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| **Course Code** | **11MA201 / 12MA201 / MA244** | **Duration** | **3hrs** |
| **Course Name** | **ALGEBRA, DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State the fundamental theorem of algebra. | | CO1 | R | 1 |
| 2. | If one of the roots of the quadratic equation f(x) = 0 is 2 + 3i. What is the other root. | | CO1 | U | 1 |
| 3. | If the eigen values of a square matrix A of order 3 are 2, 4, 5. What are the eigen values of the matrix A3 ? | | CO1 | U | 1 |
| 4. | State Cayley Hamilton Theorem. | | CO1 | R | 1 |
| 5. | Write down the equation of the straight line through (2,3,6) and having direction cosines 1,2,3. | | CO1 | A | 1 |
| 6. | Write the equation of the plane in normal form. | | CO1 | R | 1 |
| 7. | What is the curvature of a straight line. | | CO1 | R | 1 |
| 8. | Write the equation of the circle of curvature. | | CO1 | R | 1 |
| 9. | If *u = x2y – y2x*, what is the value of | | CO1 | U | 1 |
| 10. | If then what is the value of | | CO1 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find one of the roots of x 3– 15x2 + 71x = 105 if they are in A.P. | | CO1 | E | 3 |
| 12. | Find the characteristic equation of the matrix | | CO1 | E | 3 |
| 13. | Find the envelope of , where m is a parameter. | | CO1 | E | 3 |
| 14. | Prove that the points A (3, 2, 4), B (4, 5, 2) and C (5, 8, 0) are collinear. | | CO1 | U | 3 |
| 15. | If and y, find the value of | | CO1 | E | 3 |
| 16. | Find the minimum of x2 + y2 + 6x + 12 | | CO1 | 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. |  | Solve x4 + 4x3 +5x2 +2x–2 = 0 given that –1+i is a root of the equation. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Reduce the quadratic form 3x2 + 5y2 + 3z2 -2yz +2zx – 2xy to the canonical form by orthogonal reduction and find its nature . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Show that the lines and are coplanar. Find their common point and the equation of the plane in which they lie. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Find the equation of the evolute of the parabola y2 = 4ax. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Expand ex sin y in powers of x and y up to the third degree terms. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the image of the point (5, 3, 2) in the plane x + y – z = 5 | CO1 | E | 6 |
|  | b. | Find the angle between the two planes 13x+6y+5z+1=0 and 6z–4y–2x+81 = 0. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 23. |  | Verify Cayley-Hamilton theorem for the matrix and hence evaluate A-1? | CO1 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A rectangular box, open at the top, is to have a given quantity of 32 c.c. Find the dimensions of the box which requires least material for its construction. | CO1 | E | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to relate their subject knowledge with their engineering subjects during their course of study |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 7 | 25 | 24 | 63 | - | 124 |
| CO2 | - | - | - | - | - | - | - |
| CO3 | - | - | - | - | - | - | - |
| CO4 | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - |
|  | | | | | | | **124** |



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| **Course Code** | **11MA202/ 12MA202/ MA245** | **Duration** | **3hrs** |
| **Course Name** | **MULTIPLE INTEGRALS, DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Evaluate | | CO1 | R | 1 |
| 2. | Write the formula for finding the volume of a curve. | | CO1 | R | 1 |
| 3. | = ------. | | CO1 | R | 1 |
| 4. | Find the value of | | CO1 | R | 1 |
| 5. | Find the particular integral of (D2 + 3) y = cos2x. | | CO1 | R | 1 |
| 6. | Write down the formula to find the complementary function if the roots are imaginary. | | CO1 | R | 1 |
| 7. | Prove that  is solenoidal. | | CO1 | R | 1 |
| 8. | Find  if | | CO1 | R | 1 |
| 9. | The value of L(sint) is \_\_\_\_\_\_. | | CO1 | R | 1 |
| 10. | = ------------. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Calculate | | CO1 | U | 3 |
| 12. | Evaluate | | CO1 | U | 3 |
| 13. | Solve (D2 – 6D+ 9) y= 0. | | CO1 | U | 3 |
| 14. | Find  if | | CO1 | U | 3 |
| 15. | Find the Laplace transform of sin5t- cos2t. | | CO1 | U | 3 |
| 16. | Find | | CO1 | 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. |  | Find the area of the ellipse . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Establish a relation between Beta and Gamma functions. | CO1 | A | 8 |
|  | b. | Evaluate | CO1 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Solve (D2 + 6D + 9) y = e-2x. | CO1 | A | 6 |
|  | b. | Solve (D2 + 5D + 6) y = x3. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Verify Gauss divergence theorem for taken over the cube bounded by the planes x = 0, x = 1, y = 0, y = 1, z = 0 and z= 1. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Find Laplace transform of (i) sinat-4cos2t (ii) e-t sint . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Find the volume of the tetrahedron bounded by the co-ordinate planes and | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate | CO1 | A | 6 |
|  | b. | Solve (D2 + D + 1) y = ex. | CO1 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find  using partial fraction method. | CO1 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to relate their subject knowledge with their engineering subjects during  their course of study. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 22 | 92 | - | - | - | 124 |
|  | | | | | | | **124** |



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| **Course Code** | **11MA203/12MA203** | **Duration** | **3hrs** |
| **Course Name** | **ALGEBRA, ANALYTICAL GEOMETRY AND CALCULUS I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Simplify . | | CO1 | E | 1 |
| 2. | Find the real and imaginary parts of . | | CO1 | E | 1 |
| 3. | If y = x5 , find | | CO2 | E | 1 |
| 4. | Find | | CO2 | E | 1 |
| 5. | Evaluate | | CO3 | E | 1 |
| 6. | \_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Find the equation of the straight line passing through the points (1, 3) and (2, 1). | | CO4 | A | 1 |
| 8. | Find the equation of a circle if the center and radius are (2,–3) and 4 respectively. | | CO5 | A | 1 |
| 9. | Solve the equation  one root being . | | CO6 | E | 1 |
| 10. | If the roots of the equation are in G.P then one of its root is \_\_\_\_\_\_\_\_\_\_. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Prove that . | | CO1 | A | 3 |
| 12. | Find  if and . | | CO2 | E | 3 |
| 13. | Find . | | CO3 | E | 3 |
| 14. | Find the equation of the line passing through the point (–2, 9) and  perpendicular to the line joining the points (7, –4) and (–6, 5). | | CO4 | A | 3 |
| 15. | If  is a root of the second degree equation then find the equation. | | CO5 | A | 3 |
| 16. | Evaluate . | | CO3 | 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. | a. | Prove that . | CO1 | A | 6 |
|  | b. | If A + B = 45°, Show that ( 1+ tan A) (1+ tan B) =2 | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Differentiate with respect to x | CO2 | E | 6 |
|  | b. | Find  if y = log (log x). | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate | CO3 | E | 6 |
|  | b. | Evaluate | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. |  | Find the axis, vertex, focus, directrix, equation of the latus rectum,  length of the latus rectum for the parabola and hence draw their graphs  (y+2)2 = –8(x + 1) | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Solve . | CO5 | E | 6 |
|  | b. | Solve given that two roots are in the ratio. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Find, if where is the parameter. | CO2 | E | 6 |
|  | b. | Evaluate | CO3 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find the angle between the straight lines 3x–2y + 9 = 0 and 2x + y – 9 = 0. | CO4 | A | 6 |
|  | b. | Find the equation of an ellipse whose major axis is along x- axis, centre at the origin and which passes through (2, 1) and having eccentricity | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Increase the root of the equation  by 2 and hence solve it. | CO6 | A | 6 |
|  | b. | Solve  given that the roots of equation are in A.P. | CO6 | E | 6 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concept of Trigonometry. |
| CO2 | Understand the concept and application of Differentiation. |
| CO3 | Apply the concept of Integration techniques. |
| CO4 | Understand the concept of analytical geometry. |
| CO5 | Apply the concept of Conics. |
| CO6 | Understand the concept of theory of equations. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 15 | - | 2 | - | 17 |
| CO2 | - | - | - | - | 23 | - | 23 |
| CO3 | 1 | - | - | - | 25 | - | 26 |
| CO4 | - | - | 10 | - | 12 | - | 22 |
| CO5 | - | - | 10 | - | 12 | - | 22 |
| CO6 | - | - | 6 | - | 8 | - | 14 |
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| **Course Code** | **12MA337** | **Duration** | **3hrs** |
| **Course Name** | **GRAPH THEORY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | | **Marks** | |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | | | | |
| 1. | | a. | Define Graph with example. | CO1 | | U | | 5 |
|  | | b. | Prove that, in any graph, the number of vertices of odd degree is even. | CO1 | | An | | 10 |
|  | | c. | For the below graph, find its incidence matrix and adjacency matrix | CO1 | | E | | 5 |
|  | |  | **(OR)** |  | |  | |  |
| 2. | | a. | What is tree? | CO1 | | R | | 5 |
|  | | b. | Show that, in a tree, any two vertices are connected by a unique path. | CO1 | | An | | 10 |
|  | | c. | Prove that if G is a tree, then e = v - 1. | CO1 | | An | | 5 |
|  | |  |  |  | |  | |  |
| 3. | | a. | Explain Block. | CO1 | | R | | 5 |
|  | | b. | Prove that a graph G with v ≥ 3 is 2-connected if and only if any two vertices of G are connected by at least two internally-disjoint paths. | CO1 | | An | | 15 |
|  | |  | **(OR)** |  | |  | |  |
| 4. | | a. | Explain Euler Tours. | CO 1 | | R | | 8 |
|  | | b. | Prove that a nonempty connected· graph is Eulerian if and only if it has  no vertices of odd degree. | CO 1 | | A | | 12 |
|  | |  |  |  | |  | |  |
| 5. | | a. | Prove the following statements.  (i) A matching M in G is a maximum matching if and only if G contains no M-augmenting paths.  (ii) Let G be a bipartite graph with bipartition (X, Y). Then G  contains a matching that saturates every vertex in X if and only if  |N(S)| ≥ |S| for all subset S of X. | CO 1 | | U | | 20 |
|  | |  | **(OR)** |  | |  | |  |
| 6. | |  | State and prove Vizing's Theorem. | CO1 | | E | | 20 |
|  | |  |  |  | |  | |  |
| 7. | | a. | Prove that every planar graph is 5-vertex-colourable. | CO1 | | A | | 5 |
|  | | 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. | CO1 | | E | | 15 |
|  | |  | **(OR)** |  | |  | |  |
| 8. | |  | State and prove Ramsey's theorem. | CO 1 | | An | | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | | |
| 9. | |  | State and prove Brook's theorem. | CO1 | | A | | 20 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | At the end of the course, scholars will able to get knowledge in trees, vertex coloring and planar graphs. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 18 | 25 | 37 | 60 | 40 | - | 180 |



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| **Course Code** | **13MA311** | **Duration** | **3hrs** |
| **Course Name** | **FUZZY SETS AND SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Let.  Given and  are the fuzzy sets of. Find, ,, , ,, , , and . | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Let. Given  and are the fuzzy sets of.  Find,, ,,. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | State and prove First Decomposition theorem. Let A be a fuzzy set defined on the set X where . Represent A using First decomposition Theorem. | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Let. Given  and are the fuzzy sets of.  Find Standard Product, Algebraic Product, Bounded Product, Drastic Product. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Given A = [2, -6] and B = [1, 5] are two fuzzy numbers. Find  A + B, A - B, A • B and A / B. | CO1 | A | 10 |
|  | b. | Given A = {(5, 1), (6, 0.5)} and B = {(4, 1), (6, 0.5)} are two fuzzy numbers. Find A + B and A - B | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Find the solution of the equation A + X = B, where A and B are two fuzzy numbers defined by | CO1 | An | 20 |
| 7. |  | Draw the general scheme of a fuzzy controller and explain its components. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the characteristics of Fuzzy Automata. | CO1 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain the method of individual fuzzy decision making with suitable example. | CO1 | U | 20 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be familiar with the applications fuzzy mathematics to Controllers, Decision making systems and Neural networks |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 60 | 80 | 40 |  |  | 180 |
|  | | | | | | | **180** |



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| **Course Code** | **14MA2001/17MA2001** | **Duration** | **3hrs** |
| **Course Name** | **VECTOR CALCULUS AND COMPLEX ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If , then curl= ----- | | CO2 | U | 1 |
| 2. | A vector is said to be solenoidal if ---- | | CO2 | R | 1 |
| 3. | The -------- theorem relates surface integral and volume integral. | | CO1 | R | 1 |
| 4. |  | | 5 | U | 1 |
| 5. |  | | CO4 | R | 1 |
| 6. | Write down the CR equations in polar form. | | CO4 | R | 1 |
| 7. | A mapping which preserves the angle both in magnitude and direction is called\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 8. | If the mapping is represented as w=z2, find the imaginary part v**.** | | CO3 | E | 1 |
| 9. | Find the poles of the function | | CO6 | E | 1 |
| 10. | Evaluate  , where C is =3 . | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the directional derivative of  at (-1,1,2) in the direction of . | | CO5 | E | 3 |
| 12. | State Stoke’s theorem. | | CO1 | R | 3 |
| 13. | Check whether the function  is harmonic or not. | | CO4 | An | 3 |
| 14. | Find the fixed points of (i) w =1/z (ii) w=9/z | | CO3 | A | 3 |
| 15. |  | | CO6 | E | 3 |
| 16. | Check whether the functon f(z)=e-z is analytic or not. | | 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. | a. | Find the angle between the two surfaces  and  at the point . | CO2 | E | 6 |
|  | b. | A particle moves along the curve x=e-t, y=cos3t, z=2sin3t where t is the time period. Find the component of velocity and acceleration at time  t =0. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Verify Gauss divergence theorem ,  taken over the cube bounded by the plane x=0, x=1, y=0, y=1, z=0, z=1. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the analytic function whose real part is . | CO4 | E | 6 |
|  | b. | If f(z) is analytic, then prove that | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Find the image of the strip 1<x<2 under the transformation | CO3 | A | 6 |
|  | b. | Find the bilinear transformation which maps the points z=1,1,-1 on to the points w=0,1, | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. |  | CO4 | E | 6 |
|  | b. | Using Cauchy’s Residue theorem, evaluate , where  C:=2 | CO6 | An | 6 |
|  |  |  |  |  |  |
| 22. |  |  | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. |  | CO2 | E | 6 |
|  | b. | If ,find (i) grad (div) (ii) at  (1, 2, 3). | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate using contour integration. | CO6 | E | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the application of Stokes theorem. |
| CO2 | Relate their knowledge in complex variables with their engineering subjects during their course of study. |
| CO3 | Apply transformation techniques in engineering problems. |
| CO4 | Understand the main properties and examples of analytic functions and be able to compute and manipulate series expansions for analytic functions. |
| CO5 | Perform basic calculations relating to tangent planes, directional derivatives, curves and surfaces in three dimensional space. |
| CO6 | Use the major integral theorems, able to identify and classify zeroes and poles of functions and find their residues. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | - | - | 12 | - | - | 16 |
| CO2 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO3 | - | 1 | 15 | - | 1 | - | 17 |
| CO4 | 2 | - | 6 | 3 | 12 | - | 23 |
| CO5 | - | 1 | 12 | - | 3 | - | 16 |
| CO6 | - | - | 12 | 6 | 17 | - | 35 |
|  | | | | | | | **124** |



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| **Course Code** | **14MA2003/17MA2003** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL TRANSFORMS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | *L*…….. | | CO1 | R | 1 |
| 2. | *L(tn)* = …… | | CO1 | R | 1 |
| 3. | = …… | | CO2 | U | 1 |
| 4. | =…… | | CO2 | U | 1 |
| 5. | State the *Linearity property* of Fourier Transforms. | | CO3 | U | 1 |
| 6. | The *Fourier Cosine Transform* of *e – ax*is …….. | | CO3 | An | 1 |
| 7. | *Z(cos)* = ……. | | CO4 | A | 1 |
| 8. | *Z* = …… | | CO4 | A | 1 |
| 9. | = …… | | CO5 | U | 1 |
| 10. | …… | | CO5 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find. | | CO1 | An | 3 |
| 12. | State *Convolution Theorem* of Laplace Transform. | | CO2 | R | 3 |
| 13. | Find the finite Fourier sine transform of *f(x) = eax in (0, l).* | | CO3 | A | 3 |
| 14. | Find . | | CO4 | An | 3 |
| 15. | Find Z. | | CO5 | An | 3 |
| 16. | Find | | CO5 | 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. | a. | Find L. | CO1 | A | 6 |
|  | b. | Find . | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find . | CO2 | An | 6 |
|  | b. | Find using partial fraction. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Find the Fourier Transform of and hence deduce that . | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Find the Z-transform of and. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate by using convolution. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Using Laplace Transform, solve given *y(0) = 2* and . | CO6 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Find the inverse Z-transform of using partial fraction method. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Use Z- transform to solve the difference equation subject to . | CO6 | E | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to discriminate & learn all the properties of Laplace Transform. |
| CO2 | The students will be able to apply Laplace Transforms in mechanical & signal system engineering problems. |
| CO3 | The students will be able to evaluate certain definite integrals with infinite limits using Fourier Transform. |
| CO4 | The students will be able to categorize Z-Transform of sequence and series. |
| CO5 | The students will be able to list the formulas & properties of Z-Transform & Inverse Z-Transform. |
| CO6 | The students will be able to solve difference and differential equations problems in their engineering fields. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | - | 12 | 3 | - | - | 17 |
| CO2 | 3 | 2 | - | 12 | - | - | 17 |
| CO3 | - | 1 | 3 | 1 | 12 | - | 17 |
| CO4 | - | - | 2 | 15 | - | - | 17 |
| CO5 | - | 1 | 24 | 4 | 3 | - | 32 |
| CO6 | - | - | - | 12 | 12 | - | 24 |
|  | | | | | | | **124** |



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| **Course Code** | **14MA2005/17MA2005** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL FOUNDATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the imaginary part of cos. | | CO1 | U | 1 |
| 2. | Write the formula for . | | CO1 | R | 1 |
| 3. | State Cayley Hamilton theorem. | | CO2 | U | 1 |
| 4. | Find sum of the eigen values of the matrix. | | CO2 | R | 1 |
| 5. | Differentiate with respect to x. | | CO3 | U | 1 |
| 6. | If then find . | | CO3 | R | 1 |
| 7. | =\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | Evaluate dx. | | CO4 | R | 1 |
| 9. | If the roots of the auxilllary equation are 3 and 3, then write the complementary function. | | CO5 | R | 1 |
| 10. | Solve . | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Separate into real and imaginary parts of | | CO1 | U | 3 |
| 12. | Find the rank of the matrix . | | CO2 | U | 3 |
| 13. | Differentiate  with respect to x. | | CO3 | U | 3 |
| 14. | Evaluate . | | CO4 | U | 3 |
| 15. | Evaluate . | | CO5 | U | 3 |
| 16. | Find the particular integral of . | | 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. | Express in terms of . | CO1 | A | 6 |
|  | b. | If , then prove that | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Find the eigen values and eigen vectors of the matrix =. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | If then find . | CO3 | A | 6 |
|  | b. | Differentiate with respect to x. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Evaluate using method of partial fraction. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Prove that . | CO5 | A | 6 |
|  | b. | Evaluate . | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Prove that (. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Verify Cayley Hamilton Theorem for the matrix . | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Apply the knowledge of trigonometry in engineering. |
| CO2 | Apply the knowledge of matrices in computing. |
| CO3 | Solve engineering problems using differentiation. |
| CO4 | Apply the knowledge of curvature. |
| CO5 | Solve engineering problems using ODE solutions. |
| CO6 | Solve engineering problems using homogeneous ODE solutions. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO/P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 1 | 4 | 24 | - | - | - | 29 |
| CO3 | 1 | 4 | 24 | - | - | - | 29 |
| CO4 | 1 | 4 | 12 | - | - | - | 17 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
| 6 22 96 | | | | | | | **124** |



