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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **17MA2005** | **Duration** | **3hrs** |
| **Course Title** | **MATHEMATICAL FOUNDATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the formula for expansion of sin. | | CO1 | R | 1 |
| 2. | Determine the real part of . | | CO1 | U | 1 |
| 3. | Determine the characteristic equation of the matrix A=. | | CO2 | U | 1 |
| 4. | Compute the product of eigen values of the matrix A=. | | CO2 | U | 1 |
| 5. | Differentiate with respect to x. | | CO3 | U | 1 |
| 6. | If then find . | | CO3 | R | 1 |
| 7. | Integrate cos with respect to x. | | CO4 | U | 1 |
| 8. | State the formula for Integration by parts. | | CO4 | R | 1 |
| 9. | If the roots are real and different, then write complementary function of the differential equation. | | CO5 | R | 1 |
| 10. | Determine complementary function of the differential equation  . | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Separate into real and imaginary parts of | | CO1 | A | 3 |
| 12. | Determine the rank of the matrix =. | | CO2 | A | 3 |
| 13. | If then find . | | CO3 | A | 3 |
| 14. | Evaluate . | | CO4 | A | 3 |
| 15. | Compute . | | CO5 | A | 3 |
| 16. | Determine particular integral of the differential equation  . | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Prove that . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate Eigen values and Eigen vectors of the matrix | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Differentiate with respect to x. | CO3 | A | 6 |
|  | b. | If ,then find . | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Evaluate (i) (ii) . | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate using method of partial fraction. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | If ,then prove that | CO1 | E | 6 |
|  | b. | Evaluate sin6 in terms of sin. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 23. |  | Prove that the matrix satisfies Cayley Hamilton theorem. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve . | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | The students will be able to apply the knowledge of trigonometry in engineering. |
| **CO2** | The students will be able to apply the knowledge of matrices in computing. |
| **CO3** | The students will be able to solve engineering problems using differentiation. |
| **CO4** | The students will be able to solve engineering problems using integration. |
| **CO5** | The students will be able to apply the knowledge of curvature. |
| **CO6** | The students will be able to solve engineering problems using ODE solutions |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **17MA3017** | **Duration** | **3hrs** |
| **Course Title** | **DISCRETE MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Prove that ¬ (p ∨ q) and ¬ p ∧ ¬ q are logically equivalent. | CO1 | U | 10 |
|  | b. | Verify the validity of the distributive law x (y + z) = xy + xz. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prove that if n is a positive integer, then . | CO1 | A | 10 |
|  | b. | Let P (x, y) be the statement “x + y = y + x.” Determine the truth values of the quantified statements ∀x ∀y P (x, y) and ∀y ∀x P (x, y), where the domain for all variables are the set of real numbers. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Determine the sum-of-products expansion for the function  . | CO2 | A | 10 |
|  | b. | Prove the relation R on a set A is transitive if and only if Rn ⊆ R for  n = 1, 2, 3 … infinity. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Let R be a relation on a set A. Prove that there is a path of length n, where n is a positive integer, from a to b if and only if (a, b) ∈ Rn. | CO2 | A | 10 |
|  | b. | Determine the K-maps for  (i)  (ii)  (iii) . | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Prove that an undirected graph has an even number of vertices of odd degree. | CO3 | A | 10 |
|  | b. | Prove that a connected multigraph with at least two vertices has an Euler circuit if and only if each of its vertices has even degree with an example. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Determine whether the graphs G and H are isomorphic? | CO3 | A | 10 |
|  | b. | Let *G* be a connected planar simple graph with *e* edges and *v* vertices. Let *r* be the number of regions in a planar representation of *G*. Prove that *r* = *e* − *v* + 2. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Prove that a simple graph is connected if and only if it has a spanning tree. | CO4 | A | 10 |
|  | b. | Prove that an undirected graph is a tree if and only if there is a unique simple path between any two of its vertices. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Prove that a tree with *n* vertices has *n* − 1 edges. | CO5 | A | 10 |
|  | b. | Use depth-first search to find a spanning tree for the graph G | CO5 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Classify the types of Phrase-Structure Grammars with examples. | CO6 | A | 10 |
|  | b. | Determine whether the word cbab belongs to the language generated by the grammar G = (V , T , S, P ), where V = {a, b, c, A, B, C, S}, T = {a, b, c}, S is the starting symbol, and the productions are S → AB A → Ca B → Ba B → Cb B → b C → cb C → b. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to understand various proof methods. |
| CO2 | The students will be able to analyze the truth value of statements. |
| CO3 | The students will be able to compute optimal solution using graphs |
| CO4 | The students will be able to determine the languages constructed by grammars |
| CO5 | The students will be able to create new accepting devices |
| CO6 | The students will be able to determine the languages accepted by machines |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **19MA3017** | **Duration** | **3hrs** |
| **Course Title** | **GRAPH THEORY AND ALGORITHMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Prove that, for a graph with at least three vertices, the following conditions are equivalent**.**   1. is connected and has no cut-vertex. 2. For all, there are internally disjoint - paths. 3. For all, there is a cycle through  and . 4. , and every pair of edges in  lies on a common cycle. | CO1 | A | 10 |
|  | b. | Prove that, a graph having at least three vertices is 2-connected if and only if for each pair there exists internally disjoint - path in . | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let G be a graph with v-1 edges. Show that the following three statements are equivalent: (i) G is connected; (ii) G is acyclic; (iii) G is a tree. | CO1 | A | 10 |
|  | b. | In any graph, prove that the number of vertices of odd degree is even. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | A connected graph has an Euler trail if and only if it has at most two vertices of odd-degree. | CO2 | A | 10 |
|  | b. | Let G be a simple graph with degree sequence where  and  Suppose that there is no value of m less than v/2 for which and  Then G is Hamiltonian. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Show that if G is simple, then  for any edge e of G. | CO2 | A | 10 |
|  | b. | If G is a connected plane graph, then prove that | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | For every tree T of minimum order, prove that the subtree representation of G is a clique tree. | CO3 | A | 10 |
|  | b. | For each of the following cases, either **construct a suitable tree** or **justify why such a tree cannot exist:**   1. A tree with nine vertices and nine edges 2. A tree with all vertices of degree 2 3. A tree with 3 centers 4. A tree with five vertices and having total degree 8 5. A tree with six vertices and having total degree 14 | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Prove that every planar graph is 5-vertex-colourable. | CO4 | A | 10 |
|  | b. | Show that the following three statements are equivalent:  (i) Every planar graph is 4-vertex-colourable;  (ii) Every plane graph is 4-face-colourable;  (iii) Every simple 2-edge-connected 3-regular planar graph is 3-edge-colourable. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | State and prove the Max flow-Min cut theorem. | CO5 | A | 10 |
|  | b. | Find the Maximum flow for the following network from  to t | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write the Kruskal’s algorithm and find the minimal spanning tree for the given weighted graph. | CO5 | A | 10 |
|  | b. | Write the Prim’s algorithm and find the minimal spanning tree for the given weighted graph. | CO5 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Solve the following LPP by graphical method.    Subject to | CO6 | A | 10 |
|  | b. | Using simplex method solve the LPP    Subject to | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the basic structure of graphs. |
| CO2 | Construct various types of graphs and find solutions. |
| CO3 | Apply graph theory concepts in modelling and solving problems in the field of engineering. |
| CO4 | Understanding Graph network problems and give solutions to simple and complex networks. |
| CO5 | Apply appropriate algorithms to various graph structures. |
| CO6 | Formulate linear programming models and apply various methods for solving linear programming problems. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **19MA3021** | **Duration** | **3hrs** |
| **Course Title** | **MATHEMATICS FOR COMPETITIVE EXAMINATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | A rectangular courtyard, 3.78m long and 5.25m broad, is to be paved exactly with square tiles, all of the same size. Calculate the least number of square tiles covered. | CO1 | A | 6 |
|  | b. | In a bag the coins of 50p, 25p and 10p are in the ratio 2:3:5 and its total value is Rs.90. Find the number of coins of 25p in bag? | CO1 | A | 6 |
|  | c. | Three consecutive numbers such that twice the first, 3 times the second and 4 times the third together make 182. Identify the numbers. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 2. | a. | Mica borrowed some money at a rate of 6% p.a. for the first three years, 9% p.a. for the next five years and 13% p.a. for the period beyond eight years. If the total interest paid by him at the end of eleven years is ₹8160, then calculate the amount of money he borrowed. | CO2 | A | 6 |
|  | b. | A sum of money placed at compound interest doubles itself in 4 years. In how many years will it amount to eight times. | CO2 | A | 6 |
|  | c. | Find the least number to be multiplied with 21600 must to make it a perfect cube. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 3. | a. | A, B and C start a business each investing Rs.20000. After 5 months A withdrew Rs. 5000, B withdrew Rs.4000 and C invests Rs.6000 more. At the end of the year, a total profit of Rs. 69900 was recorded. Find the share of each. | CO3 | A | 6 |
|  | b. | In how many different ways can the letters of the word ‘CORPORATION’ be arranged so that the vowels always come together. | CO3 | U | 6 |
|  | c. | An urn contains 3 white balls, 4 red balls and 5 black balls. 2 balls are drawn at random. Find the probability that (i) Both of them are same color (ii) They are different color. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | A can do a piece of work in 10 days and B in 20 days. They worked together but 2 days before the completion of the work, A leaves. In how many days was the work completed. | CO4 | A | 6 |
|  | b. | A, B, and C are three pipes connected to a tank. A and B together fill the tank in 6 hours. B and C together fill the tank in 10 hours. A and C together fill the tank in 7 1/2 hours. Estimate the time it will take for pipes A, B and C to fill the tank separately. | CO4 | A | 6 |
|  | c. | How much water must be added to 60 litres of milk at 1.5 litres for ₹ 20 so as to have a mixture worth ₹ 10 2/3 a litre. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 5. | a. | A man covers a certain distance between his house and office on a Scooter. Having an average speed of 30 km/hr, he reaches office late by 10 minutes. However, with a speed of 40 km/hr, he reaches his office 5 minutes earlier. Calculate the distance between his house and office. | CO5 | A | 6 |
|  | b. | If a girl is standing at point P, which is 8 units away from a building, making an angle of elevation of 45° with point Q, Calculate the height of the building. | CO5 | A | 6 |
|  | c. | A man walked at a speed of 4 km/hr from A to B and come back from B to A at a speed of 6km/hr. Estimate the ratio of time taken, for walking from A to B to that of from B to A. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 6. | a. | A train is moving at a speed of 132 kmph. If the length of the train is 110 meters, how long will it take to cross a railway platform 165 meters long. | CO4 | A | 6 |
|  | b. | A cistern can be filled by pipes A and B in 4 hours and 6 hours respectively. When full, the tank can be emptied by a pipe C in 8 hours. Estimate the time taken by the cistern to be full in if all the taps are turned on at the same time. | CO4 | A | 6 |
|  | c. | Salaries of Ravi and Sumit are in the ratio 2:3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40:57. Calculate Sumit’s present salary. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 7. | a. | If the manufacturer gains 10%, the wholesale dealer gains 15% and the retailer gains 25%. Estimate the cost of production of the table if the retail price was Rs.1265. | CO1 | U | 6 |
|  | b. | A, B and C started a business by investing Rs. 120000, Rs.135000 and Rs. 150000 respectively. Calculate the share of each out of an annual profit of Rs. 56700 | CO3 | U | 6 |
|  | c. | The H.C.F. of two numbers is 11 and their L.C.M. is 693. If one of the numbers is 77, then identify the other number. | CO1 | U | 4 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and the answer the questions based on it.  **Various Expenditures (in percentage) Incurred in Publishing a Book**  https://www.indiabix.com/_files/images/data-interpretation/pie-charts/15-2-1-1.png  1. If for a certain quantity of books, the publisher has to pay Rs. 30,600 as printing cost, then what will be amount of royalty to be paid for these books?  2. What is the central angle of the sector corresponding to the expenditure incurred on Royalty?  3. The price of the book is marked 20% above the C.P. If the marked price of the book is Rs. 180, then what is the cost of the paper used in a single copy of the book?  4. If 5500 copies are published and the transportation cost on them amounts to Rs. 82500, then what should be the selling price of the book so that the publisher can earn a profit of 25%?  5.If for an edition of the book, the cost of paper is ₹56250, then find the promotion cost for this edition. | CO6 | An | 10 |
|  | b. | The bar graph given below shows the foreign exchange reserves of a country (in million US $) from 1991 - 1992 to 1998 - 1999. Answer the question based on this graph.  **Foreign Exchange Reserves of a Country (in million US $)**    1. The foreign exchange reserves in 1997-98 was how many times that in 1994-95?  2. Find the percentage increase in the foreign exchange reserves in 1997-98 over 1993-94.  3. For which year, the percent increase of foreign exchange reserves over the previous year, is the highest?  4. The foreign exchange reserves in 1996-97 were approximately what percent of the average foreign exchange reserves over the period under review?  5. Find the ratio of the number of years, in which the foreign exchange reserves are above the average reserves, to those in which the reserves are below the average reserves. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Solve problems in Elementary Algebra |
| CO2 | Estimate interests |
| CO3 | Know the short cut methods to solve the arithmetical reasoning problems |
| CO4 | Arrange objects in a particular order |
| CO5 | Understand concepts of trigonometry |
| CO6 | Analyze data |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **19MA3027** | **Duration** | **3hrs** |
