

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013****Subject code: 1724709****Date: 07-06-2013****Subject Name: Futuristic Manufacturing Systems****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

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 spherical 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

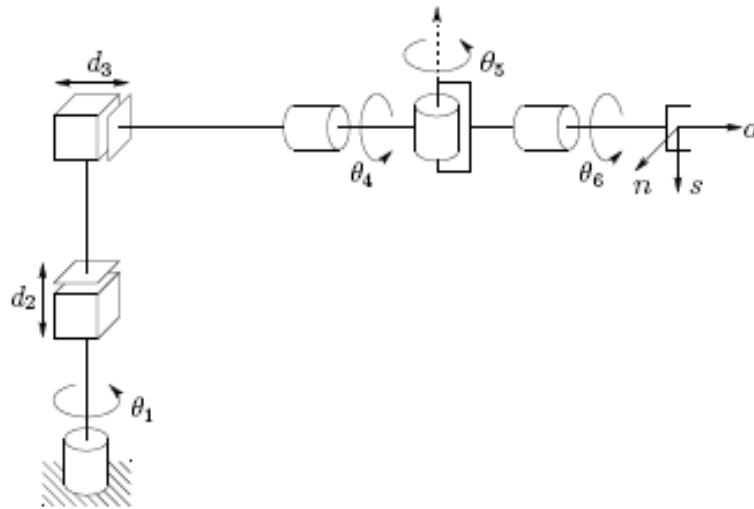


Fig.1 Cylindrical manipulator with spherical wrist.

(b) Explain the following term: **07**

1. Speed of motion
2. Load-Carrying Capacity

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

OR

(b) Explain in briefly four types of robot control systems. Out of these which method of motion control would be the best for spray painting by robot? **07**

Q.3 (a) What is different between a hierarchical structure and a chain type structure in a classification and coding scheme? **07**

- (b) An FMS consists of three station plus a load/unload station. station1 loads 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
(c) Average utilization of the system

Part j	Part Mix P_i	Operation K	Description	Station i	Process time(min)
A	0.2	1	Load	1	4
		2	H.Mill	2	15
		3	V.Mill	3	14
		4	Drill	4	13
		5	Unload	1	3
B	0.2	1	Load	1	4
		2	Drill	4	12
		3	H.Mill	2	16
		4	V.Mill	3	11
		5	Drill	4	17
		6	Unload	1	3
C	0.25	1	Load	1	4
		2	H.Mill	2	10
		3	Drill	4	9
		4	Unload	1	3
D	0.35	1	Load	1	4
		2	H.Mill	3	18
		3	Drill	4	8
		4	Unload	1	3

OR

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

- (b) Apply the rank order clustering technique to the part-machine incidence matrix 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. **07**

Machines	Parts									
	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? **07**
(b) Describe the requirements of sensors in robots. Explain any one sensor in details. **07**

OR

- Q.4 (a)** Explain types of gripper mechanisms in detail. **07**
(b) A point $P(8,6,2)^T$ is attached to a frame (n,o,a) and is subjected to the transformations described. Find the coordinates of the point relative to the reference frame at the conclusion of transformations. **07**
 (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 Retrieval CAPP systems. **07**
(b) Difference between FMC and FMS. **07**

OR

- Q.5 (a)** What is the Rapid Prototyping? List different RP methods and explain any two. **07**
(b) What is the differentiate between CAD/CAM and CIM? **07**
