

पण्डित सुन्दरलाल शर्मा (मुक्त) विश्वविद्यालय छत्तीसगढ़, बिलासपुर
सत्रीय कार्य (Assignment Work) सत्र – जनवरी–दिसंबर 2026
एम.ए./एम.एससी. (गणित) अंतिम

विषय – Operations Research

प्रश्नपत्र: प्रथम

पूर्णांक : 30

न्यूनतम उत्तीर्णांक: 12

नोट:— परीक्षार्थी प्रत्येक खण्ड के निर्देशों को ध्यान से पढ़कर प्रश्नों को हल करें।

Instructions for Candidate :

Section—A : Question Nos. **01** to **08** are very short answer type questions. Attempt all questions. Each question carries 1/2 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 1 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 02 marks. Answer each of these questions in about 150 words or one page.

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Section—E : Question Nos. **23** and **24** are long answer type questions. Attempt any *one* question. Each question carries 8 marks. Answer each of these questions in about **600—750** words or 04—05 pages.

(Assignment—1)

Section—A

1. Write the types of models.
2. Define simple event.
3. Write the objective of inventory problem.
4. The variables in a basic feasible solutions are called the
5. Define convex hull.
6. The degeneracy appears in an L. P. P. at the very first iteration when some component of vector b i.e. some b_i is
7. A feasible solution (not necessarily basic) is said to be if it minimizes the total transportation cost.
8. Define connected graph.

Section—B

9. During the course of a day, a machine turns out either 0, 1 or 2 defective pens with probability $1/6$, $2/3$ and $1/6$ respectively. Calculate the mean value and the variance of the defective pens produced by the machine in a day.
10. An item is produced at the rate of 50 items per day. The demand occurs at the rate of 25 items per day. If the set up cost is ` 100 per set up and holding cost is 0.01 per unit of item per day, find the economic lot size for one run, assuming that the shortages are not permitted.
11. Show that the set of all the internal points of a convex set S is a convex set.
12. Give the brief note on CPM method.
13. What is Operations Research ?
14. A hyperplane is given by the equation $3x_1 + 3x_2 + 4x_3 + 7x_4 = 8$. Find in which half spaces do the points $(-6, 1, 7, 2)$ and $(1, 2, -4, 1)$ lie.

(Assignment—2)

Section—C

15. Discuss the various phases in solving an OR problem.
16. Solve graphically the following linear programming problem :

$$\text{Min.} \quad z = 3x_1 + 5x_2$$

$$-3x_1 + 4x_2 \leq 12$$

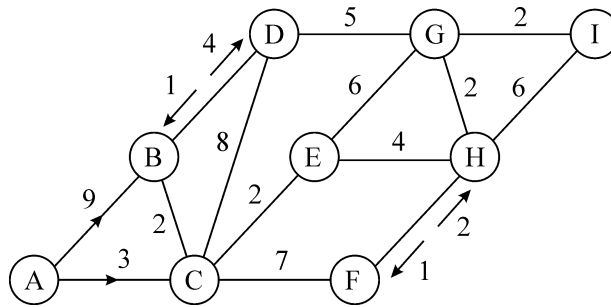
$$2x_1 - x_2 \geq -2$$

$$2x_1 + 3x_2 \geq 12$$

$$x_1 \leq 4, x_2 \geq 2$$

$$\text{and} \quad x_1, x_2 \geq 0.$$

17. Prove that every B. F. S. is an extreme point of the convex set of feasible solutions.
18. Find the critical path for the following network.



(Assignment—3)

Section—D

19. An owner of five overnight cabins is considering buying television sets to rent to cabin occupants. He estimates that about half of his customers would be willing to rent sets. Finally, he buys three sets. Assuming 100% occupancy at all times :
- What fraction of the evening will there be more requests than TV sets ?
 - What is the probability that a customer who requests a television set will receive one ?
 - If the owner's cost per set per day is C , what rental R must he charge in order to break even in the long run ?
20. Derive the optimal order level and the minimum average cost under the following assumptions :
- Demand rate is uniform at a rate of r units per unit time.
 - Production is instantaneous,
 - Lead time is zero.
 - C_1 = holding cost per unit per unit time.
 - C_2 = shortage cost per unit per unit time.
 - C_3 = set up cost per production run.
 - Shortages are allowed and are backlogged.
 - Q = total demand per production run of fixed time interval t .
21. Solve the following system of simultaneous linear equations :

$$x_1 - x_3 + 4x_4 = 3$$

$$2x_1 - x_2 = 3$$

$$3x_1 - 2x_2 - x_4 = 1$$

22. Determine the optimal transportation plan from the following table given, the plant to market shipping costs, and quantities required at each market and available at each plant :

