Course Title: Project Planning and Management | Course Code: CE 401
Time: 3:00 hrs | Full Marks: 100

There are SEVEN Questions answer any FIVE
(Graph sheet would be supplied)

1. (a) The manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows:

Process	Inputs (units)		Outputs	
	Crude1	Crude2	Petrol (superior)	Petrol (ordinary)
A	10	3	10	16
B	12	15	12	12

The availability of the two varieties of crude is limited to the extent of 400 and 450 units respectively per day. The market demand indicates that atleast 200 units and 240 units of superior and ordinary quality of petrol is required every day. The profitability analysis indicate that process A contributes Tk. 180 per day while the process B contributes Tk. 240 in a day. Determine the number of production runs of process A and process B to maximize the company's profit. Formulate this as an LP model. (10)

(b) The following table contains figures on the annual usage and unit costs for a random sample of 12 items. Develop an A-B-C classification for these items. (10)

Item Name	Annual usage	Unit cost
1	1100	TK 4000
2	9000	720
3	1900	600
4	1000	710
5	2500	250
6	2500	192
7	5000	200
8	500	100
9	200	210
10	1000	35
11	3000	100
12	9000	300

2. (a) Objective function: (14)
$$\text{Maximize } Z = 3x_1 + 5x_2$$
Constrains:
$$-3x_1 + 4x_2 \leq 12$$
$$2x_1 - x_2 \geq -2$$
$$2x_1 + 3x_2 \geq 12$$
$$x_1 \leq 4$$
$$x_2 \geq 2$$
$$x_1 \geq 0$$

i.   Find the optimum value of X_1 and X_2 by graphical method.
ii. Find maximum profit
iii. Find the range of optimality for coefficient of X_1 and X_2 in the objective function

(b) Assign the tasks to the employees such that each employee will be assigned by only one job to minimize the total cost. Find at least two multiple solutions if there is any. (6)

Tasks

		1	2	3	4	5
Employees	A	10	9	9	18	10
	B	13	9	9	18	11
	C	3	2	4	18	10
	D	18	9	12	17	11
	E	11	11	14	12	13

3. (a) A chemical company produces two products, X and Y. Each unit of product X requires 3 hours on operation I and 4 hours on operation II while each unit of product Y requires 4 hours on operation I and 5 hours on operation II. Total available time for operation I and II is 20 hours and 26 hours, respectively. The production of each unit of product Y also results in 2 units of a byproduct Z at no extra cost. Product X sells at a profit of Tk. 10 per unit while Y sells at a profit of Tk. 20 per unit.
Byproduct Z brings a unit profit of Tk. 6 if sold; incase it cannot be sold the destruction cost id Tk. 4 per unit. Forecasts indicate that not more than 5 units of Z can be sold. Determine the quantities of X and Y to be produced, keeping Z is in mind so that the profit earned is maximum. Formulate the above as LP problem. (10)

(b) Discuss different qualitative forecasting methods. Why is the Delphi Method superior than other methods? (6)

(c) Discuss the importance of MRP in detail. (4)

4. (a) Discuss the activities associated with different stages of Project life cycle. (4)
   (b) Judy Kramer, the project manager for the St. John's Hospital Project, Project activity
   status are shown below: (16)

Activity	Description	Activity Predecessor	Time (Weeks)
A	Select Admin Staff	-------	3
B	Site selection and survey	-------	4
C	Select medical equipment	-------	4
D	Prepare final construction plan	A	5
E	Bring utilities to sites	B	2
F	Interview for nursing and staff	C	6
G	Purchase and deliver equipment	D,E	3
H	Construct hospital	F,G	1

   A. Draw the AON network diagram
   B. Find the project completion time
   C. Find the critical path
   D. Find ES/EF and LS/LF for each of the activity
   E. If you reduce the time required for activity F & G by 1 week each, find the project
      completion time and critical path as well.

5. (a) Suppose you have 1,00,000/- for investment and Project A and Project B is offering
   the repayment schedule as shown in the following cash flow: (12)

Year	Cash flow of Project A	Cash flow of Project B
0 (investment)	1,00,000/-	1,00,000/-
1	50,000/-	20,000/-
2	30,000/-	20,000/-
3	20,000/-	20,000/-
4	10,000/-	40,000/-
5	10,000/-	50,000/-
6		60,000/-

   You can earn a total 1,20,000/- in 5 years from project A and earn a total of 2,10,000/- in
   6 years from project B as shown in the above table. Find the NPV, BCR and Discounted
   Pay Back Period for each of the project. Also make comments on the result in respect to
   investment decision. Consider 10% annual interest/discount rate.
   (b) What do you mean by money inflation? Discuss its consequences in investment
   decision. (4)
   (c) Discuss the relation between NPV and IRR of a project for different values of discount
   rate. (4)

6. (a) A museum of natural history opened a gift shop two years ago. Managing inventories
   has become a problem. Low inventory turnover is squeezing profit margins and causing
   cash flow problem.
   One of the top selling SKUs in the container group at the museum's gift shop is a bird
   feeder. sales are 18 units per week, and the supplier charges $60 per unit. The cost of
   placing an order with a supplier is 45$. Annual holding cost is 25 percent of feeder's
   value, and the museum operates 52 weeks per year. Management chose a 390 unit lot
   size so that new orders could be placed less frequently. What is the annual cycle
   inventory cost of the current policy of using a 390 unit lot size? Would a lot size of 460 is
   better.
   Calculate the EOQ and its total annual cycle-inventory cost. How frequently will orders be
   placed if the EOQ is used? (10)

(b) The Polish General's Pizza Parlor is a small restaurant catering to patrons with a taste for European pizza. One of its specialties Polish Prize pizza. The management must forecast weekly demand for these special pizzas so that he can order pizza shells weekly. Recently, demand has been as follows: (10)

Week	Pizzas	Week	Pizzas
June 2	50	June 23	56
June 9	65	June 30	55
June 16	52	July 7	60

i. Forecast the demand for pizza for June 23 to July 14 by using the simple moving average method with n=3. Then repeat the forecast by using the weighted moving average method with n=3 and weights of 0.50, 0.30 and 0.20, with 0.50 applying to the most recent demand.

ii. Calculate the MAD for each method and make comments.

7. (a) A firm's sales for a product line during the 12 quarters of the previous three years were as follows:

Quarter	Sales	Quarter	Sales
1	600	7	2600
2	1550	8	2900
3	1500	9	3800
4	1500	10	4500
5	2400	11	4000
6	3100	12	4900

The firm wants to forecast each quarter of the fourth year, that is, quarters 13, 14, 15 and 16. Find them. (10)

(b) There are following seven jobs and they must pass through Machine 1 and Machine 2. Operating time for both the machines is shown below for each of the job. (8)

Job	Operations Time for machine 1	Operations Time for machine 2
A	9	6
B	8	5
C	7	7
D	6	3
E	1	2
F	2	6
G	4	7

i. Schedule (job sequence and show the arrangement in diagram for machine 1 & 2) the seven jobs through two machines in sequence to minimize the flow time using Johnson's rule.

ii. Find the job completion time.

iii. Find the slack time or idle time for machine 1 & 2, separately.

(c) What is safety stock? Explain. (2)