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| **Course Code** | **14MA2010/17MA2010** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE MATHEMATICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | GCD (45, 33) = \_\_\_\_\_\_\_\_\_\_. | | | CO1 | A | 1 |
| 2. | Ifand let R = {(1, 2), (2, 3), (1, 3), (4, 4)} then R is a \_\_\_\_\_\_\_\_\_\_ relation. | | | CO1 | R | 1 |
| 3. | The explicit formula of the sequence 5, 10, 15, ,… is \_\_\_\_\_\_\_\_\_ | | | CO2 | U | 1 |
| 4. | Let and let. Then the relation R is defined by aRb iff \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO2 | R | 1 |
| 5. | If R is a symmetric relation on a set A, then \_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | R | 1 |
| 6. | The degree of the vertex *c* in the graph is \_\_\_\_\_\_\_. | | | CO3 | U | 1 |
| 7. | A path of length 3 from vertex *d* to *a* is \_\_\_\_\_\_\_\_. | | | CO4 | U | 1 |
| 8. | A Hamilton path is a path that contains each \_\_\_\_\_\_exactly once. | | | CO4 | A | 1 |
| 9. | The minimal elements of the poset whose Hasse diagram is given below are \_\_\_\_\_\_\_ | | | CO5 | U | 1 |
| 10. | Write the elements of the set . | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Construct the tree of the algebraic expression and find the height of the tree. | | | CO1 | A | 3 |
| 12. | Construct the logic diagram for the Boolean polynomial | | | CO2 | An | 3 |
| 13. | Let and . Find the reflexive closure and symmetric closure of R. | | | CO3 | R | 3 |
| 14. | Let . Draw the Hasse diagram for the poset . | | | CO4 | A | 3 |
| 15. | Let A = {1, 2, 3, 4, 5}. Describe the ordered pairs in the relation determined by the hasse diagram. | | | CO5 | U | 3 |
| 16. | Find all the possible spanning trees for the graph shown below. | | | 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. | | a. | Using Euclidean algorithm, find the G.C.D of (273, 98) and express it as d = sa + tb. | CO1 | A | 6 |
|  | | b. | Show that  is a tautology. | CO1 | E | 6 |
|  | |  |  |  |  |  |
| 18. | |  | Use Warshall’s algorithm to find the transitive closure of R, whose matrix is given below, on the set {1,2,3,4} | CO2 | An | 12 |
|  | |  |  |  |  |  |
| 19. | |  | Draw the Hasse Diagram of the poset . Prove that it is a Lattice and find the complement element for every element of the set. | CO3 | An | 12 |
|  | |  |  |  |  |  |
| 20. | |  | Find the minimal spanning tree for the graph given below.  C  E  2  3  B  A  D  F  G  H  3  6  5  2  2  6  3  4  5  4 | CO4 | An | 12 |
|  | |  |  |  |  |  |
| 21. | |  | Use Fluery’s algorithm to construct an Euler circuit for the following graph. | CO5 | An | 12 |
|  | |  |  |  |  |  |
| 22. | | a. | If *A ={1, 2, 3, 4, 5, 6}* and the relation *R* on *A* is defined by *R={ (1,2), (1,3), (2,2), (2,6), (3,4), (3,5), (4,2), (4,3), (5,6), (6,4)}*. Find (i) MR (ii) digraph of R (iii) In-degrees and out degrees of all elements of A. | CO4 | An | 6 |
|  | | b. | Let A = {1, 2, 3, 4} and let R = {(1,1), (1,2), (2,1), (2,2), (3,4), (4,3), (3,3), (4,4)}. Determine whether the relation R on the set A is an equivalence relation. | CO4 | E | 6 |
|  | |  |  |  |  |  |
| 23. | | a. | Construct the truth table for the Boolean function.Also draw the logic diagram for the polynomial. | CO5 | An | 6 |
|  | | b. | Let R = {(t, u), (u, w),(u, x),(u, v),(v, z),(v, y)} be a relation on the set A = {t, u, v, w, x, y, z}. Determine whether R is a tree. If so, find its root and draw it. | CO5 | An | 6 |
|  | |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | |  | Let G be the set of all nonzero real numbers and let a\*b = ab / 2. Show that (G, \*) is an Abelian group. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamental mathematical concepts and terminology. |
| CO2 | Use and analyse recursive definitions. |
| CO3 | Use techniques for constructing mathematical proof. |
| CO4 | Understand the concepts of coding and decoding. |
| CO5 | Develop modelling for computer science and engineering problems. |
| CO6 | Understand some basic properties of graphs and related discrete structures and be able to relate. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 |  | 10 |  | 6 | - | 17 |
| CO2 | 1 | 1 |  | 15 |  | - | 17 |
| CO3 | 4 | 1 |  | 12 |  | - | 17 |
| CO4 |  | 1 | 4 | 18 | 6 | - | 29 |
| CO5 |  | 4 |  | 24 |  | - | 28 |
| CO6 |  | 1 |  | 12 | 3 | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **14MA2015/17MA2015** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY, RANDOM PROCESS AND NUMERICAL METHODS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | A ball is picked from a bag containing 8 yellow, 7 blue, and 6 black balls. What is the probability that it is neither yellow nor black? | | CO1 | U | 1 |
| 2. | What is the probability that there will be 53 Sundays in a leap year? | | CO1 | R | 1 |
| 3. | A random variable X has the following probability density function f(x)=kx,0<x<1.Find the value of k | | CO2 | R | 1 |
| 4. | If F(x) is the CDF of a random variable X, then | | CO2 | R | 1 |
| 5. | What is the mean of Poisson distribution? | | CO3 | U | 1 |
| 6. | The variance of Exponential distribution is ----------. | | CO3 | R | 1 |
| 7. | Define a WSS process. | | CO5 | U | 1 |
| 8. | In a random process X{(s,t)},if s is fixed then X{(s,t)}is a---------. | | CO5 | R | 1 |
| 9. | State Newton’s backward difference formula to find dy/dx. | | CO6 | U | 1 |
| 10. | In order to apply Simpson’s one-third rule, the number of intervals must be ----------. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If P(A) = 1/3, P(B)=1/4 and  P(AՈB)= 1/12 then find P(A/B). | | CO1 | U | 3 |
| 12. | A random variable X has the following probability distribution. Find the value of k   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | P(x) | 0 | k | 2k | 2k | 3k | k2 | 2 k2 | 7 k2 +k | | | CO2 | E | 3 |
| 13. | When seven coins are thrown simultaneously, find the probability of getting exactly three heads | | CO3 | U | 3 |
| 14. | Find the mean of the stationary process whose autocorrelation function is | | CO4 | U | 3 |
| 15. | Define Correlation Ergodic process | | CO6 | U | 3 |
| 16. | The table given below gives the velocity v of a moving particle at  time ‘t’ seconds. Find the distance covered by the particle in 12 sec.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | t | 0 | 2 | 4 | 6 | 8 | 10 | 12 | | v | 4 | 6 | 16 | 34 | 60 | 94 | 136 | | | 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. | a. | The chances of A, B and C becoming the general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company. If A,B and C become general manager are 0.3,0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as general manager? | CO1 | A | 6 |
|  | b. | A problem is given to 3 students whose chances of solving it are  1/2,1/3 and 1/4. What is the probability that (i) Exactly two of them  solves the problem (ii) atleast one of the solves the problem.(iii)  None of them solves the problem | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | The 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) Evaluate *P(X<2)* and *P(-2<X<2)* (iii) Find the cdf of X and (iv) Evaluate the mean of X. | CO2 | E | 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 Find (i) K (ii) Marginal probability distributions (iii) Conditional probability distributions | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a Binomial Distribution to the following data and find theoretical frequencies.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | f | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO3 | A | 6 |
|  | b. | 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 (iii) Between Rs.69 and Rs.72 | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Fit a poisson distribution to the following data and find the theoretical frequencies.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | f | 142 | 156 | 69 | 27 | 5 | 1 | | CO4 | A | 6 |
|  | b. | The mileage which car owners get with a certain kind of radial tire is a random variable having an exponential distribution with mean 40,000 km. Find the probabilities that one of these tires will last (i) atleast 20,000 km and (ii) at most 30,000 km | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Two random processes and are defined by  and Show that and are jointly wide sense process, where‘’ and ‘’ are random variables. If (i) (ii) (iii) | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate by using (i) Trapezoidal rule (ii) Simpson’s rules | CO5 | A | 6 |
|  | b. | Find at x=30 and x=35 from the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | y | 85.9 | 86.85 | 87.73 | 88.64 | 89.52 | 90.37 | 91.1 | | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find the value of y at x=0.1 using (i) Euler’s method (ii) Taylor’s method (iii) Fourth order Runge-Kutta methods for the differential equation of given y(0)=1. | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to gain knowledge in Probability theory. |
| CO2 | Students will get knowledge on various distributions. |
| CO3 | Students will be able to make simple mathematical descriptions or modeling of random  Signals. |
| CO4 | Students will be able to solve problems based on central limit theorem. |
| CO5 | Students are able to apply numerical methods for scientific computing. |
| CO6 | Students are able to solve differential equations using numerical methods. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 2 | - | 12 | - | 15 | - | 29 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | - | 3 | 12 | 12 | - | - | 27 |
| CO5 | 1 | 1 | 12 | - | - | - | 14 |
| CO6 | - | 5 | - | 12 | 3 | - | 20 |
|  | | | | | | | **124** |



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| **Course Code** | **16MA3004** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED OPERATIONS RESEARCH** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | A company manufactures two products A and B. Both the products pass through two machines M1 and M2. The time required to process each unit of products A and B on each machine and the available machine capacity are given below:   |  |  |  | | --- | --- | --- | |  | Machine | | |  | M1 | M2 | |  | Processing time per unit (in hours) | | | A | 6 | 2 | | B | 4 | 4 | | Available capacity (Hours) | 3600 | 2000 |   The availability of materials is sufficient to produce 500 nos. of product ‘A’ and 400 nos. of product ‘B’. Each unit of product ‘A’ gives a profit of Rs. 25 and each unit of product ‘B’ gives a profit of Rs. 20. Construct a Linear Programming Model to determine the quantity of each product to be manufactured to maximize the profit and solve it using graphical method. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Solve the following linear programming problem by simplex method.  Max Z= 3x+5y  Subject to x ≤ 40, y ≤ 30, x + y ≤ 60, x , y ≥ 0. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | Find the initial basic feasible solution of the following transportation problem by North west corner rule and Vogel’s approximation method:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Source | Destination | | | | Supply | |  | I | II | III |  | | A | 1 | 2 | 6 | 7 | | B | 0 | 4 | 2 | 12 | | C | 3 | 1 | 5 | 11 | | Demand | 10 | 10 | 10 |  | | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Find the optimal job sequence and idle time in each machine involving three machines in the order M1, M2 and M3 for the following five jobs J1, J2, J3, J4 and J5. The processing time in each machine is given below.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Job | J1 | J2 | J3 | J4 | J5 | | Machine M1 | 7 | 12 | 11 | 9 | 8 | | Machine M2 | 8 | 9 | 5 | 6 | 7 | | Machine M3 | 11 | 13 | 9 | 10 | 11 | | CO1 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | A Machine tool company decides to make four sub-assemblies through four contractors. Each contractor is to receive only one sub-assembly. The cost of each sub-assembly is determined by the bids submitted by each contractor  (in thousands of rupees)and is shown in the table below:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | Contractors | | | | |  |  | I | II | III | IV | | Sub-assemblies | A | 15 | 13 | 14 | 17 | | B | 11 | 12 | 15 | 13 | | C | 13 | 12 | 10 | 11 | | D | 15 | 17 | 14 | 16 |   Solve the problem using Hungarian Method and arrive at the optimal assignment. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | There are two players in a game, Player A and player B. Each of them randomly shows selected fingers of his right hand. If the sum of the number of fingers shown by both the players is an even number, then the player B has to give money in rupees equivalent to the number of fingers shown by him to the player A; if the sum of the number of fingers shown by both the players is an odd number, then the player A has to give money in rupees equivalent to the number of fingers shown by him to the Player B. Construct the matrix with respect to the player A and find the optimal solution for this game. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | The cost of a machine is Rs. 61,000. And its scrap value is Rs. 1000. The maintenance costs assessed from experience are found to be as shown in the table below:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Maintenance Cost (Rs.) | 1000 | 2500 | 4000 | 6000 | 9000 | 12500 | 16000 | 20000 |   When should the machine be replaced? | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | At a public Telephone booth in a Post Office arrivals are considered to be Poisson with an average inter-arrival time of 12 minutes. The length of the phone call may be assumed to be distributed exponentially with an average of 4 minutes. Calculate the following:   1. What is the probability that a fresh arrival will not have to wait for the phone? 2. What is the probability that an arrival will have to wait more than 10 minutes before the phone is free? 3. What is the average length of Queue formed from time to time? | CO2 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Consider the following table summarizing the details of a project involving 11 activities.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Activity | Predecessor(s) | Duration (weeks) | | | | a | m | b | | A | - | 6 | 7 | 8 | | B | - | 1 | 2 | 9 | | C | - | 1 | 4 | 7 | | D | A | 1 | 2 | 3 | | E | A,B | 1 | 2 | 9 | | F | C | 1 | 5 | 9 | | G | C | 2 | 2 | 8 | | H | E,F | 4 | 4 | 4 | | I | E,F | 4 | 4 | 10 | | J | D,H | 2 | 5 | 14 | | K | I,G | 2 | 2 | 8 |  1. Construct the project network. 2. Find the expected duration and variance of each activity. 3. Find the critical path and the expected project completion time. | CO3 | A | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to develop linear programming. |
| CO2 | The students will be able to determine optimal solutions to a variety of mathematical programming problems. |
| CO3 | The students will be able to present managerial recommendations based on optimal solutions. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 40 | 40 |  |  |  | 80 |
| CO2 |  |  | 40 | 40 |  |  | 80 |
| CO3 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **16MA4001** | **Duration** | **3hrs** |
| **Course Name** | **RESEARCH METHODOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Define Research and explain the types of research. | CO1 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Draw a flow chart of the research process and explain the steps involved in it. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the problems encountered by researchers in India. | CO1 | An | 10 |
|  | b. | Explain the techniques involved in defining a research problem. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain the different types of sample designs. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain the classification of measurement scales. | CO1 | U | 10 |
|  | b. | State the importance of rating scales and explain the different types of rating scales used in research. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the different types of informal experimental designs. | CO2 | U | 10 |
|  | b. | Discuss the various types of graphical representation of data. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. |  | Define hypothesis and discuss the characteristics of hypothesis. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Find the mean median and mode of the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | f | 5 | 9 | 12 | 17 | 14 | 10 | 6 | | CO2 | A | 10 |
|  | b. | Obtain the rank correlation coefficient for the following data.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 40 | 65 | 61 | 49 | 53 | 42 | 68 | 57 | 58 | 46 | | y | 51 | 58 | 67 | 55 | 76 | 45 | 69 | 56 | 73 | 63 | | CO2 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the steps involved in writing a research report. | CO3 | U | 10 |
|  | b. | Explain the ethical practices to be followed in research. | CO3 | U | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Review the current research based on literature and identify a research gap, define research problem, formulate hypothesis and methodology for research. |
| CO2 | Gain hands on experience in the usage of various techniques and statistical tools for research. |
| CO3 | Publish one literature review article in a reputed journal. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 20 | 70 | 10 |  |  |  | 100 |
| CO2 |  | 20 | 40 |  |  |  | 60 |
| CO3 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **17MA1006** | **Duration** | **3hrs** |
| **Course Name** | **FOUNDATIONS OF MATHEMATICS AND STATISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | |
| 1. | State the condition on which the binomial expansion is valid. | | CO6 | R | 1 |
| 2. | Expand in terms of . | | CO6 | U | 1 |
| 3. | Expand . | | CO6 | R | 1 |
| 4. | Find the value of in . | | CO6 | U | 1 |
| 5. | Find . | | CO2 | R | 1 |
| 6. | Find if . | | CO2 | U | 1 |
| 7. | Evaluate ­­­­­. | | CO3 | R | 1 |
| 8. | Evaluate ­­­­­­. | | CO3 | U | 1 |
| 9. | If and are independent events then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 10. | If and are mutually exclusive events then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 11. | Find the probability of getting a tail when a coin is tossed. | | CO4 | R | 1 |
| 12. | If is the complementary event of , then =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 13. | The mean of the binomial distribution is \_\_\_\_\_. | | CO2 | R | 1 |
| 14. | Variance of the poisson distribution is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 15. | The probability mass function of the poisson distribution is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 16. | The standard normal variate ­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| 17. | When the sample size n is < 30, we used \_\_\_\_\_\_\_\_ sample test. | | CO5 | R | 1 |
| 18. | State the formula to find the test statistic for goodness of fit. | | CO4 | U | 1 |
| 19. | Define Null hypothesis. | | CO3 | R | 1 |
| 20. | The ‘t’-test statistic formula for single mean is \_\_\_\_\_\_\_. | | CO2 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Expand (2*x* – 3*y*) 6 using binomial theorem. | | CO6 | A | 5 |
| 22. | Split into partial fractions. | | CO5 | A | 5 |
| 23. | If y=  find | | CO4 | A | 5 |
| 24. | Evaluate . | | CO4 | A | 5 |
| 25. | What is the probability that   1. a leap year chosen at random has 53 Sundays. 2. a non-leap year chosen at random has 53 Sundays? | | CO3 | A | 5 |
| 26. | Three students A,B,C have the chances of solving an Agriculture problem are 1/3, 2/3 and 3/4 respectively. Find the probability that the problem is solved. | | CO6 | A | 5 |
| 27. | Ten coins are thrown simultaneously. Find the probability of getting exactly 5 heads. | | CO2 | A | 5 |
| 28. | A Random variable X is normally distributed with Mean 12 and Standard Deviation 4. Find  (i)  (ii) | | CO3 | A | 5 |
| 29. | A sample of size of 600 persons selected at random from a large city shows that the percentage of males in the sample is 53. It is believed that the ratio of males to the total propotion in the city is. Test whether the belief is confirmed by the observation. | | CO1 | A | 5 |
| 30. | Two independent sample on dry weight (gms) of plants were observed from two population as:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Sample A | 24 | 27 | 26 | 21 | - | | Sample B | 27 | 30 | 28 | 31 | 22 |   Is the difference between the means significant on dry weight of plants? | | CO2 | A | 5 |
| 31. | A and B alternately throw a pair of dice. A win if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, what is the chance that A wins? | | CO1 | A | 5 |
| 32. | The number of monthly breakdowns of a computer is a RV having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month without a breakdown. | | CO3 | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Evaluate  using Bernoulli’s formula. | CO6 | A | 8 |
|  | b. | Differentiate | CO6 | A | 7 |
|  |  |  |  |  |  |
| 34. |  | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Fit a Poisson distribution to the given data and calculate the theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 122 | 60 | 15 | 2 | 1 | | | CO4 | A | 15 |
|  |  |  |  |  |  |
| 35. | a. | A lot consists of 10 good articles, 4 with minor defect and 2 with major defects. Two articles are drawn at random. Find the probability that;  i) both are good  ii) both have major defects  iii) both have minor defects  iv) exactly one is good  v) neither is good. | CO3 | A | 10 |
|  | b. | Expand in ascending powers of .  Find the coefficient of . State the condition on which the expansion is valid. | CO3 | A | 5 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand basic mathematics and the technique, methodology. |
| CO2 | Know the applications of Maxima and Minima concepts. |
| CO3 | Use the applications of statistics in practical life . |
| CO4 | Apply Probability Distributions logics to solve the problems. |
| CO5 | Understand in collection, presentation and drawing conclusion about biological data. |
| CO6 | Apply the subject knowledge in their engineering subjects. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 2 | 10 |  |  |  | 14 |
| CO2 | 2 | 2 | 10 |  |  |  | 14 |
| CO3 | 2 | 1 | 30 |  |  |  | 33 |
| CO4 | 1 | 2 | 25 |  |  |  | 28 |
| CO5 | 1 |  | 5 |  |  |  | 6 |
| CO6 | 2 | 3 | 25 |  |  |  | 30 |
|  | | | | | | | **125** |



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| **Course Code** | **17MA3033** | **Duration** | **3hrs** |
| **Course Name** | **CONTROL THEORY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Show that the second order differential equation with the observation is observable on [1,2]. | CO1 | A | 10 |
|  | b. | Show that the observed linear system is observable on if and only if the Observability Grammian matrix is positive definite, where the star denotes the matrix transpose. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | The system where is a scalar positive constant is globally a) observable at time b) completely observable or or c) differentially observable if the following conditions holds  (i) there exist a constant such that  (ii) a positive constant satisfies  Prove that  a) for some in the case of observable system at time  b) for all and for some in the case of completely observable system.  c) for all and for all in the case of differentially observable system. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Derive the desired control variable u(t) for the control harmonic oscillator which steers from to during the interval . | CO3 | A | 10 |
|  | b. | The system is controllable on [0,T] if and only if the adjoint linear observed system is observable on [0,T]. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | If the system is completely controllable and continuous function is bounded locally in and satisfies the following condition  (i) , uniformly in  (ii) for each there exists a constant such that for every we have .  Then show that the system is completely controllable. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | State and prove the Gronwall’s inequality. | CO4 | A | 10 |
|  | b. | Show that the system is uniformly asymptotically stable if and only if there exists constants with . | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let be a fundamental matrix of . If there exists constants such that then prove that there exists a constant such that | CO4 | A | 10 |
|  | b. | If is a fundamental matrix of such that where is a constant and with then prove that the zero solution of asymptotically stable. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Prove that the invertible pendulum is stabilizable using feedback control. | CO5 | A | 10 |
|  | b. | Show that if the system is controllable then it is stabilizable. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Verify the stabilizability of two identical mass spring systems  with non-zero. | CO5 | A | 10 |
|  | b. | Prove that the control problem for the system is solvable if and only if . | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Consider the linear system 𝑥̇(𝑡) = 𝐴(𝑡)𝑥(𝑡) + 𝐵(𝑡)𝑢(𝑡) and the cost functional  Then prove that there exists an optimal control of the form    where 𝐾(𝑡) is the solution of the Riccati equation  with 𝐾(𝑡) = 𝐹. | CO6 | A | 20 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend the advanced concept in Control Theory. |
| CO2 | Use linear & nonlinear systems appropriately. |
| CO3 | Apply Controllability concept in their subjects. |
| CO4 | Have knowledge about stability in linear & nonlinear systems. |
| CO5 | Estimate stabilizability for various methods. |
| CO6 | Compute & conclude optimal control for linear & nonlinear systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | 40 | - | - | - | 40 |
| CO3 | - | - | 20 | - | - | - | 20 |
| CO4 | - | - | 40 | - | - | - | 40 |
| CO5 | - | - | 40 | - | - | - | 40 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **17MA3041** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL THEORY OF ELASTICITY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Derive the expression for  and  (i). Rotating disc and cylinder.  (ii).Thin hollow disc of external radius b and internal radius a. | CO1 | U | 10 |
|  | b. | Derive the equations of Equilibrium in 2D case. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain plane state of stress with its mathematical expressions. | CO1 | R | 10 |
|  | b. | Discuss the interpretation of the shear strain components. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. |  | Derive the mathematical expression for the torsion of general prismatic bars of solid cross sections. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Derive the expression for stresses due to gravitation. | CO2 | A | 10 |
|  | b. | A steel shaft of 10 cm diameter is shrunk inside a bronze cylinder of 25 cm outer diameter. The shrunk allowance is 1 part per 1000 (i.e., 0.005 cm difference between the radii). Find the tangential stress in the bronze cylinder at the inside and outer radii and the stress in the shaft. Adopt Esteel = 214 x 106 kPa, Ebronze = 107 x 106 kPa and υ = 0.3 for both metals. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Derive the mathematical expression for the rotating disks of uniform thickness. | CO3 | A | 10 |
|  | b. | The inner surface of the hollow tube is at temperature Ti and the outer surface at zero temperature. Assuming the steady state conditions, calculate the stresses. What are the values of the and  near the inner and outer surfaces. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | A flat steel disk of 75 cm outside diameter with a 15 cm diameter hole is shrunk around a solid steel shaft. The shrink-fit allowance is 1 part in 1000 (i.e., an allowance of 0.0075 cm in radius). E = 214 x 106 kPa.  (i) What are the stresses due to shrink-fit?  (ii) At what rpm will the shrink-fit lossen up as a result of rotation?  (iii) What is the circumferential stress in the disk when spinning at the above speed?Assume that the same equations as for the disk are applicable to the solid rotating shaft also. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Discuss the laminates and derive the mathematical expressions. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | If an isotropic solid is heated non uniformly to a temperature distribution T(x, y, z) and the material has unrestricted thermal expansion, the resulting strain will be eij = αTδij. Show that this case can only occur if the temperature is a linear function of the coordinates; that is,  T = ax + by +cz +d. | CO5 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the stress analysis in pressure vessel. | CO6 | A | 10 |
|  | b. | Obtain the expression for various elastic constants for the transversely isotropic materials. | CO6 | R | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Derive the mathematical formulation of bending of torsion and bar. |
| CO2 | Derive the mathematical formulation of stress strain relations. |
| CO3 | Derive the mathematical formulation of circular and elliptical bars. |
| CO4 | Derive the mathematical formulation of understand how to collect the data. |
| CO5 | Derive the mathematical formulation of axisymmetric problems. |
| CO6 | Derive the mathematical formulation of composite materials. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 10 | 40 | - | - | - | 60 |
| CO2 | - |  | 10 | 10 | - | - | 20 |
| CO3 | - | - | 10 | 10 | - | - | 20 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 20 | 20 | - | - | - | 40 |
| CO6 | 10 | - | 10 | - | - | - | 20 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **17MA3042** | **Duration** | **3hrs** |
| **Course Name** | **SEMIGROUPS OF LINEAR OPERATORS AND APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Let be a semigroup. Prove that there exist constants and such that for . | CO1 | A | 10 |
|  | b. | Let and be uniformly continuous semigroups of bounded linear operators. If then prove that for . | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prove that a linear unbounded operator is the infinitesimal generator of a semigroup of contractions if and only if  (i) is closed and  (ii) The resolvent set of contains and for every | CO3 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Let be a semigroup and let be its infinitesimal generator. Show that is a compact semigroup if and only if is continuous in the uniform operator topology for and is compact for . | CO6 | A | 10 |
|  | b. | If is a semigroup and is compact for then prove that is continuous in the uniform operator topology for . | CO6 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | If then prove that there exists a constant such that for every and  and | CO6 | A | 10 |
|  | b. | If and then show that | CO6 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Let be a Banach space and let be the infinitesimal generator of a semigroup on satisfying . If is a bounded linear operator on then prove that A+B is the infinitesimal generator of a semigroup on satisfying . | CO2 | A | 10 |
|  | b. | Let be a semigroup satisfying . Let be a bounded operator on . Then show that there exists a unique family of bounded operators on such that is continuous on for every and  for . | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let be the infinitesimal generator of a semigroup of contractions. Let be dissipative and satisfy and for where is a constant. If , the adjoint of is densely defined then show that the closure of is the infinitesimal generator of a semigroup of contractions. | CO2 | A | 10 |
|  | b. | Let be the infinitesimal generator of a semigroup of contractions. Let be dissipative and satisfy and for where is a constant. If , the adjoint of is densely defined then show that the closure of is the infinitesimal generator of a semigroup of contractions. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Let be a continuous valued function on [0,T]. If for n=1,2,… then show that on [0,T]. | CO5 | A | 10 |
|  | b. | Let . If is the mild solution of  on [0,T] then prove that for every is the uniform limit on of solutions of above differential equation. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Let be the infinitesimal generator of a analytic semigroup and let with . If is the mild solution of  then prove that is Holder continuous with exponent on for every . If moreover then is Holder continuous with the same exponent on . | CO5 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Let be a continuous in on and uniformly Lipschitz continuous with constant on . If is the infinitesimal generator of a semigroup on then prove that for every the initial value problem  has a unique mild solution Moreover, the mapping is Lipschitz continuous from into | CO4 | A | 20 |

