OMR Answer Sheet No.

Question Booklet Number

2041

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B.C.A. (II Sem.) Examination, 2023-24

Booklet Series

D

Numerical Methods

(To be filled by the Candidate / निम्न पूर्तियाँ परीक्षार्थी स्वयं भरें)

Roll No. (in figures)
अनुक्रमांक (अंकों में) —

Roll No. (in words)
अनुक्रमांक (शब्दों में) _____

[Time : 2 : 00 Hours
[समय : 2 : 00 घण्टे

[Maximum Marks : 50
[अधिकतम अंक : 50

Name of Examination Centre
परीक्षा केन्द्र का नाम _____

Signature of Invigilator
कक्ष निरीक्षक के हस्ताक्षर

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. **The booklet contains 75 questions. Examinee is required to answer any 65 questions in the OMR Answer-Sheet provided and not in the question booklet. In case Examinee attempts more than 65 Questions, first 65 attempted questions will be evaluated. All questions carry equal marks.**
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be immediately replaced.

(Remaining Instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. **प्रश्न-पुस्तिका में 75 प्रश्न हैं। परीक्षार्थी को किन्हीं 65 प्रश्नों को दी गई ओ0एम0आर0 आन्सर-शीट पर ही हल करना है। परीक्षार्थी द्वारा 65 से अधिक प्रश्नों को हल करने की स्थिति में, प्रथम 65 उत्तरों को ही मूल्यांकित किया जायेगा। सभी प्रश्नों के अंक समान हैं।**
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR उत्तर-पत्रक को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका, जिसमें कुछ भाग छपने से छूट गये हों या प्रश्न एक से अधिक बार छप गये हो या किसी भी प्रकार की कमी हो, उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. What is backward difference operator?

(A) $\nabla y_x = y_x - y_{x-1}$

(B) $\nabla y_x = y_x + y_{x-1}$

(C) $\nabla y_x = y_{x-1} - y_x$

(D) $\nabla y_x = y_{x-1} - y_{x+1}$

2. Using Range-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0)=1$ at $x=0.2$.

(A) 1.196

(B) 1.961

(C) 1.691

(D) 1.169

3. What is forward difference operator?

(A) $\Delta y_x = y_x - y_{x-1}$

(B) $\Delta y_x = y_{x+1} + y_x$

(C) $\Delta y_x = y_{x+1} - y_x$

(D) $\Delta y_x = y_{x-1} - y_x$

4. Solve the equation $\frac{dy}{dx} = 1 - y$ with the initial condition $x=0$, $y=0$ using Euler's method at $x=0.1$

(A) 0.19

(B) 0.1

(C) 0.271

(D) 0

5. Apply False-Position method the first iterative value of the equation $3x - \cos x - 1 = 0$ is

(A) 0.706

(B) 0.607

(C) 0.067

(D) 0.76

6. Solve the given system of equation by Gauss Elimination method.

$3x + 4y - z = -6$

$-2y + 10z = -8$

$4y - 2z = -2$

(A) (-2,-1,-1)

(B) (-1,-2,-1)

(C) (-1,-1,-2)

(D) (-1,-1,-1)

7. Bisection Method is based on which theorem

(A) Taylor's Theorem

(B) Pythagoras Theorem

(C) Intermediate Theorem

(D) None of the above

8. The equation f(x) is given as $x^3+4x+1=0$. Consider the initial approximation at x=1 then using Newton's Raphson method the value of x_1 is goven as

(A) 1.85

(B) 1.86

(C) 1.87

(D) 1.67

9. Consider the below data:

x:	0	1	2
f(x):	4	3	12

The value of $\int_0^2 (x)\,dx$by Trapezodial rule will be

(A) 11

(B) 12

(C) 15

(D) 9

10. The process of finding the value of x for the corresponding value of y is called

(A) Divided difference

(B) Interpolation

(C) Cubic Spline

(D) Inverse Interpolation

11. Which method can be used for find interpolation both equal and unequal intervals

(A) Newton's method

(B) Divided difference method

(C) Lagrange's method

(D) Cubic Spline method

12. The value pf $\Delta\log x$ is

(A) log(1+hx)

(B) $\log\left(1+\frac{h}{x}\right)$

(C) log(1+x)

(D) log(1−hx)

