Register Number: ……..

M.E DEGREE EXAMINATIONS MAY/JUNE 2013

Second Semester

POWER ELECTRONICS AND DRIVES

PED505 : Operation Research

(Statistical Table May Be Permitted)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

1. What are the main characteristics of operation research?
2. What is an assignment problem?
3. What are the advantages of duality?
4. Differentiate between pure and mixed IPP.
5. What is network?
6. What is the formula for finding the variance of an activity in terms of optimistic and pessimistic time estimates?
7. Define the cost time slope of an activity ?
8. Differentiate between group replacement and Individual replacement.
9. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the mean queue size.
10. State any four principal assumptions made while dealing with sequencing problem?

PART B (5 x 16 = 80 Marks)

11. a) i.) Use simplex method to solve the LPP (8)

$$\text{Min } z = x_2 - 3x_3 + 2x_5$$

$$\text{subject to } 3x_2 - x_3 + 2x_5 \leq 7$$

$$-2x_2 + 4x_3 \leq 12$$

$$-4x_2 + 3x_3 + 8x_5 \leq 10$$

$$x_2, x_3, x_5 \geq 0$$

ii) A company has 5 jobs to be done on five machines. Any job can be done on any machine. The cost of doing the jobs in different machines are given below. Assign the jobs for different machines so as to minimise the total cost. (8)

	Machines				
Jobs	A	B	C	D	E
1	13	8	16	18	19
2	9	15	24	9	12
3	12	9	4	4	4
4	6	12	10	8	13
5	15	17	18	12	20

(OR)

b) i) A company produces 2 types of hats. Every hat A require twice as much labour time as the second hat B. If the company proclues only hat B then it can produce a total of 500 hats a day. The market limits daily sales of the hat A and hat B to 150 and 250 hats. The profits on hat A and B are Rs. 8 and Rs. 5 respectively. Solve graphically to get the optimal solution. (8)

ii) Solve the following transportation problem starting with the initial solution obtained by VAM. (8)

	D_1	D_2	D_3	D_4	**Supply**
O_1	2	2	2	1	3
O_2	10	8	5	4	7
O_3	7	6	6	8	5
Demand	**4**	**3**	**4**	**4**	**15**

12. a) Use revised simplex method to solve the following LPP.

Max Z = $6x_1 - 2x_2 - 3x_3$

Subject to $2x_1 - x_2 + 2x_3 \leq 2$

$x_1 + 4x_3 \leq 4$

$x_1, x_2, x_3 \geq 0$

(OR)

b) Solve the integer programming problem.

Max Z = $7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_1, x_2 \geq 0$ are integers.

13. a) A project consists of a series of tasks labelled A, B, ….H, I with the following constraints A<D, E; B, D<F: C<G; B<H; F, G<I.W<X, Y means X, and Y can't start until W is completed. You are required to construct a network using this notation. Find the total float for each activity. Also find the minimum time of completion of the project when the time of completion of each task is given as follows.

Task	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Time (days)	23	8	20	16	24	18	19	4	10

(OR)

b) A small project is composed of seven activities whose time estimates are listed in the table as follow:

	Estimated duration (weeks)		
	Optimistic	**Most likely**	**Pessimistic**
	Pessimistic		
1-2	**1**	**1**	**7**
1-3	**1**	**4**	**7**
2-4	**2**	**2**	**8**
2-5	**1**	**1**	**1**
3-5	**2**	**5**	**14**
4-6	**2**	**5**	**8**
5-6	**3**	**6**	**15**

a) Draw the project network.
b) Find the expected duration and variance of each activity.
c) Calculate the early and late occurrence for each event and the expected project length.
d) Calculate the variance and standard deviations of project length.
e) What is the probability that the project will be completed –
i) 4 weeks earlier than expected.
ii) Not more than 4 weeks later than expected.
iii) If the project due date is 19 weeks, what is the probability of meeting the due date

14. a) The table below provides cost and estimates for a seven activity project.

Activity	Time estimate (weeks)		Direct cost estimate (Rs. 1000)	
	Normal	Crash	Normal	Crash
A 1-2	2	1	10	15
B 1-3	8	5	15	21
C 2-4	4	3	20	24
D3-4	1	1	7	7
E3-5	2	1	8	15
F4-6	5	3	10	16
G5-6	6	2	12	36

a) Draw the project network corresponding to normal time.
b) Determine the critical path and the normal duration and cost of the project.
c) Crash the activities so that the project completion time reduces to 9 weeks

(OR)

b) The probability P_n of failure just before age n is shown below. If individual replacement costs Rs. 12.50 and group replacement costs Rs. 3.00 per item. Find the optimal replacement policy.

n	1	2	3	4	5
P_n	0.1	0.2	0.25	0.3	0.15

15. a) i) A T. V. repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come in. If the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? (8)

(ii) A readymade garments manufacturer has to process 7 items through two stages of production namely cutting, and sewing. The time taken for each of these at the different stages are given below in appropriate units. (8)

Item	1	2	3	4	5	6	7
Process Time Cutting	5	7	3	4	6	7	12
Time Sewing	2	6	7	5	9	5	8

Find an order in which these items are to be processed through these stages so as to minimise the total processing time.

(OR)

b) (i) A barber shop has space to accommodated only 10 customers. He can server only one person at a time. If a customer comes to his shop and finds it full he goes to the next shop. Customers randomly arrive at an average rate $\lambda = 10$ per hours and the barber service time is negative exponential with an average of $1/\mu=5$ minutes per customer. Find P_0, P_n. (8)

(ii) A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost of going from one city to another is shown below. You are required to find the least cost route. (8)

To City

From City	A	B	C	D	E
A	∞	4	10	14	2
B	12	∞	6	10	4
C	16	14	∞	8	14
D	24	8	12	∞	10
E	2	6	4	16	∞

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