

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION MO/SP20\*\*)**

**CLASS: MTECH / PRE-PHD  
BRANCH: CS**

**SEMESTER : I  
SESSION : MO/2022**

**SUBJECT: CS501 MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE  
TIME: 03 Hours FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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- Q.1(a) Differentiate between the strategy behind solving a set of linear equations by Gauss Seidel and Jacobi approaches. [BL-2: Understand, CO-2] [2]
- Q.1(b) Explain the main idea of Gauss elimination method for solving a set of linear equations. [BL-2: Understand, CO-2] [3]
- Q.1(c) Use Gaussian elimination to solve the system of linear equations:  
 $2x_2 + x_3 = -8, \quad x_1 - 2x_2 - 3x_3 = 0, \quad -x_1 + x_2 + 2x_3 = 3$  [BL-3: Apply, CO-1] [5]
- Q.2(a) Define vector space over R. [BL-1: Remember, CO-3] [2]
- Q.2(b) Check the linear dependency of the following vectors in  $R^4$ :  $v_1 = (2, 1, 1, 5), v_2 = (2, 2, 1, 1), v_3 = (3, 1, 6, 1), v_4 = (1, 1, 1, 1)$ . Give only the important steps. [BL-3: Apply, CO-1] [3]
- Q.2(c) Give some important applications of Matrices. Let  $A = \begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}$  be a matrix. Is this matrix diagonalizable? If so, find its eigen values and the corresponding eigen vectors. [BL-1: Remember, CO-1] [5]
- Q.3(a) A fair coin is tossed 10 times. What is the probability that we get (a) exactly 5 Heads (b) at least 3 Heads? [BL-3: Apply, CO-2] [2]
- Q.3(b) An urn contains 10 black and 10 white balls. Draw 3 balls (a) without replacement, and (b) with replacement. What is the probability that all three are white? [BL-3: Apply, CO-2] [3]
- Q.3(c) What do you know about descriptive statistics and inferential statistics? Explain. [BL-2: Understand, CO-4] [5]
- Q.4(a) Differentiate between t-test and Z-test. [BL-2: Understand, CO-4] [2]
- Q.4(b) Discuss the importance of data transformation. Does Z-score transformation always result in Normal distribution? Justify your answer. [BL-4: Analyze, CO-5] [3]
- Q.4(c) A sample of 900 Heart patients is created from a database (consisting of 1048576 patients) for diagnosing Heart disease based on 12 symptoms (features/attributes). Suppose the symptom: Heart-rate (out of 12 symptoms) has a mean of 3.4 bpm and SD 2.61 bpm, where the population mean is 3.25 bpm and SD is 2.61 bpm for this attribute. If the population is normal, infer the mean of the sample considering 95% confidence limit. The value of Z at 5% significant level is  $|Z_\alpha| = 1.96$ . [BL-3: Apply, CO-5] [5]
- Q.5(a) Let  $G=(V,E)$  be graph and  $G^-$  its complement. Prove or disprove the following. [BL-4: Analyze, CO-1] [2]  
If G is connected, then  $G^-$  is connected.
- Q.5(b) Give some applications of graph. [BL-2: Understand, CO-5] [3]
- Q.5(c) Multiple graphs can have the same adjacency matrix. Justify your answer. [BL-4: Evaluate, CO-3] [5]

:::21/11/2022:::E