(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

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 :

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

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 :

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

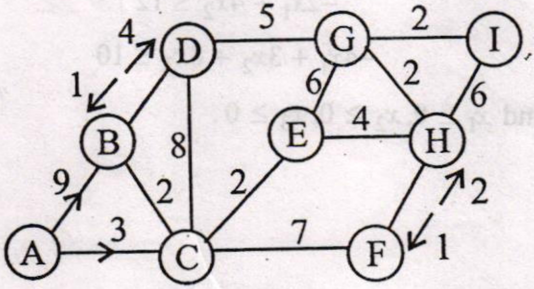
$$-2x_1 + 4x_2 \le 12$$

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

and $x_1 \ge 0, x_2 \ge 0, x_3 \ge 0$.

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 nth year	Salvage 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%.

18. Find the zeros and discuss the nature of singularities of

$$f(z) = \frac{(z-2)}{z^2} \sin \frac{1}{z-1}.$$

Section—D

19. Show that the function :

$$f(z) = e^{-z^4},\ z \neq 0 \text{ and } f(0) = 0$$

is not analytic at $z = 0$ although the Cauchy-Riemann equations are satisfied at the point.

20. Find the images of the infinite strips :

(i) $\frac{1}{4} < y < \frac{1}{2}$

(ii) $0 < y < \frac{1}{2}$

21. Evaluate $\int_C (z^2 + 3z)\, dz$ along the circle $|z| = 2$ from $(2, 0)$ to $(0, 2)$.

22. State and prove Cauchy's theorem for any closed curve.

Section—E

23. Evaluate :

$$\int_C \frac{z-3}{z^2+2z+5}\, dz$$

where C is the circle (a) $|z| = 1$ and (b) $|z+1-i| = 2$.

24. State and prove inverse function theorem.

H–2206

M. A./M. Sc. (Final)

Term End Examination, June-July, 2017

MATHEMATICS

Paper Second

(Complex Analysis)

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. Find the moduli of the following complex number
$$\frac{(2+i)^2}{(3-i)^2}.$$

2. Write Cauchy-Riemann equations for $w = u + iv = f(z)$.

3. Find the radius of convegence of the series :
$$\Sigma\left(1-\frac{1}{n}\right)^{n^2} z^n$$

4. Define entire function.

5. Define pole and zeros of a complex function.

6. Find the fixed points of the bilinear transformation :
$$w = \frac{z}{2-z}$$

7. Define uniform convergence of a sequence.

8. If $\sin(x+iy) = p + iq$, then find p and q.

Section—B

9. For two complex numbers z_1 and z_2, prove that :
$$|z_1+z_2|^2 + |z_1-z_2|^2 = 2\left\{|z_1|^2 + |z_2|^2\right\}$$

10. Show that :
$$u = \frac{1}{2}\log\left(x^2+y^2\right)$$
is a harmonic function.

11. Show that radius of convegence of the series $\Sigma n^n z^n$ is zero.

12. Evaluate $\int (\bar{z})^2\, dz$ around the circle $|z| = 1$.

13. Expand $f(z) = \dfrac{1}{(z+1)(z+3)}$ in a Laurent's series for the region $|z| < 1$.

14. Test for uniform convergence of the series :
$$\Sigma\frac{1}{z^2 - n^2\pi^2}$$

Section—C

15. Find the analytic function whose imaginary part is $\cos x \cosh y$.

16. Using the definition of an integral as the limit of the sum evaluate the integral $\int_L z\, dz$, where L is any rectifable arc limit of the sum points $z = \alpha$ and $z = \beta$.

17. Evaluate $\int_C \dfrac{1}{z(z-1)}\, dz$, where C is the circle $|z| = 3$.

Section—D

19. A bag contains 6 white balls and 9 black balls 4 balls are drawn at random. Find the probability that two are white and two are black.

20. A continours random variable X has a p. d. f. $f(x) = 3x^2, 0 \le x \le 1$. Find a and b s. t.

(i) $P[X \le a] = P[X > a]$

(ii) $P[X > b] = 0.05$

21. Show that for triangular distribution with density function :

$$f(x) = \begin{cases} x & 0 \le x \le 1 \\ 2 - x & 1 \le x \le 2 \end{cases}$$

$\mu_1 = 1, \mu_2 = \dfrac{1}{6}$.

