Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS)

END SEMESTER EXAMINATIONS, NOVEBER 2018

SUBJECT: AUTOMATED MANUFACTURING SYSTEMS [MTE 5133]

(24/11/2018)

TIME: 3 HOURS MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. Enumerate the different types of Adaptive control (AC) systems used in CNC machines. Also, list the machining situations where adaptive control can be beneficially applied. Configure and explain suitable AC machining system for cutting a workpiece that has casting defect. **(05)**

1B. Comprehend the need of automatic data identification in material handling system and list the different methods of automatic data identification. **(03)**

1C. Summarize, how the latest technological advancement likes Artificial Intelligence and Machine vision can aid in enhancing the process planning activity in production systems? **(02)**

2A. A XYZ company has manufacturing unit which produces different variant of parts and they do not exhibit too much similarity and new part are introduced on a regular basis. For this kind of manufacturing environment, which CAPP module do you suggest? Elaborate the module that you suggest. **(05)**

2B. Discuss the significance of G98 and G99 in canned cycle. **(03)**

2C. Differentiate between station and server with regards to Bottle neck model? **(02)**

3A. In CNC, center of the tool follows the programmed path. Then how the machining along the edges of billet is possible? Discuss in detail. **(04)**

3B. Apply the PFA method for the following part mix and machines to identify logical part families and machine groups to derive the benefit of Group Technology. The part mix consists of 06 variants (Part A, Part B, Part C, Part D, Part E, and Part F). Machine 1 performs Milling, Machine 2 performs Drilling, Machine 3 Performs Turning, Machine 4 Performs Shaping, Machine 5 Performs Grinding and whereas Machine 6 performs Honing. Part A is manufactured by Milling and Turning operations, Part B is manufactured by Turning and Grinding processes, Part C is manufactured by shaping and honing processes part D requires Drilling, Shaping, and Honing operations, Part E requires Milling and Grinding, whereas Part F is **(06)**

manufactured out of Drilling and Honing processes.

4A. An FMS consists of four stations. Station 1 is a load/unload station with one server. Station 2 performs milling operations with three servers (three identical CNC milling machines). Station 3 performs drilling operations with two servers (two identical CNC drill presses). Station 4 is an inspection station with one server that performs inspections on a sampling of the parts. The stations are connected by a part handling system that has two work carriers and whose mean transport time = 3.5 min. The FMS produces four parts. A, B, C, and D. The part mix fractions and process routings for the four parts are presented in the Table 4A. Determine: **(07)**

(a) Maximum production rate of the FMS.
(b) Corresponding production rate of each part.
(c) Utilization of each station in the system.
(d) The overall FMS utilization.

Table 4A: Process routings and part mix details

Part (j)	Part Mix (P_j)	Operation (k)	Description	Station (i)	Process Time (t_{ijk}) min.	Frequency F_{ijk}
A	0.1	1	Load	1	4	1.0
		2	Mill	2	20	1.0
		3	Drill	3	15	1.0
		4	Inspect	4	12	0.5
		5	Unload	1	2	1.0
B	0.2	1	Load	1	4	1.0
		2	Drill	3	16	1.0
		3	Mill	2	25	1.0
		4	Drill	3	14	1.0
		5	Inspect	4	15	0.2
		6	Unload	1	2	1.0
C	0.3	1	Load	1	4	1.0
		2	Drill	3	23	1.0
		3	Inspect	4	8	0.5
		4	Unload	1	2	1.0
D	0.4	1	Load	1	4	1.0
		2	Mill	2	30	1.0
		3	Inspect	4	12	0.333
		4	Unload	1	2	1.0

4B. Modify the traditional information cycle in typical manufacturing firm by introducing the concept of digital thread. **(03)**

5A. The warehouse layout of an Ecommerce enterprise is shown in Fig.Q5A. The material transport vehicles travel in a shown direction around the loop to deliver loads from the load station to the unload station. Loading time at the load station = 5.5 min, and unloading time at the unload station = 3.2 min. It is desired to determine how many vehicles are required to satisfy demand for this layout if the vehicles must complete a total of 25 del/hr. Site 1 is ASRS system used for loading and unloading the components. Site 2, 3 and 4 are for packaging and sorting. **(05)**

Estimate the total travel distance and empty distance for the sequence of

i) 5 times 1-2-1, ii)2 times 1-2-4-1, and iii)1 time 1-2-3-1. The following performance parameters are given: vehicle velocity= 50m/min, availability = 0.92, traffic factor =

0.85, and E = 0.90 also Determine: (a) travel distances loaded and empty, (b) ideal delivery cycle time, and (c) number of vehicles required to satisfy the delivery demand.

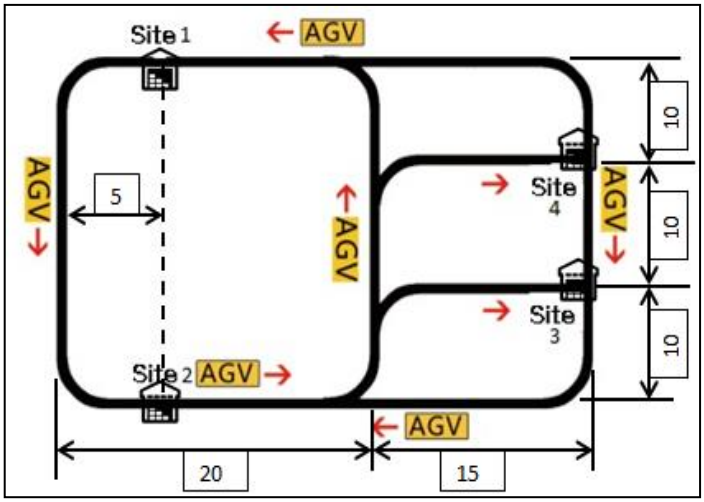

Fig. Q5A: Warehouse layout map (All distances are in meters)

5B. You are running a startup which focuses on automating the existing small-scale manufacturing system. Illustrate the approach and strategies you seek for automating a manufacturing system of your choice, emphasising on the control parameters and components of automation. **(05)**