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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015**

COURSE NAME : INDUSTRIAL AUTOMATION
COURSE CODE : BPC 41203
PROGRAMME : 3 BPB
EXAMINATION DATE : DECEMBER 2014/JANUARY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) Explain the automation production line. (4 marks)
- (b) Describe **FOUR (4)** functions of automation production line. (6 marks)
- (c) Illustrate the position of automation and control technologies in the production system with explanations. (10 marks)
- Q2** (a) Explain **FOUR (4)** types of joint used in robotic arms and wrists. (8 marks)
- (b) Describe the following notation schemes for defining manipulator configurations:
- (i) TRT (4 marks)
- (ii) VVR (4 marks)
- (iii) VROT (4 marks)
- Q3** (a) List **FOUR (4)** major categories of material handling equipment. (4 marks)
- (b) A planned fleet of forklift trucks has an average travel distance per delivery is 500 feet loaded and an average empty travel distance is 350 feet. The fleet must make a total of 60 deliveries per hour. Load and unload times are each 0.5 min and the speed of the vehicles are 300 feet/min. The traffic factor for the system = 0.85. Availability = 0.95, and worker efficiency = 90%.
- Determine:
- (i) Ideal cycle time per delivery. (4 marks)
- (ii) The resulting average number of deliveries per hour that a forklift truck can make. (4 marks)
- (iii) How many trucks are required to accomplish the 60 deliveries per hour. (8 marks)

- Q4** (a) Construct with simplify a logic circuit = $A + \overline{AB} + \overline{(AB \cdot \overline{CD})} + \overline{BC} + D$
 (10 marks)
- (b) Analyze the logic circuit as shown at **Figure Q4** to simplest forms using Boolean algebra expression.

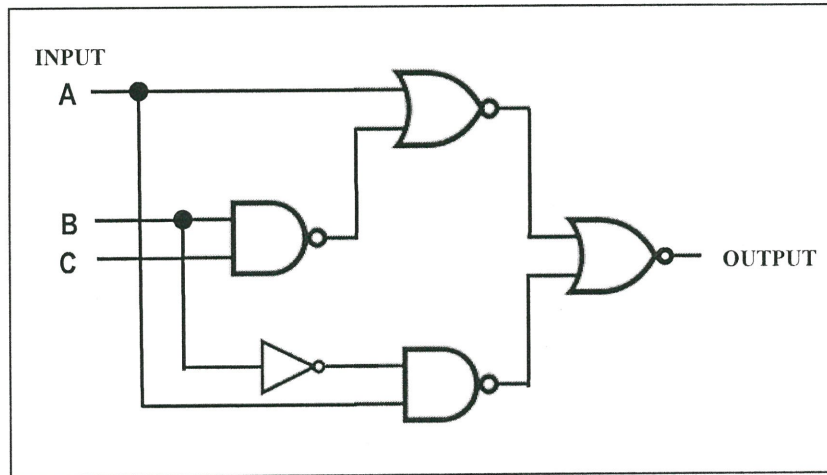


Figure Q4

(10 marks)

- Q5** A robot performs a loading and unloading operation for a machine tool. The work cycle consists of the following sequence of activities in **Table Q5**:

Seq.	Activity	Time
1	Robot reaches and picks part from incoming conveyor and loads into fixture on machine tool.	5.0 sec.
2	Machining cycle (automatic)	37.0 sec.
3	Robot reaches in, retrieves part from machine tool, and deposits it onto outgoing conveyor.	5.8 sec.
4	Move back to pick up position	2.2 sec.

The activities are performed sequentially as listed. For every 40 workparts, the cutting tools in the machine must be changed. This irregular cycle takes 3.0 minutes to accomplish. The uptime efficiency of the robot is 96% and the uptime efficiency of the machine tool is 97%, not including interruptions for tool changes. These two efficiencies are assumed not to overlap. Downtime results are from electrical and mechanical malfunctions of the robot, machine tool and fixture.

Calculate :

- (a) Time per cycle (5 marks)
- (b) Total change time per piece (5 marks)
- (c) Production rate per hour during uptime efficiency (10 marks)

-END OF QUESTION-