| **Course Title** | **FUZZY SET THEORY AND ITS APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Let.  Given and  are the fuzzy sets of. Find,,, , ,, , , and . | CO1 | A | 10 |
|  | b. | Prove that a fuzzy set *A* in *R* is convex if and only if  for all and for all . | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let f:be an arbitrary crisp function. Then, for any and all Prove that  i.  ii. | CO1 | A | 10 |
|  | b. | State and prove the Second Decomposition Theorem. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. |  | Let. Let  be a fuzzy set defined by. Find all -cuts and strong -cuts, Supp(A), Core(A), h(A). Find whether the fuzzy set  is normal or subnormal and justify your answer. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Show that if c is a continuous fuzzy complement, then c has a unique equilibrium. | CO2 | A | 10 |
|  | b. | State and prove Second Characterization theorem of fuzzy complements. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Let denote the class of Yagar t-norms then prove that *min (a,b)* for all | CO3 | A | 10 |
|  | b. | Prove that the standard fuzzy intersection is the only idempotent t - norm. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Let MIN and MAX be binary operations on R. Prove that for any A,B,C∈R, the following properties hold:   1. MIN [MIN (A, B), C] = MIN [A, MIN(B, C)] 2. MIN [A, MAX (A, B)] = A. 3. MIN [A, MAX (B, C)] = MAX [MIN (A, B), MIN (A, C)]. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain fuzzy neural networks and their significance in handling uncertain and imprecise information. | CO4 | A | 10 |
|  | b. | Let \* ∈ {+, −, ., /} and let A, B denote continuous fuzzy numbers. Then, prove that the fuzzy set (A \* B)(z) = sup min[A(x), B(y)], z = x \* y is a continuous fuzzy number. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the characteristics of Fuzzy Automata. | CO5 | A | 10 |
|  | b. | Explain the process of a fuzzy controller with an example. | CO5 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the method of individual fuzzy decision making with suitable example. | CO6 | A | 10 |
|  | b. | Explain fuzzy multistage decision making. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the basic concepts of fuzzy sets, fuzzy numbers and fuzzy systems |
| CO2 | Classify the various operations on fuzzy sets |
| CO3 | Solve the arithmetic operations on fuzzy numbers |
| CO4 | Design the fuzzy systems using the basic concepts |
| CO5 | Apply the concepts of fuzzification in decision making |
| CO6 | Recognize and justify the best fuzzy decision making techniques |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **19MA3029** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTATIONAL TOOLS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain matrix computation in MATLAB with example. | CO1 | An | 10 |
|  | b. | Write a MATLAB program to solve an ordinary differential equation. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Discuss the build-in functions in MATLAB. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Discuss about numerical differentiation on polynomials in MATLAB. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Solve partial differential equation using MATLAB program. | CO2 | A | 10 |
|  | b. | Explain briefly about global variables in Python. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | What is an array?. Create an array in Python with example. | CO3 | A | 10 |
|  | b. | Explain loop in Python with example. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain in detail about variables and multi variables in Python. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Create and explain a list in LaTeX with example. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the process to write equations in LaTeX with example. | CO5 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain about referencing equations, figures and tables. | CO6 | A | 10 |
|  | b. | Explain the algebraic operations in MATLAB using symbolic tools. | CO2 | An | 10 |

**CO – COURSE OUTCOME BL – BLOOM’S LEVEL M – MARKS ALLOTTED**

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Develop MATLAB code for solving engineering problems |
| CO2 | Analyze the engineering problems using various plots and user defined functions using MATLAB commands |
| CO3 | Compute basic arithmetic and use variables in PYTHON |
| CO4 | Operate data structures such as Python list and NumPy arrays |
| CO5 | Use features designed for the production of the technical and scientific documentation |
| CO6 | Create great looking presentations of their technical projects |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **20MA2006** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND STOCHASTIC PROCESSES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define mutually exclusive events. | | CO1 | U | 1 |
| 2. | In a packet of 100 bits transmitted over a noisy channel, 30 bits are corrupted.  Compute the probability that a randomly selected bit is not corrupted. | | CO1 | U | 1 |
| 3. | If F(x) is the CDF of a random variable X, then  -------. | | CO2 | R | 1 |
| 4. | A random variable X has the probability density function f(x)=kx, 0<x<1. Calculate the value of k. | | CO2 | R | 1 |
| 5. | The standard deviation of the normal distribution is -------. | | CO3 | R | 1 |
| 6. | The variance of exponential distribution is ----------. | | CO3 | R | 1 |
| 7. | State the uniqueness property of the characteristic function. | | CO4 | U | 1 |
| 8. | State the nature of , if both ‘T’ and ‘S’ are continuous. | | CO4 | R | 1 |
| 9. | A random process that is not stationary in any sense is called ---------. | | CO5 | U | 1 |
| 10. | If the functions of Gaussian process are uncorrelated, they are----------. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | The probability that a communication system has high selectivity is 0.54 , the  probability that it will have high fidelity is 0.81 and the probability that it will have  both is 0.18. Estimate the probability that a system with high fidelity will also have  high selectivity. | | CO1 | An | 3 |
| 12. | Compute P(x<3), if X is a continuous random variable with the probability density function f(x) =, 0<x<3. | | CO2 | U | 3 |
| 13. | Construct the probability mass function of the poisson distribution which is approximately equivalent to B(100, 0.02). | | CO3 | A | 3 |
| 14. | If a random variable X has the moment generating function , then find the mean of X. | | CO4 | U | 3 |
| 15. | Calculate the mean of the stationary process {X(t)}, whose autocorrelation is given by | | CO5 | A | 3 |
| 16. | State any two properties of Poisson process. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | A lot consists of 10 good sensors, 4 with minor defects, 2 with major defects. Two sensors are chosen from the lot at random (without replacement). Compute the probability that:  (i) both are good (ii) both have major defects (iii) at least one is good (iv) exactly one is good (v) neither has major defects (vi) neither is good. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | The joint probability mass function of  is given by ,. Estimate all the marginal and conditional probability distributions. Also, compute the probability distribution of. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Fit a Binomial distribution to the following data and calculate the theoretical/expected frequencies:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | f(x) | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO3 | A | 6 |
|  | b. | The resistance of a particular type of resistor follows a normal distribution with a mean of 100 Ω and a standard deviation of 5 Ω. Determine the percentage of resistors that have: (i) a resistance between 95 Ω and 105 Ω. (ii) a resistance less than 90 Ω. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Derive the moment generating function of Poisson distribution. | CO4 | A | 6 |
|  | b. | If X represents the outcome of a fair die is tossed, compute its moment generating function and hence find its mean and variance. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. |  | Two random processes X(t) and Y(t) are defined by  X(t) = Acost+Bsint and Y(t) = Bcost - Asint, show that X(t) and Y(t) are jointly wide sense stationary process if   1. E(A) = E(B) =0 2. E(A2) = E(B2) = 3. E(AB) =0. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | p(x) | 0.1 | k | 0.2 | 2k | 0.3 | 3k |   Compute (i) the value of ‘k’ (ii)P(-2<X<2) (iii)P(X<2) (iv) Mean of X  (v) Variance of X (vi) CDF of X. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | The mileage that car owners get with a certain kind of radial tire is an random variable having an exponential distribution with mean of 40,000km. Estimate the probabilities that one of these tires will last (i) at least 20,000 km (ii) atmost 30,000 km. | CO3 | A | 6 |
|  | b. | In a shooting test, the probability of hitting the target is 1/2 for A, 2/3 for  B and 3/4 for C. If all of them fire at the target, then compute the probability that  (a) none of them hits the target (b) at least one of them hits the target  (c)exactly two of them hits the target. | CO1 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | If is a Gaussian process with μ(t)=10 and C(,) = 16 . Compute (i)P (ii) P | CO6 | E | 6 |
|  | b. | Suppose a customer arrives at a bank according to a Poisson process with a mean rate of 3 per minute. Estimate the probability that during a time interval of 2 minutes,  (i) exactly 4 customers arrive (ii) less than 3 customers arrive (iii) more than 4 customers arrive. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize probability models. |
| **CO2** | Solve using discrete and continuous random variables. |
| **CO3** | Classify the problems using probability distributions. |
| **CO4** | Knowledge in functions of random variables. |
| **CO5** | Determine the characteristics of random processes. |
| **CO6** | Understand propagation of random signals in linear systems. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA2008** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY, STATISTICS AND RANDOM PROCESS FOR ROBOTIC ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The probability of an impossible event is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | Calculate is the complementary event of A and =0.65. | | CO1 | R | 1 |
| 3. | If , , and , then find . | | CO1 | R | 1 |
| 4. | Calculate the **mean** of an exponential distribution given the parameter of an exponential distribution | | CO2 | R | 1 |
| 5. | The average number of phone calls arriving at a call center per minute is 3. Calculate the probability that exactly 2 calls arrive in a given minute. | | CO2 | R | 1 |
| 6. | Define the region of acceptance. | | CO3 | R | 1 |
| 7. | Give the formula of the Chi-Square test. | | CO4 | R | 1 |
| 8. | In a **three-factor ANOVA** experiment, if the first three quartile values of treatment means are =100, ​=20, ​=30, ​=40. Calculate the **fourth quartile**  of the treatment. | | CO5 | R | 1 |
| 9. | State the term used for the smallest division of experimental material to which treatments are applied and observations are made. | | CO6 | R | 1 |
| 10. | State the formula for the autocorrelation function of a stationary process . | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If P(A)=1/3, P(B)=3/4 and P(A ∪ B) =11/12, then evaluate (i) 𝑃(A) (ii)  (iii) | | CO1 | A | 3 |
| 12. | A warehouse robot makes an average of 𝜆=3 navigation errors per week. Calculate the probability that it makes exactly 2 errors in a week. | | CO2 | U | 3 |
| 13. | Suppose a company is considering putting a new type of glue on the different layers of polymer it produces. The average number of tear with the current glue is known to be 4. Research claims that the new type of glue has decreased the instances of tear. Write the null hypothesis and alternative hypothesis to test the claim. | | CO3 | U | 3 |
| 14. | Define **type I**, type II errors, and explain their significance in hypothesis testing. | | CO4 | U | 3 |
| 15. | Discuss completely randomized block design and Latin square design. | | CO5 | R | 3 |
| 16. | State the properties of an autocorrelation function. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Suppose that, there are X=0,1,2,3,4,5 power failures in a certain city with the probabilities P(X=x): a,2a,3a,5a,2a, respectively a during the month of July. Calculate  (i) the value of ‘a’ (ii) P(X<2) (iii) P(X2) (iv) CDF of X (v) mean of X. | CO1 | E | 7 |
|  | b. | A bag contains 3 white balls, 4 red balls and 5 black balls. 2 balls are drawn at random. Compute the probability that  (i) both of them are same colour (ii) they are different colour. | CO1 | A | 5 |
| 18. | a. | A company manufactures **autonomous drones,** and the probability that a drone passes all quality tests is **0.85.** A sample of **8 drones** is tested. Calculate the probability that  (a) exactly **6** drones pass the tests. (b) a**t least 6** drones pass the tests. (c) the **mean** and **standard deviation** of the distribution, using binomial distribution. | CO2 | A | 8 |
|  | b. | A navigation system chooses the correct path with probability p=0.85 with 15 decisions. Calculate P(X≥13). | CO2 | E | 4 |
| 19. | a. | In a large population, 30% and 25% respectively of fair-haired people. Examine the difference likely to be hidden in sample of 1200 and 900 respectively from the two population. | CO3 | A | 6 |
|  | b. | Two sets of 100 students each were taught to read by different methods. After the instruction were over, the reading test given to them reveal = 73.4; = 70.3, =8, =10. Test the hypothesis that = . | C03 | A | 6 |
| 20. | a. | A random variable Y has the following probability distribution.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Y | 0 | 1 | 2 | 3 | 4 | 5 | | P(Y) | 2k | k | 3k | 4k | 2k | k |   Find (i) the value of ‘k’ (ii) P(Y<3) (iii) P(Y) (iv) CDF of Y (v) mean of Y. | CO1 | E | 7 |
|  | b. | Give the autocorrelation function for a stationary process  Calculate the (i) mean (ii) mean square value (iii) variance of the process. | CO6 | A | 5 |
| 21. | a. | In an experiment conducted to test the **effectiveness of a new antibiotic supplement** on preventing bacterial infections in poultry, the following results were obtained:   |  |  |  | | --- | --- | --- | |  | Infected | Not infected | | Supplemented | 60 | 120 | | Not Supplemented | 80 | 40 |   Discuss the effect of antibiotic in controlling susceptibility to bacterial infection in poultry. | CO4 | An | 7 |
|  | b. | Out of a sample of 1000 persons, 800 were found to be tea drinkers. After the increase in excise duty of coffee seeds, 800 people were found to take tea out of a sample 1200. Test whether there is any significant decrease in the consumption of tea after the increase in excise duty. | CO4 | An | 5 |
| 22. |  | Examine the variance from the following Latin Square design of yield of paddy (in Kgms).   |  |  |  |  | | --- | --- | --- | --- | | D 122 | A 121 | C 123 | B122 | | B 124 | C 123 | A 122 | D 125 | | A 120 | B 119 | D 120 | C 121 | | C 122 | D 123 | B 121 | A 122 | | CO5 | An | 12 |
| 23. |  | Examine the process , where A and B are random variables is Wide Sense Stationary if  (i)  (ii) =k  (iii) | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | The transition probability matrix of a Markov chain , n=1,2,3….having 3 states 1,2 and 3 is P= and the initial distribution, .    Compute  (i) (ii) (iii)  (iv) (v)  (vi) | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize probability models and solve using discrete and continuous random variables. |
| **CO2** | Classify the problems using probability distributions. |
| **CO3** | Apply statistical testing techniques for mobile robot applications. |
| **CO4** | Perform small sample tests using statistical techniques. |
| **CO5** | Design experiments for Data Analysis. |
| **CO6** | Apply Random Process for Stochastic Modeling. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA2026** | **Duration** | **3hrs** |
| **Course Title** | **NUMERICAL MATHEMATICS AND COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Convert the number base from binary to hexadecimal. . | | CO1 | U | 1 |