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

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| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Applications of semigroup Theory to partial differential equations. |
| CO2 | Perturbations and approximations. |
| CO3 | Applications of semigroup theory to regard a time-dependent PDE as an ODE on a function space. |
| CO4 | Nonlinear evolution equations. |
| CO5 | Initial value problems. |
| CO6 | Analytic semigroups. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | 40 | - | - | - | 40 |
| CO3 | - | - | 20 | - | - | - | 20 |
| CO4 | - | - | 40 | - | - | - | 40 |
| CO5 | - | - | 20 | - | - | - | 20 |
| CO6 | - | - | 40 | - | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **18MA1004** | **Duration** | **3hrs** |
| **Course Name** | **CALCULUS, MATRICES AND VECTOR SPACES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define involute of a curve. | | CO1 | R | 1 |
| 2. | Find the value of | | CO2 | R | 1 |
| 3. | Examine the convergence of the sequence Examine the convergence of the sequence | | CO3 | U | 1 |
| 4. | If p=1, the series = \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 5. | Find the product of the Eigen values of matrix | | CO4 | R | 1 |
| 6. | If the eigenvalues of A is -3, 6, 7 then find the Eigen values of | | CO4 | R | 1 |
| 7. | Let  be a linear map and  a finite-dimensional vector space. If  then find | | CO5 | U | 1 |
| 8. | Define span for a vector space. | | CO6 | R | 1 |
| 9. | Find if . | | CO5 | R | 1 |
| 10. | If . Find | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Prove that | | CO1 | U | 3 |
| 12. | Examine for convergence the series | | CO3 | R | 3 |
| 13. | Express A as the sum of a symmetric and skew symmetric matrix where | | CO4 | U | 3 |
| 14. | Check whether the vectors (1, 1, 2), (0, 0, 1) and (1, 1, 0) are linearly independent or linearly dependent. | | CO5 | U | 3 |
| 15. | Find the directional derivative of  at the point (1,-2, 1) in the direction of. | | CO5 | U | 3 |
| 16. | An inner product can be defined on by. If  and , then (i) check  and  are orthogonal and (ii) find  and | | 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. |  | Find the coordinates of the center of curvature at any point of the parabola. Hence show that its evolute is | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Test the convergence of the series | CO3 | An | 6 |
|  | b. | Discuss the convergence of the series. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Reduce the Quadratic form  to the canonical form and specify the matrix transformation. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find the coordinates of (2,3,4,-1) relative to the ordered basis  for | CO5 | A | 6 |
|  | b. | Let  be a linear map defined by. Verify that. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find the values of and such that the surface  and  cut orthogonally at (1,-1, 2). | CO5 | A | 6 |
|  | b. | Find and where | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Solve the system of equations  by using Cramer's rule. | CO4 | A | 6 |
|  | b. | Find the inverse of the matrix  by using Cayley Hamilton theorem. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Express in terms of gamma function. | CO2 | E | 6 |
|  | b. | Evaluate | CO2 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find an orthonormal basis of the vectors (1, 0, 1, 1), (-1,0,-1,1) and  (0, -1, 1, 1) of using standard inner product. | CO5 | A | 8 |
|  | b. | Let V be an inner product space. Then for arbitrary vectors u, v in V, prove that | CO5 | U | 4 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to Demonstrate knowledge in special functions. |
| CO2 | The student will be able to Evaluate surface area and volume using definite integral. |
| CO3 | The student will be able to Express functions as infinite series. |
| CO4 | The student will be able to Understands solving system of equations using matrices. |
| CO5 | The student will be able to Relate vector spaces with magnetic field and moving fluid. |
| CO6 | The student will be able to Construct linear transformation. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 | 12 | - | - | - | 16 |
| CO2 | 1 | - | - | - | 12 | - | 13 |
| CO3 | 4 | 1 | - | 12 | - | - | 17 |
| CO4 | 2 | 3 | 24 | - | - | - | 29 |
| CO5 | 8 | 11 | 20 | - | - | - | 39 |
| CO6 | 7 | 3 | - | - | - | - | 10 |
|  | | | | | | | **124** |



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| **Course Code** | **18MA1012** | **Duration** | **3hrs** |
| **Course Name** | **DIFFERENTIAL CALCULUS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If  find . | | CO1 | U | 1 |
| 2. | State Euler’s theorem on homogenous function. | | CO1 | R | 1 |
| 3. | Find the complementary function of | | CO2 | A | 1 |
| 4. | Solve the differential equation = 0. | | CO2 | A | 1 |
| 5. | Write the value of | | CO3 | U | 1 |
| 6. | Convert  as a Legendre polynomial. | | CO3 | U | 1 |
| 7. | Determine the complete solution of | | CO4 | A | 1 |
| 8. | Find the complementary function of | | CO4 | A | 1 |
| 9. | What is the value of , if is an odd function in the interval ? | | CO5 | R | 1 |
| 10. | Give the most suitable solution of one dimensional wave equation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If and , evaluate . | | CO1 | U | 3 |
| 12. | Let , find the Wronskian of. | | CO2 | A | 3 |
| 13. | Prove that . | | CO3 | A | 3 |
| 14. | Solve | | CO4 | A | 3 |
| 15. | Express as a half range sine series in . | | CO5 | A | 3 |
| 16. | Write down the three possible solutions of one dimensional heat equation. | | 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. | If show that  and | CO1 | A | 9 |
|  | b. | If *u* and v are functions of *x* and *y* then determine the value of . | CO1 | A | 3 |
|  |  |  |  |  |  |
| 18. | a. | Solve | CO2 | An | 9 |
|  | b. | Find the particular integral of | CO2 | A | 3 |
|  |  |  |  |  |  |
| 19. |  | Solve in series the equation | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Obtain the series solution of the equation | CO3 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Solve . | CO4 | A | 6 |
|  | b. | Solve | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Obtain the Fourier series for in the interval | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Obtain the Fourier series up to second harmonic from the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | : | 0 | 1 | 2 | 3 | 4 | 5 | | : | 4 | 8 | 15 | 7 | 6 | 2 | | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A tightly stretched string with fixed end points  is initially in a position given by . If it is released from rest from the position, find the displacement . | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to solve using differentiation techniques. |
| CO2 | The student will be able to classify different types of higher order ODE |
| CO3 | The student will be able to understand solution of first and second order ODE |
| CO4 | The student will be able to demonstrate knowledge in solution of PDE |
| CO5 | The student will be able to apply solution of PDE in heat and wave equations |
| CO6 | The student will be able to express functions as infinite series |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 12 |  |  |  | 17 |
| CO2 |  |  | 8 | 9 |  |  | 17 |
| CO3 |  | 2 | 3 | 12 | 12 |  | 29 |
| CO4 |  |  | 17 |  |  |  | 17 |
| CO5 | 1 |  | 15 | 12 |  |  | 28 |
| CO6 | 1 | 3 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18MA2001** | **Duration** | **3hrs** |
| **Course Name** | **FOUNDATIONS OF MATHEMATICS AND STATISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | | |
| 1. | If, find . | | | CO4 | U | 1 |
| 2. | Find the derivative of . | | | CO4 | U | 1 |
| 3. | Evaluate | | | CO4 | R | 1 |
| 4. | if *f(x)*is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO4 | R | 1 |
| 5. |  | | | CO4 | R | 1 |
| 6. | The sum of Binomial coefficient is \_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | 1 |
| 7. |  | | | CO1 | R | 1 |
| 8. | The Binomial expansion of is\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | 1 |
| 9. | The condition for which the binomial expansion to be valid is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | 1 |
| 10. | If A and B are mutually exclusive events, then. | | | CO3 | U | 1 |
| 11. | A coin is tossed two times, then n(S) =\_\_\_\_\_\_\_\_\_ . | | | CO3 | U | 1 |
| 12. | The probability of an impossible event is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | R | 1 |
| 13. | If A is any event, then = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | R | 1 |
| 14. | In Poisson distribution Mean is equal to \_\_\_\_\_\_\_\_\_\_. | | | CO5 | R | 1 |
| 15. | Find the mean of the binomial distribution for n=10 and p = . | | | CO5 | U | 1 |
| 16. | The total area bounded by the normal curve and x- axis is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO5 | R | 1 |
| 17. | The standard normal variate Z =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO5 | R | 1 |
| 18. | Mention different types of data. | | | CO2 | R | 1 |
| 19. | Ogives is known as \_\_\_\_\_\_\_\_\_\_\_ | | | CO2 | R | 1 |
| 20. | Define Pie diagram. | | | CO2 | R | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | | |
| 21. | Differentiate with respect to given, | | | CO4 | A | 5 |
| 22. | Find if . | | | CO4 | A | 5 |
| 23. | Using Bernoulli’s formula find. | | | CO4 | A | 5 |
| 24. | Split into partial fractions. . | | | CO1 | U | 5 |
| 25. | Using Binomial theorem, find the 7th power of 11. | | | CO1 | A | 5 |
| 26. | A statistical problem is given to two students. The chances of solving it are 0.8 and 0.9 respectively. What is the probability that the problem is solved? | | | CO3 | A | 5 |
| 27. | If, and . Find . | | | CO3 | A | 5 |
| 28. | A machine manufacturing screws is known to produce 5% defectives. In a random sample of 15 screws, what is the probability using the binomial distribution that there are exactly 3 defectives. | | | CO5 | A | 5 |
| 29. | A random variable X is normally distributed with mean 12 and standard deviation 4. Find P(x≥20). | | | CO5 | A | 5 |
| 30. | Construct a pie chart to visually display the favorite fruits of the students in a class based on the given data: Mango - 45; Orange - 30; Plum - 15; Pineapple - 30; Melon – 30. | | | CO2 | A | 5 |
| 31. | Draw a histogram for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Weekly wages in rupees(mid value) | 410 | 430 | 450 | 470 | 490 | | Number of workers | 15 | 40 | 65 | 50 | 5 | | | | CO2 | U | 5 |
| 32. | Draw frequency polygon and curve to the following data.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Seed yield g(X) | 2.5-3.5 | 3.5-4.5 | 4.5-5.5 | 5.5-6.5 | 6.5-7.5 | 7.5-8.5 | 8.5-9.5 | 9.5-10.5 | | No. of plants | 4 | 6 | 10 | 26 | 24 | 15 | 10 | 5 | | | | CO2 | U | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | | |
| 33. | | a. | Evaluate | CO4 | A | 5 |
| b. | If Find . | CO4 | A | 5 |
| c. | Find | CO4 | A | 5 |
|  | |  |  |  |  |  |
| 34. | | a. | Expand in ascending powers of . Find the coefficient of . State the condition on which the expansion is valid. | CO1 | A | 8 |
| b. | Fit a Poisson distribution and hence deduce theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f(x) | 122 | 60 | 15 | 2 | 1 | | CO5 | A | 7 |
|  | |  |  |  |  |  |
| 35. | | a. | In a test of 2000 electric bulbs, it was found that the life of a particular type was normally distributed with average life of 2040 hrs and standard deviation 60 hrs. Estimate the number of bulbs likely to burn for (i) more than 2150 hrs (ii) less than 1950 hrs (iii) more than 1920 hrs but than 2160 hrs. | CO5 | A | 8 |
| b. | A and Balternativelythrow a pair of dice. Player A wins if he throws 6 before B throws 7. Player B wins if he throws 7 before A throws 6. If player A begins the game, find the probability of his winning the game. | CO3 | A | 7 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand Basic mathematics and the technique, methodology. |
| CO2 | Understand classification and tabulation of data. |
| CO3 | Apply probability theory to solve the problems. |
| CO4 | Knowledge in technique and methodology of solving problems in calculus. |
| CO5 | Knowledge in technique and methodology of solving problems using probability distribution. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 5 | 13 |  |  |  | 22 |
| CO2 | 3 | 10 | 5 |  |  |  | 18 |
| CO3 | 2 | 2 | 17 |  |  |  | 21 |
| CO4 | 3 | 2 | 30 |  |  |  | 35 |
| CO5 | 3 | 1 | 25 |  |  |  | 29 |
|  | | | | | | | **125** |

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| **Course Code** | **18MA2002** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN AND ANALYSIS OF EXPERIMENTS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | |
| 1. | Find the median for the following data: 32, 35, 33, 37, and 34. | CO1 | U | 1 |
| 2. | Compute the median for the following data: 30, 32, 35, 30, and 24. | CO1 | U | 1 |
| 3. | Determine the coefficient of variation, If 20 and σ =5. | CO1 | U | 1 |
| 4. | State the relation between mean, median and mode. | CO1 | R | 1 |
| 5. | If the correlation coefficient, then the correlation is said to be \_\_\_\_\_\_. | CO2 | R | 1 |
| 6. | State the relation between correlation coefficient and regression coefficient. | CO2 | R | 1 |
| 7. | Estimate the value of , If . | CO2 | U | 1 |
| 8. | If the correlation coefficient, then the correlation is said to be \_\_\_\_\_\_. | CO2 | U | 1 |
| 9. | List out the two types of error in sampling. | CO4 | R | 1 |
| 10. | Define Null hypothesis. | CO4 | R | 1 |
| 11. | In sampling techniques, if the sample size is small then the value of n is \_\_\_\_. | CO4 | R | 1 |
| 12. | State the formula to find the test statistic of chi-square test for Goodness of fit. | CO4 | R | 1 |
| 13. | Identify the degrees of freedom to perform F- test, from the two samples A and B with 9 and 11 sample observations. | CO4 | U | 1 |
| 14. | What is meant by ANOVA? | CO5 | R | 1 |
| 15. | Give an example of experimental design. | CO5 | R | 1 |
| 16. | What do you mean by the term ‘experiment’ in design of experiment? | CO5 | U | 1 |
| 17. | Name the basic principles of experimental design. | CO5 | R | 1 |
| 18. | An experiment in which the treatment consists of all possible combinations of the selected levels in two or more factors is referred as\_\_\_\_\_\_\_. | CO3 | R | 1 |
| 19. | Analysis of variance of a split plot design divided into the \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ analysis. | CO3 | R | 1 |
| 20. | The linear model for simple split plot design is \_\_\_\_\_\_\_. | CO3 | R | 1 |

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| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | The following frequency distribution gives the number of chilies per plant:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. of chilies /Plant | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No. of Plants | 8 | 10 | 25 | 32 | 15 | 5 |   Calculate quartile deviation for the number of chilies per plant. | | CO1 | E | 5 |
| 22. | The income of farmers in two villages A and B are given below:   |  |  |  | | --- | --- | --- | | Villages | A | B | | Sample Size | 600 | 500 | | Sample Mean | 175 | 186 | | Standard deviation | 10 | 9 |   Using coefficient of variation, find which farmers of the villages earn consistently? | | CO1 | An | 5 |
| 23. | The following data gives the number of capsules and seed yield per Sesame plant. Estimate the correlation coefficient and give the comment.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Seed Yield: | 25 | 28 | 35 | 32 | 31 | 36 | 29 | 25 | | No. of capsules: | 43 | 46 | 49 | 41 | 36 | 32 | 31 | 43 | | | CO2 | A | 5 |
| 24. | In a certain crop production competition, two judges x and y gave ranks for 10 competitors as follows. Find the rank correlation coefficient.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 6 | 5 | 10 | 3 | 2 | 4 | 9 | 7 | 8 | | y | 6 | 4 | 9 | 8 | 1 | 2 | 3 | 10 | 5 | 7 | | | CO2 | An | 5 |
| 25. | From the following information, obtain the line of regression of consumption  (x) on price (y)   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Consumption (x) | 22 | 26 | 29 | 30 | 31 | 34 | 35 | | Price (y) | 20 | 20 | 21 | 29 | 27 | 27 | 31 | | | CO2 | A | 5 |
| 26. | In an experiment on the immunization of goats from Anthrax, the following results were obtained. Derive your inference on the efficacy of the vaccine. Test the goodness of fit using chi-square test.   |  |  |  | | --- | --- | --- | |  | Died of Anthrax | Survived | | Inoculated | 4 | 23 | | Not inoculated | 11 | 14 | | | CO4 | A | 5 |
| 27. | A sample of 50 cows in a herd has average lactation yield 1290 litres. Test whether the sample has been drawn from the population having herd average lactation yield of 1350 litres with a standard deviation of 65 litres. | | CO4 | A | 5 |
| 28. | The nicotine contents in milligrams in two samples of tobacco were found to be as follows:   |  |  |  |  | | --- | --- | --- | --- | | Sample | Size | Sample Mean | Standard Deviation | | 1 | 10 | 15 | 2.5 | | 2 | 12 | 14 | 2.8 |   Calculate using F test and test whether the samples have come from the same normal population. | | CO4 | An | 5 |
| 29. | A completely randomized design experiment with 10 plots and 3 treatments gave 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 | 1 | 7 | 1 | 5 | 5 | 3 | 3 | 4 | 7 | 4 |   Analysis the results for treatment effects. | | CO5 | An | 5 |
| 30. | Compare the differences between RBD and LSD. | | CO5 | U | 5 |
| 31. | Explain the layout of 22-factorial experiment. | | CO3 | R | 5 |
| 32. | Give the layout of split plot design involving two fertilizer (F1,F2) as subplot treatments and three varieties(V1,V2,V3) as main plot treatments in three replications. | | CO3 | U | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. |  | The following frequency distribution gives the number of chillies per plant:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. of chillies /Plant | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No. of Plants | 8 | 10 | 23 | 29 | 18 | 12 |   Calculate mean, median and mode. | CO1 | E | 15 |
|  |  |  |  |  |  |
| 34. |  | A group of 10 rats fed on diet A and another group of 8 rats fed on a different diet B, recorded the following increase in weight.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | - | - |   Use ‘t’ test to find whether the two diets differ significantly. | CO4 | An | 15 |
|  |  |  |  |  |  |
| 35. |  | The effects of 4 cultivation sequences on the yield of sugar (tones/ha) from sugar-beet were tested using Latin Square Design with 4 blocks.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Blocks | Cultivation sequences | | | | | 1 | 2 | 3 | 4 | | 1 | 10 | 14 | 19 | 20 | | 2 | 11 | 15 | 17 | 21 | | 3 | 9 | 12 | 16 | 19 | | 4 | 8 | 13 | 17 | 20 |   Carry out an analysis of variance. | CO5 | A | 15 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand basic statistics and the technique, methodology. |
| CO2 | Use the applications of statistics. |
| CO3 | Apply statistical methods to solve Agricultural problems. |
| CO4 | Knowledge in technique and methodology of solving problems in testing of hypothesis. |
| CO5 | Knowledge in technique and methodology of solving problems in design of experiments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 3 |  | 5 | 20 |  | 28 |
| CO2 | 2 | 2 | 10 | 5 |  |  | 19 |
| CO3 | 8 | 6 |  |  |  |  | 14 |
| CO4 | 4 | 1 | 10 | 20 |  |  | 35 |
| CO5 | 3 | 6 | 15 | 5 |  |  | 29 |
|  | | | | | | | **125** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18MA2003/19MA2001** | **Duration** | **3hrs** |
| **Course Name** | **PARTIAL DIFFERENTIAL EQUATIONS, PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Find the degree of the partial differential equation . | | CO1 | E | 1 |
| 2. | Solve . | | CO1 | E | 1 |
| 3. | One dimensional wave equation is given by­­­­­\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | What is the nature of the one-dimensional heat equation? | | CO2 | A | 1 |
| 5. | A marble is picked at random from a box containing 7 yellow, 5 blue and 3 black marbles. What is the probability that it is neither yellow nor black? | | CO3 | U | 1 |
| 6. | The mean of Binomial distribution is given by \_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | State any one property of the cumulative density function of a two-dimensional random variable (X, Y). | | CO4 | R | 1 |
| 8. | What is the variance of standard normal distribution? | | CO4 | R | 1 |
| 9. | The correlation coefficient  lies between \_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | Define null hypothesis. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the complete solution of . | | CO1 | E | 3 |
| 12. | Write all the possible solutions of one-dimensional heat equation. | | CO2 | R | 3 |
| 13. | From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. What is the probability that the product is positive? | | CO3 | E | 3 |
| 14. | Find the rank correlation co-efficient for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Rank in x | 3 | 2 | 4 | 1 | 5 | | Rank in y | 2 | 5 | 3 | 4 | 1 | | | CO4 | E | 3 |
| 15. | In a city, a sample of 500 people, 280 are tea drinkers and the rest are coffee drinkers. Can we assume that both coffee and tea are equally popular in this city at 5% level of significance? | | CO4 | E | 3 |
| 16. | Define Type I and Type II errors. | | 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. | Solve . | CO1 | E | 6 |
|  | b. | Solve | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. |  | A tightly stretched flexible string has its ends fixed at  and . At time , the string is in the initial position  and then released. Find the displacement at any point  of the string at any time . | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | A lot consists of 10 good articles, 4 with minor defects, 2 with major defects. Two articles are chosen from the lot at random (without replacement). Find 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. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | The joint probability mass function of  is given by *,* ; . Find all the marginal and conditional probability distributions. Also find the probability distribution of. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Calculate mean, median, mode, upper quartile and lower quartile for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class | 0-10 | 10–20 | 20–30 | 30 –40 | 40 – 50 | 50 – 60 | | Freq. | 14 | 17 | 22 | 26 | 23 | 18 | | CO3 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | A problem is given to 3 students whose chances of solving it are 1/2, 1/3 and 1/4 . What is the probability that (i) only one of them solves the problem (ii) the problem is solved (iii) none of them solved (iv) all the 3 solved (v) exactly 2 solved (vi) atleast 2 solved. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Find correlation coefficient from the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 | | Y | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 | | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Two random samples of 11 and 9 items show the sample standard deviation of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test the hypothesis that the true variances are equal. | CO5 | An | 6 |
|  | b. | Find if there is any association between extravagance in fathers and extravagance in sons from the following data.  Question No.24 from Module 6   |  |  |  | | --- | --- | --- | |  | Extravagance father | Miserly father | | Extravagance son | 327 | 741 | | Miserly son | 545 | 234 | | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand solution of partial differential equations. |
| CO2 | Apply solution of partial differential equations in heat and wave equations. |
| CO3 | Understand conditional probability and moment generation. |
| CO4 | Measure the relationship between variables. |
| CO5 | Execute the test of hypothesis for large and small samples. |
| CO6 | Examine the independence of attributes. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | - | 17 | - | 17 |
| CO2 | 4 | - | 13 | - | - | - | 17 |
| CO3 | 1 | 1 | 12 | - | 15 | - | 29 |
| CO4 | 2 | - | 12 | 12 | 18 | - | 44 |
| CO5 | 1 | - | - | 6 | - | - | 7 |
| CO6 | 1 | - | 3 | 6 | - | - | 10 |
|  | | | | | | | **124** |



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| **Course Code** | **18MA2005** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If A and B are mutually exclusive events with P(A) =1/4, P(B) =1/5 then find P(AUB). | | CO1 | U | 1 |
| 2. | If P(A) = 1/3, P(B)=1/4 and P(AՈB)= 1/12 then find P(A/B) | | CO1 | U | 1 |
| 3. | If F(x,y) is the CDF of a two-dimensional random variable (X,Y) then | | CO2 | R | 1 |
| 4. | Find k from the following probability distribution of X.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | P(X) | k | 2k | 3k | 4k | | | CO2 | R | 1 |
| 5. | What is the variance of Binomial distribution? | | CO3 | R | 1 |
| 6. | The mean of exponential distribution is ------- | | CO3 | R | 1 |
| 7. | The correlation coefficient rxy lies between ---------- | | CO5 | R | 1 |
| 8. | The second moment about the mean is --------- | | CO4 | U | 1 |
| 9. | The Probability of TypeI error is ------- | | CO6 | U | 1 |
| 10. | The statistical averages of population are known as ------- | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | What is the probability that there will be 53 Sundays in a non-leap year? | | CO1 | U | 3 |
| 12. | If f(x)=kx2,0<x<3,is to be the density function, find the value of. | | CO2 | U | 3 |
| 13. | Write the normal equations to fit a parabola y = ax2 +bx+c by the method of least squares. | | CO5 | R | 3 |
| 14. | If the second third and fourth moments about the mean are  ,  , and then find the (i)measure of skewness (ii) measure of kurtosis | | CO4 | U | 3 |
| 15. | If X is exponentially distributed, then find P(X>10/X>8) | | CO3 | E | 3 |
| 16. | Define (i) null hypothesis (ii) alternative hypothesis | | 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 articles, 4 with minor defects and 2 with  major defects. Two articles are chosen at random. Find the  probability that (i) both are good (ii) both have major defects (iii)  atleast one is good (iv) atmost one is good (v) exactly one is good(vi) none is good | CO1 | A | 12 |
|  |  |  |  |  |  |
| 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) Evaluate P(-2<X<2) (iii) Find the cdf of X and (iv) Evaluate the mean of X. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | For the bivariate distribution of (x, y) given below, find (a).P(x  1)  (b).P( y  3) (c).P(x  1, y  3) (d). P (x≤1 / y≤ 3) (e).P (y≤3 / x≤ 1)  (f).P( x + y  4).     |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | | CO2 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | The weekly wages of 1000 workmen are normally distributed with mean Rs.70 and standard deviation Rs 5. Estimate the number of workers, whose weekly wages will be (i) less than Rs. 69. (ii) more than Rs.72. (iii)between Rs 69 and Rs72. | CO3 | A | 6 |
|  | b. | If 10% of the screws produced by a machine are defective find the probability that of 20 screws selected at random there are (i).exactly two are defectives (ii.) almost three are defective (iii.)at least two are defective (use Binomial distribution) | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Fit a Poisson distribution and find the theoretical frequencies for the given data :   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | Total | | f | 109 | 65 | 22 | 3 | 1 | 200 | | CO3 | E | 6 |
|  | b. | The time required to repair a machine is exponentially distributed with parameter λ=1/2. (i) find the probability that the repair time exceeds 2hrs. (ii) find the probability that the repair time is less than 2hrs. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Find the two Lines of Regression   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population with a standard deviation of 2.5 inches? | CO6 | A | 6 |
|  | b. | Fit a straight line y = ax +b by the method of least squares for the following data  X : 0 5 10 15 20 25  Y : 12 15 17 22 24 30 | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, recorded the following increase in weight. Test whether the variances are significantly different   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize probability models. |
| CO2 | Solve using discrete and continuous random variables. |
| CO3 | Classify the problems using probability distributions. |
| CO4 | Measure central tendency, of the data. |
| CO5 | Compare variables using correlation and regression. |
| CO6 | Testhypothesis for small samples. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 5 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | - | - | 24 | - | 29 |
| CO3 | 2 | - | 18 | - | 9 | - | 29 |
| CO4 | - | 4 | 6 | - | - | - | 10 |
| CO5 | 1 | 3 | - | 12 | - | - | 16 |
| CO6 | 1 | 4 | 6 | 12 | - | - | 23 |
|  | | | | | | | **124** |



