GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1724709 Subject Name: Futuristic Manufacturing Systems Time: 10.30 am – 01.00 pm Instructions:

Date: 07-06-2013

Total Marks: 70

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Consider Cylindrical manipulator with sperical wrist shown in fig. No 1. 07 Construct
 - (a) Set of robotic coordinate frame.
 - (b) A table for joint parameter.
 - (c) Find individual of all T matrices of each joint



Fig.1 Cylindrical manipulator with spherical wrist.

- (b) Explain the following term:
 - 1. Speed of motion
 - 2. Load-Carrying Capacity

Q.2	(a)	Basic Structure of the Opitz Parts Classification and Coding System.				
	(b)	Sketch and discriminate the various configurations of a robot.	07			

configura OR

- (b) Explain in briefly four types of robot control systems. Out of these which 07 method of motion control would be the best for spray painting by robot?
- Q.3 (a) What is different between a hierarchical structure and a chain type structure 07 in a classification and coding scheme?

07

(b) An FMS consists of three station plus a load/unload station. station1 loads 07 and unloads parts from the FMS using two servers (material handling workers).station 2 performs horizontal milling operations with two servers (two identical CNC horizontal milling machines).station 3 performs vertical milling operations with three servers (three identical CNC vertical milling machines). Station 4 performs drilling operations with two servers (two identical drilling presses). The machines are connected by a part handling system that has two work carriers and a mean transport time =3.5 min. The FMS produces four parts, A, B, C and D. the operation frequency f_{ijk} =1.0 for all operation.

Determine:

- (a) Maximum production rate of the FMS
- (b) Utilization of each machine in the system

Dort i	Part Mix	Operation	Description	on Station Process	Station	Process
Faltj	Pi	K	Description	i	time(min)	
		1	Load	1	4	
		2	H.Mill	2	15	
Α	0.2	3	V.Mill	3	14	
	0.2	4	Drill	4	13	
		5	Unload	1	3	
		1	Load	1	4	
		2	Drill 4		12	
Б	0.2	3	H.Mill	2	16	
В	0.2	4	V.Mill	3	11	
		5	Drill	4	17	
		6	Unload	1	3	
		1	Load	1	4	
C	0.25	2	H.Mill	2	10	
C		3	Drill	4	9	
		4	Unload	1	3	
	0.35	1	Load	1	4	
		2	H.Mill	3	18	
		3	Drill	4	8	
		4	Unload	1	3	
			OR			

(c) Average utilization of the system

Q.3 (a) What are the various type of layouts used in FMS design? Explain briefly 07 their applications.

(b) Apply the rank order clustering technique to the part-machine incidence 07matrix in the following table to identify logical part families and machine groups. Also determine Similarity coefficients between all the machines and using Single Linkage Cluster analysis method develop a dendrogram.

Maahinaa	Parts									
Wachines	1	2	3	4	5	6	7	8	9	10
SAW01	/		/	/	/			/	/	
LATHE01				/						
LATHE02	/		/		/			/	/	
DRL01		/								
MILL02		/								
MILL05						/	/			
GRIND05	/									
GRIND06			/							/
INSP03		/				/	/			
INSP06	/		/	/	/			/	/	/

Q.4	(a)	What is CIM? What are the benefits of CIM?					
	(b)	Describe the requirements of sensors in robots. Explain any one sensor in	07				

OR

(a) Explain types of gripper mechanisms in detail. 0.4

details.

- (b) A point $P(8,6,2)^{T}$ is attached to a frame (n,o,a) and is subjected to the 07 transformations described. Find the coordinates of the point relative to the reference frame at the conclusion of transformations.
 - (1) Rotation of 90° about the o-axis,
 - (2) Followed by a rotation of 90° about the n-axis.
 - (3) Followed by a translation of [6, -2, 4]
- Q.5 (a) What is computer Aided Process Planning? Explain in details Retrival CAPP 07 systems.
- (b) Difference between FMC and FMS. 07 OR (a) What is the Rapid Prototyping? List different RP methods and explain any 07 Q.5
 - two. 07
 - (b) What is the differentiate between CAD/CAM and CIM?

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