| 2. | If the root of the function f(x) = 0 lies in the interval x0 and x1, then the next approximation of the root x2 using Regula Falsi method is \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The interpolating polynomial by Newton’s algorithm \_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Use the **nested form** to evaluate the polynomial P(x) = 2x3+3x2-5x+7 at x=2. | | CO2 | U | 1 |
| 5. | Simpson’s 1/3rd rule is applicable only when the number of ordinates ‘n’ is \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | A cubic spline is constructed using the formula \_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 7. | The domain of S is on the interval \_\_\_\_\_\_\_\_\_ when, | | CO4 | U | 1 |
| 8. | Write Adams-Moulton’s predictor formula. | | CO5 | R | 1 |
| 9. | is solved, using \_\_\_\_\_\_\_\_\_\_ method. | | CO6 | U | 1 |
| 10. | Determine the nature of the PDE . | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Evaluate a real root of the equation in the interval (0.36, 0.37) using Regula-Falsi method. | | CO1 | A | 3 |
| 12. | Construct the divided difference with arguments 2, 4, 9, 10 of the function  . | | CO2 | A | 3 |
| 13. | Write down (i) Trapezoidal rule formula.  (ii) Simpson rule formula.  (iii) Simpson rule formula. | | CO3 | R | 3 |
| 14. | Determine whether this function is a first degree spline function. | | CO4 | An | 3 |
| 15. | Compute y(0.25) by modified Euler’s method given and | | CO5 | A | 3 |
| 16. | How do you classify  as  (i) elliptic (ii) parabolic and (iii) hyperbolic | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Determine the positive root of correct to four decimal places by Bisection method. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Construct the Newton’s interpolating polynomial from the table.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | -1 | -2 | -3 | | y | -5 | -3 | -15 | 39 | -9 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Using Lagrange’s interpolation evaluate f(10) from the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 5 | 6 | 9 | 11 | | f(x) | 12 | 13 | 14 | 16 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Using Romberg’s method, evaluate I= correct to 4 decimal places. Check the answer by actual integration. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Compute and using cubic spline from the following table.   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | y | -8 | -1 | 18 | | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Solve using Taylor’s series method given and get the values of and correct to four decimal places. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Solve , using finite difference method given Find the values of *u* up to by taking . | CO6 | E | 12 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Apply Liebmann’s iteration processes to find the values at the interior lattice points of a square region of the harmonic equation whose boundary values are given in the following mesh:  C:\Users\Admin\Downloads\WhatsApp Image 1.jpg | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Solve algebraic and transcendental equations occur in engineering fields, numerically. |
| **CO2** | Apply interpolation in forming polynomials to predict data. |
| **CO3** | Find solutions to complicated integrals arising in the field of engineering using numerical Integration techniques. |
| **CO4** | Approximate polynomials to find desired solution using spline functions. |
| **CO5** | Apply different numerical techniques to solve ordinary differential equations. |
| **CO6** | Find approximate solutions to partial differential equations using numerical methods. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA3001** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND BIOSTATISTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | The chances that food technologists X, Y and Z will lead a new packaging innovation project are in the ratio 5 : 3 : 2. The probabilities that an eco-friendly biodegradable packaging system will be launched if X, Y and Z become the project lead are 0.2, 0.6 and 0.9, respectively. If the eco-friendly packaging system has been launched, what is the probability that technologist Z was appointed as the project lead? | CO1 | A | 8 |
|  | b. | The number of equipment breakdowns in a food processing plant are given by the following data during the month of July.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | | P(X) | a | 2a | 3a | 5a | 2a | a |   Find (i) value of ‘a’ (ii) P (1 < X < 4) (iii) mean (iv) variance | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | In a quality control study of 2000 packets of packaged biscuits, it was found that the shelf life (before loss of crispness) of a particular brand follows a normal distribution with a mean of 2040 hours and a standard deviation of 60 hours. Estimate the number of biscuit packets likely to have a shelf life: (i) more than 2150 hours (ii) less than 1950 hours (iii) between 1920 hours and 2160 hours. | CO2 | A | 8 |
|  | b. | Fit a Binomial Distribution to the following data and hence find the expected frequency   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | 5 | | *f* | 18 | 35 | 30 | 12 | 4 | 1 | | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. |  | Determine the two lines of regression for the following data related to raw material input and their corresponding production output. Also estimate the production output corresponding to the raw material input of 30 tons.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *Raw Material (in tons)* | 42 | 55 | 35 | 50 | 55 | 40 | 35 | | *Production Output (in Kgs)* | 40 | 50 | 65 | 60 | 60 | 58 | 20 | | CO3 | A | 16 |
|  |  |  |  |  |  |
| 4. | a. | In a random sample of 1000 persons from the city of Coimbatore, 400 are found to consume wheat. In another sample of 800 person from the city of Chennai, 400 are found to consume wheat. Do these data reveal a significant difference between two cities so far as the proportion of wheat consumers are concerned? | CO4 | An | 8 |
|  | b. | A group of 5 patients treated with medicine A weighed 42, 39, 48, 60 and 41 kgs. Another group of 7 patients treated with medicine B weighed 38, 42, 56, 64, 68, 69 and 62 kgs. Do you agree with the claim that medicine B increases weight significantly. | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Use Sign test to determine whether there is a significant difference between the number of days needed to process a batch of food before and after implementing a new process technique at 5 % level of significance.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *Before* | 30 | 28 | 34 | 35 | 40 | 42 | 33 | 38 | 34 | 45 | | *After* | 32 | 29 | 33 | 32 | 37 | 43 | 40 | 41 | 37 | 44 |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *Before* | 28 | 27 | 25 | 41 | 36 | | *After* | 27 | 33 | 30 | 38 | 36 | | CO5 | An | 8 |
|  | b. | A total of 12 patients are randomly divided into two groups of six and assigned to receive either a new drug or a placebo. The number of panic attacks experienced by each patient during the study period was recorded.  New Drug : 3 5 1 4 3 5  Placebo : 4 8 6 2 1 9  Conduct a Mann–Whitney U test to determine whether there is a significant difference in the number of panic attacks between the placebo group and the new drug group at the 5% level of significance. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 6. | a. | Find the correlation coefficient for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 25 | 26 | 27 | 28 | 30 | 32 | 35 | | *y* | 20 | 22 | 24 | 25 | 26 | 27 | 34 | | CO3 | A | 8 |
|  | b. | If , , , , and  , then find the second order partial correlation coefficient | CO3 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | From the following data, check whether the habit of smoking is independent of literacy   |  |  |  | | --- | --- | --- | |  | Smokers | Non - Smokers | | Literates | 83 | 57 | | Illiterates | 45 | 68 | | CO4 | An | 8 |
|  | b. | Check if there is any significant difference between the samples using F – test for the following data   |  |  |  | | --- | --- | --- | |  | Sample I | Sample II | | Size | 8 | 10 | |  | 84.4 | 102.6 | | CO4 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | A Latin Square Design varietal trial was conducted on wheat using varieties A, B, C and D. The plan of the experiment and the per plot yield are given below. Analyze the data and interpret the result   |  |  |  |  | | --- | --- | --- | --- | | C25 | B23 | A20 | D20 | | A19 | D19 | C21 | B18 | | B19 | A14 | D17 | C20 | | D17 | C20 | B21 | A15 | | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to solve problems on discrete and continuous random variable |
| CO2 | Students will be able to classify the problems using probability distributions and appropriate distributions |
| CO3 | Students will be able to compare variables using partial and multiple correlations |
| CO4 | Students will be able to test hypothesis for large and small samples |
| CO5 | Students will be able to test hypothesis using non – parametric tests |
| CO6 | Students will be able to construct design of experiments |

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**END SEMESTER EXAMINATION – NOV/DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA3003** | **Duration** | **3hrs** |
| **Course Title** | **STATISTICAL METHODS FOR FOOD SCIENCE** | **Max. Marks** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** |  | **Questions** | **CO** | **BL** | **M** |
| 1. | a. | Find the mean, median and mode of the data set 45, 43, 52, 66, 37, 58, 32, 50. | CO1 | E | 10 |
|  | b. | The marks scored by 10 students in a test are 25, 29, 30, 33, 35, 37, 38, 40, 44, 48. Find the standard deviation. | CO1 | E | 10 |
| **(OR)** | | | | | |
| 2. | a. | For the following distribution of marks scored by 40 students, calculate the range and Quartile deviation.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Range | 0 -10 | 10 -20 | 20 -40 | 40-60 | 60 -90 | | Frequency | 5 | 8 | 16 | 7 | 4 | | CO1 | E | 10 |
|  | b. | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No of tomatoes per plant | 20 | 21 | 22 | 23 | 24 | 25 | | No of plants | 4 | 2 | 7 | 1 | 3 | 1 |   The number of tomatoes per plant is given above. Find the harmonic mean. | CO1 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Define positive correlation and negative correlation with examples. Calculate the Karl Pearson correlation coefficient for the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 3 | 4 | 5 | 7 | 8 | 10 | | Y | 2 | 6 | 8 | 10 | 14 | 16 | 20 | | CO2 | E | 10 |
|  | b. | The marks obtained by 10 students in Mathematics and statistics are given below. Obtain Spearman rank correlation.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 75 | 30 | 60 | 80 | 53 | 35 | 15 | 40 | 38 | 48 | | Y | 85 | 45 | 54 | 91 | 58 | 63 | 35 | 43 | 45 | 44 | | CO2 | E | 10 |
| **(OR)** | | | | | |
| 4. |  | Find the correlation coefficient between the variables X and Y. Obtain the regression equation of the line X on Y for the following data. Also find the value of X when Y = 70.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 72 | | Y | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 | | CO2 | E | 20 |
|  |  |  |  |  |  |
| 5. | a. | Define null and alternative hypothesis. Discuss the two types of error in accepting hypothesis. Write the procedure for testing of hypothesis. | CO3 | U | 10 |
|  | b. | A manufacturer claimed at least 98% of the audio equipment’s will meet the required specifications. A sample of 500 equipment’s were tested and 30 were found to be defective. Test his claim at a significance level of 0.05. | CO4 | An | 10 |
| **(OR)** | | | | | |
| 6. | a. | Two independent sample of sizes 7 and 9 have the following values:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample 1 | 10 | 12 | 10 | 13 | 14 | 11 | 10 | - | - | | Sample 2 | 10 | 13 | 15 | 12 | 10 | 14 | 11 | 12 | 11 |   (i)Find the mean of sample 1 and 2 (ii) Test whether the difference between the mean is significant. | CO4 | U | 10 |
|  | b. | Write the procedure for conducting (i) F test (ii) Chi –square test of independence with the relevant formula’s. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | A sample of 20 items has mean 42 units and S. D 5 units. Find the calculated value using t test for a random sample from a normal population with mean 45 units. | CO4 | An | 10 |
|  | b. | The weights of 10 people of a locality are found to be 70, 67,62,68,61, 68,70,64,64, 66 kilograms. Is it reasonable to believe that the average weights of the people of locality is greater than 64 kg? Test at 5% level of significance. | CO4 | An | 10 |
| **(OR)** | | | | | |
| 8. | a. | Explain acceptance sampling and six sigma concepts with example. | CO5 | U | 10 |
|  | b. | Explain the randomization, replication and local control principles of design of experiment. Discuss about the experiments, treatment and output response components in design of experiment. | CO6 | An | 10 |
|  | | **Compulsory** |  |  |  |
| 9. |  | The following data resulted from an experiment to compare three burners A, B and C. The Latin square design was designed and the tests were made on three engines, spread over 3 days.   |  |  |  |  | | --- | --- | --- | --- | | Days | Engines | | | | 1 | 2 | 3 | | 1 | A-16 | B-17 | C-20 | | 2 | B-16 | C-21 | A-15 | | 3 | C-15 | A-12 | B-13 |   Test the hypothesis that there is no significant difference between the burners. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Determine the measures of central tendency of statistical data. |
| CO2 | Relate the position of data with moments, skewness and kurtosis. |
| CO3 | Test the hypothesis for large samples. |
| CO4 | Analyze the parameters and attributes of small samples. |
| CO5 | Identify the appropriate sampling techniques. |
| CO6 | Construct the experimental designs using Analysis of Variance. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21MA2001** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY THEORY AND RANDOM PROCESSES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If and  are mutually exclusive events, then P(AB) =\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Estimate the probability of getting 2 heads when a coin is tossed 2 times. | | CO1 | R | 1 |
| 3. | A random variable X follows the PDF  estimate the value of k. | | CO2 | U | 1 |
| 4. | If is the cumulative distribution function of two dimensional random variable , then | | CO2 | R | 1 |
| 5. | State the memory less property of exponential distribution. | | CO3 | R | 1 |
| 6. | The mean of the binomial distribution is \_\_\_\_\_. | | CO3 | R | 1 |
| 7. | What is the nature of, if both ‘T’ and ‘S’ is continuous? | | CO4 | R | 1 |
| 8. | If the process X(t) and Y(t) are orthogonal, then Rxy() = \_\_\_\_. | | CO5 | R | 1 |
| 9. | State mean ergodic theorem. | | CO5 | R | 1 |
| 10. | The Mean of the Poisson Process is \_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | From the bag containing 3 red and 2 black balls, 2 balls are drawn at random. Find the probability that they are of the same colour. | | CO1 | An | 3 |
| 12. | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | *p(x)* | 0 | K | 2K | 2K | 3K | K2 | 2K2 | 7K2+K |   Find (i) the value of K (ii) P(X>2). | | CO2 | E | 3 |
| 13. | If the mean and variance of Binomial distribution are 6 and 3, then determine the distribution. | | CO3 | A | 3 |
| 14. | If a random variable X has the moment generating function  obtain the variance of X. | | CO4 | An | 3 |
| 15. | Find the mean and variance of the stationary process {X(t)}, whose autocorrelation is given by | | CO5 | E | 3 |
| 16. | If is a Gaussian process with μ(t)=10 and C(,) = 16 , then P | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen at random (without replacement). Find the probability that (i) both are good  (ii) at least one is good (iii) exactly one is good. | CO1 | An | 6 |