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| **Course Code** | **18MA2009** | **Duration :** | **3hrs** |
| **Course Name** | **DISCRETE MATHEMATICS** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **CO/BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Let A={1, 2} and B ={a, b, c}. Find the Cartesian product . | CO1 / R | 1 |
| 2. | Find the power set of the set A={a,b,c}. | CO 1 / R | 1 |
| 3. | Give an example of onto function. | CO1 / R | 1 |
| 4. | State Fundamental theorem of Algebra. | CO2 / R | 1 |
| 5. | State Pigeonhole principle. | CO2 / R | 1 |
| 6. | Find the number of permutation in the word “MATLAB” | CO3 / R | 1 |
| 7. | Define syntax. | CO 3 / R | 1 |
| 8. | Write the truth table for . | CO 4 / R | 1 |
| 9. | Write the rule modus ponens. | CO4 / R | 1 |
| 10. | Define Commutative property. | CO 5 / R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Draw the digraph and matrix representation for the following relation R={(4,1),(4,2),(4,3),(3,1),(3,2),(2,1)} | CO1 / U | 3 |
| 12. | Compute and  if , and  where . | CO1 / U | 3 |
| 13. | Find GCD using Euclidean algorithm. | CO2 / U | 3 |
| 14. | A committee of 12 has to be selected out of 10 men & 10 women. In how many ways a committee of 6 men & 6 women can be formed? | CO3 / U | 3 |
| 15. | In a group of 25 people, how many were born on the same day of the week? | CO 4 / U | 3 |
| 16. | Check whether ( N, + ) is a semigroup, where ‘N’ is the set of all natural numbers. | CO5 / U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | (i) In a survey of 260 college students, the following data were obtained: 64 had taken a mathematics course, 94 had taken computer science course, 58 had taken business course, 28 had taken both mathematics and business course, 26 had taken both mathematics and computer science course, 22 had taken both computer science and business course and 14 had taken all the three types of courses. How many students had not taken none of the three courses?  How many had taken only one course? | CO 1 / A | 6 |
| b. | Let X={1,2,3…7} and R={(x,y)/x-y is divisible by 3}. Show that R is an equivalence relation. | CO1 / A | 6 |
|  |  |  |  |  |
| 18. |  | (ii) Prove that the set S = {1,2,3,5,6,10,15,30} is a partially ordered set under relation a divides b }. Also draw the Hasse diagram of R. | CO1 / A | 12 |
| 19. | a. | Let f(x)=x+2,g(x)=x-2 and h(x)=3x for ,where R is the set of real numbers. Find and | CO1 / A | 6 |
|  | b | Prove that “*if n2 is odd then n is odd*” using contraposition method of proof. | CO2 / A | 6 |
|  |  |  |  |  |
| 20. |  | Show (i) , for every ,  (ii)  for  by mathematical induction. | CO2 / A | 12 |
|  |  |  |  |  |
| 21. | a. | Prove that is a tautology. | CO4 / C | 6 |
| b. | Show that  using truth table. | CO4 / C | 6 |
|  |  |  |  |  |
| 22. | a. | Show that  is tautologically implied by | CO4 / A | 6 |
| b. | Write the quantifiers and proper connectives for the following statements.  (i) If the teacher is absent, then some students do not keep quiet.  (ii) All the students keep quiet and the teacher is present.  (iii) Some of the students do not keep quiet or the teacher is absent. | CO4 / A | 6 |
|  |  |  |  |  |
| 23. | a. | Show that ( R, + ) is a group. | CO5 / A | 6 |
| b. | Define Monoid. Determine whether (I, + ) is a monoid, where ‘I’ is the set of all integers. | CO6 / A | 6 |
|  |  | **Compulsory:** | | |
| 24. |  | Show that the following set of premises is inconsistent:  1. If David gets his degree, he will go for a job.  2. If he goes for a job, he will get married soon.  3. If he goes for higher study, he will not get married.  4. David gets his degree and goes for higher study. | CO4 / A | 12 |

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

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Knowledge in sets, relation and function. | | | | | | | |
| CO2 | Analyze using Mathematical induction | | | | | | | |
| CO3 | Understand basic counting techniques | | | | | | | |
| CO4 | About propositional logic | | | | | | | |
| CO5 | Understand algebraic structures and morphisms | | | | | | | |
| CO6 | Classify different types of graphs. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 2 | 5 | 24 | - | - | - | 31 |
| CO2 | | 2 | 2 | 15 | - |  |  | 19 |
| CO3 | | 2 | 2 | - | - | - | - | 04 |
| CO4 | | 2 | 2 | 19 | 10 |  |  | 33 |
| CO5 | | 1 | 2 | 5 | - | - | - | 08 |
| CO6 | | - | - | 5 | - | - | - | 05 |
|  | | | | | | | | **100** |



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| **Course Code** | **18MA3004** | **Duration** | **3hrs** |
| **Course Name** | **OPERATIONS RESEARCH TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Solve the following LPP using simplex method:  Maximum  Subject to | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | A manufacturer produces 2 types of models and . Each model requires 4 hours of grinding and 2 hours of polishing whereas each model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an model is Rs.3 and model is Rs.4. Whatever is produced in a week is sold in the market. How should manufacturer allocate his production capacity to the two types of models so that he may take maximum profit in a week. Formulate LPP and solve by Graphical method. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Using duality, solve the following LPP.  Max Z = 45x1 +80 x2  Subject to 5 x1 + 20 x2 ≤ 400  10 x1 +15 x2 ≤ 450  x1 , x2 ≥ 0 | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Find the initial basic feasible solution of the following transportation problem by Least cost method and North west corner rule:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Source | Destination | | | | Supply | |  | I | II | III |  | | A | 1 | 2 | 6 | 7 | | B | 0 | 4 | 2 | 12 | | C | 3 | 1 | 5 | 11 | | Demand | 10 | 10 | 10 |  | | CO2 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | The processing time in hours for the jobs when allocated to the different machines are indicated below. Assign the machines for the jobs so that the total processing time is minimum.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Jobs |  | Machines | | | | | | M1 | M2 | M3 | M4 | M5 | | J1 | 9 | 22 | 58 | 11 | 19 | | J2 | 43 | 78 | 72 | 50 | 63 | | J3 | 41 | 28 | 91 | 37 | 45 | | J4 | 74 | 42 | 27 | 49 | 39 | | J5 | 36 | 11 | 57 | 22 | 25 | | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Obtain the optimum solution to the following transportation problem by MODI method:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Origin | Distribution Centres | | | | Available | |  | I | II | III |  | | A | 7 | 3 | 2 | 2 | | B | 2 | 1 | 3 | 3 | | C | 3 | 4 | 6 | 5 | | Requirements | 4 | 1 | 5 |  | | CO3 | A | 20 |
|  |  |  |  |  |  |
| 7. |  | Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following processing time in hours. Find also the total elapsed time and idle time of machines   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Job: | A | B | C | D | E | | Machine M1 : | 8 | 5 | 4 | 6 | 5 | | Machine M2 : | 6 | 2 | 9 | 7 | 4 | | Machine M3 : | 10 | 13 | 11 | 10 | 12 | | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and next. The duration of the phone call is assumed to be exponentially distributed with mean 3 minutes. (i) what is the probability that a person arriving at the booth will have to wait? (ii) The telephone department will install a second booth when convinced that an arrival would expect waiting for atleast 3 minutes for phone. By how much should the flow of arrivals increase in order to justify the second booth? (iii) Find the average number of units in the system (iv) Estimate the fraction of the day that the phone will be in use. | CO4 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Construct the network for the project whose activities are given below and compute the total float of each activity, determine the critical path and the project duration.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activity | 1-2 | 1-3 | 1-5 | 2-3 | 2-4 | 3-4 | 3-5 | 3-6 | 4-6 | 5-6 | | Duration in weeks | 8 | 7 | 12 | 4 | 10 | 3 | 5 | 10 | 7 | 4 | | CO6 | A | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply artificial variable techniques. |
| CO2 | Solve linear programming problems. |
| CO3 | Classify the problems using feasible solutions. |
| CO4 | Apply queuing models. |
| CO5 | Knowledge in job sequences problems. |
| CO6 | Find the shortest path by using network models. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 20 |  | 20 |  |  | 40 |
| CO2 |  | 40 |  |  |  |  | 40 |
| CO3 |  |  | 40 |  |  |  | 40 |
| CO4 |  |  | 20 |  |  |  | 20 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **19MA1002** | **Duration** | **3hrs** |
| **Course Name** | **CALCULUS AND LAPLACE TRANSFORM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | State Mean Value Theorem. | | CO1 | U | 1 |
| 2. | What is the necessary condition for *f*(*x,y)* to have maximum? | | CO1 | R | 1 |
| 3. | Write the linearity property of Laplace Transform | | CO2 | R | 1 |
| 4. | Evaluate | | CO2 | E | 1 |
| 5. | If then what is the value of | | CO3 | U | 1 |
| 6. | Evaluate . | | CO4 | E | 1 |
| 7. | Evaluate | | CO4 | E | 1 |
| 8. | Write the formula to find the volume enclosed by plane curves whose equations are given in cartesian form. | | CO4 | R | 1 |
| 9. | Evaluate given | | CO5 | E | 1 |
| 10. | If , then evaluate . | | CO5 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Express in terms of gamma function. | | CO1 | A | 3 |
| 12. | Evaluate L(sin2t) | | CO2 | E | 3 |
| 13. | If and y, find the value of | | CO3 | E | 3 |
| 14. | Evaluate | | CO4 | E | 3 |
| 15. | Find the directional derivative of at the point  (1, –2, –1). | | CO5 | E | 3 |
| 16. | State Green’s Theorem | | CO5 | 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. |  | Using (i) first derivative (ii) second derivative , find the critical and extreme values of | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find | CO2 | E | 4 |
|  | b. | Find | CO2 | E | 8 |
|  |  |  |  |  |  |
| 19. |  | Expand in powers of x and y up to terms of third degree. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Evaluate the volume of a sphere x2 + y2 + z2 = a2 using triple integration. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate the div and curl at the point (1,2,3) given | CO5 | E | 6 |
|  | b. | Show that the vector is solenoidal. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Verify Gauss Divergence theorem for taken over the rectangular parallelopiped , and | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Change the order of integration and hence evaluate | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | If , , , show that the Jacobian of y1, y2, y3 with respect to x1, x2, x3  is 4 | CO3 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to apply differentiation techniques to find the extreme values of the functions. |
| CO2 | Students will be able to relate the properties of Laplace Transforms. |
| CO3 | Students will be able to solve using multivariable differentiation techniques. |
| CO4 | Students will be able to solve problems using integration techniques. |
| CO5 | Students will be able to apply basic tools in vector differentiation. |
| CO6 | Students will be able to apply Matlab tools to solve mathematical problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 3 | - | 12 | - | 17 |
| CO2 | 1 | - | - | - | 16 | - | 17 |
| CO3 | - | 1 | - | - | 27 | - | 28 |
| CO4 | 1 | - | - | - | 29 | - | 30 |
| CO5 | 3 | - | - | 18 | 11 | - | 32 |
| CO6 |  |  |  |  |  |  |  |
|  | | | | | | | **124** |



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| **Course Code** | **18MA1008 / 19MA1008** | **Duration** | **3hrs** |
| **Course Name** | **ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define Beta function. | | CO1 | U | 1 |
| 2. | = \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The order of the ordinary differential equation =\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | A | 1 |
| 4. | The solution of the Clairaut’s equation =\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | The Legendre polynomial  =\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | If the roots are 2, -3, then the Complementary Function=\_\_\_\_\_\_\_\_\_. | | CO3 | A | 1 |
| 7. | The Cauchy Riemann equation in polar form is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | The fixed points of the mapping is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 9. | Write the residue formula for pole of order two. | | CO5 | U | 1 |
| 10. | The value of the integral  onis \_\_\_\_\_\_\_\_\_\_. | | CO5 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write down the formula for the center of curvature at the point | | CO1 | R | 3 |
| 12. | Evaluate | | CO2 | A | 3 |
| 13. | Find the particular integral of | | CO3 | A | 3 |
| 14. | Determine whether the function is analytic. | | CO4 | U | 3 |
| 15. | Compute the residue of  at each of its pole. | | CO5 | A | 3 |
| 16. | Evaluate | | 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. |  | Find the center of curvature of the parabola  at . Also prove that its evolute is | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Solve | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Show that is harmonic and find its conjugate harmonic function. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Solve using variation of parameter method. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Evaluate , where c is the circle using Cauchy’s Integral formula. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate  using contour integration. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find | CO6 | A | 6 |
|  | b. | Evaluate using partial fraction method. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Evaluate surface area and volume using definite integral. |
| CO2 | Understands solution of first and second order ODE. |
| CO3 | Classify different types of higher order ODE and their solution. |
| CO4 | Construct harmonic and bilinear transformations. |
| CO5 | Evaluate definite integral using complex integration. |
| CO6 | Express complex functions as infinite series. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 | 12 | -- | -- | -- | 17 |
| CO2 | 1 | -- | 16 | -- | -- | -- | 17 |
| CO3 | -- | 1 | 16 | -- | -- | -- | 17 |
| CO4 | 4 | -- | 25 | -- | -- | -- | 29 |
| CO5 | -- | 1 | 28 | -- | -- | -- | 29 |
| CO6 | -- | -- | 15 | -- | -- | -- | 15 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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| --- | --- | --- | --- |
| **Course Code** | **19MA2001** | **Duration** | **3hrs** |
| **Course Name** | **PARTIAL DIFFERENTIAL EQUATIONS, PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Find the degree of partial differential equation: | | CO1 | U | 1 |
| 2. | Solve = 10 | | CO1 | R | 1 |
| 3. | The one dimensional heat equation is ------- | | CO2 | R | 1 |
| 4. | The value of a2in one dimensional wave equation is ------- | | CO2 | R | 1 |
| 5. | If A and B are mutually exclusive events with P(A) =1/4, P(B) =1/5 then find P(AUB). | | CO3 | U | 1 |
| 6. | If A and B are independent events the P(AՈB)= -------- | | CO3 | U | 1 |
| 7. | What are the Mean and variance of standard normal distribution? | | CO4 | R | 1 |
| 8. | The mean of Binomial distribution is ------- | | CO4 | R | 1 |
| 9. | The mode of the numbers 8, 9, 9, 9, 11, 11, 13, 15, 15, 17, 18, 18, 18, 18 | | CO5 | U | 1 |
| 10. | Define a small sample. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the complete solution of partial differential equation:  *p-x = q-y* | | CO1 | An | 3 |
| 12. | Write all the possible solutions of one-dimensional wave equation. | | CO2 | R | 3 |
| 13. | Eight coins are thrown simultaneously find probability of getting exactly five heads | | CO3 | An | 3 |
| 14. | A continuous random variable X has the following pdf  . Find the value of k. | | CO4 | E | 3 |
| 15. | Ten participants in a contest are ranked by two judges as follows:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 1 | 6 | 5 | 10 | 3 | 2 | 4 | 9 | 7 | 8 | | *y* | 6 | 4 | 9 | 8 | 1 | 2 | 3 | 10 | 5 | 7 |   Calculate the rank correlation coefficient. | | CO5 | E | 3 |
| 16. | Define Type I and Type II errors | | CO5 | 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. | Solve | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | A tightly stretched string with fixed end points x=0 and x=*l* is initially at rest in its equilibrium position. If it is set vibrating by giving each point a velocity *k(lx-x2)* . Find the displacement of the string. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | In a shooting test, the probability of hitting the target is ½ for A, 2/3 for B and ¾ for C. If all of them fire at the target, find the probability that (i) atleast one hits the target (ii) exactly one hits the target(iii) none hits the target. | CO3 | An | 6 |
|  | b. | The chances of A, B, C becoming general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A,B,C become general manager are 0.3,0.7,0.8 respectively. If the bonus scheme has been introduced, what is the probability that Mr. A has been appointed as general manager. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | The 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 |  1. Find K (ii) Evaluate *P(X<2)*   *(iii)* Cumulative Distribution function, *CDF (iv) mean of X.* | CO4 | E | 6 |
| b. | Fit a Poisson distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 43 | 38 | 22 | 9 | 1 | | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | The weekly wages of 1000 workmen are normally distributed with mean Rs.70 and standard deviation Rs 5. Estimate the number of workers, whose weekly wages will be (i) less than Rs. 69. (ii) more than Rs.72. (iii)between Rs 69 and Rs72. | CO4 | E | 6 |
|  | b. | For the bivariate probability distribution of (X,Y) given below, find(i) P(X≤1) (ii) P(Y≤1) (iii)P(X≤1,Y≤ 1) (iv)P(X≤1/Y≤1)     |  |  |  |  | | --- | --- | --- | --- | |  | y | | | | x | 0 | 1 | 2 | | 0 | 0.1 | 0.04 | 0.06 | | 1 | 0.2 | 0.08 | 0.12 | | 2 | 0.2 | 0.08 | 0.12 | | CO4 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Calculate mean, median, mode, upper quartile and lower quartile of the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class | 10– 15 | 15–20 | 20–25 | 25 –30 | 30 – 35 | 35 – 40 | | Freq. | 2 | 28 | 125 | 270 | 303 | 197 | | Class | 40– 45 | 45– 50 | | Freq. | 65 | 10 | | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Fit a second degree parabola to the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | | *y* | 1 | 1.8 | 1.3 | 2.5 | 6.3 | | | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | In an experiment on immunization of cattle from a disease the following results are obtained   |  |  |  | | --- | --- | --- | |  | affected | unaffected | | Inoculated | 40 | 70 | | Not inoculated | 60 | 30 |   Examine whether the effect of vaccine is independent of controlling the incidence of the disease. | CO5 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to acquire knowledge in solution of PDE |
| CO2 | Students will be able to apply solution of PDE in heat and wave equations |
| CO3 | Students will be able to calculate the central tendency of statistical data |
| CO4 | Students will be able to measure the probability of the given event |
| CO5 | Students will be able to test the hypothesis for samples |
| CO6 | Students will be able to apply Matlab and R tools to solve mathematical problems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO2 | 5 | - | 12 | - | - | - | 17 |
| CO3 | - | 2 | - | 15 | - | - | 17 |
| CO4 | 2 | - | 6 | 6 | 15 | - | 29 |
| CO5 | - | 5 | 24 | - | 15 | - | 44 |
| CO6 |  |  |  |  |  |  |  |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **19MA2002** | **Duration** | **3hrs** |
| **Course Name** | **NUMERICAL METHODS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | | **BL** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | | | |
| 1. | The normal equation for fitting of a straight line y = a + bx is | | | CO1 | | U | 1 |
| 2. | The method of least squares finds the best fit line that \_\_\_\_\_ the error between observed and estimated points on the line. | | | CO1 | | R | 1 |
| 3. | The Newton Raphson method fails if ……. | | | CO2 | | U | 1 |
| 4. | In Gaussian elimination method, equations are transformed by using …… | | | CO2 | | R | 1 |
| 5. | Write the Newton’s divided difference interpolation formula? | | | CO3 | | R | 1 |
| 6. | What is the order of error in Trapezoidal rule? | | | CO4 | | R | 1 |
| 7. | To use Simpson’s 1/3rd rule, the number of subinterval n should be…. | | | CO4 | | U | 1 |
| 8. | Write the Taylor’s series expansion of y(x3). | | | CO5 | | R | 1 |
| 9. | What is the classification | | | CO5 | | An | 1 |
| 10. | Write the general form of diagonal five point formula. | | | CO5 | | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | | | |
| 11. | Following data is given for the curve *y = a + bx.* Find the value of b.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | X | 1 | 20 | 30 | 40 | | Y | 1 | 400 | 800 | 1300 | | | | CO1 | | A | 3 |
| 12. | Find the values of x, y and z in the following system of equations:  *2x+y – 3z = - 10; -2y +z= -2; z = 6.* | | | CO2 | | A | 3 |
| 13. | Write the sufficient condition for Gauss-Seidel method to converge? | | | CO2 | | U | 3 |
| 14. | State Newton’s formula to find f’(x) and f’’(x) using the forward differences. | | | CO3 | | R | 3 |
| 15. | How many sub-intervals are needed to approximate  with error not to exceed  using the trapezoid rule? | | | CO4 | | E | 3 |
| 16. | Using Crank Nicholson method, find the value of *u* from the below table. | | | CO5 | | 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. |  | Fit a straight line to the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 6 | 11 | 16 | 20 | 26 | | Y | 13 | 16 | 17 | 23 | 24 | 31 | | | CO1 | | An | 12 |
|  |  |  | |  | |  |  |
| 18. | a. | Find a real root of the equation *cosx – 4x + 2 = 0* by Newton Raphson method up to four decimal places. | | CO2 | | A | 6 |
|  | b. | Solve the equations using Gauss Jordan methods  *x+2y+6z=22; 3x+4y+z=26; 6x – y – z = 19.* | | CO2 | | An | 6 |
|  |  |  | |  | |  |  |
| 19. |  | Using cardinal functions, find the Lagrange’s interpolating polynomial for the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 2 | 3 | 4 | |  | 7 | 11 | 28 | 63 | | | CO3 | | An | 12 |
|  |  |  | |  | |  |  |
| 20. |  | Find the value of  using Trapezoidal rule, Simpson’s one - third and Simpson’s three - eighth rule. | | CO4 | | E | 12 |
|  |  |  | |  | |  |  |
| 21. |  | Given that , find *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | | CO4 | | An | 12 |
|  |  |  | |  | |  |  |
| 22. |  | Solve with and *u(x,0) = 20 = u(x,1)* by taking *h = 0.25* using Liebmann’s iterative method. | | CO5 | | An | 12 |
|  |  |  | |  | |  |  |
| 23. | a. | Using Taylor’s series method, find y(1.1) given that y ‘ = x+y; y(1) =0. | | CO4 | | A | 6 |
|  | b. | Using Eule’s method, solve y ‘ = x + y + xy; y(0) = 1 compute y at x = 0.1 by taking h = 0.05. | | CO4 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | a. | By using Gauss-Seidel iterative method, solve *x + y +54z = 110; 27x + 6y – z = 85; 6x + 15y + 2z = 72.* | | CO2 | | An | 6 |
|  | b. | Solve *uxx = 2ut,* when *u(0,t)=0 = u(4, t)* and *u(x, 0)=x(4-x)* upto *t=1* sec assuming *h=1.* | | CO5 | | An | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to discriminate and learn techniques of curve fitting. |
| CO2 | The students will be able to understand the basic concepts and techniques of solving algebraic and transcendental equations. |
| CO3 | The students will be able to appreciate the numerical techniques of interpolation in various intervals in real life situations. |
| CO4 | The students will be able to gain the knowledge of various techniques and methods for solving first and second order ordinary differential equations. |
| CO5 | The students will be able to solve the ordinary differential equations with boundary conditions by using certain techniques with engineering applications. |
| CO6 | The students will be able to apply MATLAB tools to solve mathematical problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO2 | 1 | 4 | 9 | 12 | - | - | 26 |
| CO3 | 4 | - | - | 12 | - | - | 16 |
| CO4 | 1 | 1 | 12 | 12 | 15 | - | 41 |
| CO5 | 2 | - | - | 22 | - | - | 24 |
| CO6 | - | - | - | - | - | - | - |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code:** | **19MA2010** | **Duration :** | **3hrs** |
| **Course Name:** | **NUMERICAL MATHEMATICS AND COMPUTING** | **Max. Marks:** | **100** |

