

P-7295

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

Term End Examination, June-July, 2020-21

MATHEMATICS

Paper First

(Operations Research)

Time : Three Hours]

[Maximum Marks : 70

[Minimum Pass Marks : 14

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.

P. T. O.

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. The probability of the happening of any *one* of the n mutually exclusive events is the sum of their separate probabilities. This statement is true or false ?
2. Define a non-singular matrix.
3. A card is selected at random from a pack of 52 cards, then the probability that it is a king or queen is
..... .
4. Define a feasible solution.
5. Define a convex set.
6. What is a tree ?
7. What is network ?
8. Define most likely time in PERT.

Section—B

9. Find the probability of obtaining a total of 7 in a single throw of two dice.

10. Write some properties of determinants.
11. Classify inventory models.
12. In a central grain store, it takes about 15 days to get the stock after placing the order and daily 500 tons are dispatched to neighbouring markets. On an adhoc basis safety stock is assumed to be 10 days stock. Calculate the reorder point p .
13. Describe the exponential distribution and the normal distribution.
14. Formulate a transportation problem.

Section—C

15. Discuss the characteristics of operations research.
16. The cost of a machine is ₹ 6,100.00 and its scrap value (resale value) is only ₹ 100.000. The maintenance costs are found from experience to be as under :

Years	Maintenance costs (₹)
1	100
2	250
3	400
4	600
5	900
6	1250
7	1600
8	2000

When should the machine be replaced ?

17. Find all the basic solutions of the following system :

$$\begin{aligned}x_1 + \quad + \quad &= \\2x_1 + \quad + \quad &= \end{aligned}$$

and prove that they are non-degenerate.

18. Prove that the set of all feasible solutions of a LPP is a convex set.

Section—D

19. Derive an economic lot-size formula and the minimum average costs under the following assumptions :

- (i) demand is uniform at a rate of r units per unit time
- (ii) production is instantaneous
- (iii) lead time is zero
- (iv) G = holding cost per unit time
- (v) C_3 = set up cost per production run
- (vi) Shortages are not allowed

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

Age of car	Repair cost (₹)	Salvage value (₹)
1	5,000	8,000
2	10,000	6,400
3	10,000	5,120

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%.

21. Apply simplex method to find the inverse of the matrix

$$\begin{bmatrix} & \\ & \\ & \\ & \end{bmatrix}$$

22. Solve the following transportation problem :

						a_i	
	5	3	7	3	8	5	3
	5	6	12	5	7	11	4
	2	1	3	4	8	2	2
	9	6	10	5	10	9	8
b_j	3	3	6	2	1	2	17

Section—E

23. Solve the following LPP :

max. :

$$z = _ + _ + _ - _ .$$

subject to :

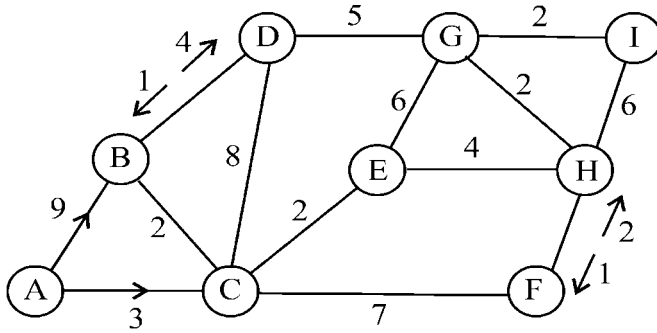
$$x_1 + _ + _ =$$

$$2x_1 + _ + _ =$$

$$x_1 + _ + _ + _ =$$

$$x_1, x_2, x_3, x_4 \geq _ .$$

24. Find the critical path for the following network :



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Term End Examination, June-July, 2020-21

MATHEMATICS

Paper Second

(Complex Analysis)

Time : Three Hours]

[Maximum Marks : 70

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Instructions for Candidate :

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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.

P. T. O.

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. Write principal argument of iy ($y > 0$).
2. Imaginary part of $z = c + iy$ is
3. Write C-R equations.
4. Function $f(z) = \frac{1}{z+i}$ is not analytic at $z = \dots$.
5. If C is circle $|z-i| = 1$, then $\int_C \frac{1}{z} dz = \dots$.
6. If $f(z)$ is analytic inside and on a closed curve C, then $\int_C f(z) dz = \dots$.
7. Number of zeros of the function $f(z) = \frac{1}{z}$ is
8. If $z = i$ is pole of $f(z)$, then $\lim_{z \rightarrow i} f(z) = \dots$.

