



B.E DEGREE EXAMINATIONS: APRIL/MAY 2023

(Regulation 2018)

Sixth Semester

MECHANICAL ENGINEERING

U18MET6002: OPERATIONS RESEARCH

COURSE OUTCOMES

CO1:	Apply linear programming model and assignment model to domain specific situations
CO2:	Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
CO3:	Apply the concepts of PERT and CPM for decision making and optimally managing projects.
CO4:	Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions.
CO5:	Analyze and apply appropriate inventory techniques in domain specific situations
CO6:	Analyze and apply appropriate queuing theories in domain specific situations

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	What condition must exist in a simplex table to establish the existence of an alternative solution?	CO1	[K ₂]
2.	Define a basic feasible solution?	CO1	[K ₂]
3.	When transportation problems are said to be unbalanced. How to resolve it?	CO2	[K ₂]
4.	When is an assignment model said to have multiple solutions?	CO2	[K ₂]
5.	Distinguish between CPM and PERT.	CO3	[K ₂]
6.	State the Ford and Fulkerson's rule for numbering the nodes in a network diagram.	CO3	[K ₂]
7.	Explain the Johnson's procedure of solving a sequencing problem of 'n' jobs on 3 machines.	CO4	[K ₂]
8.	Explain the Group displacement policy.	CO4	[K ₂]
9.	Classify inventory models.	CO6	[K ₂]
10.	Define Kendall's notation to specify the queuing system.	CO5	[K ₂]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	A machine tool manufacturing corporation has one plant located on the outskirts	16	CO1	[K ₄]
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of the city. Its manufacturing is limited to two types of products, drilling machine and milling machine. The unit contribution for each machine has been computed by standard department as Rs.5000 per drilling machine and Rs. 6000 per milling machine. The assembly manager has the following data in connection with the assembly of each machine.

Department	Required time (Hours)		Available Hour in a month
1	2	3	1500
2	3	2	1500

In addition to the above data the marketing department has provided certain information about the restriction of quantity to be manufactured. Finally the assembly manager restricts the manufacturing to a maximum of 400 units of these two machines. Suggest a plan to maximize the profit through graphical method.

12. a) Find the initial feasible solution for the following transportation problem by VAM method and find the optimal solution by MODI method. The cost is given in Rupees.

FROM	TO			SUPPLY
		2	7	4
	3	3	1	8
	5	4	7	7
	1	6	2	14
DEMAND	7	9	18	

16 CO2 [K₃]

13.	a)	The utility data for a network is given below. Determine the total, free and independent floats and identify the critical path.	16	CO3	[K ₃]																								
		<table border="1"> <tr> <td>Activity</td> <td>1-2</td> <td>2-3</td> <td>2-4</td> <td>3-5</td> <td>3-6</td> <td>4-5</td> <td>4-7</td> <td>5-8</td> <td>6-8</td> <td>7-8</td> </tr> <tr> <td>Duration (Days)</td> <td>2</td> <td>8</td> <td>10</td> <td>6</td> <td>3</td> <td>3</td> <td>7</td> <td>5</td> <td>2</td> <td>8</td> </tr> </table>	Activity	1-2	2-3	2-4	3-5	3-6	4-5	4-7	5-8	6-8	7-8	Duration (Days)	2	8	10	6	3	3	7	5	2	8					
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Duration (Days)	2	8	10	6	3	3	7	5	2	8																			
14.	a)	There are five jobs, each of which must go through machines M1, M2 and M3, in the order of M1- M2- M3. Processing times in minutes are given below:	16	CO4	[K ₃]																								
		<table border="1"> <tr> <td>Job</td> <td>J1</td> <td>J2</td> <td>J3</td> <td>J4</td> <td>J5</td> </tr> <tr> <td>M1</td> <td>8</td> <td>5</td> <td>4</td> <td>6</td> <td>5</td> </tr> <tr> <td>M2</td> <td>6</td> <td>2</td> <td>9</td> <td>7</td> <td>4</td> </tr> <tr> <td>M3</td> <td>10</td> <td>13</td> <td>11</td> <td>10</td> <td>12</td> </tr> </table> <p>Determine the optimal sequence. Find the minimum elapsed time. Calculate the idle time for the machines.</p>	Job	J1	J2	J3	J4	J5	M1	8	5	4	6	5	M2	6	2	9	7	4	M3	10	13	11	10	12			
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M1	8	5	4	6	5																								
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15.	a)	Derive the Wilson's EOQ Formula for purchase model with shortage.	16	CO5	[K ₄]																								
16.	a)	A bank has two tellers working on savings accounts. The first teller handles withdrawals only. The second teller handles deposits only. It has been found that the service time distribution for the deposits and withdrawals both are exponential with mean service time 3 minutes per customer. Depositors are found to arrive in a Poisson fashion throughout the day with a mean arrival rate	16	CO6	[K ₄]																								

		of 16 per hour. Withdrawers also arrive in a Poisson fashion with a mean arrival rate of 14 per hour. What would be the effect on the average waiting time for depositors and withdrawers if each teller could handle both withdrawals and deposits? What would be the effect if this could only be accomplished by increasing the service time to 3.5 minutes?			