Plant	W_1	W_2	W_3	W_4	Availability
F_1	11	20	7	8	50
F_2	21	16	10	12	40
F_3	8	12	18	9	70
Requirement	30	25	35	40	

(Assignment—4)

Section—E

23. (a) At time zero, all items in a system are new. Each item has a probability p of failing immediately before the end of first month of life, and probability $q = 1 - p$ of failing immediately before the end of the second month, (i. e. all items fail by the end of the second month). If all items are replaced as they fail, show that the expected number of failures $f(x)$ at the end of the month x is given by :

$$f(x) = \frac{N}{1+q} \left[1 - (-q)^{x+1} \right],$$

where N is the number of items in the system.

- (b) If the cost per item of individual replacement is C_1 and the cost per item of group replacement is C_2 , find the condition under which :
- (i) A group replacement policy at the end of each month is the most profitable.
 - (ii) a group replacement policy at the end of every other month is the most profitable.
 - (iii) No replacement policy is better than a policy of pure individual replacement.
24. Solve the following L. P. problem by using the Big-M method.

Max. $z = x_1 + 2x_2 + 3x_3 - x_4$

subject to $x_1 + 2x_2 + 3x_3 = 15$

$$2x_1 + x_2 + 5x_3 = 20$$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$

$$x_1, x_2, x_3, x_4 \geq 0.$$

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आवश्यक निर्देश :-

1. सत्रीय लेखन कार्य को घर से लिखकर उत्तरपुस्तिका दिनांक 31 अगस्त 2026 तक संबंधित अध्ययन केन्द्र में जमा करें। सत्रीय कार्य स्व-हस्तलिखित होना चाहिए। दूसरे के द्वारा लिखा गया, फोटोकापी या पुस्तक का हिस्सा चिपकाना अनुचित साधन का प्रयोग माना जायेगा।
2. छात्र सत्रीय कार्य लेखन हेतु अन्य संदर्भित पुस्तकों का भी उपयोग कर सकते हैं।
3. सत्रांत परीक्षा सत्र जनवरी-दिसंबर 2026 का सैद्धांतिक प्रश्न पत्र का स्वरूप सत्रीय कार्य जनवरी-दिसंबर 2026 जैसा ही रहेगा।
4. सत्रीय कार्य के मूल्यांकन में छात्र द्वारा किए गए अध्ययन एवं लेखन, विषय की व्याख्या तथा लेखन में मौलिकता को आधार बनाया जायेगा। इसमें अध्ययन लेखन पर अधिकतम 60 प्रतिशत (18 अंक) दिया जावेगा, विषय-वस्तु की व्याख्या के लिए अधिकतम 20 प्रतिशत (6 अंक) तथा सृजनात्मक, मौलिक-सोच प्रदर्शित होने पर अधिकतम 20 प्रतिशत (6 अंक) प्राप्त हो सकते हैं। इस प्रकार मूल 100 प्रतिशत (30 अंक) का विभाजन रहेगा।

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एम.ए./एम.एससी. (गणित) अंतिम

विषय – **Complex Analysis**

प्रश्नपत्र: द्वितीय

पूर्णांक : 30

न्यूनतम उत्तीर्णांक: 12

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(Assignment—1)

Section—A

1. In an Argand plane the radius of the circle $|5z + 15 - 16i| = 20$ is
2. The equation $|z - i| = |z + i|$ represents
3. If $f(z) = u + iv$ is analytic and $u = \frac{1}{2} \log(x^2 + y^2)$, then $v = \dots\dots\dots$
4. The analytic function whose real part is $e^x(x \cos y - \sin y)$; is
5. If L is a closed curve and $z = a$ is outside L , then $\int_L \frac{dz}{z - a}$ is =

6. If $f(z)$ is an analytic function and $f'(z)$ is continuous at each point within or on a closed curve C , then $\int_C f(z) dz = \dots\dots\dots$.
7. The number of isolated singular points of $f(z) = \frac{z+3}{z^2(z^2+2)}$ is $\dots\dots\dots$.
8. For the function $f(z) = \sin \frac{1}{z}$, $z=0$ is a $\dots\dots\dots$.

