Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Sixth Semester B. Tech. (Mechanical Engineering)

Summer – 2018

Course Code: MEU 601

Course Name: Operations Research Management

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. A company is manufacturing 2 products A & B. The net profit for these products is Rs.60 & Rs.50 respectively. These products require working in 2 departments C & D. The available hours / month in these departments are 150 each. Product A requires 2 hours in department C & 3 hours in department D. Product B requires 3 hours in department C & 2 hours in department D. The production of products A & B cannot exceed 40 units each because of manufacturability constrains. Solve this LP problem by Simplex method. **12**

2. **Solve 2 Qs.**

a) An automobile dealer wishes to put 4 repairmen to 4 different jobs. The repairmen have somewhat different kinds of skills and they exhibit different **6**

Contd.

levels of efficiency from one job to another. The dealer has estimated number of man-hour that would be required for each job- man combination. This is given in the matrix from in the table below: Effectiveness matrix in man-hours needed is as per following table:-

Man	Jobs			
	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

Find optimal assignment.

b) Solve the following transportation problem **6**

Plants	Warehouses			
	P	R	S	CAPACITY
A	35	25	15	875
B	10	20	30	575
DEMAND	350	350	450	

c) ABC company has one hob regrinding machine. The hobs needing grinding are sent from company's tool crib to this machine which is operated one shift /day of 8 hrs duration. It takes on the average half an hour to regrind a hob. The arrivals of hobs is random with an average of 8 hobs per shift. Calculate present utilization of hob regrinding machine. The management is prepared to recruit another grinding operator when utilization of machine increase to 80%. What should the arrival arte of hobs then be? Solve by queuing theory **6**

3. Solve any 1 Qs.

a) Discuss significance of CPM/ PERT/ networks techniques in space launching programs in India **12**

b) Discuss significance of CPM/ PERT/ networks techniques in flyover bridges construction in smart cities in India **12**

4. a) We have 9 jobs each of which needs to be processed on 2 machines I & II in the order of I, II. Processing times in hours are given in the table below:- **6**

Machines	Jobs								
	A	B	C	D	E	F	G	H	I
M-I	4	7	6	11	8	10	9	7	6
M-II	8	10	9	6	5	11	5	10	13

Determine the sequence of the jobs that will minimize the total elapsed time.

b) A pipeline is due for repairs. It will cost Rs. 20,000/- & lasts for 3 years. Alternatively , new pipeline can be laid at a cost of Rs.60,000/- & lasts for 10 years. Assuming cost of capital= 10%, ignoring salvage cost, which alternative should be selected. Solve this by replacement analysis method. **6**

5. The increase in profit for 3 market areas as a function of the sales effort expended is given in the table below. How will you distribute a given number of salesmen so as to achieve maximum increase in profit. **12**

No. of salesmen	Markets		
	I	II	III
0	0	0	0
1	42	60	60
2	50	65	70
3	60	75	80
4	66	85	88
5	75	95	105
6	82	110	105
7	90	120	130

Solve this problem by dynamic programming

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Instructions to Candidate

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1. (a) Write characteristics of and phases of OR model. **12**

(b) What is Simulation? Explain with one application.

(c) What is dynamic programming? State Bellman's principle of optimality.

(d) Write two applications of CPM and PERT each.

2 (a) Determine an initial basic feasible solution to the following transportation problem using VAM

		Destination				
		I	II	III	IV	Supply
Origin	A	19	30	50	10	7
	B	70	30	40	60	9
	C	40	8	70	20	18
	Dem-and	5	8	7	14	

6

(b) Assign of 4 workers (A, B, C and D) to 4 jobs (I, II, III, and IV). The time taken by different workers in completing the different jobs is given below. Also find the total time taken in completing the jobs. 6

	I	II	III	IV
A	8	10	12	16
B	11	11	15	8
C	9	6	5	14
D	15	14	9	7

3 **Solve any two**

(a) Solve the following LP problem using simplex method 6

Maximize $Z = 3X_1 + 2X_2 + 5X_3$

Subject to $X_1 + X_2 + X_3 \leq 9$

$2X_1 + 3X_2 + 5X_3 \leq 30$

$2X_1 - X_2 - X_3 \leq 8$

X_1, X_2, and $X_3 \geq 0$

(b) Explain economic significance of duality. Form the dual of the LP problem given in Q2 (a) 6

