B.Sc. (Hons.) SEMESTER – III EXAMINATION 2021-22
COMPUTER SCIENCE
CS – 103/CS - 104 : Numerical Computing

Time : 4.30 hours   **Max. Marks : 70**

Instructions

1. The Question Paper contains 08 questions out of which you are required to answer any 04 questions. The question paper is of 70 marks with each question carrying 17.5 marks.

    प्रश्नपत्र में आठ प्रश्न पूँछे गये हैं जिनमें से 4 प्रश्नों का उत्तर देना है। प्रश्नपत्र 70 अंकों का है, जिसमें प्रत्येक प्रश्न 17.5 अंक का है।

2. The total duration of the examination will be **4.30 hours** (Four hours and thirty minutes), which includes the time for downloading the question paper from the Portal, writing the answers by hand and uploading the hand-written answer sheets on the portal.

    परीक्षा का कुल समय 4.30 घंटे का है जिसमें प्रश्नपत्र को पोर्टल से डाउनलोड करके पुनः हस्तलिखित प्रश्नों का उत्तर पोर्टल पर अपलोड करना है।

3. For the students with benchmark disability as per Persons with Disability Act, the total duration of examination shall be **6 hours** (six hours) to complete the examination process, which includes the time for downloading the question paper from the Portal, writing the answers by hand and uploading the hand-written answer sheets on the portal. .

    दिव्यांग छात्रों के लिये परीक्षा का समय 6 घंटे निर्धारित हैं जिसमें प्रश्नपत्र को पोर्टल से डाउनलोड करना एवं हस्तलिखित उत्तर को पोर्टल पर अपलोड करना है।

4. Answers should be hand-written on a plain white A4 size paper using black or blue pen. Each question can be answered in upto 350 words on 3 (Three) plain A4 size paper (only one side is to be used).
    हस्तलिखित प्रश्नों का उत्तर सादे सफेद A4 साइज के पन्ने पर काले अथवा नीले कलम से लिखा होना चाहिये। प्रत्येक प्रश्न का उत्तर 350 शब्दों तक तीन सादे पृष्ठ A4 साइज में होना चाहिये। प्रश्नों के उत्तर के लिए केवल एक तरफ के पृष्ठ का ही उपयोग किया जाना चाहिए।

5. Answers to each question should start from a fresh page. All pages are required to be numbered. You should write your Course Name, Semester, Examination Roll Number, Paper Code, Paper title, Date and Time of Examination on the first sheet used for answers.

    प्रत्येक प्रश्न का उत्तर नये पृष्ठ से शुरू करना है। सभी पृष्ठों को पृष्ठांकित करना है। छात्र को प्रथम पृष्ठ पर प्रश्नपत्र का विषय, सेमेस्टर, परीक्षा अनुक्रमांक, प्रश्नपत्र कोड, प्रश्नपत्र का शीर्षक, दिनांक एवं समय लिखना है।

Questions

1   (a) Find the relationship between shift operator and central difference operator.   [4]

    (b) When do we use the power method? How to terminate an iterative procedure?   [4]

    (c) Explain the Jacobi's method for real symmetric matrix.   [5.5]

    (d) What are numerical errors? How to measure numerical errors? Why error measurement is important [4]
    in numerical computing?

2   (a) Give the graphical interpretation of Secant and Regula Falsi method, which method will converge [6]
    faster and why?

    (b) Using Newton Raphson method, find the real root of the equation $3x = \cos x - 1$ correct to five [7]
    decimal places. .

    (c) Find the rate of convergence of Secant method.   [4.5]

P.T.O.

3 (a) What do you understand by interpolation? What are the underlying assumptions for the validity of the various methods used for interpolation? [4.5]

(b) Given $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$, $\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$. Find $\log_{10} 657$ by using any interpolation method of your choice. [6]

(c) The area A of a circle of diameter d is given for the following values: [7]

d:	80	85	90	95	100
A:	5026	5674	6362	7088	7854

Find approximate value for the area of circle of diameter 82 using Newton's Forward interpolation formula.

4 (a) Solve the system of equations [8]

$$2w + x + y - 2z = -10$$
$$4w + 2y + z = 8$$
$$3w + 2x + 2y = 7$$
$$w + 3x + 2y - z = -5$$

using the Gauss elimination method with partial pivoting.

(b) Discuss the iterative methods for finding the solution of system of linear equations. [4]

(c) Find inverse of the following matrix using LU decomposition method (Do little method). [5.5]

$$A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$$

5 (a) Explain Cayley-Hamiltion theorm and its applications. [4]

(b) Find all the eigen values and eigen vectors of the matrix [6]

$$\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$$

(c) Determine the largest eigen value in magnitude and the corresponding eigen vector of the following matrices by power method. Use suitable initial approximation to the eigen vector. [7.5]

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

When can we expect faster convergence in power method?

(2/3)

P.T.O.

6   (a) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given   [10.5]
    below for various values of the time t seconds. Find the velocity of the slider and its acceleration when
    t=0.6 second.

t =	0	0.1	0.2	0.3	0.4	0.5	0.6
x =	30.13	31.62	32.87	32.64	33.95	33.81	33.24

    (b) Find the first order derivative formula using backward difference formula.   [4]

    (c) Write down the application of numerical differentiation and integration.   [3]

7   (a) Evaluate $\int_0^1 \dfrac{dx}{1+x}$ taking 7 ordinates by applying Simpson's 1/3 and 3/8 rules. Deduce the value of   [10.5]
    $\log_e 2$. Show which method gives better accuracy.

    (b) Give the graphical interpretation of Trapezoidal and Simpson's 1/3 rule. Which method is better in   [7]
    Trapezoidal and Simpson's 1/3 rule and why?

8   (a) Solve the differential equation

$$\frac{dy}{dx} = -xy^2, \text{ y=2 at x=0}$$
   [9.5]

   [8]

        using Modified Euler's method and obtain y at x=0.2 in two steps of 0.1 each.

    (b) Using Runge-Kutta method of fourth order, solve for y at x=1.2 from

$$\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x} \text{ with } x_0=1 \ y_0=0.$$

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(3/3)