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| **Q. No.** | **Questions** | **CO/BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | What is the nested multiplication form of *f(x) = x3 – 2x2 + x - 3*? | CO1/U | 1 |
| 2. | (AB.04)16 = (…..) 2. | CO1/ An | 1 |
| 3. | In divided difference table, if *f[x2, x1] = 2,* then *f[x1, x2] =* ……….. | CO2/U | 1 |
| 4. | For the below table, *l0(x) =* ….   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | f(x) | 2 | 4 | 4 | | CO2/E | 1 |
| 5. | To use Simpson’s 3/8th rule, the number of subinterval *n* should be … | CO3/R | 1 |
| 6. | If *R(4, 0) = 7* and *R(3, 0) = 4*, then *R(4, 1)* = … | CO3/U | 1 |
| 7. | Is a linear spline function? Justify your answer. | CO4/U | 1 |
| 8. | The B splines of degree 0, *Bi0(x)* is ……….. | CO4/R | 1 |
| 9. | In fourth order Runge-Kutta method, *k4* = ……….… | CO5/R | 1 |
| 10. | The corrector formula is …. | CO5/R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Write the pseudo code for the expression *a1 + a2 + … +an.* | CO6/R | 3 |
| 12. | Find the polynomial that interpolates the following values.   |  |  |  | | --- | --- | --- | | x | 0 | 2 | | f(x) | 7 | 11 | | CO2/A | 3 |
| 13. | Find the value of using Gaussian quadrature by taking 2 points? | CO2/E | 3 |
| 14. | Fit a linear spline to the following data:   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | 0 | | CO3/A | 3 |
| 15. | Using the second order Runge-kutta method, find the value of *k1* given *y’ = - y, y(0) = 1* by taking *h = 0.1.* | CO4 /An | 3 |
| 16. | Using Crank Nicholson method, find the value of *u* from the below table. | CO5/E | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. |  | Using *Bisection Method*, find a root of the equation *x3 – 4x – 9 = 0*  correct to 4 decimal places. | CO1/An | 12 |
|  |  |  |  |  |
| 18. | a. | Construct the Divided – Difference table for the below data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 3 | 2 | 5 | | y | 2 | 1 | 5 | 6 | -183 | | CO2/A | 5 |
| b. | Using cardinal functions, find the Lagrangian interpolating polynomial for the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 2 | 3 | 4 | |  | 7 | 11 | 28 | 63 | | CO2/An | 7 |
|  |  |  |  |  |
| 19. | a. | Find the value of  using (i) Trapezoidal rule (ii) Simpson’s rules | CO2/E | 6 |
| b. | Romberg Algorithm to approximate  by evaluating R(1,1). | CO2/E | 6 |
|  |  |  |  |  |
| 20. | a. | Determine whether the below function is a quadrature spline function. | CO3/U | 4 |
| b. | Find the natural cubic interpolating spline function for the below table.   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | -1 | | CO3/A | 8 |
|  |  |  |  |  |
| 21. | a. | Using Taylor’s series method, find *y(1.1)* given that *y ‘ = x+y*; *y(1) =0.* | CO4/E | 6 |
| b. | Using Eule’s method, solve *y ‘ = x + y + xy; y(0) = 1* compute *y* at *x = 0.1* by taking *h = 0.05.* | CO4/E | 6 |
|  |  |  |  |  |
| 22. | a. | Convert the following.  (7152.46)8= (\_\_\_\_\_\_\_\_\_\_) 10 = (\_\_\_\_\_\_\_\_\_ )16 = ( \_\_\_\_\_\_\_ )2. | CO1/U | 6 |
| b. | Find the root of *f(x) = x3 – x + 1 = 0* by using *Newton Raphson* method correct to five decimal places. | CO1/A | 6 |
|  |  |  |  |  |
| 23. | a. | How many sub-intervals are needed to approximate with error not to exceed using the trapezoid rule? | CO2/E | 6 |
| b. | Convert *p4(x) = -5 + 2x – 4x(x-1) + 8x(x-1)(x+1) + 3x(x-1)(x+1)(x-2)* to nested form then find the value of *p4(3).* | CO1/U | 6 |
|  |  | **COMPULSORY QUESTION** | | |
| 24. | a. | By using Gauss-Seidel iterative method, solve *x + y +54z = 110; 27x + 6y – z = 85; 6x + 15y + 2z = 72.* | CO5/An | 6 |
| b. | Solve , the boundary conditions are given below(give only 3iterations) | CO5/An | 6 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The Student will be able to get knowledge about different methods of solving algebraic equations. |
| CO2 | The Student will be able to evaluate integration using numerical techniques. |
| CO3 | The Student will be able to compute using spline functions. |
| CO4 | The Student will be able to solve ordinary differential equations using numerical techniques. |
| CO5 | The Student will be able to solve partial differential equations using numerical techniques. |
| CO6 | The Student will be able to apply MATLAB tools in numerical problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 13 | 6 | 13 | - | - | 32 |
| CO2 | - | 1 | 8 | 7 | 22 | - | 38 |
| CO3 | 1 | 5 | 11 | - | - | - | 17 |
| CO4 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO5 | 2 | - | - | 12 | 3 | - | 17 |
| CO6 | 3 | - | - | - | - | - | 3 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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

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| --- | --- | --- | --- | --- | --- |
| **Q.**  **No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Find the least number which when divided by 7, leaves a remainder of 6 and  when divided by 11, leaves a remainder of 8. | CO1 | A | 8 |
|  | b. | If 50% of (x-y)=40% of (x+y), then what percent of x is y? | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | The product of three integers x,y,z is 192, z equal to 4 and p is equal to the  average of x and y. What is the minimum possible value of p? | CO2 | U | 6 |
|  | b. | A sum of money on compound interest amount to Rs.9680 in 2 years and to  Rs.10648 in 3 years. What is the rate of interest per annum? | CO2 | A | 6 |
|  | c. | A man has some hens and cows. If the number of heads be 48 and the  number of feet equals 140, then find the number of hens. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 3. | a. | Arun is 2 years older than Bharat who is twice as old as Charat. If the total  of the ages of Arun, Bharat and Charat be 27, then how old is Bharat? | CO3 | U | 5 |
|  | b. | Two lots of onions with equal quantity, one costing Rs.10 per kg and the other costing Rs.15 per kg are mixed together and whole lot is sold at Rs.15  per kg. What is the profit or loss? | CO3 | U | 5 |
|  | c. | Cost of two types of pulses is Rs.15 and Rs, 20 per kg, respectively. If both the pulses are mixed together in the ratio 2:3, then what should be the price  of mixed variety of pulses per kg? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 4. | a. | In how many ways can 4 boys and 3 girls be arranged in a bench (i) if there are no restrictions (ii) if boys and girls are seated in separate groups (iii) if  boys are seated first, followed by girls are seated | CO4 | A | 8 |
|  | b. | A Box contains 4 white, 2 green and 5 red balls. Three balls are drawn from the box randomly. (i) What is the probability that they are of same color?  (ii) What is the probability that they are not same color? | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Two pipes P and Q can fill a cistern in 36 and 48 minutes respectively. Both  pipes are opened together, after how many minutes should Q be turned off, so that the cistern be full in 24 minutes. | CO3 | A | 8 |
|  | b. | A train 300 m long is running at a speed of 54 km/hr. In what time will it  pass a bridge 150 m long? | CO3 | U | 4 |
|  | c. | A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish  the remaining work? | CO3 | U | 4 |
|  |  |  |  |  |  |
| 6. | a. | A sum of money is to be distributed among A, B, C, D in the proportion of  5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share? | CO1 | A | 6 |
|  | b. | The average weight of a class of 15 boys and 10 girls is 38.4kg. If the average weight of the boys is 40 kg, then what is the average weight of the  girls? | CO1 | A | 6 |
|  | c. | 66 cubic centimetres of silver is drawn into a wire 1 mm in diameter. Find  the length of the wire in metres. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 7. | a. | Two poles of equal heights stand on either sides of a roadway which is 100m wide. At a point on the roadway between the poles, the elevations of the top of the poles are 60 degree and 30 degree. Find the heights of the poles. | CO5 | A | 8 |
|  | b. | A man’s speed with the current is 15km/hr and the speed of the current is  2.5km/hr. Find the man’s speed against the current? | CO4 | U | 4 |
|  | c. | The angle of elevation of a ladder leaning against a wall is 600c and the foot of the ladder is 4.6m away from the wall. Find the length of the ladder. | CO5 | U | 4 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Study the bar chart and answer the question based on it.  Production of Fertilizers by a Company (in 1000 tonnes) Over the Years     1. What was the percentage decline in the production of fertilizers from 1997 to 1998? 2. The average production of 1996 and 1997 was exactly equal to the average production of which pair of years? 3. What was the percentage increase in production of fertilizers in 2002 compared to that in 1995? 4. In which year was the percentage increase in production as compared to the previous year the maximum? 5. In how many of the given years was the production of fertilizers more than the average production of the given years? | CO6 | An | 15 |
|  | b. | The following pie chart shows the amount of subscriptions generated for India Bonds from different categories of investors.  Subscriptions Generated for India Bonds | CO6 | An | 5 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 1. In the corporate sector, approximately how many degrees should be there in the central angle? 2. If the investment by NRI's are Rs 4,000 crore, then find the investments by corporate houses and FII's together. |  |  |  |

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

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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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 8 | 28 | - | - | - | 36 |
| CO2 | - | 6 | 6 | - | - | - | 12 |
| CO3 | - | 18 | 14 | - | - | - | 32 |
| CO4 | - | 4 | 16 | - | - | - | 20 |
| CO5 | - | 4 | 8 | - | - | - | 12 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **15MA3017 / 19MA3021** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR COMPETITIVE EXAMINATIONS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | 60 litres of a mixture contains milk and water in the ratio 2:1. How much more water is to be added to get a new mixture containing milk  and water in the ratio 2:1 | CO1 | A | 6 |
|  | b. | The population of a town is 1, 76,400 if it increases at the rate of 5% per annum, what will be its population 2years hence? What was it 2 years ago? | CO1 | U | 5 |
|  | c. | The traffic lights at three different road crossings change after every 48 sec, 72 sec and 108 sec respectively. If they all change simultaneously  at 8:20:00 hours, then at what time will they again change simultaneously? | CO1 | U | 5 |
|  |  |  |  |  |  |
| 2. | a. | Find the sum. | CO2 | R | 6 |
|  | b. | If 3565÷ 23+4675÷x=430 find x. | CO2 | A | 5 |
|  | c. | Find the compound interest on Rs 10,000 in 2 years at 4% per annum, the interest being compounded half yearly | CO2 | U | 5 |
|  |  |  |  |  |  |
| 3. | a. | A,B,C start a business investing Rs 20,000. After 5 months A withdraw Rs 5,000, B withdraw Rs 4000 and C invests Rs 6,000 more. At the end of the year a total profit of Rs 69,900 was recorded. Find the share of each | CO3 | A | 6 |
|  | b. | ‘A’ speaks truth in 80% cases, ‘B’ in 75% of cases. In what percentage of cases are they likely to contradict each other in narrating the same incident | CO3 | A | 5 |
|  | c. | In how many ways can the letter “FOREST” be arranged so that  i) all vowels are together ii)vowels are never together. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 4. | a. | A can do a piece of work in 7 days of 9 hours each , B can do it in 6 days of 7 hours each. How long will they have to take to do it together working hours a day. | CO4 | A | 6 |
|  | b. | Ramesh can do a work in 5 days .Suresh can do the same work in 7 days. The amount given for their work to them is Rs 480. If both are working together then what will be the share of Suresh. | CO4 | A | 5 |
|  | c. | A cistern has two taps which fill it in 12 minutes and 15 minutes respectively .There is also a waste pipe in the cistern. When all the three are opened the empty cistern is full in 20 minutes. How long will the waste pipe take to empty the full cistern? | CO4 | A | 5 |
|  |  |  |  |  |  |
| 5. | a. | Two trains 100 meters and 120 meters long are running in the same direction with speeds of 72 km/hr and 54km/hr. In how much time first train cross the second? | CO4 | A | 6 |
|  | b. | A man can row 6km/hr in still water. It takes him twice as long to row up as to row down the river. Find rate of stream. | CO4 | A | 5 |
|  | c. | In what ratio should rice at Rs 9.30 per kg mixed with rice at Rs 10.80 per kg so that the mixture be worth Rs 10 per kg? | CO4 | R | 5 |
|  |  |  |  |  |  |
| 6. | a. | The average temperature for Monday, Tuesday, Wednesday and Thursday was 46° and for Tuesday, Wednesday, Thursday and Friday was 45°. If the temperature on Monday was 40° find the temperature on Friday. | CO1 | U | 6 |
|  | b. | A rectangular courtyard, 3.78m long and 5.25m broad, is to be paved exactly with square tiles, all of the same size. Find the least number of square tiles covered. | CO1 | R | 5 |
|  | c. | If a fraction has its numerator increased by 1, it becomes equal to 1/3, but if its denominator is increased by 1, it becomes equal to 1/4. Find the fraction. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 7. | a. | A person reaches his destination 40 minutes late if his speed is 3km/hr and reached 30 minutes before time if his speed is 4 km/hr. Find the distance of his destination from his starting point. | CO5 | A | 6 |
|  | b. | Two poles of equal heights stand on either side of a roadway between the poles, the elevation of the top of the poles are 60˚ and 30˚. Find the heights of the poles and the position of the point. | CO5 | U | 5 |
|  | c. | A book was sold for Rs 27.50 with a profit of 10%. If it was sold for Rs 25.75, then what would have been the percent of profit or loss? | CO5 | A | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | The following pie chart shows the amount of subscriptions generated for India Bonds from different categories of investors.  Subscriptions Generated for India Bonds     1. In the corporate sector, approximately how many degrees should be there in the central angle? 2. If the investment by NRI’s is Rs 4,000 crore, then the investments by corporate houses and FII's together is? 3. What percentage of the total investment is coming from FII's and NRI's? | CO6 | U | 5 |
|  | b. | The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2000 and 2001.    1. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?  2. Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?  3. What percent of the average sales of branches B1, B2 and B3 in 2001 is the average sales of branches B1, B3 and B6 in 2000?  4. What is the average sale of all the branches (in thousand numbers) for the year 2000?  5. What is the total sales of branches B1, B3 and B5 together for both the years (in thousand numbers)? | CO6 | A | 15 |
|  |  |  |  |  |  |

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

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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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 16 | 11 |  |  |  | 32 |
| CO2 | 6 | 5 | 5 |  |  |  | 16 |
| CO3 |  | 5 | 11 |  |  |  | 16 |
| CO4 | 10 |  | 22 |  |  |  | 32 |
| CO5 |  | 5 | 11 |  |  |  | 16 |
| CO6 |  | 5 | 15 |  |  |  | 20 |
|  | | | | | | | **132** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Discuss the build-in function and user-defined functions in MATLAB. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain matrix computation in MATLAB with example. | CO1 | R | 10 |
|  | b. | Write a MATLAB program to solve an ordinary differential equation. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. |  | Discuss about numerical differentiation in MATLAB with example. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a MATLAB program to solve partial differential equation. | 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 |
|  |  |  |  |  |  |
| 6. |  | Explain in detail about expressions and arithmetic in Python. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | How to create a list in LaTex? Explain with example. | CO5 | U | 20 |
|  |  |  |  |  |  |
| 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 | R | 10 |

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

|  |  |
| --- | --- |
|  | **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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 20 | 10 | - | - | - | 40 |
| CO2 | 10 |  | 30 | - | - | - | 40 |
| CO3 | - | - | 10 | 10 | - | - | 20 |
| CO4 | - | - | - | 30 | - | - | 30 |
| CO5 | - | 20 | 20 | - | - | - | 40 |
| CO6 | - | - | 10 | - | - | - | 10 |
|  | | | | | | | **180** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA1001** | **Duration** | **3hrs** |
| **Course Name** | **ANALYTIC GEOMETRY, CALCULUS AND LINEAR ALGEBRA** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is the eccentricity of the parabola? | | CO1 | U | 1 |
| 2. | Mention the latus rectum of Hyperbola. | | CO1 | R | 1 |
| 3. | Define orthogonal matrix. | | CO2 | U | 1 |
| 4. | State Cayley-Hamilton theorem. | | CO2 | R | 1 |
| 5. | The sequence  is oscillatory through-----. | | CO3 | U | 1 |
| 6. | The Geometric series  converges if | | CO3 | R | 1 |
| 7. | Write the half range Fourier cosine series in | | CO4 | R | 1 |
| 8. | In a Fourier cosine transform, | | CO4 | R | 1 |
| 9. | In integral calculus,  represents\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | When is a vector said to be irrotational? | | CO6 | R | 1 |
|  | **PART – B (6 X 3 = 18 MARKS)** | |  |  |  |
| 11. | Write the directrix of the ellipse | | CO1 | E | 3 |
| 12. | Find the characterstic equation of | | CO2 | E | 3 |
| 13. | Test the convergence of sequence | | CO3 | A | 3 |
| 14. | State Dirichlet’s condition for Fourier series. | | CO4 | An | 3 |
| 15. | Find the value of  . | | CO5 | E | 3 |
| 16. | Show that  is solenoidal | | 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. | Find the center, foci, eccentricity and vertices of the following ellipse  and draw it. | CO1 | An | 6 |
|  | b. | Find the shortest distance between the skew lines and find its equations. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Find the Eigen values and Eigen vectors of | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Test the convergence of the series | CO3 | A | 6 |
|  | b. | Test for convergence of the alternating series | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Find the Fourier series of | CO4 | E | 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 | | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and evaluate | CO5 | E | 6 |
|  | b. | Find the area between the curves  . | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. |  | Verify Caley-Hamilton theorem and find its inverse of | CO2 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | A particle is moving along the curves , and  , where t is the time. Find the velocity, speed and acceleration at t=1 in the direction of  . | CO3 | A | 6 |
|  | b. | Verify Green’s theorem for  where c is bounded by and . | CO4 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Verify Gauss divergence theorem for  bounded by the lines | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the geometry of 2D and 3D structures. |
| CO2 | Relate matrices to solve dynamic problems. |
| CO3 | Express functions as infinite series. |
| CO4 | Apply Fourier series and transform techniques to find values of physical variables. |
| CO5 | Calculate area and volume using integration techniques. |
| CO6 | Make use of vector space concepts in magnetic field and moving fluid |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 6 | 6 | 3 | - | 17 |
| CO2 | 1 | 1 | -- | - | 27 | - | 29 |
| CO3 | 1 | 1 | 21 |  | - | - | 23 |
| CO4 | 1 | 1 |  | 9 | 12 | - | 23 |
| CO5 | 1 | - |  | - | 15 | - | 16 |
| CO6 | 1 | - |  | 15 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1002** | **Duration** | **3hrs** |
| **Course Name** | **DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The volume of the solid generated about the y-axis,x=f(y) and the ordinates y=a and y=b is \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | If the tangents are real and distinct then the double point is called \_\_\_\_\_\_. | | CO1 | U | 1 |
| 3. | In Legendre’s polynomial the value of \_\_\_. | | CO2 | R | 1 |
| 4. | In Cauchy’s Euler differential equation, the substitution for xDis \_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 5. | Write the Cauchy Riemann equations in cartesian form. | | CO3 | R | 1 |
| 6. | State Liouville’s theorem. | | CO3 | R | 1 |
| 7. | dt using Laplace Transforms. | | CO4 | R | 1 |
| 8. | Find the Laplace Transform of . | | CO4 | U | 1 |
| 9. | Obtain the complete solution of . | | CO5 | R | 1 |
| 10. | The degree of the partial differential equation +=0 is \_\_\_\_\_\_\_. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the asymptotes for the curve parallel to x-axis. | | CO1 | U | 3 |
| 12. | Solve . | | CO2 | U | 3 |
| 13. | Find the poles of . | | CO3 | U | 3 |
| 14. | Find the Laplace Transform of | | CO4 | U | 3 |
| 15. | Solve . | | CO5 | U | 3 |
| 16. | Write the three possible solutions of one-dimensional wave equation. | | 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. |  | Expand the function by using Taylor’s theorem in powers of x and y about the point (0,upto the second degree term. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Solve by using method of variation of parameters. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate using Cauchy Integral formula. | CO3 | A | 6 |
|  | b. | Find the Bilinear Transformation which maps (1,i,-1) onto the point(0,1,). | CO3 | A | 6 |
| 20. | a. | Find L(). | CO4 | A | 6 |
|  | b. | Evaluate using Convolution theorem. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Solve . | CO5 | A | 6 |
|  | b. | Solve . | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Find the inverse Laplace Transform of using partial fraction method. | CO4 | A | 6 |
|  | b. | Solve (. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find the extremum values of the function . | CO1 | A | 6 |
|  | b. | Solve : . | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A tightly stretched string has its ends fixed at x=0 and x=l. At time t=0  the string is given a shape defined by y(x,0)=)  and then released. Find the displacement at any point x of the string at  any time t > 0. | CO6 | A | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Evaluate surface area and volume using definite integral. |
| CO2 | Understands solution of first and second order ODE. |
| CO3 | Classify different types of higher order ODE and their solution. |
| CO4 | Construct harmonic and bilinear transformations. |
| CO5 | Evaluate definite integral using complex integration. |
| CO6 | Apply MATLAB tools to solve mathematical problems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 18 | - | - | - | 23 |
| CO2 | 1 | 4 | 18 |  |  |  | 23 |
| CO3 | 2 | 3 | 12 |  |  |  | 17 |
| CO4 | 1 | 4 | 18 |  |  |  | 23 |
| CO5 | 1 | 4 | 18 |  |  |  | 23 |
| CO6 | 3 | - | 12 |  |  |  | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA1003** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR DATA SCIENCE AND MACHINE LEARNING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The following data relates to the height of `0 students (in cms) in a school. Calculate the range 158, 164, 168, 170, 142, 160, 154, 174, 159, 146. | | CO1 | E | 1 |
| 2. | Find the mode of the following data 4,8,15, 12, 10, 18, 3, 11, 4, 11. | | CO1 | R | 1 |
| 3. | If X and Y are independent then covariance between X and Y defined as --------- | | CO2 | U | 1 |
| 4. | State the line of regression formula. | | CO2 | R | 1 |
| 5. | A coin is tossed 3 times. Find the probability to get a more tails than heads. | | CO3 | A | 1 |
| 6. | Define probability. | | CO3 | R | 1 |
| 7. | For any event A in a random experiment, the value of  P(A) + P() = ----------- | | CO4 | R | 1 |
| 8. | Define Joint probability density function. | | CO5 | R | 1 |
| 9. | Define small sample. | | CO6 | R | 1 |
| 10. | Define Null Hypothesis. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | The following data relates to the height of `0 students (in cms) in a school. Calculate the range and coefficient of range 258, 264, 268, 270, 242, 260, 254, 274, 259, 246. | | CO1 | E | 3 |
| 12. | Define Spearman’s rank correlation. | | CO2 | R | 3 |
| 13. | From a well shuffled deck of 52 playing cards, find the probability of getting (a) a spade (b) 2 kings. | | CO3 | A | 3 |
| 14. | State Baye’s theorem. | | CO4 | U | 3 |
| 15. | Determine the binomial distribution with mean 4 and variance 3. | | CO5 | An | 3 |
| 16. | Define Type I and Type II error in Sampling. | | 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. | a. | Find the Geometric mean for the following distribution of data   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | xi | 50 | 72 | 54 | 82 | 93 | Total | | log xi | 1.6990 | 1.8573 | 1.7324 | 1.9138 | 1.9685 | 9.1710 | | CO1 | E | 7 |
|  | b. | Find the Harmonic mean for the following distribution of data   |  |  |  |  | | --- | --- | --- | --- | | Dividend yield | 2-6 | 6-10 | 10-14 | | No.of companies | 10 | 12 | 18 | |  | E | 5 |
|  |  |  |  |  |  |
| 18. |  | Calculate the correlation coefficient for the following heights of fathers X and their sons Y.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 72 | | Y | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | A bag contains 10 white and 3 black balls. Another bag contains 3 white and 5 black balls .two are drawn at random from the first bag and placed in second bag and then one ball is taken at random from the latter. What is the probability that it is a white ball? | CO3 | E | 8 |
|  | b. | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | p(x) | a | 3a | 5a | 7a | 9a | 11a |  1. Find a , (b) Evaluate P(X< 3) |  | E | 4 |
|  |  |  |  |  |  |
| 20. | a. | A machine used for particular job in the forenoon and for a different job in the afternoon. The joint pdf of (X, Y), where X and Y represent the number of times the machine breaks down in the forenoon and in the afternoon respectively, is given in the following table. Examine if X and Y are independent RV’s   |  |  |  |  | | --- | --- | --- | --- | | X | Y | | | | 0 | 1 | 2 | | 0 | 0.1 | 0.04 | 0.06 | | 1 | 0.2 | 0.08 | 0.12 | | 2 | 0.3 | 0.08 | 0.12 | | CO4 | An | 8 |
|  | b. | The joint pdf of two –dimensional RV (X,Y) is given below by  *f(x,y)* = 8xy, 0<x<1 , 0 < y <1  = 0 elsewhere  Compute (i) P, (ii) P. |  | E | 4 |
|  |  |  |  |  |  |
| 21. | a. | The life of a lamp produced by a factory is distributed normally with a mean of 50 days and standard deviation of 15 days .If 5000 lamps are fitted on the same day; find the number of lamps to be replaced after 74 days. | CO5 | E | 8 |
|  | b. | If X is Poisson variable with parameter λ and if 3P(X = 2). |  | E | 4 |
|  |  |  |  |  |  |
| 22. | a. | A certain manufacturing process yields electrical fuses of which in the long run 12 (1/2) % are defective. Find the probability that in a random sample of 10 fuses there will be (i) no defective  (ii) At most 2 are defective. | CO5 | An | 9 |
|  | b. | The variance of a Poisson distribution is 0.5, Find P(X=5) |  | E | 3 |
| 23. |  | Two horse A and B were tested according to the time(in sec) to run a particular race with the following results:  Test whether the horse A is running faster than B at 5% level.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Horse A | 28 | 30 | 32 | 33 | 33 | 29 | 34 | | Horse B | 29 | 30 | 30 | 24 | 27 | 29 | - | | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | In an investigation into the health and nutrition of two groups of children of different social status, the following results are got,   |  |  |  |  | | --- | --- | --- | --- | | **Social status/Health’s** | **Poor** | **Rich** | **Total** | | **Below normal** | 130 | 20 | 150 | | **Normal** | 102 | 108 | 210 | | **Above Normal** | 24 | 96 | 120 | | **Total** | 256 | 224 | 480 |   Discuss the relation between the Health and their social status. | CO6 | An | 12 |

