level engineering interfaces | CO5 |
| 47 | Factors to be considered in selecting DCS | CO5 |
| 48 | Case studies in DCS | CO5 |
| 49 | Case studies in DCS | CO5 |

## Course Articulation Matrix

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | **2** | | | | | | | | | | | **1** | | |
| **CO2** | **1** | **2** | **2** | | | **1** | | | | | | | **1** | **2** | |
| **CO3** | **2** | **2** | **2** | | | **1** | | | | | | | **1** | **2** | |
| **CO4** | **1** | **2** | | | | | | | | | | | **1** | | |
| **CO5** | **2** | | | | | | | | | | | | | **2** | |
| **Articulation Level** | **1.6** | **2** | **2** | | | | | | | | | | **1** | **2** | |

**FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):**

| FACULTY | SECTION | FACULTY | SECTION |
|---|---|---|---|
| Mr. Bipin Krishna | B | | |
| Dr. Bhagya R Navada | A | | |

**References:**


1. John. W. Webb Ronald A Reis, *Programmable Logic Controllers - Principles and Applications*, PHI, (5e). 2022.

2. Lukcas M.P, *Distributed Control Systems*, Van Nostrand Reinhold Co., 2016.

3. Frank D. Petruzella, *Programmable Logic Controllers*, MGH, (4e), 2011.

4. Liptak, B.G., *Instrument engineers' handbook, volume two: Process control and optimization*, CRC press, 2018.


**Submitted by: Bipin Krishna**

**(Signature of the faculty)**

**Date: 30-01-2023**

**Approved by:**

**(Signature of HOD)**