Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

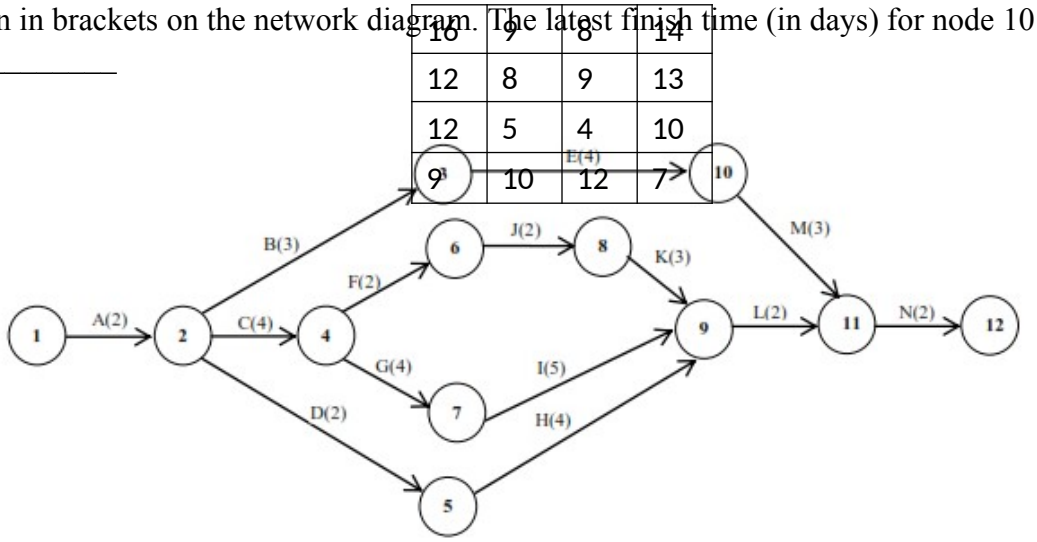
Course: **Operations Research (IPEG452)** **Semester: VII**
Program: B.Tech Mechancial
Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A (20 marks)

S. No.		Marks	CO
Q1	Table shows a feasible solution to a transportation problem. Is it optimal solution? If not, find an optimal solution using this feasible solution.	5	CO1

2 (10)	3 (30)	3 (40)	4	6 (20)	100
4 (20)	7	6	5 (40)	7	60
5	6	3 (30)	4	3 (20)	50
4	7 (30)	8	4 (50)	8	80
30	60	70	90	40	

Q2	A project consists of 14 activities, A to N. The duration of these activities (in days) are shown in brackets on the network diagram. The latest finish time (in days) for node 10 is _____  	**5**	**CO3**
Q3	Four parts have to be assigned to four machines. All the machines can do all jobs but one job is to be assigned to one machine and one machine should get one job. The time taken by the machines in minutes is given in table. If the parts have to be assembled after machining and assembly takes 10 minutes. Find the earliest time the assembly is completed?	**5**	**CO1**
Q4	Solve the following game by using the principle of dominance. Player B Player A 		I	II	III	IV	V	VI
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1	4	2	0	2	1	1
2	4	3	1	3	2	2
3	4	3	7	−5	1	2
4	4	3	4	−1	2	2
5	4	3	3	−2	2	2		**5**	**CO2**

SECTION-B (60 Marks)			
Q 6	Determine the optimal sequence of jobs that minimizes the total elapsed time bases on the following information processing time on machines is given in hours and passing is not allowed: Job A B C D E F G Machine M_1 3 8 7 4 9 8 7 Machine M_2 4 3 2 5 1 4 3 Machine M_3 6 7 5 11 5 6 12	**12**	**CO2**
Q 7	A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The set-up cost per change depends on the item presently on the machine and the set-up to be made according to the following table: From item / To item: A B C D E A: ∞ 4 7 3 4 B: 4 ∞ 6 3 4 C: 7 6 ∞ 7 5 D: 3 3 7 ∞ 7 E: 4 4 5 7 ∞ If he processes each type of item once and only once each week, how should he sequence the item on his machine in order to minimize the total set-up cost?	**12**	**CO4**

Q 8	For a given linear programming problem: Maximize $Z = 4X_1 - 3X_2 + 3X_3$ Subjected to $2X_1 + X_2 + 3X_3 \leq 7$ $2X_1 - X_2 + 4X_3 \geq 8$ $X_1, X_2, X_3 \geq 0$ a) Solve the problem without using artificial variables. b) Find the solution to the dual of the given problem. c) If the first constraint changes to $2X1 + X2 + 3X3 \leq 5$, use the sensitivity analysis to find the effect of the change.	**12**	**CO4**
Q 9	A large steel manufacturing company has three options with regard to production: (i) produce commercially (ii) build pilot plat (iii) stop producing steel. The management has estimated that their pilot plant, if built, has 0.8 chance of high yield and 0.2 chance of low yield. If the pilot plant does show a high yield, management assigns a probability of 0.75 that the commercial plant will also have a high yield. If the pilot plant shows a low yield, there is only a 0.1 chance that the commercial plant will show a high yield. Finally, management's best assessment of the yield on a commercial-size plant without building a pilot plant first has a 0.6 chance of high yield. A pilot plant will cost Rs. 3, 00,000. The profits earned under high and low yield conditions are Rs. 1, 20, 00,000 and Rs. 12, 00,000 respectively. Find the optimum decision for the company.	**12**	**CO4**

Q10	A project has the following time schedule: Construct PERT network and compute: (i) Total float for each activity (ii) Critical path and its duration. (iii) And determine the minimum number of cranes the project must have for its activities 2-5, 3-7 and 8-9 without delaying the project.	**12**	**CO4**

Activity	Time in months	Activity	Time in months
(1-2)	2	4-6	3
(1-3)	2	5-8	1
(1-4)	1	6-9	5
(2-5)	4	7-8	4
(3-6)	8	8-9	3
(3-7)	5		

SECTION-C (20 Marks)
(Do either 12th or 13th question)

Q 12	XYZ Company has three departments – Assembly, Painting and Packing, and can make three types of almirahs. An almirah of type 1 requires on hour of assembly, 40 minutes of painting and 20 minutes of packing time, respectively. Similarly, an almirah of type 2 needs 80 minutes, 20 minutes and one hour, respectively. The almirah of type 3 requires 40 minutes each of assembly, painting and packing time. The total available time at assembly, painting and packing departments is 600 hours, 400 hours and 800 hours, respectively. Determine the number of each type of almirahs that must be produced in order to maximize the profit. The unit profit for types 1, 2 and 3 is Rs 40, Rs 80 and Rs 60, respectively. Suppose that the manager of XYZ company is thinking of renting the production capacities of the three departments to another almirah manufacturer – ABC Company. ABC Company is interested in minimizing the rental charges. On the other hand, the XYZ Company would like to know the worth of production hours to them, in each of the departments to determine the rental rates. (a) Formulate this Problem as an LP problem and solve it to determine the number of each type of almirahs that should be produced by the XYZ Company in order to maximize its profit. (b) For LP problem in (a), formulate its dual and interpret your results.	**20**	**CO3**
	OR		
Q 13	Dr. STRONG is dentist who schedules all per patients for 30 minutes appointments. Some of the patient take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time actually needed to complete the work. Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the illness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8:00 am. Use the following random numbers for handling the above problem: 40 82 11 34 25 66 17 79	**20**	**CO3**

Categories	Filling	Crown	Cleaning	Extraction	Checkup
Time required (min):	45	60	15	45	15
Prob. of category:	0.40	0.15	0.15	0.10	0.20