No	Course Information	
1	Unit name:	Programmable Logic Control I
2	Code:	EP 41028
3	Classification:	Engineering subject
4	Credit value:	2.5
5	Semester/ Year Offered:	1/4
6	Pre-requisite:	NA
7	Mode of delivery:	Lecture, Practical
8	Assessment system and breakdown of marks:	
	Test	20%
	Mid-term Examination	30%
9	Academic staff teaching unit:	6
10	Course outcome of unit: In this course students will be able • To memorize the basic knowledge of PLC,components of PLC hardware • To memorize the useful numbering system and codes for PLC • To draw the relationship between the relay schematics, ladder logic programs and the equivalent logic gate circuits • To memorize the basic instructions of PLC programming and field devices used in PLC connection and process control • To Apply the components of relay schematic diagrams, compare the PLC connections with I/O modules and built the logic gate circuits by using software	
11	Synopsis of unit: The course covers the fundamental and components of PLC, number systems and logics and input/output control devices commonly found in PLC installations. This course introduces students to PLC, the parts of PLC, input/output control devices commonly found in PLC installations, and fundamental of logics and illustrates the	

	ladder diagram for the process of the machine operation. Topic: **Chapter Title**
	1. Programmable Logic Controllers(PLCs): An Overview • Programmable Logic Controllers • Parts of a PLC • Principles of Operation • Modifying the Operation • PLCs versus Computers • PLC size and Application **2. PLC Hardware Components** • The I/O Section • Discrete I/O Modules • Analog I/O Modules • Special I/O Modules • I/O Specifications • The Central Processing Unit (CPU) • Memory Design • Memory Types • Programming Terminal Devices • Recording and Retrieving Data • Human Machine Interfaces(HMIs) **3. Number Systems and Codes** • Decimal System • Binary System • Negative Numbers • Octal System • Hexadecimal System • Binary Coded Decimal (BCD) System

- Gray Code
- ASCII Code
- Parity Bit
- Binary Arithmetic
- Floating Point Arithmetic

4. Fundamentals of Logic

- The Binary Concept
- AND, OR, and NOT Functions
- Boolean Algebra
- Developing Logic Gate Circuits From Boolean Expressions
- Producing the Boolean Equation for a Give Logic Gate Circuit
- Hardwired Logic Versus Programmed Logic
- Programming Word Level Logic Instructions

5. Basics of PLC Programming

- Processor Memory Organization
- Program Scan
- PLC Programming Languages
- Bit-Level Logic Instructions
- Instruction Addressing
- Branch Instructions
- Internal Relay Instructions
- Programming Examine If Closed and Examine If Open Instructions
- Entering the Ladder Diagram
- Modes of Operation
- Connecting with Analog Devices

6. Developing fundamental PLC Wiring Diagrams and Ladder Logic Programs

- Electromagnetic Control Relays
- Contactors
- Motor Starters
- Manually Operated Switches
- Mechanically Operated Switches
- Sensors
- Output Control Devices
- Seal-In Circuits
- Electrical Interlocking Circuits
- Latching Relays
- Converting Relay Schematics into PLC Ladder Program

	• Writing a Ladder Logic Program Directly from a Narrative Description • Instrumentation
14	Main references: 1. FrankD. Petruzella, Fifth Edition. 2. Previous Editions: 2011, 2005 and 1998.
L	Additional references:

Information on Lab Practical

Job	Title
1.	**Study on equipment of motor control and components of PLC** **Objectives:** - To study some of typical symbols used in motor control circuit diagrams - To state the names of PLC hardware components - To represent motor control drawings and ladder diagram of PLC.
2.	**JOB-2 Direct on line Motor Control System** **Objectives** - To understand the usage of relay logic diagram - To make wiring connection for direct on line motor control system - To explain the operation of the motor control system. **Required equipment** 1. Main and sub feeder isolating circuit breakers 2. Power and control circuit fuses 3. Indicating pilot lamps 4. Pushbuttons (stop , start) 5. Magnetic Contactor 6. Overload Relay 7. 3 phase motor 8. Cables as required

3.	**JOB-3 Logic Circuit Modelling and Simulation with Multisim** **Objectives:** - To understand the binary concept and the functions of logic gates - To be able to drive Boolean equations for logic circuits - To use the NI Multisim software **Required equipment** — **Qty** 1. V_{CC} (5V) — 1 2. Resistor (1kΩ) — 1 3. Indicators (pilot lamps) — 2 4. Switches (SPST) — 3 5. Switches (SPDT) — 1 6. AND gate (7408J) — 2 7. OR gate (7432N) — 1 8. NOT gate (7404N) — 1 9. Output (Lamp 5V_1W) — 1 10. Logic analyzer (XLAI) — 1
4.	**JOB-4 Hardwired Logic versus Programmed Logic** **Objectives** - To understand the operation of relay ladder schematics - To implement hardwired logic by using relays and relay ladder schematics - To convert relay ladder schematics to ladder logic program **Required equipment** 1. Main and sub feeder isolating circuit breakers 2. Power and control circuit fuses 3. Indicating pilot lamps 4. Pushbuttons (stop , start) 5. Magnetic Contactor 6. Overload Relay 7. Cables as required

5.	**JOB-5 Forward-Reverse Motor Operation** **Objectives** - To understand the usage of relay logic diagram - To change the direction of a three phase motor rotation - To learn about the principle of electrical interlocking **Required equipment** 1. Main and sub feeder isolating circuit breakers 2. Power and control circuit fuses 3. Indicating pilot lamps 4. Pushbuttons 5. Magnetic Contactors 6. Overload Relay 7. 3 phase motor 8. Cables as required