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

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | - | - | - | 16 | - | 17 |
| CO2 | 4 | 1 | 12 | - | - | - | 17 |
| CO3 | 1 | - | 4 | - | 12 | - | 17 |
| CO4 | 1 | 3 | - | 8 | 4 | - | 16 |
| CO5 | 1 | - | - | 12 | 15 | - | 28 |
| CO6 | 5 | - | - | 24 | - | - | 29 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1004** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL MODELLING FOR ENGINEERING PROBLEMS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If the matrix A = then |A| = ------------ | | CO1 | U | 1 |
| 2. | Compute the rank of the matrix | | CO1 | R | 1 |
| 3. |  | | CO2 | R | 1 |
| 4. | If then find the value of | | CO2 | U | 1 |
| 5. | The vector v(x, y, z) is solenoidal if …… | | CO3 | R | 1 |
| 6. | Compute the complementary function (C.F) for | | CO4 | A | 1 |
| 7. | A simple pendulum is the suitable example for …… | | CO4 | R | 1 |
| 8. | The coefficient of friction *µ = …….* | | CO5 | U | 1 |
| 9. | Write down the equations of motion in a straight line with constant acceleration. | | CO5 | R | 1 |
| 10. | State static friction and dynamic friction. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If the Eigen values of matrix A are -2,3,6, then what are the Eigen values  (i) 2A (ii) A-1 (iii) A2. | | CO1 | A | 3 |
| 12. | If u = x2y + xy2-xy then, Find ux and uy. | | CO2 | E | 3 |
| 13. | If = x + y + z, Find the Curl . | | CO3 | A | 3 |
| 14. | Evaluate the particular integral (P.I) for | | CO4 | E | 3 |
| 15. | Write the horizontal motion and vertical motion of projectile problems. | | CO5 | R | 3 |
| 16. | Write the radon transform general form of the discrete function *f(x, y).* | | 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. | a. | State Cayley Hamiltonian theorem and verify for the matrix given below.  A = . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate dx. | CO2 | E | 6 |
|  | b. | If *u = tan-1* show that*x + y = sin 2u* using Euler’s theorem. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Using Green’s theorem evaluate dx + -6x) dy where c is boundary of the square bounded by the line x = 0, y = 0,  x = 1, y = 1. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | A copper spring suspended from a fixed point supports a scale pan of mass 0.05 kg at equilibrium. The scale pan descends 40mm to a new equilibrium position when a 1 N weight is placed on it. Calculate the   1. Spring constant, 2. The total mass of the scale pan and the 1 N weight.[g can be taken as 10 ms-2] 3. The scale pan, with 1 N weight on it, is pulled a distance of 15mm downwards from equilibrium and then released. Calculate the time period of the oscillations, and the maximum speed of the scale pan. | CO4 | An | 6 |
|  | b. | Solve −2D + 1) = + *3 cos2x +x.* | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Suppose a golfer hits a ball with a velocity of 45ms-1 at an angle of 20 degree to the horizontal.   1. Where will the ball be 2 seconds later? 2. What is the greatest height the ball will reach? | CO5 | An | 6 |
|  | b. | A 50g mass vibrates in SHM at the end of the spring. The amplitude of the motion is *12 cm* and the period is *0.1* mts. Find the maximum speed of the mass. What will be the speed at *x = A/2*? | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Verify the Stoke’s theorem for F = (+)I-2xyJ taken around the rectangle bounded by the lines x = , y = 0, y = b. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | If u = 2xy, v = − , x = r cos θ , y = r sin θ. Evaluate , without actual substitution. | CO2 | E | 9 |
|  | b. | Evaluate using Integration by parts. | CO2 | E | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A body of weight 300N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25 degree with the horizontal. | CO6 | An | 6 |
|  | b. | Consider car traffic on a highway, with just one lane for simplicity. Discuss the conservation derives a partial differential equation. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply the mathematical tools - matrices into fields of engineering appropriately. |
| CO2 | Design and solve the engineering problems using variational techniques. |
| CO3 | Construct the differentiation model to develop solutions in the fields of physical phenomena. |
| CO4 | Recognize and find solution for real time technical problems using ordinary differential equations. |
| CO5 | Make use of mathematical principles in solving linear and nonlinear vibration problems. |
| CO6 | Solve inverse problems in continuum mechanical systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 3 |  | 12 |  | 17 |
| CO2 | 1 | 1 | 6 |  | 27 |  | 29 |
| CO3 | 1 | - | 3 | 24 | - | - | 28 |
| CO4 | 1 | - | 1 | 6 | 9 | - | 17 |
| CO5 | 4 | 1 | - | 12 | - | - | 17 |
| CO6 | 4 | - | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1005** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL FOUNDATIONS OF COMPUTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the inverse of the matrix A=. | | CO1 | U | 1 |
| 2. | Find the rank of . | | CO1 | R | 1 |
| 3. | What are the Eigen values of matrix A-1 if 2, 4, 6 are the Eigen values of matrix A? | | CO2 | R | 1 |
| 4. | Write the quadratic form of the given matrix form  A= | | CO2 | U | 1 |
| 5. | If *u* and *v* are the functions of r and s, where *r* and s are the functions of x and *y* then = | | CO3 | R | 1 |
| 6. | = | | CO3 | R | 1 |
| 7. | Evaluate = | | CO4 | E | 1 |
| 8. | Evaluate β | | CO4 | R | 1 |
| 9. | Compute  *dx.* | | CO5 | R | 1 |
| 10. | If in (- , then the Fourier coefficient \_\_\_\_\_\_\_\_. | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Check the matrix A = is Hermitian or not. | | CO1 | An | 3 |
| 12. | If the canonical form of the quadratic form is , then find the Rank, Index and Signature and Nature of quadratic form. | | CO2 | An | 3 |
| 13. | If ,  and , evaluate at . | | CO3 | E | 3 |
| 14. | Compute | | CO4 | E | 3 |
| 15. | Evaluate | | CO5 | E | 3 |
| 16. | If, then find the Fourier Coefficient in. | | 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. | a. | Test the consistency of the system of equations and solve using Gauss Elimination Method  2𝑥 +𝑦+ 2𝑧 =10 ; 𝑥 +2𝑦 +𝑧 = 8; 3𝑥+y - 𝑧 = 2 | CO1 | A | 6 |
|  | b. | Find the inverse of the matrix A using Gauss Jordan Method  A= | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Evaluate (i) Characteristic equation (ii) Eigen values (iii) Eigen vectors of the matrix  A= | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the maxima and minima using second derivative test  𝑓(𝑥) = 2𝑥3 − 3𝑥2 − 36𝑥 + 10. | CO3 | A | 8 |
|  | b. | If find the partial derivative of Ux , Uy, Uxy ,Uyy . | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate ∫ 𝑥2 cos3x 𝑑𝑥. | CO4 | E | 6 |
|  | b. | Evaluate . | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and evaluate | CO5 | An | 8 |
|  | b. | Evaluate. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Find the volume of the sphere *x*2  *y*2  *z*2  *a*2. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Obtain the Half range Fourier Cosine series and Half range Fourier Sine Series for f(x) =x in the interval (0,  | CO6 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  / 3 | 2 / 3 |  | 4 / 3 | 5 / 3 | 2  | | y | 10 | 12 | 15 | 20 | 17 | 11 | 10 |   Find the first three harmonic of the Fourier series of y given by  the following table: | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to solve linear systems of equations using matrices. |
| CO2 | The student will be able to find the Eigen values, Eigen vectors of matrices and diagonalize the matrices. |
| CO3 | The student will be able to apply differentiation techniques to find extreme values of functions. |
| CO4 | The student will be able to demonstrate knowledge in integration. |
| CO5 | The student will be able to evaluate area and volume using definite integral. |
| CO6 | The student will be able to express periodic functions as a series of sine and cosine functions |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO2 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO3 | 2 | 4 | 8 | - | 4 | - | 18 |
| CO4 | 1 | - | - | - | 15 | - | 16 |
| CO5 | 1 | - | 16 | 8 | 3 | - | 28 |
| CO6 | - | - | 12 | - | 16 | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1006** | **Duration** | **3hrs** |
| **Course Name** | **CALCULUS, VECTOR SPACES AND LAPLACE TRANSFORMS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The coordinates of centre of curvature  is \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | The volume of the solid generated by the revolution, about the y-axis, of the area bounded by the curve  the y-axis and the ordinates  is \_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | State whether the series  is convergent or divergent. | | CO2 | U | 1 |
| 4. |  | | CO2 | U | 1 |
| 5. | Let  be a linear transformation such that dim(U)=3 and rank(T)=2. Find the nullity(T). | | CO3 | U | 1 |
| 6. | Let  be a linear transformation defined by  Find the matrix of the linear transformation. | | CO3 | U | 1 |
| 7. | If  then find | | CO4 | U | 1 |
| 8. | For any vector | | CO4 | R | 1 |
| 9. | If  then find | | CO5 | U | 1 |
| 10. |  | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Evaluate | | CO1 | U | 3 |
| 12. | Expand the following: | | CO2 | U | 3 |
| 13. | Verify whether the vectors  and  are linearly independent. | | CO4 | U | 3 |
| 14. | Check whether the vector  is solenoidal at the point (1,0,1). | | CO4 | U | 3 |
| 15. | Compute the distance between two vectors and | | CO5 | U | 3 |
| 16. | Find the Laplace transform of | | 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. | Find the area of the cardioid | CO1 | A | 6 |
|  | b. | Evaluate the volume generated by the graph  between and  rotated completely, around the x-axis. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Test the convergence of the series | CO2 | An | 6 |
|  | b. | Compute | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Verify that  defined by  is a linear transformation. Also, find the Kernel, nullity and rank of T. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | A particle moves along a curve   and  where  is the time. Find the component of its velocity, speed and acceleration at  in the direction of | CO4 | A | 8 |
|  | b. | Find the directional derivative of  at the point  in the direction of | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Find the curvature and torsion of the curve  at | CO4 | A | 8 |
|  | b. | Find  if  is irrotational. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 22. |  | Let    and  Construct an orthogonal basis  of | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate the Laplace transform of (i)  and  (ii) | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate  using partial fraction method. | CO6 | A | 6 |
|  | b. | Compute (i)  and  (ii) | CO6 | A | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Evaluate surface area and volume using definite integral. |
| CO2 | Demonstrate knowledge in expansion and convergence of functions. |
| CO3 | Analyze images using linear transformation. |
| CO4 | Relate vector spaces with magnetic field and moving fluid. |
| CO5 | Find orthogonal and orthonormal vectors. |
| CO6 | Analyze circuit design using the properties of Laplace transform. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | - | 5 | 6 | 6 | - | - | 17 |
| CO3 | - | 2 | 12 | - | - | - | 14 |
| CO4 | 1 | 15 | 16 | - | - | - | 32 |
| CO5 | - | 4 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 24 | - | - | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1007** | **Duration** | **3hrs** |
| **Course Name** | **ELEMENTARY MATHEMATICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | |
| 1. | Find the midpoint of A (3,-1) and B (-1,9). | | CO1 | A | 1 |
| 2. | Write the equation of straight line parallel to X-axis at a distance of 10 units above the X-axis. | | CO1 | R | 1 |
| 3. | The equation of the straight line with slope 7 and y-intercept 5 is \_\_\_. | | CO2 | U | 1 |
| 4. | The equation of a circle with centre (2, 3) and radius 2 units is \_\_\_\_\_. | | CO3 | R | 1 |
| 5. | A line that just touches the circle as it passes by is called a \_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | Find the centre of the circle x2 + y2 +8x + 2y – 4 = 0. | | CO3 | U | 1 |
| 7. | Evaluate . | | CO4 | A | 1 |
| 8. | Check whether the function is continuous at z = -2. | | CO4 | A | 1 |
| 9. | The value of | | CO4 | U | 1 |
| 10. | In finding the maxima and minima of a function, if then is \_\_\_\_\_\_\_value. | | CO4 | U | 1 |
| 11. | . | | CO5 | A | 1 |
| 12. | The value of . | | CO5 | U | 1 |
| 13. | Find . | | CO5 | A | 1 |
| 14. | The formula of . | | CO5 | R | 1 |
| 15. | The value of . | | CO5 | A | 1 |
| 16. | Find the transpose of the matrix . | | CO6 | A | 1 |
| 17. | Identify the matrix . | | CO6 | U | 1 |
| 18. | The matrix A is a skew symmetric matrix if and only if A =\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| 19. | Find the determinant of the matrix | | CO6 | A | 1 |
| 20. | Write the order of the matrix | | CO6 | R | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the coordinates of the point of intersection of the lines *2x-3y=6* and *x+y=3*. | | CO2 | A | 5 |
| 22. | Find the equation of the circle on the line joining (-1, 2) and (-3, 5) as diameter. Also find the centre and radius of the circle. | | CO3 | A | 5 |
| 23. | Find the equation of the normal at the point (4, -1) to the circle . | | CO3 | A | 5 |
| 24. | If , find and hence find and . | | CO4 | A | 5 |
| 25. | Find if . | | CO4 | A |  |
| 26. | If then find . | | CO4 | A | 5 |
| 27. | Solve . | | CO5 | A | 5 |
| 28. | Evaluate using integration by parts. | | CO5 | A | 5 |
| 29. | Evaluate the definite integral . | | CO5 | A | 5 |
| 30. | If and B then find A+B, A-B and 3A-2B. | | CO6 | A | 5 |
| 31. | If and B then find AB and BA. | | CO6 | A | 5 |
| 32. | Find if . | | CO6 | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Find the acute angle between the lines and | CO1 | A | 5 |
|  | b. | Find the equation of the circle passing through the points (1, 0), (-1, 0) and (0, 1). Also find its centre and radius. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 34. | a. | Find | CO4 | A | 5 |
|  | b. | Find the maxima and minima of . Also find the maximum and minimum value. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 35. | a. | Find if | CO4 | A | 5 |
|  | b. | Find the equations of the bisectors of the angles between the straight lines 3 and | CO1 | A | 10 |

CO – COURSE OUTCOME BL – BLOOMS’ LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the different forms of straight lines. |
| CO2 | Determine intersection of straight lines. |
| CO3 | Relate the circle equations with agricultural problems. |
| CO4 | Recognize the methods of calculus. |
| CO5 | Apply integral calculus to find area. |
| CO6 | Represent and solve agricultural problems using matrix. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | - | 16 | - | - | - | 17 |
| CO2 | - | 1 | 5 | - | - | - | 6 |
| CO3 | 1 | 2 | 20 | - | - | - | 23 |
| CO4 | - | 2 | 37 | - | - | - | 39 |
| CO5 | 1 | 1 | 18 | - | - | - | 20 |
| CO6 | 2 | 1 | 17 | - | - | - | 20 |
|  | | | | | | | **125** |



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| **Course Code** | **20MA1007** | **Duration** | **3hrs** |
| **Course Name** | **ELEMENTARY MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | | |
| 1. | Find the midpoint of A (2, 3) and B (-4, 7). | | | CO1 | A | 1 |
| 2. | Write the equation of straight line parallel to X-axis at a distance of 5 units above the X-axis. | | | CO1 | R | 1 |
| 3. | The equation of the straight line with slope 5 and y-intercept 7 is \_\_\_. | | | CO2 | U | 1 |
| 4. | The equation of a circle with centre (1, 3) and radius 3 units is \_\_\_\_\_. | | | CO3 | R | 1 |
| 5. | A line that cuts the circle at two points is called a \_\_\_\_\_\_\_. | | | CO3 | U | 1 |
| 6. | Find the centre of the circle x2 + y2 +10x + 6y – 4 = 0. | | | CO3 | U | 1 |
| 7. | Evaluate . | | | CO4 | A | 1 |
| 8. | Check whether the function is continuous at z = -3. | | | CO4 | A | 1 |
| 9. | The value of | | | CO4 | U | 1 |
| 10. | In finding the maxima and minima of a function, if then is \_\_\_\_\_\_\_value. | | | CO4 | U | 1 |
| 11. | . | | | CO5 | A | 1 |
| 12. | The value of . | | | CO5 | U | 1 |
| 13. | Find . | | | CO5 | A | 1 |
| 14. | The formula of . | | | CO5 | R | 1 |
| 15. | The value of . | | | CO5 | A | 1 |
| 16. | Find the transpose of the matrix . | | | CO6 | A | 1 |
| 17. | Identify the matrix . | | | CO6 | U | 1 |
| 18. | The matrix A is a symmetric matrix if and only if A =\_\_\_\_\_\_\_\_\_\_\_. | | | CO6 | R | 1 |
| 19. | Find the determinant of the matrix | | | CO6 | A | 1 |
| 20. | Write the order of the matrix | | | CO6 | R | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | | |
| 21. | Find the coordinates of the point of intersection of the lines *2x+3y=7* and . | | | CO2 | A | 5 |
| 22. | Find the equation of the circle on the line joining (2, -3) and (3, 1) as diameter. Also find the centre and radius of the circle. | | | CO3 | A | 5 |
| 23. | Find the equation of the normal at the point (2, 3) to the circle . | | | CO3 | A | 5 |
| 24. | If , find and hence find and . | | | CO4 | A | 5 |
| 25. | Find if . | | | CO4 | A |  |
| 26. | If then find . | | | CO4 | A | 5 |
| 27. | Solve. | | | CO5 | A | 5 |
| 28. | Evaluate using integration by parts. | | | CO5 | A | 5 |
| 29. | Evaluate the definite integral . | | | CO5 | A | 5 |
| 30. | If and B then find A+B, A-B and 2A-3B. | | | CO6 | A | 5 |
| 31. | If and B then find AB and BA. | | | CO6 | A | 5 |
| 32. | Find if . | | | CO6 | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | | |
| 33. | | a. | Find the acute angle between the lines 7x-4y=3 and 3x-11y-6=0. | CO1 | A | 5 |
|  | | b. | Find the equation of the circle passing through the points (2, 0), (-2, 0) and (0, 2). Also find its centre and radius. | CO3 | A | 10 |
|  | |  |  |  |  |  |
| 34. | | a. | Find | CO4 | A | 5 |
|  | | b. | Find the maxima and minima of . Also find the maximum and minimum value. | CO4 | A | 10 |
|  | |  |  |  |  |  |
| 35. | | a. | Find if | CO4 | A | 5 |
|  | | b. | Find the equations of the bisectors of the angles between the straight lines and | CO1 | A | 10 |
|  | |  |  |  |  |  |

CO – COURSE OUTCOME BL – BLOOMS’ LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the different forms of straight lines. |
| CO2 | Determine intersection of straight lines. |
| CO3 | Relate the circle equations with agricultural problems. |
| CO4 | Recognize the methods of calculus. |
| CO5 | Apply integral calculus to find area. |
| CO6 | Represent and solve agricultural problems using matrix. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | - | 16 | - | - | - | 17 |
| CO2 | - | 1 | 5 | - | - | - | 6 |
| CO3 | 1 | 2 | 20 | - | - | - | 23 |
| CO4 | - | 2 | 37 | - | - | - | 39 |
| CO5 | 1 | 1 | 18 | - | - | - | 20 |
| CO6 | 2 | 1 | 17 | - | - | - | 20 |
|  | | | | | | | **125** |