Section—B

9. If $|z_1| = |z_2|$ and $\arg z_1 + \arg z_2 = 0$, show that z_1 and z_2 are conjugate numbers.
10. If $f(z) = u + iv$ be an analytic function of $z = x + iy$, prove that the families of curves $u = c_1, v = c_2$ are orthogonal to each other, where c_1 and c_2 are parameters.
11. Without using Integral formula evaluate $\int_C \frac{dz}{z - z_0}$, where z_0 is any point within C .
12. A polynomial of degree n has no singularities in the finite part of the plane but has a pole of order n at infinity.
13. Specify the nature of singularity at $z = -2$ of $f(z) = (z-3) \cdot \sin\left(\frac{1}{z+2}\right)$.
14. Define :
- (i) Residue at pole
 - (ii) Meromorphic function
 - (iii) Contours

(Assignment—2)

Section—C

15. If z_1 and z_2 are two complex numbers, 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 the function $u = x^3 - 3xy^2$ is harmonic and find the corresponding analytic function.
17. State and prove Cauchy's Inequality.

18. Using Rouché's theorem determine the number of zeros of the polynomial :

$$p(z) = z^{10} - 6z^7 + 3z^3 + 1 \text{ in } |z| < 1.$$

(Assignment—3)

Section—D

19. Show that the equation of the circle passing through three given points in the Argand plane whose affixes are z_1, z_2 and z_3 is :

$$\frac{(z - z_1)(z_3 - z_2)}{(z - z_2)(z_3 - z_1)} = \frac{(\bar{z} - \bar{z}_1)(\bar{z}_3 - \bar{z}_2)}{(\bar{z} - \bar{z}_2)(\bar{z}_3 - \bar{z}_1)}$$

20. If $u - v = (x - y)(x^2 + 4xy + y^2)$ and $f(z) = u + iv$ is an analytic function of $z = x + iy$, find $f(z)$ in terms of z .

21. Find the value of the integral :

$$\int_0^{1+i} (x - y + ix^2) dz$$

(i) Along the straight line from $z = 0$ to $z = 1 + i$.

(ii) Along the real axis from $z = 0$ to $z = 1$ and then along a line parallel to the imaginary axis from $z = 1$ to $z = 1 + i$.

22. State and prove Argument principle.

(Assignment—4)

Section—E

23. Obtain the Taylor's and Laurent's series which represent the function.

$$f(z) = \frac{z^2 - 1}{(z+2)(z+3)}$$

in the regions :

- (i) $|z| < 2$
- (ii) $2 < |z| < 3$
- (iii) $|z| > 3$

24. State and prove Maximum Modulus principle.

आवश्यक निर्देश :-

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विषय – Mathematical Statistics

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(Assignment—1)

Section—A

1. Arithmetic mean of the series $1, 2, 2^2, 2^3, \dots, 2^n$ is :

(a) $\frac{2n-1}{n+1}$

(b) $\frac{2n+1}{n+1}$

(c) $\frac{2^{n-1}-1}{n+1}$

(d) $\frac{2^{n+1}-1}{n+1}$

2. For a frequency distribution, kurtosis is :
- (a) Greater than 1
 - (b) Less than 1
 - (c) Equal to 1
 - (d) Equal to 0
3. A card is selected at random from a pack of 52 cards, then the probability that it is a Face card, is :
- (a) $\frac{1}{4}$
 - (b) $\frac{3}{13}$
 - (c) $\frac{4}{13}$
 - (d) $\frac{1}{52}$
4. If two regression coefficients are 0.8 and 0.2, then the value of correlation coefficient is :
- (a) 0.16
 - (b) -0.16
 - (c) 0.4
 - (d) -0.4
5. Which of the following is true ?
- (a) $\Delta_{12} = - \begin{vmatrix} r_{12} & r_{23} \\ r_{13} & 1 \end{vmatrix}$
 - (b) $\Delta_{12} = - \begin{vmatrix} r_{23} & r_{12} \\ 1 & r_{13} \end{vmatrix}$
 - (c) $\Delta_{12} = 0$
 - (d) None of the above

