(b) After what period of burning hours would we expect that :

(i)   10% of the lamps would have failed

(ii)  10% of the lamps would be burning ?

Given $f(1.50) = 0.933, f(1.28) = 0.900$

where $f(t) = \int_{-\infty}^{t} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} \, dz$.

20. Solve the LPP by graphical method :

Max. :

$$Z = 6x_1 + 11x_2$$

s. t.          $$2x_1 + x_2 \le 104$$

$$x_1 + 2x_2 \le 76$$

and $x_1 \ge 0, x_2 \ge 0$.

21. A contractor of second hand motor trucks use to maintain a stock of trucks every month. The demand of the trucks occurs at a relatively constant rate but not in a constant size. The demand follows probability distribution :

| Demand $r$ | Prob. $p(r)$ |
|---|---|
| 0 | 0.40 |
| 1 | 0.24 |
| 2 | 0.20 |
| 3 | 0.10 |
| 4 | 0.05 |
| 5 | 0.01 |
| 6 or more | 0.00 |

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# H–2205

## M. A./M. Sc. (Final)
## Term End Examination, June-July, 2017
### 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 very 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.

**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.

**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.

**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 700 words.

### Section—A

1. What is Operations Research ?
2. Probability of an impossible event is ..........
3. Mean, Median and Mode of normal distribution coincides.                              (True/False)
4. Define Inventory.
5. What is basic feasible solution in a LPP ?
6. Define slack variable in LPP.
7. Define Network.
8. Intersection of two convex set is a convex set.
                                                            (True/Fasle)

### Section—B

9. Find the probability of obtaining a total of 6 in single throw of two dice.
10. Define a convex set with an example.
11. A hyperplane is given by the equation $3x_1 + 3x_2 + 4x_3 + 7x_4 = 8$. Find in which half spaces does the point $(1, 2, -4, 1)$ lie.
12. Show that the set of all feasible solutions of a LPP is a convex set.
13. Write some limitations of linear programming techniques.

14. Explain the term 'Degeneracy' in the context of transportation problem.

### Section—C

15. Prove that a necessary and sufficient condition for the existence of feasible solution of a $m \times n$ transportation problem is :

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$$

16. Examine the convexity of the set :

$$s\left\{ (x_1, x_2) : x_1^2 + x_2^2 \le 1, x_1 + x_2 \ge 1 \right\}$$

17. The storage cost of one item is ₹ 1 per month and the set up cost is ₹ 25 per run. If the production is instantaneous and the demand is 200 units per month, find the optimal size of the batch and the minimum average cost.

18. The sales tax return of a salesman is exponentially distributed 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 ?

### Section—D

19. The local authorities in a certain city installed 2000 electric lamps in a street of the city. If the lamps have an average life of 1000 burning hours with an s. d. of 200 hours.

    (a) What number of the lamps might be expected to fail in the first 700 burning hours ?

24. Solve by simplex method the following LPP :

Min. :

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

Subject to :

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

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

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
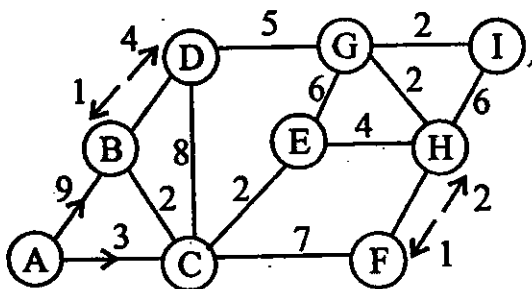
and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

The holding cost of an old truck in stock for one month is ₹ 100.00 and the penalty for a truck if not supplied on the demand is ₹ 1000.00. Determine the optimal size of the stock for the contractor.

22. Find the critical path for the following network :



**Section—E**

23. 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 $n$th year | Salvage value at the end of the $n$th 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%.