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

CLASS: BE **SEMESTER : VI**
BRANCH: PRODUCTION **SESSION : SP/18**

SUBJECT: PE6007 MANUFACTURING AUTOMATION AND ROBOTICS

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)	What are the levels of automation?	[2]
Q.1(b)	Differentiate between open and closed loop control system. When would one use open loop control system.	[4]
Q.1(c)	What are the reasons of incorporating manufacturing automation?	[6]
Q.2(a)	With a suitable example explain absolute and incremental positioning in CNC systems.	[2]
Q.2(b)	Differentiate between direct numeric control and distributed numeric control.	[4]
Q.2(c)	Identify the various basic components of the CNC machine tool, giving in brief the function of each component with the help of block diagram.	[6]
Q.3(a)	Sketch the CNC machine tool axis system for lathe and milling machine tool.	[2]
Q.3(b)	Discuss the motion control systems of an NC system.	[4]
Q.3(c)	With an example explain the following preparatory/miscellaneous functions of a Part program (in FANUC): (i) G01, (ii) M06, (iii) M03, (iv) G03 and (v) M08 (vi) G21	[6]
Q.4(a)	What is a pallet fixture in context to automated production lines?	[2]
Q.4(b)	Why are storage buffers used in automated production lines?	[4]
Q.4(c)	What are different system configurations of automated production lines? Discuss in short	[6]
Q.5(a)	What is a flexible manufacturing system?	[2]
Q.5(b)	Enlist four benefits of incorporating a FMS.	[4]
Q.5(c)	Discus the various types of FMS layout with figure.	[6]
Q.6(a)	Discuss the need of using robots in manufacturing. (any four)	[2]
Q.6(b)	In context to robotics, what are roll, pitch and yaw?	[4]
Q.6(c)	Discuss the various types of body-arm configuration of an industrial robot.	[6]
Q.7(a)	Write a short note on PLC.	[2]
Q.7(b)	An FMS consists of three stations plus a load/unload station. Station 1 loads and unloads parts from the FMS using two servers. Station 2 performs horizontal milling operations with two servers. Station 3 performs vertical milling operations with three servers. Station 4 performs drilling operations with two servers. The machines are connected by 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, whose part mix fractions and process routings are presented in the table below. The operations frequency f_{ijk} = 1.0. Determine (a) maximum production rate of the FMS, (b) untilzation of each machine in the system, and (c) average untilization of the system, using the server average U_s.	[10]

Part j	Part mix p_j	Operation k	Description	Station l	Process time t_{ijk} (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	V. MILL	3	18
		3	DRILL	4	8
		4	UNLOAD	1	3

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