6. There is complete dis-association between the attributes, if :

- (a) $Q = 0$
- (b) $Q = 1$
- (c) $Q = -1$
- (d) None of the above

7. If $\Delta f(x) = 6$, then $f(x)$:

- (a) $6x$
- (b) $6x + c$, c is constant
- (c) $6x^2$
- (d) None of the above

8. The Marshall-Edgeworth Index is based on :

- (a) Geometric Mean
- (b) Arithmetic Mean
- (c) Harmonic Mean
- (d) None of the above

Section—B

9. Show that the weighted arithmetic mean of first n natural numbers whose weights are equal to the corresponding number is equal to $\frac{2n+1}{3}$.

10. A problem in statistics 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 ?

11. If β be the angle between the lines of regression, show that $\tan \beta = \frac{(1-r^2)\sigma_x \sigma_y}{r(\sigma_x^2 + \sigma_y^2)}$. Explain

the significance of the formula when $r = 0$ and, $r = \pm 1$.

12. If the regression lines are $8x - 10y + 66 = 0$, $44x - 18y = 214$, then find the mean values of x and y .

13. If $u_x = \sin x$ show that $\Delta^2 u_x = kEu_x$, where k is a constant.
14. Prove that :

$$u_4 = u_3 + \Delta u_2 + \Delta^2 u_1 + \Delta^3 u_1.$$

(Assignment—2)

Section—C

15. The means of two samples of sizes 50 and 100 respectively are 54.1 and 50.3. The standard deviation are 8 and 7. Find the mean and standard deviation of the sample of size 150 by combining the two samples.
16. Four persons are chosen at random from a group containing 3 men, 2 women and 4 children. Show that the chance that exactly two of them will be children is $\frac{10}{21}$.
17. Given $u_0 = 3$, $u_1 = 12$, $u_2 = 81$, $u_3 = 200$, $u_4 = 100$, $u_5 = 8$. Find $\Delta^5 40$.
18. Prepare index number for 1904 on the basis of 1902 where the following information is given :

Year	Article I		Article II		Article III	
	Price	Qty.	Price	Qty.	Price	Qty.
1902	5	10	8	6	6	3
1904	4	12	7	7	5	4

(Assignment—3)

Section—D

19. Find the mean, standard deviation and skewness of the following distribution :

Variable	Frequency
0—5	2
5—10	5
10—15	7
15—20	13
20—25	21
25—30	16
30—35	8
35—40	3

20. A bag contains six balls of different colours and a ball is drawn from it. A speaks truth twice out of three times and B speaks truth 4 times out of 5. If both A and B say that a red ball has been drawn, find the probability of their joint statement being true.

21. Find the line of best fit to the following data :

x	y
6	5
7	5
7	4
8	5
8	4
8	3
9	4
9	3
10	3

22. Calculate the coefficient of correlation between the values of x and y given below :

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

(Assignment—4)

Section—E

23. Prove that :

$$\sigma_{x-y}^2 = \sigma_x^2 + \sigma_y^2 - 2r_{xy} \sigma_x \sigma_y$$

where r_{xy} is the correlation coefficient between x and y .

Hence or otherwise find r from the following data :

x	y
21	60
23	71
30	72
54	83
57	110
58	84
72	100
78	92
87	113
90	135

24. (a) If $r_{23} = 1$, prove that $R_{1(23)}^2 = r_{12}^2 = r_{13}^2$ and $\sigma_{1.23}^2 = \sigma_1^2(1 - r_{12}^2)$.

(b) u_x is a polynomial in x , the following values of which are known :

$$u_2 = u_3 = 27, u_4 = 78, u_5 = 169.$$

Find the function u_x .