|  | b. | In a bolt factory machines A, B, C produce 25%, 35% and 40% of the total output respectively of their output 5%, 4% and 2% respectively are defective bolts. If a bolt chosen at random from the combined output, then what is the probability that it is defective? If a bolt chosen at random is found to be defective, then what is the probability that it was produced by machine B? | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | For the bivariate probability distribution of given below:  Find , and | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Fit a Binomial Distribution to the following data and find theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 5 | 29 | 36 | 25 | 5 | | CO3 | E | 6 |
|  | b. | The time required to repair a machine is exponentially distributed with parameter =1/2, then (i) What is the probability that the repair time exceeds 2 hrs? (ii) What is the conditional probability that the repair time takes at least 10 hrs given that its duration exceeds 9 hrs?. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | A random variable has mean and variance and an unknown probability distribution. Find using Chebyshev inequality. | CO4 | E | 6 |
|  | b. | Find the Moment Generating function of the Poisson distribution and evaluate its mean. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. |  | Two random processes and are defined by  and Show that and are jointly wide sense process, where‘’ and ‘’ are random variables with (i)  (ii) (iii) | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | If the joint pdf of a two dimensional Random variable (x,y) is given by f (x, y) = where 0<x<1,0<y<1, then find  (i) Marginal density function (ii) Conditional density function and also check whether x and y are independent random variables. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | The weekly wages of 1000 workmen are normally distributed around a mean of Rs.70 with a standard deviation of Rs.5. Estimate the number of workers whose weekly wages will be (i) More than Rs.72 (ii) Less than Rs.69. | CO3 | A | 6 |
|  | b. | The auto correlation function of the random telegraph signal process is given by . Determine the power spectral density function. | CO4 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | If customers arrive at a counter in accordance with a Poisson process with a mean rate of 2 per minute, then find the probability that the interval between 2 consecutives arrivals is (i) more than 1 min (ii) between 1 min and 2 min (iii) less than 4 min. | CO6 | An | 6 |
|  | b. | A fair die is tossed repeatedly. If Xn denotes the maximum of the numbers occurring in the first n tosses, then find the transition probability matrix P of the Markov chain and also find and 6). | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize probability models. |
| CO2 | Discrete and continuous random variables. |
| CO3 | Classify the problems using probability distributions. |
| CO4 | Analyze the problems using statistical averages. |
| CO5 | Determine the characteristics of random processes. |
| CO6 | Identify the classification of random processes. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **21MA4001** | **Duration** | **3hrs** |
| **Course Title** | **RESEARCH METHODOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the essential characteristics of a well-defined research problem. Illustrate how these characteristics guide a scholar in formulating a research study. | CO1 | E | 10 |
|  | b. | Discuss the systematic approach followed to convert a general research interest into a precise problem statement. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Compare basic research and applied research. Identify your own research interest and classify it under one of these categories with valid justification. | CO1 | C | 10 |
|  | b. | Critically analyze the process of defining a research hypothesis. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Illustrate the steps involved in conducting an effective literature review. List the digital and physical research resources available in KITS library that support literature search. | CO2 | U | 10 |
|  | b. | Categorize the research design and elaborate each case in detail. | CO2 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Articulate the basic principle of experimental design. Describe each component with suitable examples. | CO2 | An | 10 |
|  | b. | Categorize the types of sampling techniques with respect to research design. Estimate the implications of the poor sampling. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the Measure of Central Tendency with a suitable example. Describe the process of evaluating mean, median and mode. | CO3 | E | 10 |
|  | b. | Differentiate between correlation and regression. Explain the importance of regression models in predictive analytics with an example. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Enumerate the characteristics of hypothesis. List them with an example. | CO5 | E | 10 |
|  | b | An airplane covered a distance of 800 miles with four different speeds of 100, 200, 300 and 400 miles/hour for the first, second, third and fourth quarter of the distance. Using harmonic mean, find the average speed in miles/hour. | CO5 | E | 10 |
|  |  |  |  |  |  |
| 7. |  | Find the range and quartile deviation for the following distribution:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Class Interval | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | | No. of Frequency | 15 | 23 | 18 | 31 | 23 | 13 | 7 | | CO4 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Discuss the significance of research ethics in publishing. Prepare a model outline for a research report based on your current or proposed research study. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Outline the importance of acquiring an IP for an invention or an innovation. Tabulate the different types of IPs in the country. | CO6 | A | 10 |
|  | b. | Explain the step-by-step process followed in India to write a patent disclosure form. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Review the current research based on literature survey |
| CO2 | Identify a research gap, define research problem, formulate hypothesis and methodology for research |
| CO3 | Use various mathematical techniques and statistical tools for research |
| CO4 | Publish literature review article in a reputed journal |
| CO5 | Understand the significance of IPR |
| CO6 | Cognize the role of IPR and the need of patenting |

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**END SEMESTER EXAMINATION – NOV/DEC 2025**

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| --- | --- | --- | --- |
| **Course Code** | **21MA4002** | **Duration** | **3hrs** |
| **Course Title** | **RESEARCH AND PUBLICATION ETHICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | List some of the plagiarism software and explain its usage in scientific writings. | CO3 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Evaluate the significance of Intellectual honesty and research integrity in publications. | CO2 | E | 20 |
|  |  |  |  |  |  |
| 3. |  | Describe definition, nature, scope and branches of Research Ethics. | CO1 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Narrate the process to classify journals based on their research metrics | CO6 | A | 20 |
|  |  |  |  |  |  |
| 5. |  | Apply tools that are helpful in checking the similarity index of a publication content | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Illustrate the unethical behavior, Publication misconduct and violation of publication ethics with example | CO5 | R | 20 |
|  |  |  |  |  |  |
| 7. |  | Detail the Software tools to identify predatory publications. List its process flow. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | How to check publisher copy right and self-archiving policies using online resources. | CO4 | A | 20 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Narrate how the Indexing data bases and Citation databases play a significant role in publication practices | CO6 | A | 20 |

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance of publication ethics |
| CO2 | Identify and avoid various types of ethical issues while publishing papers and writing reports |
| CO3 | Use various tools that are helpful in checking similarity index |
| CO4 | Infer about open access publication and be able to use various search indices |
| CO5 | Grade the reports and articles in order to minimize the similarity index |
| CO6 | Categorize the journals based on their quality and metrics |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22MA2001** | **Duration** | **3hrs** |
| **Course Title** | **BUSINESS MATHEMATICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | The sum of three numbers in Arithmetic progression is 24 and their product is 440. Find the numbers. | CO1 | An | 10 |
|  | b. | A person borrows Rs. 1200 at the total interest of Rs.168. He repays the entire amount in 12 instalments each instalment being less than the preceding one by Rs. 20. Find the first instalment. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | A warehouse stock grows by doubling every day, starting with 10 units. How much stock will there be on the 8th day? | CO1 | A | 5 |
|  | b. | Find the sum of 7 terms of the G.P. 1+4+16+…. | CO1 | U | 5 |
|  | c. | The sum of three numbers in geometric progression is 35 and their product is 1000. Find the numbers. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Determine the rate of interest at which ₹ 5000 yield ₹ 750 in simple interest in 3 years. | CO2 | A | 5 |
|  | b. | Calculate the compound interest and compound amount of the following investments  (i) ₹15000 @ 9% p.a., for 6 years and interest compounded annually.  (ii) ₹20000 @ 10% p.a., for 3 years and interest compounded half-yearly. | CO2 | A | 8 |
|  | c. | Find the effective rate of interest percent per annum equivalent to a nominal rate 12% per annum, the interest being compounded monthly. | CO2 | A | 7 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | In a company a machine costs ₹80000 and its life is estimated to be 20 years. Sinking fund is created for replacing the machine at the end of its life time when its scrap realizes a sum of ₹5000 only. Calculate the amount which should be provided every year for the sinking fund if it accumulates at 9% p.a. compounded annually. | CO2 | A | 10 |
|  | b. | A bill with a face value of ₹8,000 is due in 3 months. If the rate of interest is 8% per annum, then calculate the Banker’s Discount, True Discount, and the Banker’s Gain. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Given that there are 600 online customers, 800 in-store customers, and 150 customers who shopped both ways. The marketing team wants to send a special offer to customers who have shopped both online and in-store. How many customers will receive the special offer? Additionally, how many customers shopped either online or in-store? | CO3 | A | 10 |
|  | b. | A transport company uses three types of trucks T1, T2 and T3 to transport three types of vehicles V1, V2 and V3. The carrying capacity of each truck in terms of three types of vehicles is given below.   |  |  |  |  | | --- | --- | --- | --- | |  | V1 | V2 | V3 | | T1 | 1 | 3 | 2 | | T2 | 2 | 2 | 3 | | T3 | 3 | 2 | 2 |   Using Cramer’s rule, find the number of trucks of each type that are required to transport 85, 105 and 110 vehicles of type V1, V2 and V3 respectively. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Find the inverse of the matrix . | CO4 | A | 10 |
|  | b. | Solve by graphical method,  Maximize Z = -3x1 + 4x2  Subject to constraints x1 + x2 ≤ 4  2x1 + 3x2 ≥ 18  and x1, x2 ≥ 0. | CO4 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | Find the derivative of . | CO5 | U | 5 |
|  | b. | Differentiate with respect to x. | CO5 | U | 5 |
|  | c. | Find the maximum and minimum value of the function . | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Integrate with respect to x. | CO5 | U | 5 |
|  | b. | Use substitution method to integratewith respect to x. | CO5 | U | 5 |
|  | c. | The marginal cost function for producing ‘*x’* units is and the total cost for producing 1 unit is 40. Obtain the total cost function and the average cost function. | CO5 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | A and B together can complete a piece of work in 15 days, and B alone can complete the same work in 20 days. In how many days can A alone complete the work? | CO6 | A | 5 |
|  | b. | Rani purchased a watch for Rs. 2,516 and sold it for Rs. 2,272. Determine the loss percentage. | CO6 | A | 5 |
|  | c. | How many distinguishable permutations of the letters in the words  (i) ECONOMICS and (ii) DAUGHTER are there? | CO6 | An | 5 |
|  | d. | Pointing to a photograph of a boy, Suresh said, "He is the son of the only son of my mother." How is Suresh related to that boy? | CO6 | An | 5 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the progression techniques in solving finance problems. |
| CO2 | Determine the solutions to financial transactions. |
| CO3 | Represent the business problems using set theory. |
| CO4 | Construct and solve business problems using matrix methods and LPP. |
| CO5 | Relate the differentiations and integrations techniques in business. |
| CO6 | Solve arithmetic and logical reasoning problems. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA1003** | **Duration** | **3hrs** |
| **Course Title** | **CALCULUS AND DIFFERENTIAL EQUATIONS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The sequence  is oscillatory through\_\_\_\_\_\_. | | CO1 | A | 1 |
| 2. | The p-series  is divergent if \_\_\_. | | CO1 | R | 1 |
| 3. | What is the radius of curvature of a circle ?. | | CO2 | R | 1 |
| 4. | Write down the value of . | | CO2 | A | 1 |
| 5. | In a Fourier series of  in the value of is\_\_\_\_. | | CO3 | A | 1 |
| 6. | Write down the half range cosine series in the interval | | CO3 | A | 1 |
| 7. | When a function has neither maximum nor minimum, then the stationary point is known as\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | When is a vector said to be irrotational?. | | CO4 | R | 1 |
| 9. | In integral calculus,  represents\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Change the order of integration and find the limits of | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compute the value of | | CO1 | A | 3 |
| 12. | Test the convergence of the sequence | | CO2 | An | 3 |
| 13. | Find the R.M.S value of  in | | CO3 | E | 3 |
| 14. | For a given function  find the value of | | CO4 | A | 3 |
| 15. | Find the value of  . | | CO5 | E | 3 |
| 16. | Find the particular integral of | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Test the convergence of the series | CO1 | An | 6 |
|  | b. | Test for convergence of the alternating series | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Find the center of curvature of the Ellipse  at , hence show that its Evolute is | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the Fourier series of | CO2 | A | 6 |
|  | b. | Compute the first two harmonics for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 0 | π/3 | 2π/3 | π | 4π/3 | 5π/3 | | f(x) | 1.98 | 1.3 | 1.05 | 1.3 | -0.88 | -0.25 | | CO2 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | If , then compute the Jacobian and prove that | CO3 | A | 6 |
|  | b. | Find the maxima and minima of the function | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and evaluate | CO4 | E | 6 |
|  | b | Find the area between the curves  . | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Verify Green’s theorem for  where c is bounded by and . | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Verify Gauss divergence theorem for the function  bounded by the lines | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve | CO6 | A | 6 |
|  | b | Solve  by the method of variation of parameters. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL  **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Express functions as infinite series. |
| CO2 | Evaluate surface area and volume using definite integral. |