Section—B

9. Find argument of :

$$\frac{1-i}{1+i}$$

10. Find the loci of point z satisfying the condition

$$|z-1| = |z+1|$$

11. Show that :

$$f(z) = \frac{1}{z}$$

is not analytic anywhere.

12. Prove that :

$$U = x^2 - y^2$$

is harmonic function.

13. Cauchy Goursat theorem.

14. State Rouche's theorem.

Section—C

15. If z_1 and z_2 are two complex numbers, then prove that

$|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2$ if and only if $z_1 \bar{z}_2$ is purely imaginary.

16. Show that an analytic function with constant modulus is constant.

17. Find the expansion of $\frac{1}{(1+z)^2}$ for :

(i) $|z| < 1$

(ii) $1 < |z| < \infty$

18. Evaluate :

$$\int \dots ,$$

around the circle $|z - \dots| = \dots$.

Section—D

19. Prove that a rational function has no singularities other than poles.

20. Show that points z_1, z_2, z_3, z_4 taken in order are concyclic if and only if :

$$\frac{(z_3 - z_1)(z_2 - z_4)}{(z_3 - z_4)(z_2 - z_1)},$$

is purely real.

21. State and prove the sufficient condition for $f(z)$ to be analytic.

22. State and prove maximum module principle.

Section—E

23. State and prove Laurent's theorem.

24. State and prove Taylor's theorem.

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Term End Examination, June-July, 2020-21

MATHEMATICS

Paper Third

(Mathematical Statistics)

Time : Three Hours]

[Maximum Marks : 70

[Minimum Pass Marks : 14

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.

P. T. O.

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. Write relation between A.M. 'A', G.M. 'G' and H.M. 'H'.
2. What is the value of β_1 in symmetric distribution ?
3. A problem in statistic is given to three students whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$. What is the probability that the problem will be solved ?
4. Write the relation between coefficient of correlation and coefficient of regression.
5. Time Reversal test is :
 - (a) $I_{01} \times \dots =$
 - (b) $I_{01} \times \dots = \frac{1}{100}$
 - (c) $I_{01} \times \dots =$
 - (d) None of the above

6. If $\Delta =$, then $f(x) =$:
- $6x$
 - $6x + c$
 - $6x^2$
 - None of the above
7. Which of the following is true for coefficient of association Q between two attributes ?
- $- < <$
 - $- \leq \leq$
 - $- \leq <$
 - None of the above
8. For a frequency distribution, kurtosis is :
- greater than 1
 - less than 1
 - equal to 1
 - equal to 0

Section—B

9. Show that :

$$\beta > \beta .$$

10. Nine cards are drawn at random from a set of cards. Each card is marked with the numbers 1, 0 or -1 and it is equally likely that any of the three numbers will be drawn. Find the chance that the sum of the numbers drawn is zero.

11. For two variables x and y with the same mean, the two regression equations are $y = \alpha + \beta x$ and $x = \alpha' + \beta' y$. Show that $\frac{b}{\beta} = \frac{1}{\beta'}$. Find also the common mean.
12. 100 children took three examinations, 40 passed the first, 39 passed the second and 48 passed the third, 10 passed all three, 9 passed the second and failed in third, 19 failed the first two and passed the third. Find how many children passed at least two examinations.
13. Find u_6 , given $u_0 = -$, $u_1 =$, $u_2 =$, $u_3 =$, third differences being constant.
14. From the chain base index numbers given below, prepare fixed base index numbers :

1945	92
1946	102
1947	104
1948	98
1949	103
1950	101

Section—C

15. Calculate the mean deviation from the mean and standard deviation of the series :
- $a, a + \dots + \dots + \dots$

16. If x and y are two correlated variables with same S. D. and the correlation coefficient r , show that the correlation between x and $x + y$ is $\sqrt{\frac{1+r}{2}}$.
17. A computer while calculating the correlation coefficient between two variables x and y from 25 pairs of observations obtained the following results :

$$n = \quad \Sigma = \quad \Sigma = \quad \Sigma = \quad \Sigma = \quad ,$$

$$\Sigma =$$

It was however discovered at the time of checking that

he had copied down two pairs as $\frac{x}{6} \frac{y}{14}$ while the $\frac{x}{8} \frac{y}{6}$

correct value was $\frac{x}{8} \frac{y}{12}$ obtain the correct value of $\frac{x}{6} \frac{y}{8}$

correlation coefficient.