13. In fourth order Runge-Kutta Method, the formula for k_2 is ___ for n^{th} interval.

(A) $k_2=hf\{x_{n-1}-h/2, y_{n-1}-k_1/2\}$

(B) $k_2=hf\{x_{n-1}+h/2, y_{n-1}+k_1/2\}$

(C) $k_2=hf\{x_{n-1}+h/2, y_{n-1}+h/2\}$

(D) None of the above

14. In fourth order Runge-Kutta Method, the formula for k_4 is _____ for n^{th} interval.

(A) $k_4=hf\{x_{n-1}+h, y_{n-1}+k_3\}$

(B) $k_4=hf\{x_{n-1}-h, y_{n-1}-k_3\}$

(C) $k_4=hf\{x_{n-1}+h, y_{n-1}+h\}$

(D) None of the above

15. Which of the following methods is used in the first two steps of fourth order Runge-Kutta method?

(A) Forward Euler method

(B) Backward Euler method

(C) Euler method

(D) None of the above

16. In which of the following method, we approximate the curve of solution by the tangent in each interval.

(A) Euler's method

(B) Newton's method

(C) Picard's method

(D) Runge-Kutta method

17. Match the following:

I. Newton Raphson	1. Integration
II. Runge-Kutta	2. Finding Roots
III. Gauss-Seidal	3. Differential Equations
IV. Simpson's Rules	4. Solution of system of Linear Equation

(A) I-2, II-3, III-4, IV-1

(B) I-3, II-2, III-1, IV-4

(C) I-1, II-4, III-2, IV-3

(D) None of the above

18. The forward difference operator is defined as

(A) $\Delta f(x)=f(x+h)+f(x)$

(B) $\Delta f(x)=f(x+h)-f(x)$

(C) $\Delta f(x)=f(x-h)-f(x)$

(D) $\Delta f(x)=f(x-h)+f(x)$

19. While solving by Gauss-Seidal method, which of the following is the first iterative solution system $x-2y=1$ and $x+4y=4$?

(A) (1, 0.75)

(B) (0, 25.1)

(C) (0, 0)

(D) (1, 0.65)

20. The points where the Newton-Raphson method fails are called

(A) Floating

(B) Continuous

(C) Stationary

(D) Non-stationary

21. Which among the following is correct?

(A) $E=1+\Delta$

(B) $E=1-\Delta$

(C) $E=\Delta$

(D) $E=\Delta-1$

22. A partial differential equation requires

(A) Exactly one independent variable

(B) Two or more independent variables

(C) More than one dependent variable

(D) Equal number of dependent and independent variables

23. The order is a measure for the speed of

(A) Iteration

(B) Convergence

(C) Divergenece

(D) Non-convergence

24. Trapezoidal rule for evaluation of $\int_a^b f(x)dx$ requires the interval (a,b) to be divided into

(A) 2n sub-intervals of equal width

(B) 2n+1 sub-intervals of equal width

(C) Any number of sub-intervals of equal width

(D) 3n sub-intervals of equal width

25. The Elimination process in Gauss Elimination method is also known as _____

(A) Forward Elimination

(B) Backward Elimination

(C) Sideways Elimination

(D) Crossways Elimination

26. Apply Gauss Elimination method to solve the following equations:

$2x+y+z=10$

$3x+2y+3z=18$

$x+4y+9z=16$

(A) X=7, y=-4, z=5

(B) X=7, y=-9, z=5

(C) X=5, y=1, z=-8

(D) X=5, y=1, z=-3

27. Gauss seidal method is similar to which of the following methods?

(A) Iteration method

(B) Newton Raphson method

(C) Jacobi's method

(D) Regula-Falsi method

28. Which of the following method is employed for solving the system of linear equations?

(A) Runge Kutta

(B) Newton Raphson

(C) Gauss Seidal

(D) Simpson's Rule

29. Newton-Gregory Forward interpolation formula can be used _____

(A) only for equally spaced intervals

(B) only for unequally spaced intervals

(C) for both equally and unequally spaced intervals

(D) for unequally intervals

30. Which of the following is shifting operator

(A) Δ

(B) E

(C) T

(D) ∇

31. Which of the following is Backward Difference operator

(A) Δ

(B) E

(C) T

(D) ∇

32. What is the relationship between Δ and E is represented by

(A) $E=1+\Delta$

(B) $\Delta=1+E$

(C) $E=1-\Delta$

(D) None of the above

33. Which of the following is correct

(A) $(1+\Delta)(1-\nabla)=1$

(B) $(1-\Delta)(1+\nabla)=1$

(C) $(1-\Delta)(1+E)=1$

(D) None of the above

34. Which of the following is correct

(A) $\delta=E^{-1/2}\Delta$

(B) $\delta=E^{1/2}\nabla$

(C) Both (A) and (B)