| CO3 | Apply differentiation techniques to find extreme values of functions. |
| CO4 | Calculate gravity and mass using integration techniques. |
| CO5 | Relate vector spaces with magnetic field and moving fluid. |
| CO6 | Solve ordinary differential equations. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2001** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

(Use of Statistical table is permitted)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If P(A)=0.3,P(B)=0.6 and  P(AՈB)=0.2   then find ). | | CO1 | U | 1 |
| 2. | If P(A)=1/2, P(B)=1/3 and P(AꓵB) = 1/12 then find P(A/B). | | CO1 | U | 1 |
| 3. | A continuous RV X has the probability density function f(x) = kx2 0<x<3. Find the value of. | | CO2 | U | 1 |
| 4. | If F(x,y)  is the cumulative distribution function  of (X,Y) then F(∞,∞)= ----. | | CO2 | R | 1 |
| 5. | An AI model for sentiment analysis correctly identifies the sentiment of tweets with an accuracy of 90%. If 50 tweets are analysed, then find the expected number of correctly classified tweets. | | CO3 | U | 1 |
| 6. | The waiting time at an airport check in counter follows an exponential distribution with mean time of 20 mins. Construct the pdf of exponential distribution. | | CO3 | U | 1 |
| 7. | A nutritionist wants to predict a patient's cholesterol level (Y) based on the daily intake of saturated fats ( X1 gm.), daily exercise time (X2 min), and age(X3 in years) . Based on the past data, he developed a multiple linear regression model given by, Y= 2.69X1 - 0.07X2+0.33X3 + 115.119. Predict the cholesterol level of a 48-year-old person who consumes 28 grams of saturated fats daily and exercises for 25 minutes per day using the MLR model. | | CO4 | U | 1 |
| 8. | Find the correlation coefficient between the size of the CPU cache (in mb) and the time taken to execute a particular algorithm or program (in seconds), given that the regression coefficients are 0.4 and 0.9. | | CO4 | U | 1 |
| 9. | The standard value of Z for a two tailed test at 5%LOS is ----. | | CO5 | R | 1 |
| 10. | Define Type I error in testing of hypothesis | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A lot consists of 10 good articles, 6 with minor defects, 2 with major defects. If two articles are taken at random, then find the probability that both are good articles. | | CO1 | U | 3 |
| 12. | If f(x,y) is the joint probability density function of (X,Y) given by f(x,y)=kxy ;  1<x<3, 2<y<4 then find the marginal density of X. | | CO2 | U | 3 |
| 13. | It is observed that about 10% of the customers of an E-commerce company, return the items purchased for various reasons. On a particular day, if 20 customers purchased items, then using Binomial distribution find the probability that exactly 5 customers will return the items purchased. | | CO3 | U | 3 |
| 14. | Find the rank correlation coefficient between high performing sales people and customer satisfaction.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Sales ranks | 1 | 2 | 3 | 4 | 5 | | Customer satisfaction ranks | 3 | 1 | 2 | 5 | 4 | | | CO4 | U | 3 |
| 15. | A software company is testing a new feature on its website. Out of 2000 users who were randomly selected for this experiment, 540 users interacted with the new feature. The company wants to estimate the true proportion of users who will use this new feature. Find the 95% confidence interval. | | CO5 | U | 3 |
| 16. | Construct a null hypothesis and alternative hypothesis to the following problem:  A company claims that its new server software has an average response time of **2.5 seconds** under typical usage conditions. A software engineer wants to test this claim by collecting response time data from **12 random instances and finds that the mean response time is 2.55 seconds and the standard deviation is 0.15 seconds.** | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | From the following dataset of emails labelled as spam and not spam, classify a new email, “Free offer, claim your money now” using the Naïve Bayes algorithm.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | S. No. | Email | Word=  ”free” | Word=  ”money” | Word=  ”offer” | class | | 1 | Free money | Yes | Yes | No | spam | | 2 | Offer is here | No | No | Yes | Not spam | | 3 | Get free offer | Yes | No | Yes | spam | | 4 | Discount offer | No | No | Yes | Not spam | | 5 | Money back guarantee | No | Yes | No | Not spam | | CO1 | An | 6 |
|  | b. | In a bolt factory, machines A,B, C produce 25%,35% and 40% of the total output respectively. Of their outputs, 5%,4% and 2% respectively are defective bolts. If a bolt is chosen at random from the combined output, then find the probability that it is defective. If a bolt chosen at random is found to be defective, then find the probability that it was produced by machine B. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | A random variable X has the following probability distribution:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | P(x) | 0.1 | k | 0.2 | 2k | 0.3 | 3k |   (i)Find k (ii)Find P(X<1) (iii) P(-2<X<2)  (iv) Find P(X<1/-2<X<2) (v) Find cumulative distribution function, CDF, of X. (vi)Find mean of X (vii)Find variance of X. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | The joint probability mass function of (X,Y) is p(x,y)=k(2x+3y),x=0,1,2, y=1,2,3. (i)Find the value of k.(ii) Find the marginal distribution of X  (iii) Find the marginal distribution of Y (iv) Find the conditional distributions of X given Y. (v) Find the conditional distributions of Y given X. (vi) Find the probability distribution of (X+Y) | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a Poisson distribution to the following data, and find the expected frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 211 | 90 | 19 | 5 | 0 | | CO3 | A | 6 |
|  | b. | The execution times of a certain algorithm on a large dataset are normally distributed with a mean of 50 milliseconds and a standard deviation of 5 milliseconds. What is the probability that a randomly selected execution time will be (i) less than 45 milliseconds (ii) more than 55 milliseconds (iii) between 45 and 55 milliseconds? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | The following data relate to advertisement expenditure (in lakhs of rupees) and their corresponding sales (in crores of rupees).   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | advertisement expenditure | 10 | 12 | 15 | 23 | 20 | | sales | 14 | 17 | 23 | 25 | 21 |   Find the two lines of Regression. Predict the sales corresponding to the advertisement expenditure of 30 lakhs and estimate the advertisement expenditure corresponding to a sales target of 35 crores. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Monthly sales revenue data were collected for a company and given below:   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Months | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | sales | 125 | 145 | 186 | 131 | 151 | 192 | 137 | 157 | 198 | 143 | 163 | 204 |   Calculate the three point moving averages. Plot the actual and trend values on a graph. Comment on the trend. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | A company is testing two versions of its AI-based voice recognition system: Version A and Version B. The company claims that both versions have similar accuracy in identifying commands. To test this, a random sample of 1000 commands is tested for each version. Version A correctly identifies 860 commands, and Version B correctly identifies 820 commands. Test the hypothesis that there is no significant difference between the two proportions at a 5% significance level. | CO5 | A | 6 |
|  | b. | The following data are obtained from a survey of food expenditure:   |  |  |  |  | | --- | --- | --- | --- | |  | Number of shoppers | Average food expenditure | Std. deviation | | Super market A | 400 | 250 | 40 | | Super market B | 400 | 220 | 55 |   Test at 5% LOS, whether the average food expenditure of the two populations of shoppers from which the samples were obtained are equal. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | In an experiment on immunization of cattle from tuberculosis, the following results were obtained:   |  |  |  | | --- | --- | --- | |  | Affected | Not affected | | Inoculated | 60 | 120 | | Not inoculated | 80 | 40 |   Discuss the effect of vaccine in controlling susceptibility to tuberculosis. | CO6 | A | 6 |
|  | b. | The table below gives the number of accidents that occurred during various days of the week.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Days of  the week | Mon | Tue | Wed | Thurs | fri | sat | | Number of accidents | 14 | 18 | 12 | 11 | 15 | 14 |     Test whether accidents are uniformly distributed over the week. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Apply the concept of probability in machine learning problems. |
| **CO2** | Analyze one dimensional and two-dimensional Random variables |
| **CO3** | Relate predictive analysis using probability distributions. |
| **CO4** | Measure the relationship between variables. |
| **CO5** | Construct the comparative analysis using testing of hypothesis. |
| **CO6** | Examine the independence of attributes. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2003** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND STATISTICS IN ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The mode of the given data 23,16,48,60,23,12,21,19 is\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | The median of 4,6,810,12 is\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 3. | The correlation coefficient lies between\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | The line of regression of X on Y is given by\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | If A and B are mutually exclusive events, then 𝑃 (𝐴 𝐵) is given by\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | The probability of getting 53 Sundays in a leap year is\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 7. | The sum of probabilities of the given experiment is always \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | The mean of the exponential distribution is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | The variance of the Poisson Distribution is\_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | The probability ‘α’ that a random value of the statistic ‘t’ belongs to the critical region is known as the\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the Geometric mean and Harmonic mean of 2,4,8. | | CO1 | A | 3 |
| 12. | The regression coefficients are 0.4 and 0.6. Calculate the correlation coefficient. | | CO2 | A | 3 |
| 13. | In a packet of 100 bits transmitted over a noisy channel, 10 bits are corrupted.  Estimate the probability that a randomly transmitted bit is not corrupted. | | CO3 | E | 3 |
| 14. | The joint probability density function of a two dimensional random variable (X, Y) is  .  Calculate the conditional density functions . | | CO4 | U | 3 |
| 15. | The waiting time at an airport check in counter follows an exponential distribution with mean time of 20 mins. Construct the pdf of exponential distribution. | | CO5 | A | 3 |
| 16. | Define type 1error and type 2 error in testing of hypothesis | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Calculate the Mean, Median and Mode of the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Class Interval | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 | 120-140 | 140-160 | | Frequency | 6 | 9 | 11 | 14 | 20 | 15 | 10 | | CO1 | A | 12 |
| 18. |  | Calculate the lines of regression of X on Y and Y on X.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO2 | A | 12 |
| 19. | a. | A lot consists of 10 good sensors, 4 with minor defects and 2 with major defects. Two sensors are chosen at random. Estimate the probability that  (i) both are good (ii) both have major defects (iii) at least one is good  (iv) at most one is good (v) exactly one is good. | CO3 | A | 6 |
|  | b. | In a shooting test, the probability of hitting the target is 1/2 for A, 2/3 for B and 3/4 for C. If all of them fire at the target then estimate the probability that (i) None of them hits the target (ii) At least one of them hits the target (iii) Exactly two of them hits the target | CO3 | A | 6 |
| 20. | a. | A Random Variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | -2 | -1 | 0 | 1 | 2 | 3 | | P(X) | 0.1 | K | 0.2 | 2K | 0.3 | 3K |   a. Estimate ‘K’  b. Evaluate P(X<2)  c. Evaluate P(-2<X<2).  d. Calculate the Cumulative Distribution Function of X.  e. Evaluate the mean.  f. Evaluate the Variance. | CO4 | E | 8 |
|  | b. | The joint pdf of a two-dimensional RV(X,Y) is given by  . Calculate the  (i) Marginal distributions (ii) Are X and Y independent? | CO4 | A | 4 |
| 21. | a. | Fit a Binomial distribution to the following data, and evaluate theoretical/expected frequencies:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | f | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO5 | A | 6 |
|  | b. | The mileage that car owners get with a certain kind of radial tyre is a RV having an exponential distribution with mean of 40,000km. Evaluate the probabilities that one of these tyres will last (i) at least 20,000 km (ii) at most 30,000 km | CO5 | E | 6 |
| 22. | a. | The number of **customer complaints received by a call center employee in a month** follows a Poisson distribution with mean 3. Out of 1000 employees, evaluate approximately the number of employees who receive:  (i) no complaints  (ii) more than 3 complaints  (iii) less than 3 complaints  (iv) exactly 3 complaints | CO5 | E | 7 |
|  | b. | The **weekly test scores of 1000 students** in a mathematics course are normally distributed with a **mean of 70 marks** and **standard deviation of 5 marks**. Estimate the number of students who scored:  (i) **More than 72 marks (**ii) **Less than 69 marks** (iii) **Between 69 and 72 marks** | CO5 | E | 5 |
| 23. |  | A bolt is manufactured by 3 machines A, B and C. A turns out twice as many times as B. Machine B and C produce equal number of items. 2% of bolts produced by machine A and B are defective and 4% of bolts produced by C are defective. All the bolts are put into one stock pile and one bolt is selected at random. (i) what is the probability for selecting a defective bolt? (ii) If the selected bolt is found to be defective, then estimate the probability that the defective bolt is produced by machine B. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | In an experiment on **pest-resistant variety and normal crop varieties,** the following results were observed:   |  |  |  | | --- | --- | --- | |  | Pest Affected | Not affected | | Resistant Variety | 60 | 120 | | Normal Variety | 80 | 40 |     Perform a **chi-square test** at the 5% significance level to determine whether pest-resistant varieties has a significant effect on reducing pest damage. Also, compute the **relative risk** and **odds ratio**, and interpret the results. | CO6 | An | 8 |
|  | b. | State the **assumptions, null hypothesis,** and **decision rule** for the F-test used to compare two population variances. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Determine the statistical measures of data. |
| **CO2** | Analyze the linear relationship of variables using linear in correlation and regression models. |
| **CO3** | Apply the concept of probability in machine learning problems. |
| **CO4** | Gain knowledge in randomness of data. |
| **CO5** | Relate predictive analysis using probability distributions. |
| **CO6** | Construct the comparative analysis using testing of hypothesis. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2004** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND STATISTICS FOR MECHANICAL**  **ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The median formula for a grouped frequency distribution is \_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | Calculate the mean of the following data, x: 7, 19, 21, 20, 23, 15, 28. | | CO1 | U | 1 |
