Mansoura University
Faculty of Engineering
Prod. Eng. Dept.

4th Year Prod. Engineering
Factory Planning
Final Exam June 2010

Time: 3 Hours
Marks: 110

Answer the following questions :-

Q1: (35 % mark)

(a) Terminal industries (TI) currently produces at 3 manufacturing plants in Phoenix, Atlanta, and Cleveland. Demand has been growing steadily, and TI either has to expand the capacity of an existing facility or add another facility somewhere else. The company ships its product to 5 major distributors located in Chicago, Denver, Los Angeles, Dallas and Philadelphia. At each plant the production cost in made up of fixed annual overhead cost to keep the plant open plus a constant cost for each unit of production. The product is shipped from the plants to the distributors in standard car load quantities so that the transportation cost per unit of product is constant on any route, but this cost varies with the route based on distance.

Table 1 lists the plant capacities, annual fixed costs, unit production costs, unit transportation costs between each plant and distributor and expected annual distributor demands.

Table 1

To / From	Distributors							
	Transportation Costs ($ / unit)					Annual fixed cost $X 10^3$ ($)	Production cost ($/ unit)	Annual capacity $X 10^3$ Units
Existing plants	Chi	Den	LA	Dal	Phi			
Atlanta	8	12	18	10	7	500	20	150
Cleveland	4	11	20	12	6	600	22	180
Phoenix	15	7	8	9	20	750	18	170
Expected annual demand $X 10^3$ Units	120	80	150	100	130			

Annual demand is expected to increase to 580,000 units during the next 3 to 5 years, but the current production capacity is only 500,000 units. Suppose the possible options available to company are the following:

1- Expand and redesign the phoenix plant. The new annual capacity would be 270,000 unit; the annual fixed cost would be $ 1,200,000 and the per unit production cost would remain at $ 18.
2- Construct a new plant in Tucson
3- Construct a new plant in Fresno

Each of the new plants would have an annual capacity of 120,000 units. The plant at Tucson would have an annual fixed cost of $ 800,000 and per unit production cost of $ 16. The plant at Fresno would have an annual fixed cost of $ 900,000 and per unit production cost of $ 16. The transportation costs in ($ / unit) between Tucson and Fresno and the distributors are as shown in Table 2. We're assuming that each alternative is acceptable with respect to other factors

i-Which alternative should the company follow? Why?
ii-What is the % operating capacity of each plant?

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Table 2

Potential Plants	Distributors				
	Chi	Den	La	Dal	Phi
Tucson	16	9	9	10	21
Fresno	18	10	4	13	22

(b) Discuss indetail the design process of an entirely new manufacturing system.

Q2: (35 % mark)

(a) ABC company wants to design a flow line consists of 7 workstations in sequence. Workstations must be separated from each other by 2m. Each workstation requires a 8m X 8m work equipment area and a rear 4m X 4m storage area for materials that are to be used at it. A 1m width conveyor is to be used to transport parts between stations.

i- Design the line layout in which the workstations installed in one side of the conveyor to allow a straight line flow pattern. Determine the approximate area needed.

ii- Repeat i-above if the stations installed outside the conveyor to allow U-shape flow pattern

iii- Neglecting the conveyors initial costs, which layout do you prefer?, state at least 2 reasons.

(b) A multi product plant is contracted to produces 3 types of product. These are X, Y, and Z using 3 types of machine, A, B and C. Process order of part X is A, B then A again, 1100 units are supplied per month. Process order of part Y is B, A then B again, 2500 units are supplied per month. Process order of part type Z is C, A then B, 800 units are supplied per month.

Production data are shown in the following table:

	Machine A	Machine B	Machine C
Part X standard time	0.15 hr / unit	0.20 hr / unit	-
Part Y standard time	0.10 hr / unit	0.10 hr / unit	-
Part Z standard time	0.10 hr / unit	0.15 hr/ unit	0.10 hr / unit
Part X % Defect	6	8	6
Part Y % Defect	8	6	6
Part Z % Defect	5	6	5
Machine efficiency	85 %	85 %	90 %
M/c available Time	200 hr / month	200 hr / month	200 hr / month

i- How many machines of each type for this contract are needed?

ii- Explain with a sketch the type of layout that would be suitable for this plant. List the advantages and limitation of this type of layout.

iii- Sketch the layout and show flow route of part types

Q3: (30 % mark)

(a) Compare indetail, sketches, and industrial application examples between the basic types of layout.

(b) Explain what is meant by worldwide county selection to be a location of a multinational firm. What are the main important factor to be consider is such selection?

(c) List all the information you would required to arrange production facilities in an empty warehouse being converted to a manufacture workshop. What are the criteria to be a good layout?

Best Wishes

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