FACULTY OF MANAGEMENT STUDIES

UNIVERSITY OF DELHI

MBA (FT) 1st year Exam, March/April 2016

Paper 6206: Production & Operations Management

Time: 3 hours

Max. Marks: 50

Attempt any **Five** questions. All questions carry equal marks

1. (a) What do you understand by the term flexibility-cost trade-off in operations strategy?
   (b) Discuss what impact the following internal factors might have on operations strategy?
   i. Maturing of a product
   ii. Technology innovation in the manufacturing process
   (c) Discuss what impact the following external factors might have on operations strategy?
   i. Major decrease on oil prices,
   ii. Water and air quality legislation.

(2 + 4 + 4 = 10)

2. (a) Sigma Instruments (P) Ltd. Is considering three locations for its new factory – Faridabad, Kolkata and Noida. The estimates of different costs for the three location options are shown in the following table

Particulars	Faridabad	Kolkata	Noida
Transportation cost per unit (Rs.)	10	20	9
Cost of materials per unit (Rs.)	120	110	100
Taxes per year (Rs.)	40,000	35,000	45,000
Construction cost of the factory (Rs.)	5 million	4 million	4.7 million
Electricity cost per year (Rs.)	22,000	15,000	25,000
Labour cost per unit (Rs.)	26	21	23

The company has financed the construction cost of the factory through a loan from the State Bank of India at 15% interest per annum. Find the economically best location option for production of 5,000 – 10,000 units.

(b) Identify two important factors that a location planner may consider with respect to each of the following:

i. A multi-specialty hospital,
ii. A state-of –the-art design centre for automobile manufacturing,
iii. A multi-cuisine restaurant.

(7 + 3 = 10)

3. (a) The following table shows financial data of a year for Costco Wholesale and Wal-Mart, two major U.S. retailers.

	Costco	Wal-Mart
	Wholesale ($ Millions)	Stores ($ Millions)
Inventories	$ 3,643	$ 29,447
Sales (net)	$ 48,106	$ 286,103
COGS	$ 41,651	$ 215,493

Assume that both companies have an average annual holding cost rate of 30 percent (i.e. it costs both retailers $3 to hold an item that they procured for $10 for one entire year).

i. How many days, on average, does a product stay in Costco's inventory before it is sold? Assume that stores are operated 365 days a year.
ii. How much lower is, on average, the inventory cost for Costco compared to Wal-Mart of a household cleaner valued at $5 COGS? Assume that the unit cost of the household cleaner is the same for both companies and that the price and the inventory turns of an item are independent.

(b) The Western Pennsylvania Milk Company is producing milk at a fixed rate of 5,000 gallons/hour. The company's clients request 100,000 gallons of milk over the course of one day. This demand is spread out uniformly from 8 a.m. to 6 p.m. If there is no milk available, clients will wait until enough is produced to satisfy their requests.

The company starts producing at 8 a.m. with 25,000 gallons in finished goods inventory. At the end of the day, after all demand has been fulfilled, the plant keeps on producing until the finished goods inventory has been restored to 25,000 gallons.

When answering the following questions, treat trucks/milk as a continuous flow process. Begin by drawing a graph indicating how much milk is in inventory and how much milk is "back-ordered" over the course of the day.

i. At what time during the day will the clients have to start waiting for their requests to be filled?
ii. At what time will clients stop waiting?
iii. Assume that the milk is picked up in trucks that hold 1,250 gallons each. What is the maximum number of trucks that are waiting?

(4 + 6 = 10)

4. (a) Flextrola, Inc., an electronics systems integrator, is planning to design a key component for their next-generation product with Solectrics. Flextrola will integrate the component with some software and then sell it to consumers. Given the short life cycles of such products and the long lead times quoted by Solectrics prior to the beginning of its selling season. Flextrola's demand during the season is normally distributed with a mean of 1,000 and standard deviation of 600.

Solectrics' production cost for the component is $52 per units, and it plans to sell the component for $72 per unit to Flextrola. Flextrola incurs essentially no cost associated with the software integration and handling of each unit. Flextrola sells these units to consumers for $121 each. Flextrola can sell unsold inventory at the end of the season in a secondary electronics market for $50 each. The existing contract specifies that once Flextrola places the order, no changes are allowed to it. Also, Solectrics does not

accept any returns of unsold inventory, so Flextrola must dispose of excess inventory in the secondary market.

i. Under this contract, how many units should Flextrola order to maximize its expected profit?