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3. सत्रांत परीक्षा सत्र जनवरी-दिसंबर 2026 का सैद्धांतिक प्रश्न पत्र का स्वरूप सत्रीय कार्य जनवरी-दिसंबर 2026 जैसा ही रहेगा।
4. सत्रीय कार्य के मूल्यांकन में छात्र द्वारा किए गए अध्ययन एवं लेखन, विषय की व्याख्या तथा लेखन में मौलिकता को आधार बनाया जायेगा। इसमें अध्ययन लेखन पर अधिकतम 60 प्रतिशत (18 अंक) दिया जावेगा, विषय-वस्तु की व्याख्या के लिए अधिकतम 20 प्रतिशत (6 अंक) तथा सृजनात्मक, मौलिक-सोच प्रदर्शित होने पर अधिकतम 20 प्रतिशत (6 अंक) प्राप्त हो सकते हैं। इस प्रकार मूल 100 प्रतिशत (30 अंक) का विभाजन रहेगा।

पण्डित सुन्दरलाल शर्मा (मुक्त) विश्वविद्यालय छत्तीसगढ़, बिलासपुर
सत्रीय कार्य (Assignment Work) सत्र – जनवरी–दिसंबर 2026
एम.ए./एम.एससी. (गणित) अंतिम

विषय – Object Oriented Programming in C++

प्रश्नपत्र: चतुर्थ

पूर्णांक : 30

न्यूनतम उत्तीर्णांक: 12

नोट:— परीक्षार्थी प्रत्येक खण्ड के निर्देशों को ध्यान से पढ़कर प्रश्नों को हल करें।

Instructions for Candidate :

Section—A : Question Nos. **01** to **08** are very short answer type questions. Attempt all questions. Each question carries 1/2 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 1 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 02 marks. Answer each of these questions in about **150** words or one page.

Section—D : Question Nos. **19** to **22** are half long answer type questions. Attempt any *two* questions. Each question carries 04 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 8 marks. Answer each of these questions in about **600—750** words or 04—05 pages.

(Assignment—1)

Section—A

1. The process of converting a C++ program in to machine code is called
2. The function used to display output on the screen in C++ is
3. In C++, a function is a block of code that performs a specific task and is defined using the keyword
4. The loop in C++ is used when the number of iterations is known in advance.
5. A class in C++ is a blueprint for creating
6. Constructors in C++ have the same name as the
7. The ability of a function or object to take multiple forms in C++ is called
8. The base class is also called the class in inheritance.

Section—B

9. Define variables in C++.
10. Write a short note on recursion.
11. How do you create objects of a class ?
12. What is destructor ? Write the syntax.
13. What are virtual functions ?
14. Explain compile-time polymorphism.

(Assignment—2)

Section—C

15. Explain class data type with example.
16. What are the differences between if and if-else statement ?
17. Explain friend function and write its characteristics.
18. Explain the types of inheritance.

(Assignment—3)

Section—D

19. Explain the following :
 - (i) Functions
 - (ii) Pointers
20. What is break statement and when is it used ? Give an example.
21. How do you write member function of a class ? Explain.
22. Which manipulators to used to format I/O in C++ ? Explain.

(Assignment—4)

Section—E

23. (a) Write the program for check a prime number.
(b) Write a C++ program to find sum of natural numbers.
(c) Write a program to add the numbers which are divisible by 5.
24. (a) What is virtual base class ? How do you pass base class constructor in the derived class ?
(b) When are constructor and destructor functions executed in context to inheritance ?

आवश्यक निर्देश :-

1. सत्रीय लेखन कार्य को घर से लिखकर उत्तरपुस्तिका दिनांक 31 अगस्त 2026 तक संबंधित अध्ययन केन्द्र में जमा करें। सत्रीय कार्य स्व-हस्तलिखित होना चाहिए। दूसरे के द्वारा लिखा गया, फोटोकापी या पुस्तक का हिस्सा चिपकाना अनुचित साधन का प्रयोग माना जायेगा।
2. छात्र सत्रीय कार्य लेखन हेतु अन्य संदर्भित पुस्तकों का भी उपयोग कर सकते हैं।
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