EXAM NO:

GANPAT UNIVERSITY

M. Tech. Semester II Mechanical Engineering(Advanced Manufacturing Techniques)

Regular Examination May-June: 2013

3ME201 Computer Integrated Manufacturing

Time: 3 Hours Total Marks: 70

Instruction: (1) Answers of two sections must be written in the separate answer book.
(2) Draw neat sketches wherever necessary.
(3) Assume suitable additional data wherever necessary.

SECTION – I

1 (a) A flexible manufacturing cell consists of three plus a load/unload stations. The load/unload station is stations1 using two servers (material handling workers). Station 2 performs milling operations and consists of two server (two CNC milling machine). Station 3 performs vertical milling operations with three servers (three identical CNC vertical milling machine). Station 4 has two server that performs drilling (two CNC drill press). The three stations are connected by a part handling system that has three work carrier. The mean transport time is 3.5 min. The FMC produces four parts A, B, C and D, the part mix fractions are process routings for the three parts are presented in the table below. The operation frequency $F_{ijk} = 1.0$ for all operations. Determine: a) maximum production rate of the FMC, b) corresponding production rates of each product. 06

Part j	Part Mix Pj	Operation k	Description	Station i	Process Time t_{ijk} (min)
A	0.2	1	Load	1	4
		2	Mill	2	15
		3	V.Mill	3	14
		4	Drill	4	13
		5	Unload	1	3
B	0.3	1	Load	1	4
		2	Drill	4	12
		3	Mill	2	16
		4	V.Mill	3	11
		5	Drill	4	17
		6	Unload	1	3
C	0.5	1	Load	1	4
		2	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

Suppose it is decided to increase the utilization of the two non-bottlenecks machining stations in the FMS by introducing a new past, part E, into the part mix. If the new product will be produced at a rate of 2 units/hr, what would be the ideal process routing (sequence and processing times) for part E that would increase the utilization of the two non-bottleneck machining stations to 100% each? The respective production rats of part A, B, C, and D will remain the same. Disregard the utilization of the load/unload station and the part handling system.

(b) A proposed synchronous transfer line will have 20 stations and will operate with an ideal cycle time of 0.5 min. all stations are expected to have an equal probability of breakdown, $p = 0.01$. The average downtime per breakdown is expected to be 5.0 min., and the upper-bound approach is applicable in the analysis. An option under consideration is to divide the line into two stages, each stage having 10 stations, with a buffer storage zone between the stages. It has been decided that the storage capacity should be 20 units. The cost to operate the line is 960 Rs/hr. installing the storage buffer would increase the line operating cost by 120 Rs/hr. ignoring material and tooling costs, determine: a) line efficiency, production rate, and unit cost for the one-stage configuration and b) line efficiency, production rate, and unit cost for the optional two-stage configuration. 05

OR

1 (a) An FMS is used to produce four parts. The FMS consists of one load/unload station and two automated processing stations (Product X and Y). the number of servers for each station type is to be determined. The FMS also includes an automated conveyor system with individual carts to transport parts between servers. The carts move the parts from one server to the next, drop them off, and proceed to the next delivery task. Average time required per transfer is 3.5 min. and ($F_{ijk} = 1$). the following table summarizes the FMS: 06

Station	Description	Number of Servers
1	Load and Unload	Number of Human servers to be determined.
2	Process X	Number of automated servers to be determined.
3	Process Y	Number of automated servers to be determined.
4	Transport System	Number of carts to be determined.

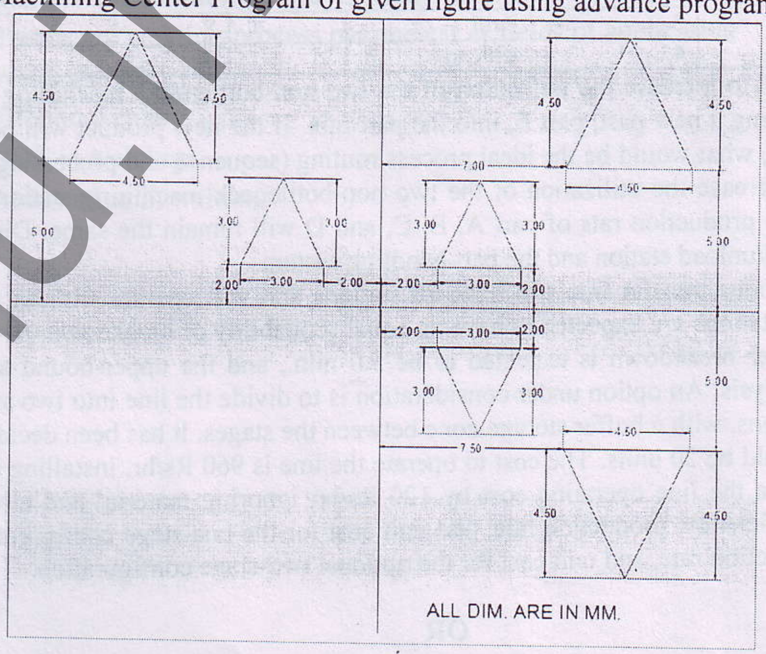
All the parts follow the same routings, which is 1→ 2→ 3→1. The product mix and process times for the parts are presented in the table below:

Product j	Product Mix Pj	Station 1 (min)	Station 2 (min)	Station 3 (min)	Station 1 (min)
A	0.1	3	15	25	2
B	0.3	3	40	20	2
C	0.4	3	20	10	2
D	0.2	3	30	5	2

Required production is 10 parts/hr, distributed according to the product mix indicated. Use the bottleneck model to determine: a) the minimum number of servers at each station and the minimum number of carts in the transport system that is required to satisfy production demand b) the utilization of each station and c) production rate of individual product.

(b) A Flexible machining system is being planned that will consist of four workstations plus a part handling system. Station1 will be a load/unload station. Station 2 will consist of horizontal machining centers. Station 3 will consist of vertical machining centers. Station 4 will be an inspection station. For the part mix that will be processed by the FMS, the workloads at the four stations are WL1=8 min, WL2=23 min, WL3=16 min. and WL4=10 min. The workload of the part handling system WL5=9 min. The FMS will be operated 17 hr/day, 255 day/yr. Maintenance will be performed during non-production hours, so uptime proportion (availability) is expected to be 96%. Annual production of the system will be 65,000 parts; Determine the number of machines (servers) of each type (station) required to satisfy production requirements. And also determine a) the utilizations of each in the system for the specified production requirements and b) the maximum possible production rate of the system if the bottleneck station were to operate at 100% utilization. 05

2 (a) Write a CNC Machining Center Program of given figure using advance programming. 06



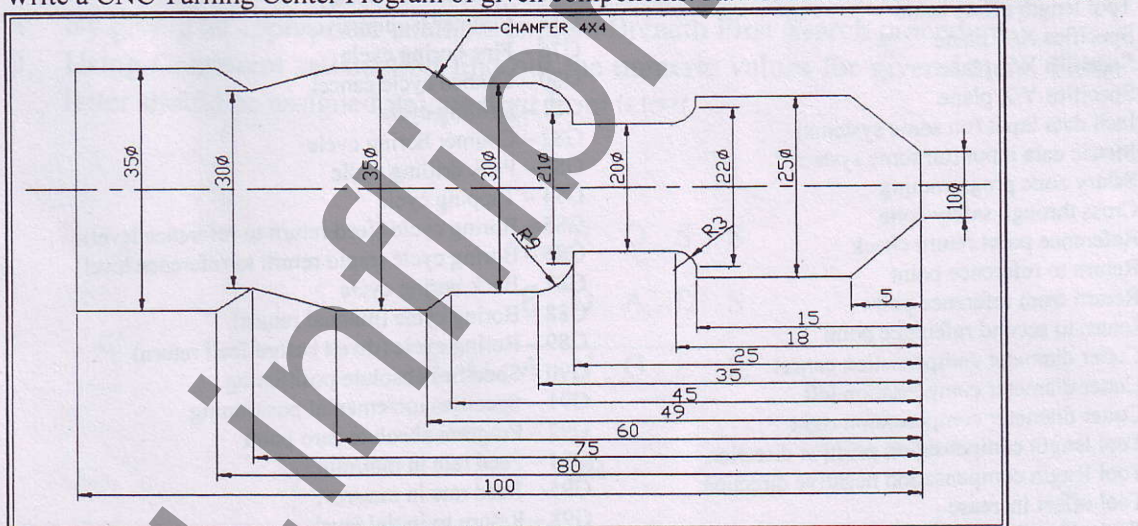
(b) The From-To chart in the table below indicates the number of loads moved per 8-hr day (above the slash) and the distances in feet (below the slash) between departments in a particular factory. Fork lift trucks are used to transport materials between departments. They move at an average speed = 275 ft/min. (loaded) and 350 ft/min. (empty). Load handling time per delivery is 1.5 min, and anticipated traffic factor = 0.9. Assume A = 0.95 and worker efficiency = 110%. Determine the number of trucks required under each of the following assumptions: a) the trucks never travel empty, and b) the truck travel empty a distance equal to their loaded distance. 06

		To Dept.				
		A	B	C	D	E
From Dept.	A	-	62/500	51/450	45/350	0
	B	0	-	0	22/400	0
	C	0	0	-	0	76/200
	D	0	0	0	-	65/150
	E	0	0	0	0	-

OR

2 (a) An automated guided vehicle system is being planned for a warehouse complex. The AGVS will be driverless train system, and each train will consist of the towing vehicle plus four pulled carts. The speed of the train will be 160 ft/min. only the pulled carts carry loads. The averaged loaded travel distance per delivery cycle is 2000 ft and empty travel distance is the same. Anticipated travel factor = 0.95. The load handling time per train per delivery is expected to be 10 min. if the requirements on the AGVS are 25 carts loads/hr. determine the number of trains required. Assume A = 1.0 06

(b) Write a CNC Turning Center Program of given components. Raw Material size: 110 mm. X 40Φ. 06



3 Answer the following. (Any Three) 12

(a) What is a Storage buffer? Why storage buffer are used on automated production line? How they control of production line.

