

Mid-West University  
**Examinations Management Office**

End Semester Examinations 2081

Master level/ M. Sc. (Construction Management)/ 1<sup>st</sup> Semester

Time: 3 hours

**Subject: Operations Research in Construction Management (CMT514)**

Full Marks: 60

Pass Marks: 30

- Attempt all the questions.
- Figures in the margin indicate full marks.
- Assume suitable values, with a stipulation, if necessary.
- Candidates are required to answer the questions in their own words as far as possible.

1. A firm uses Lathe, Millings and Grinding machines to produce two machine parts. The table represents the machining times required for each part, the machining time available on different machines and the profit on each machine parts. [6]

Type of machine	Machining time required for machine parts		Maximum time available per week (Minutes)
	I	II	
Lathes	12	6	3000
Milling	4	10	2000
Grinding	2	3	900
Profit Per Unit	Rs. 60	Rs. 100	

Find the number of parts I and II to be manufactured per week to maximize the profit by graphical method.

2. A precast concrete subcontractor makes three types of panels. In the production the quantities of cement, coarse aggregates and fines aggregates required are as follows: [8]

	Cement (m <sup>3</sup> /panel)	Coarse Aggregate (m <sup>3</sup> /panel)	Fine Aggregate (m <sup>3</sup> /panel)
Panel I	1	3	3
Panel II	1	2	3
Panel III	2	3	4

The subcontractor has the following quantities of cement, coarse aggregates and fines aggregates per week:

Cement: 300 m<sup>3</sup>

Coarse aggregates: 500 m<sup>3</sup>

Fines aggregates: 620 m<sup>3</sup>

The financial return for panel types I, II and III are and 20, 15 and 25 respectively. Prepare the LPP equation and find the number of panels of each type that should be made so that the total financial return is maximized.

3. Nepal Army is experimenting with three types of bombs M, N and O in which three kinds of explosives viz. X, Y and Z will be used. Taking the various factors into account. It has been decided to use at the maximum 600Kg of explosive X, at least 480 Kg of explosive Y and exactly 540Kg of explosive Z. Bomb M requires 3,2,2 Kg, Bomb N requires 1,4,3 Kg and Bomb O requires 4,2,3 Kg of explosive X, Y and Z respectively. Bomb M is estimated to give equivalent of a 4-ton explosion, Bomb N 6-ton explosion and Bomb O 8-ton explosion respectively. Calculate the big bang by using Big-M method? [8]

4. A company is producing a single product and selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in five more cities that do not have any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to the additional cities in such a way that the travelling distance is minimized. The distances (in km) between the surplus and deficit cities are given in the following distance matrix. [6]

Agencies	Cities				
	I	II	II	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

Determine the optimum assignment schedule of agencies in cities.

5. A cement factory manager is considering the most economical schedule to transport cement from his three manufacturing centers M1, M2 and M3 to deports D1, D2, D3, D4 and D5. The weekly production and demand with transportation cost per ton (Rs.) are given below. What should be the distribution schedule? find the minimum cost using VAM method. [6]

	D1	D2	D3	D4	D5	Supply (Ton)
M1	4	1	3	4	4	60
M2	2	3	2	2	4	35
M3	3	3	2	4	3	40
Demands (tons)	22	45	20	18	30	

6. Define queue and describe about the queue system. Koteswor Chowk Junction can serve 750 Vehicles in an hour exponentially. 575 vehicles arrive there Following Poisson's Distribution. [3+3]
- What proportion of time it is busy?
  - Find Expected number of vehicles at the junction
  - Find time a vehicle spends at the junction.

$$\rho = \frac{\lambda}{\mu}, L_s = \frac{\lambda}{\mu - \lambda}, L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}, W_q = \frac{\lambda}{\mu(\mu - \lambda)}, W_s = \frac{1}{\mu - \lambda}$$

7. The following data refers to a profit per two years of a construction project. [5]

Year	2010	2012	2014	2016	2018	2020	2022
Profit (Rs. Lakhs)	65	70	72	68	80	90	95

Fit a straight-line trend by least square method and obtain the trend values. Using trend equation estimate the profit for 2030.

8. Following are the data of manufacturing company product on the basis of season. Calculate the best season with the help of seasonal indices. [5]

Year	Season			
	Spring	Summer	Fall	Winter
2020	87	106	86	125
2021	85	110	83	127
2022	84	105	87	128
2023	88	104	88	124

9. Write short notes on (Any Four): [10]
- Integer programming
  - Forecasting application in construction management
  - Use of computer tools in operation research
  - History of OR and its uses
  - Dynamic programming

The End