(c) A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate relief. Formulate the problem as standard L.P.P. 6

4 **Solve any two**

(a) A project is composed of the 7 activities. The time estimate s in days for the activities are as follows 6

Activity	t_o	t_m	t_p
1-2	12	15	17
1-3	3	4	7
1-4	12	22	28
2-5	1	1	1
3-5	2	5	14
4-6	4	5	8
5-6	6	6	6

(i) Draw the network (ii)Identify critical path

(i) Find expected project length

(b) The data for the network is given below, Find the total float and identify the critical path 6

Activity	Duration
0-1	2
1-2	8
1-3	10
2-4	6
2-5	3
3-4	3
3-6	7
4-7	5
5-7	2
6-7	8

Cont

(c) Five jobs must pass through the two machine A and B in the order AB. Processing times(min) are given in the table below 6

Job	1	2	3	4	5	6	7
M/cA	12	6	5	11	5	7	6
M/cB	7	8	9	4	7	8	3

Determine a sequence that will minimize the processing time. Also find total elapsed time.

5 **Solve any two**

(a) A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 min. While cashier can serve 10 customers in 5 min. assuming Poisson distribution for arrival rate and exponential distribution for service time . find 6

(i) Average number of customers in the system

(ii) Average number of customers in the queue

(iii) Average time a customer spends in the system

(b) The running cost per year and resale prices of certain equipment whose purchase price is Rs 50,000 are as given below

Year	Running cost	Resale value
1	5000	30000
2	6000	15000
3	7000	7500
4	9000	5750
5	11500	2000
6	16000	2000
7	18000	2000

6

Determine at what age is the replacement due.

(c) Define Inventory. Explain : Carrying cost and Ordering cost 6

Government College of Engineering, Amravati
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Third Year B. Tech. (Mechanical Engg)

Summer- 2015 ORSM-15

Course Code: MEU601 Course Name: Operations Research Management

Time: 2 hr.30min. Max. Marks: 60

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
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4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. Solve any four 12

(a) What is CPM and PERT? What particular advantage does PERT have over CPM? Which technique do you recommend for execution of mega power project in India?

(b) Explain the following term in the context of linear programming model with suitable industrial example
(i) Objective function (ii) Constraints

(c) Enumerate, the different phases of Operations Research.

Cont.

(d) Write procedure to solve a general problem by Dynamic Programming approach.

(e) Explain
(i) Carrying cost (ii) Ordering cost

2 (a) A company has four plants A, B, C and D at different places which supply items to warehouses P, Q, R, S and T. Monthly plant capacities are 200,175,150 and 325 respectively. Monthly warehouse requirements are 110, 90, 120, 230 and 160 respectively. Unit shipping costs (in rupees) are given in the following table. Shipments from A to Q and from D to S are not possible. Determine the optimum plan to minimize the shipping cost. 6
(Use VAM to get initial basic feasible solution)

	P	Q	R	S	T
A	13	-	31	8	20
B	14	9	17	26	10
C	25	11	12	17	15
D	10	21	13	-	17

(b) Suggest optimum assignment of 4 workers (A, B, C and D) to 4 jobs (I, II, III, and IV). The time taken by different workers in completing the different jobs is given below. Also find the total time taken in completing the jobs. 6

	I	II	III	IV
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	4	15	13	9

3 (a) Solve the following LP problem using simplex method 6
Maximize $Z = 3X_1 + 2X_2$
Subject to $2X_1 + X_2 \leq 40$
$2X_1 + 3X_2 \leq 60$
$X_1 + X_2 \leq 24$
$X_1, X_2 \geq 0$

(b) Define Slack variable. What is duality in LP? Write the dual of L P problem given in Q3 (a). 6

OR

(c) Give the general mathematical formulation of assignment model. Explain the difference between transportation and assignment model. 6

4 (a) The expected times (Te) and variances (v) for the activities (A) of a PERT network are given below. Determine slack time for each event and the critical path. If the schedule completion time is 32 months, find the probability of completion on schedule 6

A	1-2	1-3	2-4	2-5	3-4	3-6	4-5	4-6	5-7	6-7
T_e	4	5	2	12	3	8	10	6	8	10
v	8	3	1	5	2	4	4	2	1	8

OR

(b) The following data pertains to some network, compress the project to the least possible duration and estimate the crashing cost 6

Cont.