22. Fit a straight line of the following data treating y as the dependent variable :

x	y
1	5
2	7
3	9
4	10
5	11

H–2207

M. A./M. Sc. (Final)

Term End Examination, June-July, 2017

MATHEMATICS

Paper Third

(Mathematical Statistics)

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. Write the Geometric mean of 1, 2, 4.
2. Write the formulae of coefficient of variation.
3. State addition theorem of probability.
4. Write the conditions of probability density function $f(x)$ for a continuous random variable.
5. If the range of the probability density function is from $-\infty$ to ∞ then, write rth moment about origin.
6. If $b_{yx} = .99$ and $b_{xy} = .85$, then what is value of coefficient of correlation ?
7. What is value of $P(A) + P(\overline{A})$?
8. Define null hypothesis.

Section—B

9. For two variables x and y with same mean, the two regression equations are $y = ax + b$ and $x = \alpha y + \beta$ show that $\frac{b}{\beta} = \frac{1-a}{1-\alpha}$.
10. Prove that :

$$\text{Cov}(x_2, x_{1.23}) = \text{Cov}(x_3, x_{1.23}) = 0$$

11. Prove that :

$$\Delta \equiv E - 1$$

12. Write a short note on "Sampling in statistics".
13. Out of 200 individuals 40% show a certain trait, and that the number expected on a certain theory in 50%. Find whether the number observed differs significantly from expectation.
14. A normal population has mean of 0.1 and a S. D. of 2.1. Find the probability that the mean of simple of 900 members will be negative.

Section—C

15. Write a short note on the choice of base period in the construction of an index number.
16. What is trend ? How is it eliminated from a time series ?
17. Calculate the Geometric mean of the following frequency distribution :

x	f
0—10	5
10—20	8
20—30	3
30—40	4

18. The first four moments about the points 4 are – 1.5, 17, – 30 and 108. Then find the first four moments about the mean.

Section—E

23. (a) Calculate the coefficient of correlation between the values of x and y :

x	y
78	125
89	137
97	156
69	112
59	107
79	136
68	123
61	108

(b) Interpolate the missing term in the following table of rice cultivation :

Year	Acres (in millions)
1911	76.6
1912	78.7
1913	?
1914	77.7
1915	78.7
1916	?
1917	80.6
1918	77.6
1919	78.6

24. Show that in a discrete series if the deviations x from the mean M are so small that the third and higher powers of $\frac{x}{M}$ and $\frac{\sigma}{M}$ can be neglected the following relative are found to hold approximately :

(i) $G = M\left[1 - \frac{1}{2}\frac{\sigma^2}{M^2}\right]$

(ii) $M^2 - G^2 = \sigma^2$

(iii) $H = M\left[1 - \frac{\sigma^2}{M^2}\right]$

(iv) $M + H = 2\,G$

H–2208

M. A./M. Sc. (Final)

Term End Examination, June-July, 2017

MATHEMATICS

Paper Fourth

(Programming in C++)

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 an inheritance ? (Give only definition).
2. Give some example of relational operators.
3. When "if-else" statement can be used ?
4. What is reference variable ?
5. Give the general syntax for declaring a parameterized constructor.
6. Give the general syntax of overloading arithmetic assignment operator.
7. What are the various types of inheritance ?
8. What are the various types of polymorphism ?

Section—B

9. Write a short note on modular programming.
10. What is an integer ? Explain with example.
11. What is the difference between break and continue statements ?
12. When do you make a function to inline ?
13. Explain new and delete operators with suitable examples.
14. What do you mean by granting access ? Explain with example.

Section—C

15. What are main C++ tokens ?
16. Write short notes on the following :
    - (i) Recursion
    - (ii) Command line arguments
    - (iii) Storage class specifiers
17. What is this pointer ? Explain use of this pointer in C++.
18. What is Stream ? Explain the various types of streams.

Section—D

19. Evaluate the expression :

    $$2*((X\%5)*(4+(Y-3)))$$

    assuming $X = 8$ and $Y = 15$.
20. Write difference between call-by reference and call-by value.
21. What is pure virtual function ? Explain advantage and disadvantage of pure virtual function.
22. How do you perform unformatted I/O operations ? Explain.

Section—E

23. Write a C++ program to obtain the norm of any matrix. The program should also display proper error messages.
24. Explain the following functions :
    - (i) fill( )
    - (ii) width( )
    - (iii) precision( )
    - (iv) setp( )