(D) None of the above

35. The process of finding the values inside the interval (x_0, x_n) is called

(A) Extrapolation

(B) Interpolation

(C) Polynomial Equation

(D) None of the above

36. Use Lagrange's formula to find (6), given that

X	1	2	3	4	7
f(x)	2	4	8	16	128

(A) 66.67

(B) 60.67

(C) 68.67

(D) 69.67

37. In Newton Forward interpolation formula u= _____

(A) $(x-x_0)/h$

(B) $(x+x_0)/h$

(C) $(x-x_n)/h$

(D) $(x+x_n)/h$

38. Stirling formula gives best estimate when _____

(A) $-1/2<u<1/2$

(B) $-1/4<u<1/4$

(C) $1/4<u<3/4$

(D) $-1/4<u<3/4$

39. Value of $\Delta^2(\cos 2x)$ is

(A) $4\sin^2 h \cos(2x+2h)$

(B) $4\cos^2 h \cos(2x+2h)$

(C) $-4[\sin^2 h \cos(2x+2h)]$

(D) $-4\cos^2 h \cos(2x+2h)$

40. By interchanging the suffixes of the operator and the operand, the value of the dividend difference

(A) Changes its sign

(B) Remains unchanged

(C) Became zero

(D) None of these

41. Given that one root of the equation $x^3-10x^2+31x-30=0$ is 5, the other two roots are

(A) 2 and 3

(B) 2 and 4

(C) 3 and 4

(D) -2 and -3

42. During the numerical solution of a first order differential equation using euler's method with step size h, the local truncation error is of order of

(A) h^2

(B) h^3

(C) h^4

(D) h^5

43. The integral $\int_1^3 \frac{1}{x} dx$, when evaluated by using Simpson's $\frac{1}{3}$rd rule on two equal sub intervals each of length 1, equals

(A) 1.000

(B) 1.098

(C) 1.111

(D) 1.120

44. In an iterative method, the amount of computation depends on the _____

(A) number of variables

(B) Degree of accuracy

(C) Rounding of errors

(D) Ease of using the operators

45. If a and (a+h) are two consecutive approximate roots of the equation $f(x)=0$, obtained by Newton's method then h is equal to

(A) $\frac{f(a)}{f'(a)}$

(B) $\frac{f'(a)}{f(a)}$

(C) $-\frac{f'(a)}{f(a)}$

(D) $-\frac{f(a)}{f'(a)}$

46. What is a root correct to three decimal places of the equation $x^3-3x-5=0$ by using Newton Raphson Method.

(A) 2.222

(B) 2.279

(C) 2.275

(D) None of these

47. The bisection method is applied to compute a zero of the function $f(x)=x^4-x^3-x^2-4$ in the interval (1,9). The method converges to a solution after ____ iterations.

(A) 1

(B) 3

(C) 5

(D) 7

48. If $f(x)$ is a polynomial of degree n, then $\Delta^2 f(x)$ is equal to

(A) 0

(B) Constant

(C) $f(x+nh)$

(D) None of these

49. Which of the following shapes is generally prefered in case of application of Simpson's rule?

(A) Square

(B) Triangle

(C) Trapezoidal

(D) Rectangle

50. The Trapezoidal rule is a numerical method that approximates the value of a ____

(A) Improper Integral

(B) Indefinite Integral

(C) Definite Integral

(D) None of the above

51. Which of the following is Centre Difference operator

(A) ∇

(B) E

(C) ∇

(D) δ

52. Iteration is also called as

(A) Accurate process

(B) Self-correcting process

(C) Approximate process

(D) Rounding off process

53. Which of the following is an iterative method?

(A) Gauss Elimination Method

(B) Gauss Jordan Method

(C) Gauss Seidal Method

(D) Factorization

54. In Picard's Method, the n^{th} approximation y_n is given by

(A) $y_n = y_0 + \int_{x_0}^{x} f(x, y_{n-1})dx$

(B) $y_n = y_0 + \int_{x_0}^{x} f(x, y_n)dx$

(C) $y_n = y_0 + \int_{x_0}^{x} f(x_{n-1}, y_{n-1})dx$

(D) None of the above

55. The rate of convergence of Newton Raphson method is

(A) 1

(B) 2

(C) 3

(D) 4

56. Find f(0.18) from the following table using Newton's Forward inter Polation formula.

x	f(x)
0	0.1
0.1	1.052
0.2	1.2214
0.3	1.3499
0.4	1.4918

(A) 0.8878784

(B) 1.9878785

(C) 1.18878784

(D) 1.8878784

57. In Simpson's 1/3 rule, curve y=f(x) is considered to be a

(A) Hyperbola

(B) Parabola

(C) Circle

(D) Straight Line

58. Newton-Raphson method is applicable to the solution of:

(A) Only Algebric equations

(B) Only Transcendental equations

(C) Both (A) and (B)