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| **Course Code** | **20MA1009** | **Duration** | **3hrs** |
| **Course Name** | **CALCULUS AND DIFFERENTIAL EQUATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | For the p-series  is \_\_\_\_\_\_\_\_\_\_. | | | CO2 | R | 1 |
| 2. | Test the convergence of the sequence | | | CO2 | R | 1 |
| 3. | Write down the formula for center of curvature. | | | CO1 | R | 1 |
| 4. | Write down the value of | | | CO1 | R | 1 |
| 5. | What is the value of  in the Fourier series expansion for  in | | | CO2 | R | 1 |
| 6. | Write the down the formula for half range Fourier cosine series of f(x) in | | | CO2 | R | 1 |
| 7. | If  then find | | | CO5 | R | 1 |
| 8. | Find the value of | | | CO3 | U | 1 |
| 9. | Write down the formula to find volume of a region. | | | CO4 | R | 1 |
| 10. | Write down the general solution of | | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Examine the convergence of the series | | | CO2 | U | 3 |
| 12. | Find the value of | | | CO1 | U | 3 |
| 13. | Calculate the root mean square value of  in | | | CO2 | U | 3 |
| 14. | If  then find the jacobian | | | CO3 | U | 3 |
| 15. | Compute | | | CO4 | U | 3 |
| 16. | Solve | | | 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. | Discuss the nature of the series | CO2 | An | 6 |
|  | | b. | Test the convergence of the series | CO2 | An | 6 |
|  | |  |  |  |  |  |
| 18. | | a. | Find the value of | CO1 | A | 6 |
|  | | b. | Compute | CO1 | A | 6 |
|  | |  |  |  |  |  |
| 19. | |  | Obtain the first three coefficients in the Fourier sine series for y, where y is given in the following table:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 0 | 30 | 60 | 90 | 120 | 150 | | y | 0 | 5224 | 8097 | 7850 | 5499 | 2626 | | CO2 | A | 12 |
|  | |  |  |  |  |  |
| 20. | | a. | Evaluate the equations of the tangent plane and normal to the surface 2+ = 3−3z at (2, 1,-3). | CO3 | A | 8 |
|  | | b. | Prove that  is irrotational. | CO5 | U | 4 |
|  | |  |  |  |  |  |
| 21. | |  | Evaluate  where  S is the surface of the cube bounded by  using Gauss Divergence theorem. | CO5 | A | 12 |
|  | |  |  |  |  |  |
| 22. | |  | A rectangular box open at the top is to have volume of 32 cubic units. Find the dimensions of the box requiring least material for its construction. | CO3 | A | 12 |
|  | |  |  |  |  |  |
| 23. | | a. | Solve | CO6 | A | 6 |
|  | | b. | Compute | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | | a. | Solve | CO6 | A | 6 |
|  | | b. | Solve the Lagranges linear equation | CO6 | A | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Evaluate the surface area and volume using definite integral. |
| CO2 | Express functions as infinite series. |
| 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 linear partial differential equations of first order |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 |  |  |  | 17 |
| CO2 | 4 | 6 | 12 | 12 |  |  | 34 |
| CO3 |  | 4 | 20 |  |  |  | 24 |
| CO4 | 1 | 3 | 6 |  |  |  | 10 |
| CO5 | 1 | 4 | 12 |  |  |  | 17 |
| CO6 | 1 | 3 | 18 |  |  |  | 22 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1010** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR ALGEBRA, TRANSFORMS AND NUMERICAL METHODS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Find the sum of all the Eigen values of the matrix A =. | | CO1 | U | 1 |
| 2. | Define a column matrix with an example. | | CO1 | R | 1 |
| 3. | The order of convergence of Newton Raphson method is …………… | | CO2 | R | 1 |
| 4. | The number of roots of + 1 = 0 is …………… and the number positive roots is --------- | | CO2 | U | 1 |
| 5. | Classify the equation Uxx + 2Uxy + 4 Uyy = 0 | | CO3 | R | 1 |
| 6. | Find the Laplace transform of . | | CO4 | U | 1 |
| 7. | Define Fourier transform of f(x). | | CO4 | R | 1 |
| 8. | Z(1) **= --------------** | | CO5 | U | 1 |
| 9. | Define Circuit. | | CO6 | R | 1 |
| 10. | Write down the degree of all the vertices of a graph. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If the Eigen values of matrix A are -2,3,6, then what are the Eigen values  (i) 5A (ii) A-1 (iii) A5. | | CO1 | A | 3 |
| 12. | Derive the relation between the operators E and ∆. | | CO2 | An | 3 |
| 13. | Compute *y* at x = 0.1 using Euler’s method given | | CO3 | A | 3 |
| 14. | Write down the finite Fourier sine and cosine transforms of f(x). Also give the inverse finite Fourier sine and cosine transforms. | | CO4 | R | 3 |
| 15. | Evaluate Z () | | CO5 | E | 3 |
| 16. | Define Hamiltonian path with an example. | | 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. |  | Reduce the quadratic form 3x2 +5y2+3z2 −2yz + 2zx−2xy to the canonical form and find the rank, signature and index. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | By dividing the range into ten equal parts, evaluate. | CO2 | E | 6 |
|  | b. | The population of a town is as follows:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Year (x) | 1941 | 1951 | 1961 | 1971 | 1981 | 1991 | | Population in lakhs(y) | 20 | 24 | 29 | 36 | 46 | 51 |   Estimate the population at 1976 using Newton’s Backward interpolation. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Find if y(x) is the solution of , given  Using Milne’ predictor and corrector method. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Apply convolution theorem to evaluate . | CO4 | A | 6 |
|  | b. | Find the Laplace transform of the periodic function | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. |  | Using Z transform solve + 4 +3 = 3n with = 0, = 1. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve the equations using Cramer’s rule 3x+y +2z = 3, 2x-3y-z = -3, x+2y+z = 4. | CO1 | A | 6 |
|  | b. | If A = is orthogonal. Find a,b,c and A -1. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Solve = x + y, given y (1) = 0 and y (1.1) by Taylor series method. | CO3 | A | 6 |
|  | b. | Evaluate L ( sin h3t) | CO4 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find a maximum flow in the given network by using Labeling Algorithm. | CO6 | An | 10 |
|  | b. | Define the planer graph with an example. | CO6 | R | 2 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Analyze quadratic form using orthogonal transformation of matrix. |
| CO2 | Compare integration solution and numerical solution. |
| CO3 | Solve differential equations using Laplace Transforms. |
| CO4 | Describe the different transform techniques. |
| CO5 | Demonstrate knowledge in different types of graph. |
| CO6 | Construct networks with maximum capacity. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 9 |  | 18 |  | 29 |
| CO2 | 1 | 1 |  | 9 | 6 |  | 17 |
| CO3 | 1 |  | 9 | 12 |  |  | 22 |
| CO4 | 4 | 1 | 6 |  | 12 |  | 23 |
| CO5 |  | `1 |  | 12 | 3 |  | 16 |
| CO6 | 6 |  | 1 |  | 10 |  | 17 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1013** | **Duration** | **3hrs** |
| **Course Name** | **CALCULUS AND DIFFERENTIAL EQUATIONS FOR ROBOTIC ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find  if . | | CO1 | E | 1 |
| 2. | If be a homogeneous function of degree  in  and , then the Euler’s theorem on homogeneous function is given by \_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | If the roots of the auxiliary equation are , then the complementary function is given by CF = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | A | 1 |
| 4. | If the complementary function of an ODE is , then the Wronskian is given by \_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | E | 1 |
| 5. | The Rodrigue’s Formula is given by \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The Legendre’s polynomial is defined by \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | The notation ‘’ in partial differential equation represents \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | If the roots of the auxiliary of a PDE are 4,5,6,7, then the CF is given by \_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 9. | The Fourier series expansion for  in the interval  is given by \_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | In the Fourier series expansion of a function  in the interval  the value of \_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Given ,  and . Find  as a function of . | | CO1 | E | 3 |
| 12. | Solve . | | CO2 | E | 3 |
| 13. | State the value of  for which the following series  is convergent. | | CO3 | An | 3 |
| 14. | Solve . | | CO4 | E | 3 |
| 15. | State the Dirichlet’s Conditions on a function  to be expanded as a Fourier series. | | CO5 | R | 3 |
| 16. | Find the nature of the PDE . | | 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. |  | Given  , find the maximum value of . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Solve . | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Express , in terms of Legendre Polynomials. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Solve . | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Find the Fourier series expansion of  from  to . | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | If ,  prove that .  Hence Show that . | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A string is stretched and fastened to two points  apart. Motion is started by displacing the string in the form, from which it is released at time . Show that the displacement of any point at a distance  from one end at time  is given by. | CO6 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve the Laplace equation subject to  and . | CO6 | E | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Apply the concepts of multivariable calculus. |
| CO2 | Solve Ordinary Differential Equations. |
| CO3 | Determine power series solutions using special functions. |
| CO4 | Compute the solution of PDEs using various techniques. |
| CO5 | Relate Fourier analysis to robot kinematics and motion planning. |
| CO6 | Perform Vibration Analysis of Robots using wave and solve heat equations. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | - | - | - | 16 | - | 17 |
| CO2 | - | - | 1 | - | 16 | - | 17 |
| CO3 | 2 | - | 12 | 3 | - | - | 17 |
| CO4 | - | 1 | 1 | - | 15 | - | 17 |
| CO5 | 5 | - | 12 | - | 12 | - | 29 |
| CO6 | - | - | - | - | 27 | - | 27 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1014** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR ALGEBRA, TRANSFORMS AND**  **NUMERICAL METHODS FOR ROBOT CONTROL** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Find the rank of the matrix . | | CO1 | U | 1 |
| 2. | If two parallel lines are identical in a determinant, then the value of the determinant is \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The characteristic equation of the matrix  is given by \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | If all the eigenvalues of a matrix  are  and one of them is equal to zero, then the nature of the quadratic form is \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | The formula to solve the differential equation , given , about the point  by Taylor series method is \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The formula to solve a differential equation using Modified Euler’s method is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | \_\_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 8. | \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_\_\_. | | CO5 | E | 1 |
| 10. | What is a planar graph? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the matrix form of the system of linear equations      . | | CO1 | A | 3 |
| 12. | Find the eigenvalues of the matrix. | | CO2 | E | 3 |
| 13. | Solve, given , and get the value ofusing Taylor series method. | | CO3 | E | 3 |
| 14. | Evaluate \_\_\_\_\_\_\_\_\_\_. | | CO4 | E | 3 |
| 15. | Evaluate ­­­\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | E | 3 |
| 16. | Find  for the given graphs. | | 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. |  | Solve the system of linear equations using Cramer’s rule      . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Verify Cayley – Hamilton theorem for the matrix . | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Compute , given , , by taking  using fourth order Runge-Kutta Method. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Solve the differential equation, given  and , using Laplace transforms. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Find the infinite Fourier transform of , and hence evaluate . | CO4 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the Z-transform of . | CO5 | E | 6 |
|  | b. | Evaluate . | CO5 | E | 6 |
|  |  |  |  |  |  |
| 23. |  | Solve the difference equation using Z – transforms, given . | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find a maximum flow in the given network. | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the fundamentals of linear algebra. |
| CO2 | Reduce quadratic form to canonical form using orthogonal transformation. |
| CO3 | Apply numerical methods to solve engineering problems. |
| CO4 | Solve differential equations using Laplace Transforms, understand Fourier transform. |
| CO5 | Analyze discrete time systems using Z transforms. |
| CO6 | Relate concepts of graph theory to robot navigation. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 3 | - | 12 | - | 17 |
| CO2 | 2 | - | 12 | - | 3 | - | 17 |
| CO3 | 2 | - | - | - | 15 | - | 17 |
| CO4 | 1 | - | 1 | - | 27 | - | 29 |
| CO5 | - | - | 12 | - | 16 | - | 28 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA1015** | **Duration** | **3hrs** |
| **Course Name** | **BASIC MATHEMATICS FOR BIOTECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the Eigen values of . | | CO1 | U | 1 |
| 2. | If the Eigen values of a 3x3 matrix A are 1, 2,-3. Find the signature of the quadratic form corresponding to the matrix A. | | CO1 | A | 1 |
| 3. | The general solution of the Clairaut’s equation  is \_\_\_\_ | | CO2 | U | 1 |
| 4. | Find the complementary function of | | CO2 | A | 1 |
| 5. | If the Jacobian, then the given function is called as functionally\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | When a function has neither maximum nor minimum, then the stationary point is known as\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | What is the value of . | | CO4 | A | 1 |
| 8. | Find the value of . | | CO4 | A | 1 |
| 9. | In the integral  , the y limit is\_\_\_\_. | | CO5 | A | 1 |
| 10. | In integral calculus, represents\_\_\_\_\_\_\_\_. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the sum and product of all Eigen values of . | | CO1 | A | 3 |
| 12. | Find the particular integral of | | CO2 | E | 3 |
| 13. | For a given , find | | CO3 | An | 3 |
| 14. | Find the value of | | CO4 | E | 3 |
| 15. | Find the value of | | CO5 | E | 3 |
| 16. | Find the value of . | | 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 the Eigen values and Eigen vectors of . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Solve by the method of variation of parameter | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | If .Compute the Jacobian and prove that | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Evaluate | CO6 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Change the order of integration and evaluate | CO6 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Solve | CO2 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Find the maxima and minima of | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find the volume of the solid bounded by the planes x=0,y=0,z=0 and x+y+z=a. | CO6 |  | 12 |

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

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | The students will be able to analyze quadratic form using orthogonal transformation of matrix. | | | | | | | |
| CO2 | The students will be able to solve ordinary differential equation. | | | | | | | |
| CO3 | The students will be able to understand different types of functions. | | | | | | | |
| CO4 | The student will be able to apply differentiation techniques to find extreme values of functions. | | | | | | | |
| CO5 | The student will be able to acquire knowledge in special functions. | | | | | | | |
| CO6 | The student will be able to evaluate surface area and volume using definite integral. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | |  | 1 | 4 | - | 12 | - | 17 |
| CO2 | |  | 1 | 13 | - | 15 |  | 29 |
| CO3 | | 2 |  | - | 3 | 12 | - | 17 |
| CO4 | |  |  | - | - | 3 |  | 3 |
| CO5 | |  |  | 1 | 12 | - | - | 13 |
| CO6 | |  |  | 3 | 24 | 18 | - | 45 |
|  | | | | | | | | **124** |



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| **Course Code** | **20MA1017** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF CALCULUS AND LINEAR ALGEBRA** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the determinant value of the matrix . | | CO1 | R | 1 |
| 2. | If ,  then find 2A+3B. | | CO1 | U | 1 |
| 3. | Two eigen values of the matrix are 1 and 2. Find the third eigenvalue. | | CO2 | R | 1 |
| 4. | Find the rank of the matrix . | | CO2 | U | 1 |
| 5. | If then find . | | CO3 | R | 1 |
| 6. | \_\_\_\_\_\_. | | CO3 | U | 1 |
| 7. | =\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. |  | | CO4 | U | 1 |
| 9. | Write the formula to find the volume of a given region R. | | CO5 | R | 1 |
| 10. | Write the Fourier Coefficient for the Half Range Cosine series in the interval (0,). | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If  and , then find AT+BT. | | CO1 | U | 3 |
| 12. | Find the nature of the quadratic form . | | CO2 | U | 3 |
| 13. | Find the Jacobian , if and. | | CO3 | U | 3 |
| 14. |  | | CO4 | U | 3 |
| 15. | Evaluate . | | CO5 | U | 3 |
| 16. | Find the Fourier coefficient  for the function in . | | 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. | Solve the system of equations by Cramer’s rule. 3x+y+2z=3;  2x-3y-z =-3 and x+2y+z=4. | CO1 | A | 6 |
|  | b. | Find the inverse of the matrix . | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Verify Cayley Hamilton Theorem for the matrix  and find its inverse. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find if . | CO3 | A | 6 |
|  | b. | If then find. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate . | CO4 | A | 6 |
|  | b. | Evaluate | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find the area of the square bounded by the region x=0, x=a, y=0 and y=a. | CO5 | A | 6 |
|  | b. | Evaluate . | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Find the eigen values and the eigenvectors of the matrix  . | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | If , then find . | CO3 | A | 6 |
|  | b. | Evaluate | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the first two harmonics of the Fourier Series for the following values   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | | y | 7.9 | 8.0 | 7.2 | 5.6 | 3.6 | 1.7 | 0.5 | 0.2 | 0 | 2.5 | 4.7 | 6.8 | | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Solve the systems of equations using matrices. |
| CO2 | Find the Eigen values and Eigen vectors of matrices and diagonalizable the matrices. |
| CO3 | Apply differentiation techniques to find extreme values of functions. |
| CO4 | Demonstrate knowledge in integration. |
| CO5 | Compute area and volume using integration techniques |
| CO6 | Relate periodic and non-periodic functions as a series of sine and cosine functions. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 12 |  |  |  | 17 |
| CO2 | 1 | 4 | 24 |  |  |  | 29 |
| CO3 | 1 | 4 | 24 |  |  |  | 29 |
| CO4 | 1 | 4 | 12 |  |  |  | 17 |
| CO5 | 1 | 3 | 12 |  |  |  | 16 |
| CO6 |  | 4 | 12 |  |  |  | 16 |
| 5 23 96 | | | | | | | **124** |



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| **Course Code** | **20MA1018** | **Duration** | **3hrs** |
| **Course Name** | **TRANSFORMS AND DIFFERENTIAL EQUATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Solve . | | CO1 | R | 1 |
| 2. | In Cauchy’s Euler differential equation, the substitution for is \_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 3. | The degree of the partial differential equation +=0 is \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Obtain the complete solution for . | | CO2 | U | 1 |
| 5. | If the partial differential equation of a vibrating string is = then is \_\_\_\_. | | CO3 | R | 1 |
| 6. | Define steady state temperature distribution. | | CO3 | R | 1 |
| 7. | dt using Laplace Transforms. | | CO4 | R | 1 |
| 8. | The Laplace Transform of is \_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | The inverse Laplace transform of is \_\_\_\_\_. | | CO5 | R | 1 |
| 10. | =\_\_\_\_\_\_. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Solve . | | CO1 | U | 3 |
| 12. | Solve | | CO2 | U | 3 |
| 13. | Write the three possible solutions of the one-dimensional heat equation. | | CO3 | U | 3 |
| 14. | Find the Laplace Transform of | | CO4 | U | 3 |
| 15. | Find the inverse Laplace transform of . | | CO5 | U | 3 |
| 16. | Write the formula for Fourier Cosine Transform and its inverse. | | 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. |  | Solve + by using Method of variation of Parameters. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Solve ()). | CO2 | A | 6 |
|  | b. | Solve using Lagrange’s equations. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | A tightly stretched string has its ends fixed at x=0 and x=l. At time t=0 the string is given a shape defined by f(x)=k(lx-) where k is constant and then released. Find the displacement at any point x of the string at any time t > 0. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find the Laplace Transform of . | CO4 | A | 6 |
|  | b. | Solve , given using Laplace Transforms. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find the inverse Laplace Transform of using partial fraction method. | CO5 | A | 6 |
|  | b. | Evaluate using Convolution theorem. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Find L(). | CO4 | A | 6 |
|  | b. | Solve (. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Solve | CO2 | A | 6 |
|  | b. | Solve . | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find the finite Fourier Sine Transform of in (0,). | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand solution of Ordinary Differential Equations. |
| CO2 | Find the solution of PDE. |
| CO3 | Apply solution of PDE in one dimensional wave and heat equations. |
| CO4 | Evaluate definite integral using Laplace transform. |
| CO5 | Solve the differential equation using Laplace transform. |
| CO6 | Calculate the output of a linear system using Fourier transform. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 18 | - | - | - | 23 |
| CO2 | 1 | 4 | 24 |  |  |  | 29 |
| CO3 | 2 | 3 | 12 |  |  |  | 17 |
| CO4 | 1 | 4 | 18 |  |  |  | 23 |
| CO5 | 1 | 4 | 12 |  |  |  | 17 |
| CO6 | 3 | - | 12 |  |  |  | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1020** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL MODELLING FOR CIVIL ENGINEERING PROBLEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | |
| 1. | The rank of unit matrix is \_\_\_\_\_. | CO1 | U | 1 |
| 2. | =\_\_\_\_\_\_\_\_\_\_\_ . | CO2 | A | 1 |
| 3. | Volume of solid of revolution is \_\_\_\_\_\_\_\_\_\_. | CO2 | R | 1 |
| 4. | A vector is said to be solenoidal if \_\_\_\_\_\_\_. | CO3 | R | 1 |
| 5. | State Gauss divergence theorem. | CO3 | R | 1 |
| 6. | Write down the complementary function for differential equationwhose roots are . | CO4 | R | 1 |
| 7. | The roots of  can be obtained using \_\_\_\_\_\_\_\_ method. | CO5 | R | 1 |
| 8. | If f(a) and f(b) are of \_\_\_\_\_\_\_\_\_\_\_\_ signs, then there is a root of f(x)=0. | CO5 | R | 1 |
| 9. | The order of error in trapezoidal rule is \_\_\_\_\_\_\_\_\_\_\_. | CO6 | R | 1 |
| 10. | Simpson’s 3/8 rule is applicable if the number of intervals is a \_\_\_\_\_\_\_\_\_\_. | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | |
| 11. | Two eigen values of the matrix are 1 and 2. Find the third eigen value. | CO1 | A | 3 |
| 12. | Find ux and uy for the function | CO2 | A | 3 |
| 13. | Integrate | CO2 | E | 3 |
| 14. | Prove that is an irrotational vector. | CO3 | An | 3 |
| 15. | Find the particular integral of . | CO4 | A | 3 |
| 16. | Find a root of the equation  using Newton Raphson method. | CO5 | An | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | State and verify Cayley Hamilton’s theorem for . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Find the volume of solid generated when the semicircle x2 + y2 = 1is rotated about the axis. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | State and verify Green’s theorem given where  is the boundary of the region defined by . | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Solve+ Sin 2x. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Fit a second degree parabola curve for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | | Y | 1 | 1.8 | 1.3 | 2.5 | 6.3 | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Solve the following system of equations using Gauss- Seidel Method. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Find the first two derivatives of at x = 50 and x = 56 from the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | Y | 3.684 | 3.7084 | 3.7325 | 3.7563 | 3.7798 | 3.8030 | 3.8059 | | CO6 | An | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate  using (i) Trapezoidal rule (ii) Simpson rules (both). | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Apply Matrix concepts to model and solve problems in the fields of engineering appropriately. |
| CO2 | Design and solve the engineering problems using variation techniques. |
| CO3 | Construct the differentiation model to develop solutions in the fields of physical phenomena. |
| CO4 | Recognize and find solution for real time technical problems using ordinary differential equations. |
| CO5 | Apply numerical techniques in solving engineering problems. |
| CO6 | Solve dynamical problems using numerical techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 1 | 15 |  |  |  | 16 |
| CO2 | 1 |  | 4 | 12 | 3 |  | 20 |
| CO3 | 2 |  |  | 3 | 12 |  | 17 |
| CO4 | 1 |  | 15 |  |  |  | 16 |
| CO5 | 2 |  | 12 | 15 |  |  | 29 |
| CO6 | 2 |  |  | 24 |  |  | 26 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1021** | **Duration** | **3hrs** |
| **Course Name** | **MULTIVARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | The series | CO2 | U | 1 |
| 2. | The series 3-2-1+3-2-1+3-2-1+------------∞ is ------------- | CO2 | R | 1 |
| 3. | ℾ(5)=---- | CO1 | E | 1 |
| 4. | Find the value of β (2, 2) | CO1 | U | 1 |
| 5. | If U(x,y)=e(x+2y),find Uy | CO3 | R | 1 |
| 6. | Evaluate. | CO4 | U | 1 |
| 7. | If U(x,y)=cos(2x+3y),find Ux | CO3 | U | 1 |
| 8. | A vector is said to be solenoidal if ----------- | CO5 | R | 1 |
| 9. | Find the degree of partial differential equation: | CO6 | R | 1 |
| 10. | Solve (D2-4D+4)y=0 | CO6 | E | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Examine whether the following sequence is convergent or divergent | CO2 | E | 3 |
| 12. | Find the area of the region bounded by y=2x+1,y=3,y=5, and the y-axis | CO1 | A | 3 |
| 13. | If , then find div and curl | CO5 | U | 3 |
| 14. | Evaluate | CO3 | E | 3 |
| 15. | Evaluate | CO4 | E | 3 |
| 16. | Solve p+q=1 | CO6 | U | 3 |

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| **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 by using Ratio test | CO2 | A | | 6 |
| b | Evaluate | CO2 | E | | 6 |
|  |  |  |  |  | |  |
| 18 | a. | Evaluate | CO1 | E | | 6 |
| b. | Compute (i) x (ii) (iii) ℾ(5/2) | CO1 | A | | 6 |
|  |  |  |  |  | |  |
| 19. |  | Compute the first three harmonic series of the Fourier series for f(x) from the following data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | π/3 | 2 π/3 | π | 4 π/3 | 5 π/3 | 2π | | f(x) | 1.0 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 | | CO2 | An | | 12 |
|  |  |  |  |  | |  |
| 20. |  | Find the (i)sine series (ii)cosine series of f(x)= x in (0,π) | CO2 | A | | 12 |
|  |  |  |  |  | |  |
| 21. | a | Determine the critical points and minima, maxima of function defined by f(x , y) = 2x2 + 2xy + 2y2 - 6x | CO3 | An | | 8 |
| b | Find the directional derivative of at the point (1,1,1) in the direction of | CO5 | U | | 4 |
|  |  |  |  |  | |  |
| 22. |  | Find the volume of a tetrahedron bounded by the planes x=0,y=0,z=0 and x+y+z=1 | CO4 | A | | 12 |
|  |  |  |  |  | |  |
| 23. | a. | Solve (D2+4)y= e3x+sinx | CO6 | E | | 6 |
| b. | Solve: | CO6 | E | | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Solve by using the method of variation of parameters  (D2+1)y =cosecx | CO6 | An | 6 | |
| b. | Solve (x2D2-xD+1)y=sin(logx) | CO6 | A | 6 | |

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

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Evaluate surface area and volume using definite integral. | | | | | | | |
| CO2 | Express functions as infinite series. | | | | | | | |
| CO3 | Apply differentiation techniques to find extreme values of functions. | | | | | | | |
| CO4 | Calculate gravity and mass using integration techniques | | | | | | | |
| CO5 | Relate vector calculus with magnetic field and moving fluid | | | | | | | |
| CO6 | Solve linear partial differential equations of first order. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | - | 1 | 9 | - | 7 | - | 17 |
| CO2 | | 1 | 1 | 18 | 12 | 9 | - | 41 |
| CO3 | | 1 | 1 | - | 8 | 3 | - | 13 |
| CO4 | | - | 1 | 12 | - | 3 | - | 16 |
| CO5 | | 1 | 7 | - | - | - | - | 8 |
| CO6 | | 1 | 3 | 6 | 6 | 13 | - | 29 |
|  | | | | | | | | **124** |