(b) Explain the 10 principles of material handling in brief.

(c) Enlist the types of AS/RS and explain its application in manufacturing industries.

(d) Different guidance techniques for AGV. Give detail of how SGV work

(e) Explain Carousel Storage Systems.

SECTION – II

4 (a) Define Computer Integrated Manufacturing. Explain the roll of computers, integration and manufacturing to develop computer integrated manufacturing system with appropriate example. 06

(b) With the help of neat sketch briefly explain co-relation of all importance elements of computer integrated manufacturing system. 06

OR

4 (a) Enlist different guidance techniques for AGV. Give detail of how SGV work 04

(b) Explain LAN concept its importance and different protocol and types 04

(c) Briefly define various terms to check the performance of storage system 04

5 (a) With neat sketch explain the concept of CIM Wheel with its strength and weaknesses also compare it with CIM enterprise wheel. 06

(b) Briefly explain different categories of manufacturing and justify that batch production is most suitable for implementation of computer integrated manufacturing 05

OR

5 (a) Explain consideration while designing material handling system. 04

(b) Brief out production flow analysis help in grouping the parts. 04

(c) Explain help of support system in Manufacturing 03

6 **Answer the following. (Any Three)** 12

(a) What is a Storage buffer? Why storage buffer are used on automated production line? How control of production line

(b) Define manual part programming. What is meant by tool offset, tool length offset and cutter diameter compensation?

(c) Shop floor data acquisition.

(d) Modulation and demodulation in communication.

PREPARATORY FUNCTIONS (G CODES):

G00 – Rapid transverse positioning
G01 – Linear interpolation (federate movement)
G02 – Circular interpolation clockwise
G03 – Circular interpolation counterclockwise
G04 – Dwell
G10 – Tool length offset value
G17 – Specifies X/Y plane
G18 – Specifies X/Z plane
G19 – Specifies Y/Z plane
G20 – Inch data input (on some systems)
G21 – Metric data input (on some systems)
G22 – Salary zone programming
G23 – Cross through safety zone
G27 – Reference point return check
G28 – Return to reference point
G29 – Return from reference point
G30 –Return to second reference point
G40 – Cutter diameter compensation cancel
G41 – Cutter diameter compensation left
G42 – Cutter diameter compensation right
G43 – Tool length compensation positive direction
G44 – Tool length compensation negative direction
G45 – Tool offset increase
G46 – Tool offset decrease
G47 – Tool offset double increase
G48 – Tool offset double decrease
G49 – Tool length compensation cancel
G50 – Scaling off
G51 – Scaling on
G73 – Peak drilling cycle
G74 – Counter tapping cycle
G76 – Fine boring cycle
G80 – Canned cycle cancel
G81 – Drilling cycle
G82 – Counter boring cycle
G83 – Peak drilling cycle
G84 – Tapping cycle
G85 – Boring cycle (feed return to reference level)
G86 – Boring cycle (rapid return to reference level)
G87 – Back boring cycle
G88 – Boring cycle (manual return)
G89 – Boring cycle (dwell before feed return)
G90 – Specifies absolute positioning
G91 – Specifies incremental positioning
G92 – Program absolute zero point
G94 – Feed rate in mm/min.
G95- Feed rate in mm/rev.
G98 – Return to initial level
G99 – Return to reference (R) level.

MISCELLANEOUS (M) FUNCTIONS:

M00 – Program stop
M01 – Optional stop
M02 – End of program (rewind tape)
M03 – Spindle start clockwise
M04 – Spindle start counterclockwise
M05 – Spindle stop
M06 – Tool change
M08 – Coolant on
M09 – Coolant off
M13 – Spindle on clockwise, coolant on (on some systems)
M14 – Spindle on counterclockwise, coolant on
M17 – Spindle and coolant off (on some systems)
M19 – Spindle orient and stop
M21 – Mirror image X axis
M22 – Mirror image Y axis
M23 – Mirror image off
M30 – End of program, memory reset
M41 – Low range
M42 – High range
M48 – Override cancel off
M49 – Override cancel on
M98 – Jump to subroutine
M99 – Return from subroutine