18. On the basis of observations made on 35 cotton plants the total correlations of yield of cotton (x_1), number of balls i.e. seed vessels (x_2) and height (x_3) are found to be :

$$r_{12} = \quad \dots = \quad \dots =$$

Determine the multiple correlation $R_{1(23)}$ and the partial correlations $r_{12.3}$ and $r_{13.2}$.

Section—D

19. Construct with the help of data given below Fisher's Ideal Index and show it satisfies the Factor Reversal Test :

	Estimated total production in thousand tons in Saran district		Harvest price per moud in Saran district			
	1931-32	1932-33	1931-32		1932-33	
			₹	As.	₹	As.
Winter Rice	71	26	3	8	3	2
Barley	107	83	2	0	2	0
Maize	62	48	2	9	2	9

20. A study of prices of a certain commodity at Hapur and Kanpur yield the following data :

	Hapur ₹	Kanpur ₹
Average price per kilo	2.463	2.797
Standard deviation	.326	.207
r	+ 0.774	

Estimate from the above data the most likely price :

- (a) at Hapur corresponding to the price of ₹ 2.334 per kilo at Kanpur
- (b) at Kanpur corresponding to the price of ₹ 3.052 per kilo at Hapur.

21. In a bolt factory, machines A, B and C manufacture 25, 35 and 40 percent of the total of their output 5, 4 and 2 percent are defective. A bolt is drawn at random and is found to be defective. What are the probabilities that it was manufactured by the machines A, B and C ?
22. 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 relations hold :

$$(i) \quad G = \left(\quad - \quad \right)$$

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

Section—E

23. (a) From the following table, estimate the number of persons earning wages between 60 and 70 rupees :

	Wages in rupees				
	Below 40	40—60	60— 80	80— 100	100— 120
Number of persons in thousands	250	120	100	70	50

- (b) Estimate the annual rate of cloth sales of 1935 from the following data :

Year	Sale of clothes in Lakhs of yards
1920	250
1925	285
1930	328
1940	444

24. (a) If the random variable X and Y have the joint probability distribution :

$$f(x, y) = \begin{cases} + & < < < < \\ = & \text{elsewhere} \end{cases}$$

Find the correlation coefficient of X and Y.

- (b) If x and y are two uncorrelated variables and $u = +$, $v = -$, find the coefficient of correlation between u and v in terms of $\sigma_{..}$ and $\sigma_{.}$.

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Term End Examination, June-July, 2020-21

MATHEMATICS

Paper Fourth

(Object Oriented Programming with C++)

Time : Three Hours]

[Maximum Marks : 70

[Minimum Pass Marks : 14

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Section—A

1. Who developed C++ language ?
2. In which operating system visual C++ compiler works ?
3. How many ways are these to insert comments in C++ ?
4. How many key words are available in ANSI C++ ?
5. Define if-else-if ladder.
6. What is the meaning of the following function prototype ?
float fun(void).
7. What is the name of binary operator && ?
8. Virtual functions are non-static member functions of a base class. (True/False)

Section—B

9. Write any *five* features of OOP.
10. What are C++ tokens ?
11. What are the differences between while-loop and do-while-loop ?

12. What is a command line argument ? Explain with one example.
13. What are different types of polymorphism in C++ ?
14. Write a short note on constructors.

Section—C

15. Classify the errors in C++ language.
16. Write a program to find the larger of two numbers using ternary operator.
17. Explain the special characteristics of the constructor functions.
18. Write syntax of derived class with *two* examples.

Section—D

19. What are arithmetic operators ? What are the operations performed by these operators ? Explain with examples.
20. What are User Defined Functions (UDFs) ? What are the elements of UDFs ?
21. Explain new and delete operators with suitable examples.
22. Discuss various types of inheritance.

Section—E

23. What is Data Type ? Explain all C++ Data types with examples.
24. What are the basic stream classes ? Explain various basic stream classes with hierarchy diagram.