Assume Flextrola orders 1,200 units.

ii. What would be Flextrola's expected sales?
iii. How many units of inventory can Flextrola expect to sell in the secondary electronics market?

Consider $L(0.33) = 0.2555$

(b) A small copy centre uses a five 500-sheet boxes of copy of paper a week. Experience suggests that usage can be well approximated by normal distribution with a mean of 5 boxes per week and standard deviation of ½ box per week. Two weeks are required to fill an order for letterhead stationery. Ordering cost is Rs. 100 and annual holding cost is Rs. 5 per box.

i. Determine the EOQ, assuming a 52-week year.
ii. If the copy centre reorders when the supply on hand is 12 boxes, compute the risk of a stockout.
iii. If a fixed-order interval of 7 weeks instead of an ROP is used for reordering, what risk does the copy centre incur that it will run out of stationery before this order arrives if it orders 36 boxes when the amount on hand is 12 boxes?

(4 + 6 = 10)

5. (a) ABC company is a DVD manufacturer in need of an aggregate plan for July through December. The company has gathered the following data:

Holding cost:	Rs. 8/DVD/month
Subcontracting:	Rs. 80/DVD
Regular time labour:	Rs. 12/hour
Overtime labour:	Rs. 18/hour for hours above 8 hours/worker/day
Current workforce (June):	8
Labour hours/DVD:	4 hours
Workdays/month:	20
Beginning inventory:	150 DVDs*
Ending inventory:	0

*There is no inventory holding cost for June

Demand data

July	Aug.	Sept.	Oct.	Nov.	Dec.
400	500	550	700	800	700

Find out the aggregate plan and cost of the same by using a constant workforce of 8 and varying overtime only.

(10)

6. (a) Powertone Gensets is a Bangalore-based company, which manufactures electrical generato for industrial use. The marketing department of Powertone Gensets has provided the data shown in the following table on demand forecasts for the coming eight weeks and the number of generators committed to institutional customers so far. For a manufacturing lot size of 300 units, prepare the projected inventory, MPS and the available-to-promise (ATP) inventory for the given duration. Initial inventory is 50 units.

	Weeks in June				Weeks in July			
	1	2	3	4	5	6	7	8
Demand forecast	76	89	163	204	88	40	112	134
Customer orders (Committed)	85	121	170	154	72			

(b) Identify an appropriate layout for each of the following situations. Justify your choice.

(i) A manufacturer of garments for Van Heusen.
(ii) An eye hospital.

(c) The following tasks must be performed on an assembly line in the sequence of and in times specified.

Task	Task Time (Seconds)	Tasks that must precede
A	50	-
B	40	-
C	20	A
D	45	C
E	20	C
F	25	D
G	10	E
H	35	B,F,G

(i) Draw the precedence diagram.
(ii) What is the theoretical minimum number of workstations required to meet a forecast demand of 400 units per eight hour day (assume no break).
(iii) Balance the line using the minimum number of stations required to produce 400 units per day. (3+2+5 = 10)

7. (a) The Watson Electric Company produces incandescent lightbulbs. The following data on the number of lumens for 40-watt lightbulbs were collected when the process was in control.

Sample	Observation 1	2	3	4
1	604	612	588	600
2	597	601	607	603
3	581	570	585	592
4	620	605	595	588
5	590	614	608	604

(i) Calculate control limits for R-chart and X-chart. Assume the values of $A_2 = 0.729$, $D_4 = 2.282$, $D_3 = 0$.

(ii) Since these data were collected, some new employees were hired. A new sample obtained the following reading: 570, 603, 623, 583. Is the process still in control? Comment.

(b) A process filling small bottles with baby formula has a target of 3 ounces with a tolerance of 0.15 ounce. Two hundred bottles from the process were sampled. The results showed that the average amount of formula placed in the bottles to be 3.042 ounces. The standard deviation of the amounts was 0.034 ounce. Determine the value of C_{pk}. Roughly what proportion of bottles meets the specifications?

(c) Are specification limits and control limits the same. Explain.

(4+4+2 = 10)

8. (a) What trade-offs are involved in shifting from a traditional operations system to JIT/lean system for a manufacturing firm?

(b) A manager wants to determine the number of containers to use for incoming parts for a Kanban system to be installed next month. The process will have a usage rate of 80 pieces per hour. Because the process is new, the manager has assigned an inefficiency factor of 0.35. Each container holds 45 pieces and it takes an average of 75 minutes to complete a cycle. How many containers should be used? As the system improves, will more or fewer containers be required? Why?

(c) Write a short note on theory of constraints.

(2+4+4 = 10)