| 3. | The range of correlation coefficient is \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | The nature of correlation when is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 5. | State addition law of probability | | CO3 | R | 1 |
| 6. | Compute the probability of getting 53 Sundays in a leap year. | | CO3 | U | 1 |
| 7. | Define marginal probability distribution. | | CO4 | U | 1 |
| 8. | A random variable X takes values 1, 2, 3 with probabilities 0.2, 0.5 and 0.3 respectively. Find | | CO4 | U | 1 |
| 9. | The probability density function of a Poisson distribution P(X=x)=\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | The standard value of Z for a single tailed test at 5% LOS is \_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compute the mean for the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | f | 5 | 9 | 12 | 17 | 14 | 10 | 6 | | | CO1 | A | 3 |
| 12. | Calculate the correlation coefficient from the regression coefficients -0.4 and -0.9. | | CO2 | A | 3 |
| 13. | Given P(A) = 0.5, P(AB) = 0.8, find P(B)  i) If A and B are mutually exclusive  ii) If A and B are independent. | | CO3 | An | 3 |
| 14. | Find the value of *k* and the probability distribution of X from the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | | P(X) |  |  | k |  | | | CO4 | An | 3 |
| 15. | The time between failures of a mechanical pump follows an exponential distribution with a mean of 10 hours. Calculate the probability that the pump runs without failure for at least 5 hours. | | CO5 | A | 3 |
| 16. | A sample of size 10 has a mean of 52 and standard deviation of 4. Test whether the population mean is 50 using t-test. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Find mean, median, mode and standard deviation for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | class | 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | | frequency | 13 | 38 | 67 | 76 | 22 | 4 | | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Calculate coefficient of variation for the following data   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 12 | 115 | 6 | 73 | 7 | 19 | 119 | 36 | 84 | 29 | | Y | 47 | 12 | 16 | 42 | 4 | 51 | 37 | 48 | 13 | 0 | | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | From the following data determine (i) the two regression equation (ii) the most likely mark in statistics when the mark in economics is 30. (iii) the most likely mark in economics when the mark in statistics is 40.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Marks in economics | 25 | 28 | 35 | 32 | 31 | 36 | 29 | 38 | 34 | 32 | | Marks in statistics | 43 | 46 | 49 | 41 | 36 | 32 | 31 | 30 | 33 | 39 | | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Obtain the rank correlation for the following data.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 68 | 64 | 75 | 50 | 64 | 80 | 75 | 40 | 55 | 64 | | Y | 62 | 58 | 68 | 45 | 81 | 60 | 68 | 48 | 50 | 70 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | A company is manufacturing bolts by 3 machines A, B and C. A turns out twice as many times as B. Machine B and C produce equal number of items. 2% of bolts produced by machine A and B are defective and 4% of bolts produced by C are defective. All the bolts are put into one stock pile and one bolt is selected at random. If the randomly selected bolt was defective, then what is the probability that the bolt was produced by machine A or B or C?. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | The joint probability mass function of (X, Y) is given in the following table:  Find , , , , , .   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Y X | 1 | 2 | 3 | 4 | 5 | 6 | | 0 | 0 | 0 | 1/32 | 2/32 | 2/32 | 3/32 | | 1 | 1/16 | 1/16 | 1/8 | 1/8 | 1/8 | 1/8 | | 2 | 1/32 | 1/32 | 1/64 | 1/64 | 0 | 2/64 | | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | The weekly wages of 1000 workmen is normally distributed with a mean of Rs. 70 and S.D Rs. 5. Estimate the number of workers whose wages will be  (i) less than Rs.69 (ii) more than Rs.72 and (iii) between Rs.69 and Rs.72. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | In a random sample of 1000 persons from the city of Coimbatore, 400 are found to be consumers of wheat. In a sample of 800 from the city of Madurai, 400 are found to be consumers of wheat. Do these data reveal a significant difference between two cities so far as the proportion of wheat consumers is concerned? | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Determine the statistical measures of data. |
| **CO2** | Analyze the linear relationship of variables using linear in correlation and regression models. |
| **CO3** | Apply the concept of probability in machine learning problems. |
| **CO4** | Gain the knowledge in randomness of data. |
| **CO5** | Model the data using probability distributions. |
| **CO6** | Describe the testing of hypothesis in decision making. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2009** | **Duration** | **3hrs** |
| **Course Title** | **NUMERICAL MATHEMATICS AND STATISTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the nested multiplication form of | | CO1 | U | 1 |
| 2. | (201.32)8 = (….)2. | | CO1 | U | 1 |
| 3. | In cubic spline function, degree of each polynomial piece should be ------------------ | | CO2 | R | 1 |
| 4. | To use Simpson’s 1/3rd rule, the number of subinterval *n* should be ----------- | | CO4 | R | 1 |
| 5. | Write the Taylor’s series expansion of *y(x2).* | | CO5 | R | 1 |
| 6. | Write the Adams predictor formulae. | | CO5 | R | 1 |
| 7. | Identify the classification of the pde *uxx – 2xuxy + 4 uyy = 0; x, y > 0.* | | CO6 | A | 1 |
| 8. | Write the general form of one-dimensional wave equation. | | CO6 | R | 1 |
| 9. | Write the probability mass function of poisson distribution. | | CO2 | R | 1 |
| 10. | Let n be the sample size, then the degrees of freedom of t-test is …… | | CO2 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the Taylor series of *f(x) = sin x* at *x=* | | CO1 | An | 3 |
| 12. | Compute for and | | CO3 | A | 3 |
| 13. | Compute given that sing Euler’s method. | | CO5 | A | 3 |
| 14. | Using Crank Nicholson method, find the value of *u* from the below table. | | CO6 | An | 3 |
| 15. | A coin is tossed 10 times. Find the probability of getting no heads. | | CO2 | An | 3 |
| 16. | In a study testing a new brain-computer interface (BCI) for motor-impaired patients, researchers expect a success rate of in basic communication tasks. In a trial of 50 patients, 36 are able to communicate successfully using the BCI. Compute *Cal z* value. | | CO2 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Compute the real root of the equation between 2 and 3 using the bisection method, correct to three decimal places. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Compute using (i) Trapezoidal rule (ii) Simpson's one-third rule (iii) Simpson's three-eighth rule, by taking 6 equal sub-intervals. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Given that , find *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Using Liebmann’s iterative process, find the first two iterations of u for the below boundary conditions. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | A set of three similar coins are tossed 100 times with the following results   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Number of heads | 0 | 1 | 2 | 3 | | Frequency | 36 | 40 | 22 | 2 |   Fit a binomial distribution and estimate the expected frequencies. | CO2 | A | 6 |
|  | b. | A group of patients was monitored to study the relationship between Heart Rate (bpm) and Oxygen Saturation (SpO₂ %), and obtained the below data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Heart Rate (X) | 72 | 80 | 68 | 76 | 85 | | SpO₂ (Y) | 98 | 95 | 99 | 96 | 97 |   Compute the rank correlation coefficient and interpret it. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | The random variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | 5 | | *p(x)* | k | 2k | 3k | 5k | 2k | k |   (i) Find the value of k (ii) Evaluate P(X<2)(iii) Find the CDF, cumulative distribution function of X (iv) Find the mean of X. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate the correlation coefficient and lines of regression for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 6 | 2 | 10 | 4 | 8 | | Y | 9 | 11 | 5 | 8 | 7 |   Also find the value of X when Y is 15. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A new sensor system is designed to measure the fuel tank pressure in an aircraft, which is known to average 90 mg/dL equivalent units in the standard calibration. A study of 100 fuel tanks using this sensor shows a mean reading of 92 mg/dL equivalent. The population standard deviation is 12 mg/dL. Test, at the 1% significance level, whether the sensor system gives readings that are significantly different from the expected average. | CO2 | An | 6 |
|  | b. | A die is rolled 120 times, and the results are as follows:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Face | 1 | 2 | 3 | 4 | 5 | 6 | | Frequency | 16 | 20 | 18 | 22 | 19 | 25 |   Using Chi-square test, test whether the die is fair at a level of significance. | CO2 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
|  | The students will be able to |
| **CO1** | Find the roots of algebraic equations by using different methods. |
| **CO2** | Interpolate the data. |
| **CO3** | Evaluate the definite integrals using numerical integration. |
| **CO4** | Compute the spline functions. |
| **CO5** | Solve ordinary differential equations using numerical techniques. |
| **CO6** | Describe the partial differential equations solutions using numerical techniques. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2010** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY, RANDOM VARIABLES AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If P(A)=0.5, P(B)=0.6 and  P(A∩B)=0.2,  then find ). | | | CO1 | U | 1 |
| 2. | If P(A)=1/3, P(B)=1/5 and P(AꓵB) = 1/15 then find P(A/B). | | | CO1 | U | 1 |
| 3. | A continuous RV X has the probability density function f(x)=kx 0<x<2. Find the value of. | | | CO2 | U | 1 |
| 4. | If F(x,y)  is the cumulative distribution function  of (X,Y) then F(-∞, -∞)= ----. | | | CO2 | R | 1 |
| 5. | If n = 40 and probability is 80%, then find the mean. | | | CO3 | A | 1 |
| 6. | The waiting time at a super market checkout counter follows an exponential distribution with mean time of 10 mins. Construct the pdf of exponential distribution. | | | CO3 | U | 1 |
| 7. | The memory less property of Exponential Distribution is \_\_\_\_\_\_\_\_\_. | | | CO4 | R | 1 |
| 8. | If X takes the values 2, 3, 3, 2, 4, 4, 4, 5, 3, 6, 3, 7, 8, 3 then the mode of the data is \_\_\_\_\_\_\_\_. | | | CO5 | U | 1 |
| 9. | The correlation coefficient takes the values from \_\_\_\_\_\_ to \_\_\_\_\_\_\_. | | | CO6 | R | 1 |
| 10. | Find the correlation coefficient given that the regression coefficients are 0.4 and 0.9. | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | A lot consists of 12 good articles, 5 with minor defects, 3 with major defects. If two articles are taken at random, then find the probability that both are good articles. | | | CO1 | An | 3 |
| 12. | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | | F(X) | 1/6 | 2/6 | 3/6 | 4/6 | 5/6 | 6/6 |   Find P(X≤ 2), from the above table | | | CO2 | U | 3 |
| 13. | If f(x,y) is the joint probability density function of (X,Y) given by f(x,y)=kxy ; 1<x<3, 2<y<4, then find the value of k. | | | CO3 | An | 3 |
| 14. | A random variable X follows binomial distribution with mean 36 and standard deviation 4. Find p, q and n. | | | CO4 | U | 3 |
| 15. | Find the rank correlation coefficient between high performing sales people and customer satisfaction.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Sales ranks | 1 | 2 | 3 | 4 | 5 | | Customer satisfaction ranks | 4 | 3 | 5 | 2 | 1 | | | | CO5 | An | 3 |
| 16. | Find β2 when μ1=0, μ2=2, μ3=0, μ4=5. Also classify the type of Kurtic curve. | | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | A fair coin is tossed 4 times. Define the sample space corresponding to this random experiment. Also give the subsets corresponding to the following events and find the respective probabilities:  (i) More heads than tails are obtained.  (ii) Tails occur on the even numbered tosses  (iii) No tail. | | CO1 | An | 6 |
|  | b. | Suppose that coloured balls are distributed in 3 boxes as follows:   |  |  |  |  | | --- | --- | --- | --- | |  | Box1 | Box2 | Box3 | | Red | 2 | 4 | 3 | | White | 3 | 1 | 4 | | Blue | 5 | 3 | 5 |   A box is selected at random from which a ball is selected at random and it is observed to be red. What is the probability that box 3 was selected? | | CO1 | E | 6 |
|  |  |  | |  |  |  |
| 18. |  | A random variable X has the following probability distribution:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -3 | -2 | -1 | 0 | 1 | 2 | | P(x) | 0.1 | k | 0.2 | 2k | 0.3 | 3k |  1. Find k (ii) P(X<1) (iii) P(-2<X<2)   (iv) Calculate P(X<1/-2<X<2) (v) Calculate cumulative distribution function, CDF of X. (vi) Calculate mean of X. | | CO2 | A | 12 |
|  |  |  | |  |  |  |
| 19. |  | The joint probability mass function of (X, Y) is p(x, y) =k(x+5y); x=1,2,3; y=0,1,2. Calculate (i) k (ii) All Marginal Probability distribution (iii) Conditional probability distributions | | CO3 | E | 12 |
|  |  |  | |  |  |  |
| 20. | a. | Fit a Poisson distribution to the following data, and calculate the expected frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 301 | 180 | 90 | 5 | 0 | | | CO4 | An | 6 |
|  | b. | The lifetimes of a certain brand of LED bulbs are normally distributed with Mean 𝜇 = 800 hours Standard deviation 𝜎 = 60 hours. A total of 200 bulbs are tested. Find the number of bulbs lasted (i) less than 740 hours (ii) between 740 to 860 hours (iii) more than 860 hours. | | CO4 | A | 6 |
|  |  |  | |  |  |  |
| 21. |  | Calculate the mean, median, mode and quartile deviation for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class interval | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 | | frequency | 15 | 25 | 65 | 85 | 30 | 5 | | | CO5 | A | 12 |
|  |  |  |  |  | |  |
| 22. |  | The following table represents the joint probability distribution of the discrete random variable (X, Y). Find all the marginal and conditional distributions. Also find P(X+Y).   |  |  |  |  | | --- | --- | --- | --- | | Y | X | | | | 1 | 2 | 3 | | 1 | 1/12 | 1/6 | 0 | | 2 | 0 | 1/9 | 1/5 | | 3 | 1/18 | ¼ | 2/15 | | CO3 | An | | 12 |
|  |  |  |  |  | |  |
| 23. |  | Calculate the coefficient of variation for the following data   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 12 | 115 | 6 | 73 | 7 | 19 | 119 | 36 | 84 | 29 | | Y | 47 | 12 | 16 | 42 | 4 | 51 | 37 | 48 | 13 | 0 | | CO5 | E | | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24 |  | The following data relate to college fee expenditure (in lakhs of rupees) and their corresponding placement package (in lakhs of rupees).   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | College fee expenditure | 10 | 12 | 15 | 23 | 20 | | Placement package | 14 | 17 | 23 | 25 | 21 |   Find the two lines of Regression. Predict the placement package if the college fee expenditure was 30 lakhs and estimate the college expenditure corresponding to a placement package target of 35 lakhs. | CO6 | A | | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand basic concepts of probability. |
| CO2 | Solve problems on discrete and continuous random variables. |
| CO3 | Understand the concepts of two dimensional random variables and solve problems. |
| CO4 | Classify the problems using probability distributions and apply appropriate distributions. |
| CO5 | Measure central tendency of the data |
| CO6 | Compare variables using correlation and regression. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| **Course Code** | **23MA3001** | **Duration** | **3hrs** |
| **Course Title** | **LOGICAL REASONING AND SOFT SKILLS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Identify the greatest number that will divide 1228, 1924, and 2820 leaving the same remainder. | CO1 | A | 5 |
