assembly line. When a part arrives a 'part' sensor will detect it. After this the

- 'clamp' output is turned on for 10 seconds to hold the part during the operation. For the first 2 seconds the part is being held a 'spray' output will be turned on to apply the thermoset ink. For the last 8 seconds a 'heat' output will be turned on to cure the ink. After this the part is released and allowed to continue along the line. Develop a ladder logic diagram for this process
- Elaborate on the different levels of Industrial Control Architecture? Where do **3C**) the PLCs fit?
- 4A) Sketch and explain the concept of sourcing and sinking with respect to the output module of a PLC.
- Write a short note on Analog PLC Operator and signal .Trace 70 V through a **4B**) system which has specification as follows :
 - a. Input volts: 0-80
 - **b.** Input Module Volts: 0-10
 - **c.** Input Module :9-bit base

- Write a ladder logic program for the following process. When a button A is pushed, a light will flash for 5 seconds. The flashing light will be on for 0.25
- sec and off for 0.75 sec. If A has been pushed 5 times the light will not flash until the system is reset. The system can be reset by pressing button B. Draw appropriate timing diagram.

Describe in detail the working of input and output module of a PLC?

- 1C) Explain the two types of latching circuits with relevant examples. What is meant by interlocking?
- Construct a ladder logic diagram that will implement the following function. 2A) If the result is greater than 100 then an output light 'P' will be turned on. Assume A, B and C are inputs.

 $X = \ln[10 + A(B\cos^{-1}(4C + 5))^2]$

- What is a mechatronic system? Explain the role of sensor and Actuator. **2B**)
- **2C**) With neat diagrams, explain different types of redundant PLCs and mention their advantages and disadvantages.
- **3A**) Write a short note on :
 - 1. Contactors 2. Relays 3. Motor Starters
- Use suitable sketches wherever required. A new printing station will add a logo to parts as they travel along an **3B**)

(6+8+6)

(8+8+4)

Max. Marks: 100



Time: 3 Hours

1A)

1B)

✓ Answer ANY FIVE full Questions.

✓ Missing data, if any, may be suitably assumed



INTERNATIONAL CENTRE FOR APPLIED SCIENCES (Manipal University)

SUBJECT: PROGRAMMABLE LOGIC CONTROLLER (MET 244) (BRANCH: MECHATRONICS ENGINEERING) Thursday, 27 April 2017

(6+6+8)

4C) Write a note on a) Different types of switches (6+6+8)b) Special varieties of modules that can be connected to PLC's. 5A) With a neat block diagram explain the operation of an Off Delay timer and updown counter. Also discuss their data types. Implement a ladder logic circuit for the following scenario with proper **5B**) addresses and labels. A temperature control system consists of three bimetallic thermostats (thermostats are de-energized (LOW) when the set point is reached). The system operates three heaters. Thermostats are set at 50°C, 60°C and 70 °C. Below 50°C three heaters are to be on. A temperature between 50°C and 60°C causes two heaters to be on. For temperatures between 60°C and 70°C only one heater is to be on. Above 70°C all heaters should be off. A buzzer is to be sounded and a safety shutoff should be energized and when temperature reaches 80°C making all three heaters off in case on stays on by mistake. A master control turns the system on and off. 5C) What are different network topologies? Write a short note on different (4+8+8)communication protocols that are followed. 6A) Explain how JUMP differs from SKIP and MCR functions. Write truth table, Boolean expression and ladder diagram for XOR and **6B**) XNOR. Also draw the digital circuit. 6C) Discuss different layers of communication layers to communicate a device in (6+6+8)the network. 7A) What is meant by the Scan cycle of PLC. Describe in detail. **7B**) Design ladder logic that uses normal timers and counters to measure time of 50.0 days. Note: Measure minutes, hours and days. Draw a ladder logic for an output to be on when the count is between 34 and 41(both inclusive). 7C) Discuss the terms: CIM, Plant Controller, Area controller, Cell controller. (6+6+8)**8A**) There are three machines each with individual start and stop buttons. Any one may run at a time. The first one should automatically stop when the second one is switched on. Construct a ladder diagram for this scenario with proper labelling and addressing. What is a DCS and what is its role in SCADA? List the different types of **8B**) DCS with suitable examples. What is a dead man switch and what is its significance? **8C**) Use FBD to solve the following problem: 2 conveyor belts feed into a main conveyor. A production unit produces 100 parts/hr.Parts on the conveyor are counted by each sensor and then the total is

counted. When more than one fourth of the total parts has been counted a

green light must go on.

(4+8+8)