J–3285

M. A./M. Sc. (Final)
Term End Examination, June-July, 2018
MATHEMATICS

Paper First

(Operations Research)

Time : Three Hours]   [*Maximum Marks : 70*

[*Minimum Pass Marks : 28*

Instructions for Candidate :

Section–A : Question Nos. **01** to **08** are very short answer type questions. Attempt all questions. Each question carries 01 mark. Answer each of these questions in 1 or 2 words/1 sentence.

Section–B : Question Nos. **09** to **14** are half short answer type questions. Attempt any *four* questions. Each question carries $2\frac{1}{2}$ marks. Answer each of these questions in about 75 words or half page.

Section–C : Question Nos. **15** to **18** are short answer type questions. Attempt any *three* questions. Each question carries 05 marks. Answer each of these questions in about **150** words or one page.

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Section–D : Question Nos. **19** to **22** are half long answer type questions. Attempt any *two* questions. Each question carries 10 marks. Answer each of these questions in about **300** words or two pages.

Section–E : Question Nos. **23** and **24** are long answer type questions. Attempt any *one* question. Each question carries 17 marks. Answer each of these questions in about **600—750** words or 04—05 pages.

Section—A

1. Probability of an impossible event is ....
2. Define continuous probability distribution.
3. What is a basic feasible solution of a LPP ?
4. Two hyperplanes $C_1 x = z$ and $C_2 x = z$ are said to be parallel if ....
5. The set of all feasible solutions of a L. P. P. is a convex set. (True/False)
6. Define Oriented Graph.
7. What is tree in Network Analysis ?
8. What is Operations Research ?

Section—B

9. From a bag containing 10 black and 5 white balls, a ball is thrown at random. What is the probability that it is white ?

10. Write a short note on replacement problem.

11. Is $x_1 = 1, x_2 = \frac{1}{2}, x_3 = x_4 = x_5 = 0$ a baisc solution of the following system :

$$x_1 + 2x_2 + x_3 + x_4 = 2$$

$$x_1 + 2x_2 + \frac{1}{2}x_3 + x_5 = 2$$

12. Show that a hyperplane is a convex set.
13. What is degeneracy ? Discuss a method to resolve degeneracy in LPP.
14. Explain the difference between a Transportation problem and an Assignment problem.

Section—C

15. Let the value of money be assumed to be 10% per year and suppose that machine A is replaced after every 3 years whereas machine B is replaced after every six years. The yearly cuts of both the machines are given as under :

Years	Machine A	Machine B
1	1000	1700
2	200	100
3	400	200
4	1000	300
5	200	400
6	400	500

Determine which machine should be purchased.

16. Let S and T be two convex sets in E^n, then for any scalars α, β, $\alpha S + \beta T$ is also convex.

17. The sales tax return of a salesman is exponentially distribution with parameter $\frac{1}{4}$. What is the probability that his sales will exceed ₹ 10,000 assuming that the sales tax is charged at the rate of 5% on the sales ?

18. Define the following terms in a probabilities PERT networks :

    (i) Optimistic time

    (ii) Most likely time

Section—D

19. Solve the following linear programming problem :

    Max. :

$$z = 0.75x_1 + x_2$$

S. t. :

$$x_1 - x_2 \geq 0$$

$$-0.5x_1 + x_2 \leq 1$$

$$x_1, x_2 \geq 0.$$

20. Solve the following Transportation problem to maximize profit and give criteria for optimality.

Profit (₹)/Unit

Origin	Destination				Supply
	1	2	3	4	
A	40	25	22	33	100
B	44	35	30	30	30
C	38	38	28	30	70
Demand	40	20	60	30	

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21. Derive the optimal order quantity from the following data :

r = 200 items/month, I = 0.02

C_3 = Ordering cost = ₹ 100

P_1 = ₹ 10.00 for $1 \leq 9 < 3000$

P_2 = ₹ 9.25 for $3000 \leq 9 \leq 5000$

P_3 = ₹ 8.75 for $9 \geq 5000$.

22. The cost of a new car is ₹ 10,000. Compare the optimum moment of replacement assuming the following cost informations :

Age of Car, n	Repair Cost in nth year	Solvage Value at the end of the nth year
1	5000	8000
2	10000	6400
3	10000	5120

Assume that repairs are made at the end of each year only if the car is to be retained and are not necessary if the car to be sold for its salvage value. Also assume that the rate of discount is 10%.

Section—E

23. Solve by Simplex method the following L. P. problems :

Minimize :

$$z = x_1 - 3x_2 + 2x_3$$

Subject to :

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0.$$

24. A steel company has three open hearth furnaces and five rolling mills. Transportation cost (rupees per quintal) for shipping steel from furnaces to rolling mills are shown in the following table :

		M_1	M_2	M_3	M_4	M_5	Capacity (in Quintal)
	F_1	4	2	3	2	6	8
Furnace	F_2	5	4	5	2	1	2
	F_3	6	5	4	7	3	14
Requirement (in quintal)		4	4	6	8	8	

What is an optimal shipping schedule ?