Activities	T_n	T_c	Cost slope
1-2	3	2	700
1-3	7	4	200
2-3	5	3	100
2-4	8	6	200
3-4	4	2	400

(c) In a factory there are five jobs to perform, each of which must be processed on the two machines M_1 and M_2 the order M_1M_2. Processing times(hrs) are given below 6

Job	1	2	3	4	5
M/c M_1	7	3	11	5	12
M/c M_2	4	8	9	10	6

Determine a sequence for the five jobs that will minimize the total elapsed time and also find idle time of each machine.

5 (a) What are the assumptions made in single channel queuing model? Explain the following i) Arrival pattern (ii) Service discipline 6

(b) The data for a machine, which cost is Rs 60,000 are given below. 6

Year	Resale Value (Rs)	Cost of spares (Rs)	Cost of labor (Rs)
1	42000	4000	14000
2	30000	4270	16000
3	20400	4880	18000
4	14400	5700	21000
5	9650	6800	25000

Determine the optimum period for replacement of the machine.

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Sixth Semester B. Tech. (Mechanical Engineering)

Summer – 2016

ORM-16

Course Code: MEU601

Course Name: Operations Research Management

Time: 2 hr. 30min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
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1. (a) "Operations Research is a tool for decision support system" Justify 12

(b) List and explain the assumptions of linear programming problems

(c) Distinguish between CPM and PERT

(d) Differentiate between transportation and Assignment model

2 **Solve any two**

(a) A company sells two different products A and B. The

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company makes a profit of Rs 40 and Rs 30 per unit resp. on the two products. The products are produced by a common production process and are sold in two different markets. The production process has a capacity of 30,000 man hours. It takes 3 hours to produce a unit of product A and 1 hour to produce a unit of product B. The market has been surveyed and company officials found out that the maximum units that can be sold for product A and Bare 8000 and 1200 resp. Formulate the above as a linear programming problem.

(b) Solve by the Simplex method

Maximize $Z = 3X_1 + 4X_2$

Subject to $X_1 + X_2 \leq 450$

$2X_1 + X_2 \leq 600$

$X_1, X_2 \geq 0$

(c) Find the optimum solution to the following transportation problem using VAM. The cells contain the transportation cost in rupees

	W1	W2	W3	W4	Supply
F1	19	39	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Demand	5	8	7	14	

3 **Solve any two**

(a) Solve the following Assignment problem

	A	B	C	D
1	5	7	11	6
2	8	5	9	6
3	4	7	10	7
4	10	4	8	3

(b) A repair shop attended by a single mechanic has average of 4 customers per hour who bring sm

appliances for repair. The mechanic inspects them for defects and quite often can fix them right away or otherwise render a diagnosis. This takes him 6 minutes on the average. Arrivals are Poisson and service time has the exponential distribution. You are required to 6

(i) Find the proportion of time during which the shop is empty.

(ii) Find the probability of finding at least one customer in the shop

(iii) The average time, including service, spent by a customer.

(c) The time estimates (in weeks) for the activities of a PERT network are given below 6

(i) Draw the project network

(ii) Identify the critical path

(iii) Determine the expected project length

(iv) Calculate the standard deviation and variance of the project length

+RM-16

Activity	t_o	t_m	t_p
1-2	1	4	7
1-3	5	10	17
2-4	3	3	3
2-6	1	4	7
3-4	8	15	26
3-5	2	4	8
4-5	5	5	5
5-6	2	5	8

4 **Solve any two**

(a) A foreman wants to process 3 different jobs on 3 machines: shaping, drilling, and tapping. The sequence of operations being shaping-drilling- tapping. Decide the 6

Contd...

optimal sequence for the 3 jobs to minimize the time elapsed if the process times are

job	Shaping (min)	Drilling (min)	Tapping (min)
1	13	3	18
2	18	8	4
3	8	6	13

Also find the total elapsed time and idle time for each machine.

(b) The purchase price of a machine is Rs 52000. The installation charges amount to Rs 14400 and its scrap value is only Rs 6400. The maintenance cost in various years is given below 6

Year	1	2	3	4	5	6	7	8
Maintenance cost (* 100)	10	30	40	60	84	116	160	192

After how many years should the machine be replaced? Assume that the machine replacement can be done only at the year ends.

(c) What is project crashing? Distinguish between resource leveling and resource allocation. 6

5 (a) Define inventory. Explain the costs involved in inventory.

(b) What is Dynamic programming? Explain with one example