M.E DEGREE EXAMINATIONS: JANUARY 2011

First Semester

INDUSTRIAL ENGINEERING

MAT502: Applied Operations Research

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

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. What is Basic feasible solution?

2. What is Assignment Model?

3. What is sensitivity analysis?

4. What is cutting plane algorithm in solving integer Programming problem?

5. What is Minimal Spanning tree problem?

6. What are the three estimates used in PERT?

7. Discuss the problem of replacement of items that fail suddenly.

8. What is resource Allocation in net work analysis?

9. What are the characteristics of the Queuing system?

10. State Kendall's notation for Queue models.

PART B (5 x 16 = 80 Marks)

11. (a) (i) Solve the following L.P.P by Simplex method.

Maximize $Z = x_1 - x_2 + 3x_3$ Subject to constraints

$x_1 + x_2 + x_3 \leq 10$, $2x_1 - x_3 \leq 2$, $2x_1 - 2x_2 + 3x_3 \leq 0$, $x_1, x_2, x_3 \geq 0$ (10)

(ii) Discuss the graphical procedure in solving Linear Programming Problem.   (6)

(OR)

(b) (i) Find the optimal assignment for the table

	Operators			
	I	II	III	IV
A	10	5	13	15
Machine B	3	9	18	3
C	10	7	3	2
D	5	11	9	7

(6)

(ii) Find the optimal solution to the following Transportation problem   (10)

	M1	M2	M3	M4	
W1	2	2	2	1	3
W2	10	8	5	4	7
W3	7	6	6	8	5
	4	3	4	4	

12. (a) Use Revised Simplex Method to solve the following L.P.P

Minimize $Z = -3x_1 + x_2 + x_3$

Subject to the constraints

$x_1 - 2x_2 + x_3 \leq 11$

$-4x_1 + x_2 + 2x_3 \geq 3$

$2x_1 - x_3 = -1$

$x_1, x_2, x_3 \geq 0$

(OR)

(b) Solve the following Integer δ Programming Problem

Maximize $Z = 7x_1 + 10 x_2$

Subject to the constraints

$-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_1, x_2 \geq 0$ and integer.

13. (a) (i) Discuss about the Maximal Flow problem in network analysis   (10)

(ii) What are the applications of PERT AND CPM   (6)

(OR)

(b) Consider a project consisting of nine jobs (A,B,…..I) with the following precedence relations
and time estimates:

Job	Predecessors	Optimistic Time (a)	Most Probable Time (m)	Pessimistic Time (b)
A	-	2	5	8
B	A	6	9	12
C	A	6	7	8
D	B,C	1	4	7
E	A	8	8	8
F	D,E	5	14	17
G	C	3	12	21
H	F,G	3	6	9
I	H	5	8	11

(i) Construct the network diagram.

(ii) Compute the Estimated time and Standard deviation for each activity, Project duration and
Standard deviation of Project duration.

(iii) What is the probability of computing the project (i) in 50 days (ii) in 41 days
(Provide Statistical Tables)

14. (a) A fleet owner finds from his past records that the cost per year of running a vehicle whose purchase price is Rs.50000 are as under

Year :	1	2	3	4	5	6	7
Running Cost (Rs.):	5000	6000	7000	9000	11500	16000	18000
Resale value(Rs.):	30000	15000	7500	3750	2000	2000	2000

Thereafter, running cost increase by Rs.2000, but resale value remains constant at Rs.2000. At what age is the replacement due?

(OR)

(b) The following table gives data on normal time, and cost and crash time and cost for a project.

Activity	Normal		Crash	
	Time (weeks)	Cost (Rs)	Times (weeks)	Cost (Rs)
1 -2	3	300	2	400
2 – 3`	3	30	3	30
2 – 4	7	420	5	580
2 – 5	9	750	4	300
3 – 5	9	250	4	300
4 – 5	5	0	0	0
5 – 6	0	320	4	410
6 – 7	6	400	3	470
6 – 8	13	780	10	900
7 – 8	10	1000	9	1200

Indirect cost is Rs. 50 per week.

a) Draw the network and identify the critical path with a double line.

b) What are the normal project duration and associated cost?

c) Find out the total float associated with each activity.

d) Crash the relevant activities systematically and determine the optimal project completion time and cost.

15. (a) (i) Explain (M/M/1) : (FCFS/N/M) Queuing system. (6)

(ii) A small bank has two tellers, who are equally efficient and who are each capable of handling an average of 60 customers transactions per hour, with the actual service times exponentially distributed. Customers arrive at the bank according to a Poisson process, at a mean rate of 100 per hour. Determine (a) the probability that there are more than three

customers in the bank at the same time, (b) the probability that a given teller is idle, and (c) the probability that a customer spends more than 3 min in the bank. (10)

(OR)

(b) (i) Discuss Travelling Salesman Problem. (6)

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

	Item	1	2	3	4	5	6	7
Process	Cutting	5	7	3	4	6	7	12
Time	Sewing	2	6	7	5	9	5	8
	Packing	10	12	11	13	12	10	11

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

(2) Find the minimum total elapsed time and Ideal time for the cutting, Sewing, Packing machine. (10)

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