BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: ME **SEMESTER : I**
BRANCH: AMS **SESSION : MO/17**

SUBJECT: MPE1001: MANUFACTURING AUTOMATION

TIME: 3. Hours **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Explain the following with suitable figure/example. [4]
(i) Explain the difference between process parameters and process variables.
(ii) Automation scale: scale for comparing grades of automation

Q.1(b) A production line with four automatic workstations (the other stations are manual) produces a certain product whose total assembly work content time = 55.0 min of direct manual labor. The production rate on the line is 45 units/hr. Because of the automated stations, uptime efficiency = 89%. The manual stations each have one worker. It is known that 10% of the cycle time is lost due to repositioning. If the balancing efficiency = 0.92 on the manual stations, find (a) cycle time, (b) number of workers and (c) workstations on the line. (d) What is the average manning level on the line, where the average includes the automatic stations? [8]

Q.2(a) A stepping motor has 200 step angles. Its output shaft is directly coupled to leadscrew with pitch = 0.250 in. A worktable is driven by the leadscrew. The table must move a distance of 5.00 in from its present position at a travel speed of 20.0 in/min. Determine: (a) how many pulses are required to move the table the specified distance, and (b) what is the required motor speed and pulse rate to achieve the desired table speed? [6]

Q.2(b) How many types of valves are used in hydraulic/pneumatic systems? What are their symbols? [6]

Q.3 Explain the following with suitable example/figure: [12]
(a) List the six basic components used in a pneumatic system.
(b) Adaptive Control System
(c) List various forms of computer process monitoring and computer process control in use today.

Q.4(a) Write classification of sensor? Explain working principle with manufacturing application of the limit switch, proximity sensor and inductive proximity sensor? [6]

Q.4(b) An 8 cm diameter pneumatic cylinder has a 4 cm diameter rod. If the cylinder receives flow at 100 LPM and 6 bar, find the (a) Extension and retraction speeds (b) Extension and retraction load carrying capacities. [6]

Q.5(a) Draw a hydraulic circuit for automatic cylinder reciprocating system using Directional control valve. [4]

Q.5(b) In the manual operation of a sheet metal stamping press, a two-button safely interlock system is often used to prevent the operator from inadvertently actuating the press while his hand is in the die. Both buttons must be depressed to actuate the stamping cycle. In this system, one press button is located on one side of the press while the other button is located on the opposite side. During the work cycle, the operator inserts the part into the die and depresses both push-buttons, using both hands, (a) Write the truth able for this interlock system (b) Write the Boolean logic expression for the system. (c) Construct the logic network diagram for the system. (d) Construct the ladder logic diagram for the system. [8]

Q.6(a) What is the difference between a 5/2 directional control valve, single solenoid and a 5/2 Directional control valve, double solenoid? [2]

Q.6(b) Draw a hydraulic circuit Control of double acting hydraulic cylinder. [4]

Q.6(c) A double acting cylinder is hooked up to reciprocate. The relief valve setting is 70 bars. The piston area is 0.016 m^2 and the rod area is 0.0045 m^2. If the pump flow is 0.0013m^3/s, find the cylinder speed and load- carrying capacity for the following: [6]
a. Extending stroke
b. Retracting stroke.

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Q.7 Explain the following with suitable figure and examples: [12]

(a) Yardstick of automation
(b) Distinguish between ‘Servo control’ and ‘feed back control’
(c) Application flexibility and adaption flexibility in machining automation

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