|  | b. | Salaries of Ravi and Sumit are in the ratio 2 : 3. If the salary of each is increased by Rs. 4000, then the new ratio becomes 40 : 57. Compute Sumit's salary. | CO1 | A | 5 |
|  | c. | In a school, there are five friends- A, B, C, D and E. The weight of A is equal to the average weight of B, C and D and the weight of B is equal to the average weight of A, C and D. The average weight of A and C is equal to the average weight of C and D. E is 30 kg heavier than C and the average weight of B and D is 60 kg. Calculate the average weight (in kgs) of A, B, C, D and E. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 2. | a. | (A) Identify the correct option for the statement and assumptions provided below: **Statement:**These apples are too cheap to be good.  **Assumptions:** (I) When the apple harvest is abundant, the prices go down.   1. (II) The lower the selling price, the inferior is the quality of the commodity. 2. (III) Very cheap apples are also good.   Option(i): None is implicit Option(ii): Only I and III are implicit  Option(iii): Only II is implicit Option(iv): Only II and III are implicit  Option(v): All are implicit  (B) Identify the correct option for the statement and arguments provided below:  **Statement:**Should the rule of wearing helmet for both driver and pillion rider, while driving a motor bike is enforced strictly?  **Arguments: (I)** Yes. It is a rule and rules should be followed strictly by all.   1. **(II)** No. Each individual knows how to protect his own life and it should be left to his discretion. 2. **(III)** No. It does not ensure safety as only the head is protected and rest of the body is not. 3. **(IV)** Yes. It is a necessity, as head, being the most sensitive organ, is protected by the helmet.   Option(i): None is strong Option(ii): Only I and III are strong  Option(iii): Only I and IV are strong Option(iv): Only II and IV are strong  Option(v): All are strong | CO2 | U | 5 |
|  | b. | (A) Identify the correct option for the statement and assumptions provided below:  **Statement:**The successful man has the ability to judge himself correctly.  **Assumptions: (I)** Inability to judge correctly causes failure.   1. **(II)** To judge others is of no use to a successful man. 2. **(III)** The successful man cannot make a wrong judgement.   Option(i): None is implicit Option(ii): All are implicit  Option(iii): Only I and II are implicit Option(iv): Only II and III are implicit  Option(v): Only I and III are implicit  (B) Identify the correct option for the statement and conclusions provided below: **Statement:**Players who break various records in a fair way get special prizes. Player X broke the world record but was found to be under the influence of a prohibited drug.  **Conclusions: (I)** X will get the special prize.  **(II)** X will not get the special prize.  Option(i): Only conclusion I follows Option(ii): Only conclusion II follows  Option(iii): Either I or II follows Option(iv): Neither I nor II follows  Option(v): Both I and II follow | CO2 | U | 5 |
|  | c. | Using Venn diagram, identify the correct option for the statement and conclusions provided below.  **Statement:**  All the windows are doors. No door is a wall.  **Conclusions: (**I). Some windows are walls. (II). No wall is a door.  Option(i): Only conclusion (I) follows Option(ii): Only conclusion (II) follows  Option(iii): Either (I) or (II) follows Option(iv): Neither (1) nor (II) follows  Option(v): Both (1) and (II) follow | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | Ramu walks 5 kms starting from his house towards west, then turns right and walks 3 km. Thereafter he takes left turn and walks 2 km. Further, he turns left and walks 3 km. Finally, he turns right and walks 3 kms. Find the direction he is now from his house. | CO3 | U | 6 |
|  | b. | If EARTH is written as FCUXM in a certain code, then identify the code for MOON. | CO3 | U | 5 |
|  | c. | Pointing to a photograph Lata says, "He is the son of the only son of my grandfather." Identify the relationship of the man in the photograph to Lata. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 4. | a. | I. Identify the answer figure which completes the problem figure matrix.    II. Choose the figure that completes the pattern. | CO4 | U | 5 |
|  | b. | I. Identify the figure which is different from the rest.    II. Identify the figure which contains figure (X) as its part. | CO4 | U | 5 |
|  | c. | Compute the number of triangles in the given figure. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 5. | a. | The simple interest on certain sum for 2 years at 5% per annum is Rs.300. Calculate the extra money gained as interest if the rate is 8% per annum on the same sum for 2 years. | CO1 | A | 5 |
|  | b. | A and B together can do a work in 4 days. A alone can do the work in 12 days. Compute the number of days that B alone will complete the work. | CO1 | A | 5 |
|  | c. | A box contains 3 white, 4 green and 5 red balls. Three balls are drawn from the box randomly. Find the probability that (i) they are of same color (ii) they are not same color. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 6. | a. | The bar graph given below shows the sales of books (in thousands) from six branches of a publishing company during two consecutive years 2000 and 2001.  Description: https://www.indiabix.com/_files/images/data-interpretation/bar-charts/15-1-1-1.png   1. Find the ratio of the total sales of branch B2 to the total sales of branch B4, for both years. 2. Calculate the percentage of total sales of branch B6 with respect to the total sales of branch B3 for both years. 3. Compute the percentage of the average sales of branches B1, B3 and B6 in 2000, with respect to the average sales of branches B1, B2 and B3 in 2001. 4. Find the average sales of all the branches for the year 2000. 5. Compute the total sale of branches B1, B3 and B5 together for both the years. 6. Determine the branch that has registered a decrease in sales. 7. Determine the branch that has registered good percentage of improvement in sales compared to other branches. | CO5 | An | 16 |
|  |  |  |  |  |  |
| 7. | a. | 1. If for a certain quantity of books, the publisher has to pay Rs. 30,600 as printing cost, then find the amount of royalty to be paid for these books. 2. Compute the central angle of the sector corresponding to the expenditure incurred on royalty. 3. Find the percent of the total expenditure for the raw material, printing and binding of the book. 4. If for a certain quantity of books, the publisher has to pay two lakhs as royalty cost, then find the amount for promotion work. 5. For publishing 5000 copies of a book, the total expenditure was 5 lakhs. If the publisher wants to sell the book with 20% profit, then calculate the selling price of each book. | CO5 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Outline the importance of verbal communication and list the essential components of effective communication in the workplace with suitable examples. | CO6 | A | 10 |
|  | b. | Define attitude. Explain the different types of attitude and discuss how a positive attitude contributes to personal and professional success in not less than 250 words. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | |  | | --- | | Students will be able to solve problems in elementary arithmetic reasoning | |
| CO2 | |  | | --- | | Students will be able to evaluate the logical reasoning problems | |
| CO3 | Students will be able to analyze statements with verbal reasoning |
| CO4 | Students will be able to apply non-verbal reasoning for exploring the problems |
| CO5 | Understand and interpret data from charts. |
| CO6 | Develop interview soft skills and expertise in line with the standards of the industry |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA3002** | **Duration** | **3hrs** |
| **Course Title** | **PROBABILITY AND FUZZY SETS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | In a factory that produces bolts, three machines A, B, and C are responsible for manufacturing 25%, 35%, and 40% of the total bolts, respectively. The defect rates of these machines differ: machine A produces 5% defective bolts, machine B produces 4% defective bolts, and machine C produces 2% defective bolts. A bolt is randomly selected from the overall production, and it is found to be defective. What is the probability that this defective bolt was produced by machine B? | CO1 | A | 10 |
|  | b. | A box contains 4 bad and 6 good tubes. Two are drawn out from the box at a time. One of them is tested and found to be good. What is the probability that the other one is also good? | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Seven coins are tossed and number of heads noted. The experiment is repeated 128 times and the following distribution is obtained:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Number of heads | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Frequencies | 7 | 6 | 19 | 35 | 30 | 23 | 7 | 1 |   Fit a binomial distribution assuming the coin is unbiased. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Let. Given and  are the fuzzy sets of . Find  (i),, ,  (ii),, ,  (iii) | CO3 | A | 10 |
|  | b. | Let. Given  and are the fuzzy sets of.  Find,, ,,. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Let. Let be a fuzzy set defined by.   1. Find all -cuts and strong -cuts 2. Find Supp(A), Core(A) and h(A) | CO3 | A | 10 |
|  | b. | State first decomposition theorem. Demonstrate the first decomposition theorem using the given fuzzy set . | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. |  | Let. Given  and are the fuzzy sets of.  Find Standard Product, Algebraic Product, Bounded Product, Drastic Product. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Given A = [2, -5] and B = [1, 4] are two fuzzy numbers. Find  A + B, A - B, A • B and A / B. | CO3 | U | 10 |
|  | b. | Given A = {(3, 1), (4, 0.5)} and B = {(2, 1), (4, 0.5)} are two fuzzy numbers. Find A + B and A - B | CO3 | U | 10 |
|  |  |  |  |  |  |
| 7. |  | Prove that  is a tautology. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Discuss the types of Fuzzy Propositions. | CO4 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Draw the general scheme of a fuzzy controller and explain its components. | CO5 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the meaning of conditional probability and Baye’s theorem. |
| CO2 | Solve problems using probability distributions. |
| CO3 | Identify different operations on fuzzy sets. |
| CO4 | Differentiate classical logic and fuzzy logic. |
| CO5 | Develop fuzzy expert systems. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

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| --- | --- | --- | --- |
| **Course Code** | **24MA1001** | **Duration** | **3hrs** |
| **Course Title** | **BASIC MATHEMATICS FOR NUMERICAL COMPUTING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the third eigen value, if two of the eigen value of the matrix  A =  are 3 and 15. | | CO1 | U | 1 |
| 2. | If the eigen values of the matrix A =  are -2,3,6, calculate the eigen values of | | CO1 | R | 1 |
| 3. | Identify the complementary function (C.F) for *(D2 – 4D + 4)y = 0.* | | CO2 | R | 1 |
| 4. | Determine the degree of the differential equation: | | CO2 | R | 1 |
| 5. | The Gauss-Elimination method is used to solve the system of -------- equations. | | CO3 | U | 1 |
| 6. | The number of normal equations to fit the straight line y = ax+ b is -------. | | CO3 | R | 1 |
| 7. | Interpret the meaning of Γ(5) in terms of the factorial function. | | CO4 | U | 1 |
| 8. | Compute | | CO4 | R | 1 |
| 9. | Recall the formula used for Newton’s backward interpolation. | | CO5 | R | 1 |
| 10. | Write down the error term obtained in Trapezoidal rule. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Estimate the product of the eigen values of the matrix | | CO1 | A | 3 |
| 12. | Compute the particular integral (P.I) for *(D2 +4D + 13) y = 2.* | | CO2 | U | 3 |
| 13. | Express the law y = axb into a linear form. | | CO3 | An | 3 |
| 14. | Evaluate using beta function. | | CO4 | U | 3 |
| 15. | Compute the area enclosed by the lines x=0, x=1, y=0 and y=1. | | CO5 | An | 3 |
| 16. | Calculate from the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | y | 10 | 22 | 26 | 29 | | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Compute the eigen values and eigen vectors of the matrix A= | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Solve the following ordinary differential equation by the method of variation of parameters : . | CO2 | A | 6 |
|  | b. | Compute the derivative of (i) (ii) . | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Solve the following system of equations using Gauss Elimination method. x+2y+z=3, 2x+3y+3z=10, 3x-y+2z=13 | CO3 | E | 6 |
|  | b. | By the method of least squares, find the best fitting a straight line to the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | | Y | 4 | 5 | 2 | 1 | | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Evaluate (i) (ii)(iii) | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and hence evaluate. | CO5 | E | 6 |
|  | b. | Evaluate +by changing into polar coordinates along the circle with radius 5. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. |  | Solve the following system of equations by Gauss Jacobi method: 8x-3y+2z=20; 4x+11y-z = 33; 6x+3y+12z = 35. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | State Cayley Hamiltonian theorem and verify it for the matrix  .. | CO1 | An | 6 |
|  | b. | Compute the value of y at x=21 from the following table using Newton’s forward difference formula.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 20 | 23 | 26 | 29 | | y | 0.3420 | 0.3907 | 0.4384 | 0.4848 | | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate using (i) Trapezoidal rule (ii) Simpson’s 1/3rd rule  (iii) Simpson’s 3/8th rule. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the quadratic form using orthogonal transformation of the matrix. |
| **CO2** | Solve the ordinary differential equations. |
| **CO3** | Develop knowledge in curve fitting. |
| **CO4** | Evaluate integration's using beta and gamma functions. |
| **CO5** | Gain knowledge in multiple integrals. |
| **CO6** | Evaluate differentiation and integration using numerical techniques. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24MA3001** | **Duration** | **3hrs** |
| **Course Title** | **MATHEMATICS FOR COMPUTER SCIENCE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Apply Fleury’s algorithm and find the Euler circuit in the following graph:  Euler Path Problems | CO1 | A | 8 |
|  | b. | Compute the chromatic number and chromatic polynomial of the following graphs:  An example of simple connected graphs ... | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | Prove that a tree with n vertices has n-1 edges. | CO2 | An | 8 |
|  | b. | Evaluate (i) 6 3 2 + \* 4 –  (ii) 5 6 2 + \* 12 4 / -  (iii) - \* 6 + 3 2 4  (iv) + 9 \* 2 6 | CO2 | E | 8 |
|  |  |  |  |  |  |
| 3. | a. | Prove the following statements, given *a, b,* and *c* are non-zero integers.  (*i* ) if *a* | *b* and *a* | *c*, then *a* | *(b* + *c)*; (*ii* ) if *a* | *b,* then *a* | *bc ,* for all integers *c*; (*iii* ) if *a* | *b* and *b* | *c*, then *a* | *c*. | CO3 | An | 8 |
|  | b. | Find GCD of 124 and 323 using Euclidean Algorithm and find its Bezout’s identity and Bezout’s Coefficients. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Find the output string generated by the finite state machine given in the following table, if the input string is 101011, 000011, 110000, 001. Also draw the state diagram.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | State | f | | g | | | Input | | Input | | | 0 | 1 | 0 | 1 | | S0 | S1 | S3 | 1 | 0 | | S1 | S1 | S2 | 1 | 1 | | S2 | S3 | S4 | 0 | 0 | | S3 | S1 | S0 | 0 | 0 | | S4 | S3 | S4 | 0 | 0 | | CO4 | A | 10 |
|  | b. | Let N = {S, A, B}, T = {0,1}. Find the language generated by the grammar G=(N, T, P, S) where the set P of productions consists of   1. S→ AB, A→ 01, B →11 2. S → AB, S →0A, A →0, B →10 3. S → AB, S → AA, A → 0B, A → 01, B → 1 | CO4 | A | 6 |