(D) Both algebric and transcendental and also used when the roots are complex

59. A root of the equation $x^3-x-11=0$ correct to four decimals using Bisection method is

(A) 2.3737

(B) 2.3838

(C) 2.3736

(D) None of these

60. In Range-Kutta method, the value of K_3 is:

(A) $hf(x_0, y_0)$

(B) $hf\left(x_0+\frac{h}{2}, y_0+\frac{K_1}{2}\right)$

(C) $hf\left(x_0+\frac{h}{2}, y_0+\frac{K_2}{2}\right)$

(D) $hf\left(x_0-\frac{h}{2}, y_0-\frac{K_3}{2}\right)$

61. If $u=\frac{x-x_0}{h}$ then Gauss backward interpolation formula is

(A) $y_0+u\Delta y_{-1}+\frac{u(u+1)}{\lfloor 2}\Delta^2 y_{-1}+\frac{u(u^2-1)}{\lfloor 3}\Delta^3 y_{-1}+\ldots\ldots$

(B) $y_0+u\Delta y_{-1}+\frac{u(u-1)}{\lfloor 2}\Delta^2 y_{-1}+\frac{u(u^2-1)}{\lfloor 3}\Delta^3 y_{-1}+\ldots\ldots$

(C) $y_0+u\Delta y_{-1}+\frac{u(u-1)}{\lfloor 2}\Delta^2 y_{-1}+\frac{u(u-1)(u-2)}{\lfloor 3}\Delta^3 y_{-1}+\ldots\ldots$

(D) None of these

62. The value of $\left(\frac{1}{3}\right)^{1/4}$ is

(A) 0.75

(B) 0.57

(C) 0.557

(D) None of above

63. The Bisection method is also known as

(A) Binary Chopping

(B) Quaternary Chopping

(C) Tri region Chopping

(D) Hex region Chopping

64. The Bisection method has which of the following convergences?

(A) Linear

(B) Quadratic

(C) Cubic

(D) Quaternary

65. The formula used for solving the equation using Regula Falsi method is

(A) $x = \frac{bf(a)-af(b)}{f(a)-f(b)}$

(B) $x = \frac{bf(b)-af(a)}{f(a)-f(b)}$

(C) $x = \frac{bf(a)-af(b)}{f(b)-f(a)}$

(D) $x = \frac{f(a)-f(b)}{bf(a)-af(b)}$

66. The Iterative formula for Newton Raphson method is given by _____

(A) $x_1=x_0-f(x_0)/f'(x_0)$

(B) $x_0=x_1-f(x_0)/f'(x_0)$

(C) $x_0=x_1+f(x_0)/f'(x_0)$

(D) $x_1=x_0+f(x_0)/f'(x_0)$

67. The Newton Raphson method fails if

(A) $f'(x_0)=0$

(B) $f''(x_0)=0$

(C) $f(x_0)=0$

(D) $f'''(x_0)=0$

68. At which point the iterations in the Newton Raphson method are stopped?

(A) When the consecutive iterative values of x are not equal

(B) When the consecutive iterative values of x differ by 2 decimal places

(C) When the consecutive iterative values of x differ by 3 decimal places

(D) When the consecutive iterative values of x are equal

69. The Newton Raphson method is also called as _____

(A) Tangent method

(B) Secant method

(C) Chord method

(D) Diameter method

70. Bessel's formula gives better estimate when ___

(A) $-1/2<u<1/2$

(B) $-1/4<u<1/4$

(C) $1/4<u<3/4$

(D) $-1/4<u<3/4$

71. If interpolation is required for the range $u>1/2$ then we use ____ for best estimate.

(A) Bessel's formula

(B) Stirling's formula

(C) Laplace-Everett's formula

(D) None of the above

72. Simpson's 1/3rd Rule is

(A) $\int_{x_0}^{x_0+nh} y\,dx = \frac{h}{3}$ $[(y_0+y_n)+4(y_1+y_3+.....+y_{n-1}]+$ $2(y_2+y_4+.....+y_{n-2})]$

(B) $\int_{x_0}^{x_0-nh} y\,dx = \frac{h}{3}$ $[(y_0+y_n)-4(y_1+y_3+.....+y_{n-1}]-$ $2(y_2+y_4+.....+y_{n-2})]$

(C) $\int_{x_0}^{x_0+nh} y\,dx = \frac{h}{3}$ $[(y_0+y_n)+6(y_1+y_3+.....y_{n-1}]+$ $8(y_2+y_4+.....+y_{n-2})]$

(D) $\int_{x_0}^{x_0+nh} y\,dx = \frac{h}{3}$ $[(y_0+y_n)-2(y_1+y_3+.....+y_{n-1}]-$ $4(y_2+y_4+.....+y_{n-2})]$

73. Trapezoidal Rule gives exact value of the integral when the integrated is a:

(A) Quadratic function

(B) Linear function

(C) Cubic function

(D) None of the above

74. Runge-Kutta method is used to solve

(A) Linear equations

(B) Differential equations

(C) Quadratic equations

(D) Interpolation and extrapolation

75. The fourth order Runge-Kutta method consists of _____ number of steps

(A) Two steps

(B) Three steps

(C) Four steps

(D) Five steps