|  |  |  |  |  |  |
| 5. |  | The probability function of an infinite discrete distribution is given by  P(x = j) = 1/(2 j). Verify that the total probability is 1. Also find P(X is even), P(X ≥ 5), P(X is multiple of 7), mean of X and variance of X. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. |  | Explain Prim’s and Krushkal’s Algorithm. Evaluate the minimal spanning tree using Prim’s and Krushkal’s algorithm for the following graph. | CO2 | E | 16 |
|  |  |  |  |  |  |
| 7. | a. | The probability of A, B, C hitting the target is 1/2, 2/3, and 3/4 respectively. If all of them fire at the target then calculate the probability that (i) atleast one hits the target (ii) exactly one hits the target (iii) none hits the target. | CO5 | A | 6 |
|  | b. | An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two balls are drawn at random from the first urn and placed in the second urn and then 1 ball is taken at random from the latter. What is the probability that it is a white ball? | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | The following table shows the distribution of marks obtained by 60 students in a test. Compute mean, median and mode. Also find Quartile Deviation.   | Marks (Class Interval) | 0–10 | 10–20 | 20–30 | 30–40 | 40–50 | 50–60 | 60–70 | 70–80 | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | No. of Students (f) | 3 | 7 | 12 | 18 | 10 | 6 | 3 | 1 | | CO6 | E | 10 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | b. | The heights (in cm) and weights (in kg) of 10 persons are:   | Height (cms) X | 160 | 162 | 165 | 168 | 170 | 172 | 175 | 178 | 180 | 182 | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Weight(kgs) Y | 55 | 58 | 60 | 62 | 64 | 66 | 70 | 73 | 75 | 77 |   (i) Find the regression line of X on Y (ii) Find the regression line of Y on X. (iii) Predict the weight of a person with height 183 cms. (iv) Predict the height of a person weighing 68 kg . | CO6 | E | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply fundamental concepts of graph theory to real-world problems. |
| CO2 | Implement and analyze graph algorithms effectively. |
| CO3 | Employ principles of number theory to address mathematical problems. |
| CO4 | Design and analyze finite-state machines and regular grammars. |
| CO5 | Comprehend and apply probability principles in computational contexts. |
| CO6 | Examine and assess data to support informed decision-making in computing. |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24MA3002** | **Duration** | **3hrs** |
| **Course Title** | **FOUNDATIONS OF MATHEMATICS AND STATISTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | A farmer has 100 meters of fencing material and wants to enclose a rectangular area next to a river. The farmer does not need to fence the side along the river. Calculate the dimensions that the farmer should choose to maximize the area. | CO1 | A | 5 |
|  | b. | Compute the maximum and minimum value for the function  . | CO1 | A | 6 |
|  | c. | Evaluate (i)  (ii) | CO1 | A | 5 |
|  |  |  |  |  |  |
| 2. | a. | Suppose that a beam lies on the x-axis between x= 20 and x = 30, and has density function σ(x) = x−19. Calculate the center of mass. | CO2 | An | 5 |
|  | b. | Evaluate | CO2 | A | 6 |
|  | c. | Evaluate (i)  (ii) Using Bernoulli’s formula. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. Calculate the probability that the product is positive. | CO3 | An | 8 |
|  | b. | Four coins are tossed 100 times. The number of heads fallen in each of 100 times were noted and results are given below. Fit a binomial distribution to observed data and calculate the expected frequency values:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 5 | 29 | 36 | 25 | 5 | | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Estimate the mean, median, mode from the data given below:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Marks | 10 | 20 | 25 | 40 | 50 | | No. of Students | 20 | 30 | 50 | 15 | 5 | | CO4 | A | 8 |
|  | b. | Calculate the Spearman’s rank correlation coefficient from the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 50 | 60 | 70 | 80 | 90 | 60 | | Y | 55 | 60 | 65 | 75 | 85 | 75 | | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | A company has developed a new AI-based spam filter for their email service. They claim that 90% of all spam emails are successfully filtered by the new system. To test this claim, the company randomly selects a sample of 800 emails, and finds that 680 of them are correctly identified as spam. Test the company's claim at a 5% significance level. | CO6 | An | 8 |
|  | b. | The number of air-craft accidents that occurred during the various days of a week is given below. Test whether the accidents are uniformly distributed over the week.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Day | Mon | Tue | Wed | Thu | Fri | Sat | | No. of accidents | 15 | 19 | 13 | 12 | 16 | 15 | | CO6 | An | 8 |
|  |  |  |  |  |  |
| 6. | a. | In a test on 2000 bulbs, it was found that the life of a particular make was normally distributed with average life of 2060 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for   1. Less than 1950 hours 2. More than 2150 hours | CO5 | An | 6 |
|  | b. | Estimate the two lines of regression. Predict the productivity index when the test score is 92. Calculate the test score when the productivity index is 75.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Aptitude score | 60 | 68 | 65 | 70 | 72 | | Productivity index | 68 | 60 | 72 | 80 | 85 | | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | The average marks scored by 32 boys is 72 with a standard deviation of 8, while that for 36 girls is 70 with a standard deviation of 6. Test at 1% level of significance whether the boys perform better than girls. | CO6 | An | 8 |
|  | b. | A sample of size 13 gave an estimated population variance of 3 while another sample of size 15 gave an estimate of 2.5. Could both samples be from populations with same variance. | CO6 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | A completely randomized design experiment with 10 plots and 3 treatments gives the following results:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Plot No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Treatment | A | B | C | A | C | C | A | B | A | B | | Yield | 5 | 4 | 3 | 7 | 5 | 1 | 3 | 4 | 1 | 7 |   Analyze the results for treatment effects. | CO6 | An | 10 |
|  | b. | Varieties of a crop are tested in a randomized block design with 4 replications, the layout being as given below. The yields are given in kilograms. Analyze for significance of yield between the varieties of crops.   |  |  |  |  | | --- | --- | --- | --- | | C48 | A51 | B52 | A49 | | A47 | B49 | C52 | C51 | | B49 | C53 | A49 | B50 | | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Evaluate maxima and minima using differentiation techniques. |
| CO2 | Apply the concept of integration in their engineering studies**.** |
| CO3 | Solve real life problems using probability theory. |
| CO4 | Estimate the potential applications of various statistical concepts. |
| CO5 | Utilize the properties of various probability distributions in the field of biotechnology. |
| CO6 | Analyze hypothesis testing of small and large sample problems using statistical techniques |

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**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **25MA2007** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTATIONAL TOOLS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the operator used to perform element-wise multiplication in MATLAB. | | CO1 | R | 1 |
| 2. | The MATLAB command ‘clc’ is used to \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The MATLAB command used to find the second derivative of a symbolic function f with respect to x is\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | The MATLAB command used to integrate the symbolic function f with respect to x from a to b is \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | The operator used to concatenate vectors by columns in R is \_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The function that returns the number of rows in a data frame df in R is \_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | The R function that returns the coefficients of a fitted linear model is \_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | In R, the function used to display a summary of a linear regression model is \_\_\_\_\_. | | CO4 | R | 1 |
| 9. | Write the LaTeX command used to automatically create a table of contents. | | CO5 | R | 1 |
| 10. | Write the LaTeX command for an unnumbered section. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Use MATLAB to create an array A = [3, 6, 9, 12, 15, 18, 21].   1. Extract all elements greater than 10. 2. Replace elements divisible by 3 with 0. 3. Display the final array. | | CO1 | U | 3 |
| 12. | The altitude of a drone is . Use MATLAB to find the **velocity** and **acceleration** at t=1.5 seconds. | | CO2 | U | 3 |
| 13. | A startup records daily sign-ups: 50, 65, 70, 55, 80. Write an R program using a for loop to print only the sign-ups that are greater than 60. | | CO3 | U | 3 |
| 14. | A streaming service records daily new subscriptions: 400, 450, 500, 420, 480, 520, 510. Use R program to   1. Create a vector to store subscriptions. 2. Calculate the average new subscriptions per day. | | CO4 | U | 3 |
| 15. | A mathematician wants to write the quadratic formula: . Write the LaTeX code using the equation environment. | | CO5 | U | 3 |
| 16. | Write the LaTeX code to include the following references in a LaTeX report using the ‘thebibliography’ environment.   1. T. Hastie, R. Tibshirani, J. Friedman (2009). *The Elements of Statistical Learning.* Springer. 2. I. Goodfellow, Y. Bengio, A. Courville (2016). *Deep Learning.* MIT Press. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a MATLAB program using **for loop** to generate and display the multiplication tables of numbers from **1 to 3**, each up to **5**. | CO1 | A | 6 |
|  | b. | Write a MATLAB program using a switch statement that comments on a movie rating:   * '5' → 'Masterpiece!' * '4' → 'Great movie' * '3' → 'Average' * '2' → 'Below average' * '1' → 'Poor' * Any other input → 'Invalid rating'. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | A product’s revenue (in $) is: where x is the number of units sold. Find the number of units that maximizes revenue and compute the maximum revenue. | CO2 | A | 6 |
|  | b. | A coach records a runner’s velocity (m/s) over 5 seconds to evaluate sprint performance: t = 0:1:5; v = [0 3 6 9 7 5]. Use MATLAB to   1. Compute total distance covered. 2. Compute cumulative distance at each second. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Write an R program to:   1. Create a **matrix** that stores the marks of 3 students in 3 subjects: Math, Physics, and Chemistry. 2. **Print** the marks table with proper row and column names. 3. Calculate and display:  * The **average marks obtained by each student**. * The **average marks obtained in each subject**. | CO3 | A | 6 |
|  | b. | A coach wants to analyze players’ performance in a tournament across three matches.   1. Create a **data frame** storing points scored by 5 players in 3 matches. 2. Add columns for **Total Points** and **Average Points**. 3. Extract players with **Average Points > 20**. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | A household recorded electricity usage (kWh) for 6 months to monitor energy consumption: 320, 300, 340, 310, 320, 330. Write an R program to find the mean, median, and mode of electricity usage. | CO4 | A | 6 |
|  | b. | A software company collected data to predict the number of defects based on project metrics:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Project** | **Lines of Code (loc)** | **Developers (devs)** | **Development Time (days)** | **Bugs** | | 1 | 2000 | 2 | 30 | 5 | | 2 | 4000 | 3 | 45 | 8 | | 3 | 6000 | 3 | 50 | 10 | | 4 | 8000 | 4 | 60 | 12 | | 5 | 10000 | 5 | 70 | 14 | | 6 | 12000 | 6 | 80 | 17 |  1. Create a data frame in R. 2. Fit a linear regression model to predict Bugs using loc, devs, and Development Time. 3. Predict the number of defects for a project with 9000 loc, 4 developers, and 65 days. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Write the LaTeX code to display the following equations in proper mathematical environments   1. . 2. . 3. . | CO5 | A | 6 |
|  | b. | Write the LaTeX code to display the following matrix:   1. . | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Write a MATLAB function checkVotingEligibility that:   * Takes a person’s age as input. * Returns 'Eligible to vote' if age ≥ 18, 'Not eligible to vote' if age < 18. * Displays 'Invalid age entered' for negative ages or ages >120.   Test the function with ages: 16, 21, -5, 130. | CO1 | A | 6 |
|  | b. | Given are the marks of 2 students in 2 subjects: M = [85 90; 78 88]  Write a MATLAB program to compute and display:   1. Sum of all marks 2. Difference between the two students’ marks 3. M × Mᵀ 4. Mᵀ × M 5. Determinant of M 6. Inverse of M | CO1 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write the LaTeX code to format and display the following paragraph exactly as shown, including all text styles and symbols.  Computer Science is the study of **algorithms** and *data structures* that allow us to solve complex problems efficiently, and understanding the fundamentals of **underlined programming languages** is essential for any aspiring software engineer; key concepts such as **SMALL CAPS VARIABLES**, typewriter functions, and **blue-colored control structures** like loops and conditionals form the backbone of programming, while Greek letters like α, β, and γ frequently appear in machine learning and computational models, representing learning rates, weighting factors, and discount factors respectively, and good programming practices including **bold italics code readability**, **red underlined modularity**, and systematic debugging ensure maintainable and efficient software, highlighting that combining **logical thinking** with *creative problem solving* is the hallmark of an effective computer scientist. | CO5 | A | 6 |
|  | b. | Design a Beamer presentation titled “Machine Learning Types and Comparison.”   1. **Slide 1:** Include title, student, supervisor, and date. 2. **Slide 2:** List three types: Supervised, Unsupervised, and Reinforcement Learning. 3. **Slide 3:** Compare them based on data type, feedback mechanism, and examples. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write the LaTeX code to prepare a **professional resume** including the following sections:   1. **Name and Contact Information** - Include email, phone number, and any professional links (LinkedIn, GitHub). 2. **Education** - List your degree, institution, duration, and grades / percentage. 3. **Skills** - Programming languages, tools, and technologies you are proficient in. 4. **Project Details** - Include 2–3 significant projects with a brief description of your contributions. 5. **Industry Internship** - Include company name, role, duration, and key responsibilities. 6. **Extra-Curricular Activities** - List relevant activities such as club memberships, volunteering, or competitions. 7. **Achievements** - Highlight awards, certifications, or notable accomplishments. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Develop MATLAB code for solving engineering problems |
| **CO2** | Analyze the engineering problems using various plots and user defined functions using MATLAB commands |
| **CO3** | Apply fundamental R programming in construction and data manipulation techniques to organize, process, and analyze structured datasets. |
| **CO4** | Analyze datasets using data visualization, statistical methods, and introductory machine learning models to extract and communicate meaningful insights. |
| **CO5** | Use features designed for the production of the technical and scientific documentation |
| **CO6** | Create great looking presentations of their technical projects |