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| **Course Code** | **20MA1022** | **Duration** | **3hrs** |
| **Course Name** | **MATRICES, TRANSFORMS AND NUMERICAL METHODS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the Eigen values of  . | | CO1 | U | 1 |
| 2. | State Cayley-Hamilton theorem. | | CO1 | R | 1 |
| 3. | In Bisection method, if f(0) = -2, f(1) = -3, f(2) = -2 and f(3) = 1, then the root lies between\_\_\_\_\_. | | CO2 | U | 1 |
| 4. | In order to apply Simpson’s three eighth rule, the number of interval must be\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Write down the Taylor’s series formula at | | CO3 | U | 1 |
| 6. | Mention the standard five point formula to solve | | CO3 | R | 1 |
| 7. | What is the value of | | CO4 | U | 1 |
| 8. | Find the value of | | CO4 | R | 1 |
| 9. | In a Fourier sine transform, | | CO5 | U | 1 |
| 10. | What is the value of | | CO6 | U | 1 |
|  | **PART – B (6 X 3 = 18 MARKS)** | |  |  |  |
| 11. | Find the characterstic equation of | | CO1 | E | 3 |
| 12. | If, then evaluate using Trapezoidal rule by taking h=1. | | CO2 | E | 3 |
| 13. | Classify the partial differential equation | | CO3 | An | 3 |
| 14. | Find | | CO4 | A | 3 |
| 15. | Writ the Fourier transform pair. | | CO5 | An | 3 |
| 16. | Find | | 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. |  | Find the Eigen values and Eigen vectors of the matrix | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate .Using (i).Trapezoidal rule (ii) Simpson’s 1/3rd rule (iii) Simpson’s 3/8 th rule by taking h=1. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Given, find the values of y at  using Euler’s method. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Find | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Find the Fourier transform of | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Find using inverse Laplace transform. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Verify Caley-Hamilton theorem and find its inverse of | CO1 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve  given using  Z- transform. | CO6 | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze quadratic form using orthogonal transformation of matrix. |
| CO2 | Numerical solution of algebraic equations |
| CO3 | Compare integration solution and numerical differentiation. |
| CO4 | Solve differential equations using Laplace Transforms. |
| CO5 | Analyze signals using Fourier transform. |
| CO6 | Categorize Z-Transform of sequence and series. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | - | 12 | 15 | - | 17 |
| CO2 | 1 | 1 | - | - | 15 | - | 29 |
| CO3 | 1 | 1 | 12 | 3 | - | - | 29 |
| CO4 | 1 | 1 | 3 | - | 24 | - | 17 |
| CO5 | - | 1 | - | 3 | 12 | - | 16 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA1023** | **Duration** | **3hrs** |
| **Course Name** | **STATISTICAL METHODS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | |
| 1. | What do you mean by type I error? | | CO4 | U | 1 |
| 2. | Write the formula for correlation coefficient. | | CO4 | R | 1 |
| 3. | Define the term statistics. | | CO1 | R | 1 |
| 4. | Mention the range of probability. | | CO1 | R | 1 |
| 5. | For the set of data 5, 5, 5, 5, 5, 5. the Standard deviation value is zero. (True/False) | | CO2 | U | 1 |
| 6. | Write the formula of binomial distribution. | | CO3 | R | 1 |
| 7. | What do you understand by two events are independent? | | CO3 | U | 1 |
| 8. | Define standard error. | | CO4 | R | 1 |
| 9. | State intercept and slope values of regression equation, y=126+2.6 x. | | CO3 | U | 1 |
| 10. | Which test is used for testing two sample means? | | CO4 | U | 1 |
| 11. | If the CV of variety I is 30% and variety II is 25% then which variety is more consistent. | | CO5 | U | 1 |
| 12. | What is sample? | | CO6 | R | 1 |
| 13. | Define the term regression. | | CO3 | R | 1 |
| 14. | What is error? | | CO5 | R | 1 |
| 15. | Give any one example of Poisson distribution. | | CO3 | Ap | 1 |
| 16. | What is probability? | | CO3 | R | 1 |
| 17. | In a symmetrical curve mean, median and mode will coincide. (True/False) | | CO4 | U | 1 |
| 18. | Write the test statistics of one sample t-test. | | CO4 | R | 1 |
| 19. | What do you mean by critical region? | | CO4 | U | 1 |
| 20. | If tcal >ttab in t test, then what is your interpretation? | | CO3 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Define probability. Mention the axioms of probability. | | CO3 | R | 5 |
| 22. | Find the mean, standard deviation and coefficient of variation for the following data:18, 20, 22, 17, 20, 17, 22, 19, 23, 22 | | CO2 | An | 5 |
| 23. | Two cards are drawn from the deck. What is the probability that both the card is king? | | CO3 | An | 5 |
| 24. | Write the procedure of testing hypothesis. | | CO4 | R | 5 |
| 25. | What is pie chart? Using the following table which contains the mark of a student in his/her final exam, draw a pie chart.   |  |  | | --- | --- | | **Subjects** | **Marks (50)** | | Tamil | 47 | | English | 36 | | Maths | 49 | | Science | 45 | | Social studies | 40 | | | CO1 | Ap | 5 |
| 26. | Eight coins are tossed simultaneously. Find the probability of getting atleast six heads. | | CO3 | Ap | 5 |
| 27. | The following numbers give the number of fruits per tree in a farm.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 4 | 7 | 4 | 6 | 8 | 11 | 4 | 6 | 7 | 8 | 6 |   b) Prove *AM*≥*GM*≥*HM* | | CO2 | An | 5 |
| 28. | Write the difference between population and sample. | | CO6 | R | 5 |
| 29. | Write a note on permutation and combination with examples. | | CO2 | R | 5 |
| 30. | Suppose on an average 1 house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during the year? [given that *e*-2 = 0.13534] | | CO3 | Ap | 5 |
| 31. | The number of yiest cells counted in a haemocytometer is compared to the theoretical value is given below. Does the experimental result support the theory?   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **No of yeast cells in the square** | **0** | **1** | **2** | **3** | **4** | **5** | | **Observed frequency** | 103 | 143 | 98 | 42 | 8 | 6 | | **Expected frequency** | 106 | 141 | 93 | 41 | 14 | 5 | | | CO5 | An | 5 |
| 32. | Define correlation and mention the properties of the correlation coefficient? | | CO3 | R | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Write the note on t test. | CO4 | U | 05 |
|  | b. | Based on field experiments, a new variety of green gram is expected to give a yield of 12.0 quintal per hectare. The variety was tested on 10 randomly selected farmer’s fields. The yield (quintals/hectare) were recorded as 14.3,12.6,13.7,10.9,13.7,12.0,11.4,12.0,12.6,13.1. Do the results confirm to the expectation? | CO4 | An | 10 |
| 34. |  | The height (cm) and yield (g) of 4 plants were given below.   |  |  |  | | --- | --- | --- | | **Plants** | **Height (cm) (x)** | **Yield (g)**  **(y)** | | Plant 1 | 1.5 | 2 | | Plant 2 | 2 | 3.5 | | Plant 3 | 2.5 | 4 | | Plant 4 | 3 | 6.5 |  1. Fit regression equations of *Y* on *X*. 2. Calculate the predicted values and residual for *y* on *x*. 3. Also estimate Y when the height of the plant is 2.1 cm. | CO5 | Ap | 15 |
| 35. | a. | 2 blue and 3 red balls are in a bag. What is the probability of getting 2 blue balls one by one without replacement? | CO2 | Ap | 05 |
|  | b. | For the frequency distribution of weights of sorghum ear-heads given in table below. Find the mean, standard deviation and coefficient of variation.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Weights of ear-heads (g)** | 0-2 | 2-4 | 4-6 | 6-8 | | **Number of ear-heads (*f*)** | 2 | 3 | 4 | 2 | | CO2 | An | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | 1. Identify the applications of statistics to Agriculture. |
| CO2 | 2. Measure the central tendency and dispersion of Data. |
| CO3 | 3. Recognize the different probability distributions. |
| CO4 | 4. Utilize testing tools to verify hypothesis. |
| CO5 | 5. Design the experiments and make appropriate decisions. |
| CO6 | 6. Apply the skills of sampling in problem solving. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 |  | 5 |  |  |  | 7 |
| CO2 | 5 | 1 | 5 | 20 |  |  | 31 |
| CO3 | 13 | 2 | 11 | 5 |  |  | 31 |
| CO4 | 8 | 10 |  | 10 |  |  | 28 |
| CO5 | 1 | 1 | 15 | 5 |  |  | 22 |
| CO6 | 6 |  |  |  |  |  | 6 |
|  | | | | | | | **125** |



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| **Course Code** | **20MA2001** | **Duration** | **3hrs** |
| **Course Name** | **NUMERICAL MATHEMATICS AND STATISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | What is the nested multiplication form of *f(x) = 2x2 - x +1*? | | | CO1 | U | 1 |
| 2. | (AC.54)16 = (…..) 2 | | | CO1 | AP | 1 |
| 3. | If *R(4, 0) = 7* and *R(3, 0) = 4*, then *R(4, 1)* = … | | | CO3 | AP | 1 |
| 4. | To use Simpson’s 3/8th rule, the number of subinterval *n* should be…. | | | CO3 | R | 1 |
| 5. | In fourth order Runge-Kutta method, *k4* = … | | | CO4 | R | 1 |
| 6. | The corrector formula is …. | | | CO4 | R | 1 |
| 7. | What is the classification | | | CO5 | U | 1 |
| 8. | Write the general form of diagonal five point formula. | | | CO5 | R | 1 |
| 9. | If A and B are independent events, then *P(A ∩ B) = …..* | | | CO6 | U | 1 |
| 10. | Define Type – I and Type – II errors. | | | CO2 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Represent the function in the nested form and find the value of. | | | CO1 | AN | 3 |
| 12. | Find the value of using Gaussian quadrature by taking 2 points? | | | CO3 | AP | 3 |
| 13. | Find *y(0.2)* by using Euler’s method given that | | | CO5 | AN | 3 |
| 14. | Using Crank Nicholson method, find the value of *u* from the below table. | | | CO6 | AN | 3 |
| 15. | State Baye’s theorem on probability. | | | CO2 | R | 3 |
| 16. | Write the normal equations of fitting of second degree parabola. | | | CO2 | 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. | |  | ­ Using *Bisection Method*, find the root of *f(x) = x3 – 6x +4 = 0* correct to 4 decimal places. | CO1 | AN | 12 |
|  | |  |  |  |  |  |
| 18. | |  | Evaluate by taking six equal sub-intervals, using  (i) Trapezoidal rule (ii) Simpson’s 1/3 rule  (iii) Simpson’s 3/8 rule. Also find the actual value. | CO3 | EV | 12 |
|  | |  |  |  |  |  |
| 19. | | a. | Given that , find *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | CO5 | AP | 6 |
|  | | b | Given that  , find *y(1.4)* by using Adams predictor and corrector methods. | CO5 | AP | 6 |
|  | |  |  |  |  |  |
| 20. | |  | Solve by using Liebmann’s iterative method, the boundary conditions are given below: | CO6 | AN | 12 |
|  | |  |  |  |  |  |
| 21. | | a. | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | P(x) | K | 3k | 5k | 7k | 9k | 11k |   Find (i) the value of a (ii) P(X <4) (iii) P(1 < X 5) (iv) Mean of X | CO2 | AN | 6 |
|  | | b | Fit a Poisson distribution for the below data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | | f | 6 | 13 | 25 | 22 | 21 | 13 | | CO2 | AP | 6 |
|  | |  |  |  |  |  |
| 22. | | a. | Determine whether the below function is a first degree spline function | CO4 | AN | 4 |
|  | | b | Construct a quadratic spline function for the below data   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 0 | 2 | 3 | 4 | | y | 7 | 11 | 28 | 63 | | CO4 | AP | 8 |
|  | |  |  |  |  |  |
| 23. | | a. | Find the two regression line equations, and also find the value of y when x = 8.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO2 | AN | 6 |
|  | | b. | Find the rank correlation for the below data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 40 | 50 | 38 | 60 | 65 | 50 | 35 | | Y | 38 | 60 | 55 | 70 | 60 | 48 | 30 | | CO2 | AN | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | | a. | Fit a straight line to the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 6 | 11 | 16 | 20 | 26 | | y | 13 | 16 | 17 | 23 | 24 | 31 | | CO2 | AN | 6 |
|  | | b. | A die is thrown 264 times with the following results. Prove that the die is unbiased by using Chi-square test.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. appeared on the die | 1 | 2 | 3 | 4 | 5 | 6 | | Frequency | 40 | 32 | 28 | 58 | 54 | 60 | | CO2 | AN | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The Student will be able to get knowledge about different methods of solving algebraic equations. |
| CO2 | The Student will be able to interpolate data. |
| CO3 | The Student will be able to compute using numerical integration. |
| CO4 | The Student will be able to compute using spline functions. |
| CO5 | The Student will be able to solve ordinary differential equations using numerical techniques. |
| CO6 | The Student will be able to solve partial differential equations using numerical techniques. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 1 | 1 | 15 | - | - | 17 |
| CO2 | 6 | 1 | 12 | 24 | - | - | 43 |
| CO3 | 1 | - | 4 | - | 12 | - | 17 |
| CO4 | 2 | - | 4 | 8 | - | - | 14 |
| CO5 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO6 | - | 1 | - | 15 | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA2002** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED COMPUTATIONAL MATHEMATICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. |  | | CO1 | U | 1 |
| 2. | Evaluate | | CO1 | R | 1 |
| 3. | State Dirichlet’s conditions. | | CO2 | R | 1 |
| 4. | Define a periodic function and give an example. | | CO2 | R | 1 |
| 5. | = ……………… | | CO3 | U | 1 |
| 6. | If , then the inverse Fourier transform of F(s) is given by ………………… | | CO3 | R | 1 |
| 7. | Form a partial differential equation by eliminating the arbitrary constants a and b from z = ax + by + ab. | | CO4 | U | 1 |
| 8. | Define a homogeneous linear partial differential equation of second order with an example. | | CO4 | R | 1 |
| 9. | Write down one dimensional wave equation. | | CO5 | U | 1 |
| 10. | Explain quasiharmonic equation. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Evaluate | | CO1 | An | 3 |
| 12. | If f(x) is an odd function defined in the interval , then what are the values of ? | | CO2 | U | 3 |
| 13. | If F(s) is the Fourier transform of f(x), then prove that | | CO3 | An | 3 |
| 14. | Solve | | CO4 | U | 3 |
| 15. | What are the possible solutions of Laplace’s equation . | | CO5 | An | 3 |
| 16. | Explain (a) NARMAX (b) DYMOS. | | 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. | Using convolution theorem, evaluate . | CO1 | An | 6 |
|  | b. | Evaluate  . | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Expand  in a Fourier series. Hence deduce that | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Find the Fourier transform of    Hence evaluate | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve | CO4 | A | 6 |
|  | b. | Solve | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | A string is stretched and fastened to two points x = 0 and apart. Motion is started by displacing the string into the form from which it is released at time t = 0. Find the displacement of any point on the string at a distance of x from one end at time t. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the complete integral of (i)  and (ii) | CO4 | A | 6 |
|  | b. | Solve | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Solve by the method of transforms, the equation | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A square plate is bounded by the lines x = 0, x = a, y = 0 and  y = 20 and its faces are insulated. The sides x = 0, y = 0, y = a  are kept at 0 and the side x = a is kept at temperature given by u(a, y) = 100, 0<y<a. Find the steady state temperature distribution in the plate. | CO5 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to build the solution of engineering problems through continuum model. |
| CO2 | The student will be able to relate Fourier series to solve dynamic problems. |
| CO3 | The student will be able to interpret the skills in Fourier transform to engineering models. |
| CO4 | The student will be able to apply differential techniques to solve multivariate models. |
| CO5 | The student will be able to make use of mathematical principles in solving heat  and wave models. |
| CO6 | The student will be able to infer the knowledge of modeling to fluid problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 18 | 9 |  |  | 29 |
| CO2 | 2 | 3 |  | 12 |  |  | 17 |
| CO3 | 1 | 1 |  | 15 |  |  | 17 |
| CO4 | 1 | 4 | 24 |  |  |  | 29 |
| CO5 |  | 1 | 12 | 15 |  |  | 1 |
| CO6 |  | 4 |  |  |  |  | 4 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA2003** | **Duration** | **3hrs** |
| **Course Name** | **SIMULATION OF NUMERICAL MATHEMATICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Convert . | | CO2 | U | 1 |
| 2. | If then . | | CO1 | R | 1 |
| 3. | Newton form of the interpolating polynomial is given by \_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 4. | The process of finding the value of y corresponding to any value of outside the interval ) is given by\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 5. | To apply Simpson’s one-third rule the number of intervals n must be \_\_\_. | | CO5 | R | 1 |
| 6. | In numerical integration for the interval (4, 5.2), if n = 6 then h = \_\_\_\_\_\_. | | CO5 | U | 1 |
| 7. | In solving using fourth order RK method, | | CO3 | R | 1 |
| 8. | The numerical solution of the equation using Taylor’s series is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 9. | The solution of a hyperbolic partial differential equation is \_\_\_\_if . | | CO3 | R | 1 |
| 10. | The two dimensional heat equation is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the equivalent octal form of . | | CO2 | U | 3 |
| 12. | Convert to nested form and evaluate P(3). | | CO4 | U | 3 |
| 13. | If R(4,2) = 8 and R(3,2) = 1, find R(4,3) using Romberg Algorithm. | | CO5 | U | 3 |
| 14. | Using Euler’s method, determine of the equation , y(0) =1 for x=0.2. | | CO3 | A | 3 |
| 15. | Find the nature of the PDE . | | CO3 | U | 3 |
| 16. | Show that y(x) = 3 is the solution of the Volterra Integral 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. |  | Find the real root of for by bisection method correct to four decimal places. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Using Newton’s divided difference formula find from the following table.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | -4 | -1 | 0 | 2 | 5 | | *f(x)* | 1245 | 33 | 5 | 9 | 1335 | | CO4 | A | 6 |
|  | b. | Compute the value of *f(x)* for x=10 from the following table using Lagrange’s interpolation method.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 5 | 6 | 9 | 11 | |  | 12 | 13 | 14 | 16 | | CO4 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Evaluate the integral using trapezoidal and Simpson’s rule. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Compute y(0.2), given , y(0)=1 by taking h=0.1using RK method of fourth order correct to four decimal places. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Solve the Laplace equation over the square mesh with boundary values as shown using Leibmann’s iteration procedure. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Perform four iterations of the Secant method to obtain the root of the equation that lies in the interval (0,1). | CO1 | A | 8 |
|  | b. | Write the pseudocode for Regula Falsi Method. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Apply Gaussian two point formula to evaluate and . | CO5 | A | 8 |
|  | b. | Write the pseudocode for Romberg’s Method. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Show that is a solution of the Volterra integral equation . | CO6 | A | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Solve algebraic equations numerically in engineering fields. |
| CO2 | Extend the uses of representation of numbers in different bases in engineering fields. |
| CO3 | Produce numerical solution for transcendental equations in engineering fields. |
| CO4 | Illustrate the interpolation techniques in other branches. |
| CO5 | Evaluate integration using numerical methods. |
| CO6 | Develop the application of splines in engineering fields. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | 24 | - | - | - | 25 |
| CO2 | - | 4 | - | - | - | - | 4 |
| CO3 | 4 | 6 | 24 | - | - | - | 34 |
| CO4 | 2 | 3 | 12 | - | - | - | 17 |
| CO5 | 1 | 4 | 24 | - | - | - | 29 |
| CO6 | - | 3 | 12 | - | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA2004** | **Duration** | **3hrs** |
| **Course Name** | **PARTIAL DIFFERENTIAL EQUATIONS, PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the degree of partial differential equation: | | CO1 | U | 1 |
| 2. | Find complete solution of partial differential equation*:*  *z = px+qy+p2+q2* | | CO1 | R | 1 |
| 3. | The one dimensional wave equation is ------- | | CO2 | U | 1 |
| 4. | The value of a2in one dimensional heat equation is ------- | | CO2 | R | 1 |
| 5. | If A and B are mutually exclusive events with P(A) =1/4, P(B) =1/5 then find P(AUB). | | CO3 | U | 1 |
| 6. | Find the probability that a non-leap year selected at random consists of 53 Sundays. | | CO3 | R | 1 |
| 7. | If F(x) is the CDF of a random variable X , then | | CO3 | U | 1 |
| 8. | The mean of Poisson distribution is ------- | | CO3 | R | 1 |
| 9. | The second moment about the mean is --------- | | CO4 | U | 1 |
| 10. | In order to test independence of attributes ----- test is used. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the complete solution of partial differential equation:  *p-x = q-y* | | CO1 | U | 3 |
| 12. | State the possible solutions of one dimensional wave equation. | | CO2 | U | 3 |
| 13. | Eight coins are thrown simultaneously find probability of getting exactly five heads | | CO3 | U | 3 |
| 14. | The joint probability density function of x and y is  f (x, y) = (3x2+xy) , 0 < x < 1, 0 < y < 2  Find the marginal density of X. | | CO3 | U | 3 |
| 15. | If the second, third and fourth moments about the mean are  ,  , and then find (i)the measure of skewness (ii) measure of kurtosis | | CO4 | U | 3 |
| 16. | Define Type I error, Type II error | | 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. | Solve | CO1 | A | 6 |
|  | b. | Solve : | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | An insulated rod 20cms long has its ends A and B kept at 30∙C and 60∙C respectively, until steady state conditions prevail. The temperature at each end is then suddenly reduced to 0∙C and kept so. Find the resulting temperature function u(x,t). | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | In a shooting test, the probability of hitting the target is ½ for A, 2/3 for B and ¾ for C. If all of them fire at the target, find the probability that (i) atleast one hits the target (ii) exactly one hits the target(iii) none hits the target. | CO3 | A | 6 |
|  | b. | Suppose that Colored balls are distributed in 3 boxes as given below:   |  |  |  |  | | --- | --- | --- | --- | |  | Box 1 | Box 2 | Box 3 | | 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 is observed to be red. Find the probability that  Box 1 was selected. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | 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 | 2 k2 | 7 k2 +k |   (i)Find k  *(iv)* Find Cumulative Distribution Function,*CDF*  *(v*) Find P(1.5 < X < 4.5 / X > 2)*.* | CO3 | A | 6 |
|  | b. | Fit a Poisson distribution to the given data and calculate the expected frequencies.     |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 43 | 38 | 22 | 9 | 1 | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | The weekly wages of 1000 workmen are normally distributed with mean Rs.70 and standard deviation Rs 5. Estimate the number of workers, whose weekly wages will be (i) less than Rs. 69. (ii) more than Rs.72. (iii)between Rs 69 and Rs72. | CO3 | A | 6 |
|  | b. | For the bivariate probability distribution of (X,Y) given below, find(i) P(X≤1) (ii) P(Y≤3) (iii)P(X≤1,Y≤ 3) (iv)P(X≤1/Y≤3)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | The joint probability mass function of (X,Y) is P(x,y)=K(2x+3y);  x = 0,1,2 and y = 1,2,3 (i) Find K (ii) Find marginal distributions of X and Y (iii) Find conditional distributions of X given Y  (iv) Find conditional distributions of Y given X. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Find the two Lines of Regression   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, recorded the following increase in weight. Test whether the variances are significantly different.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | | CO5 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand solution of partial differential equations. |
| CO2 | Apply solution of partial differential equations in heat and wave equations. |
| CO3 | Understand conditional probability and moment generation. |
| CO4 | Measure the relationship between variables. |
| CO5 | Execute the test of hypothesis for large and small samples. |
| CO6 | Examine the independence of attributes. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 12 |  |  |  | 17 |
| CO2 | 1 | 4 | - | 12 |  |  | 17 |
| CO3 | 1 | 8 | 48 |  |  |  | 57 |
| CO4 | 1 | 4 | 12 |  |  |  | 17 |
| CO5 | - | - | 12 |  |  |  | 12 |
| CO6 | 1 | 3 | - |  |  |  | 4 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA2005** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If *A ={\*,+}, B={a, e}, C= {\*,a},* then find *(AXB) Ո(AXC).* | | CO1 | U | 1 |
| 2. | For *A= {1,2,3,4}* and *B={p,q,r,s},* consider the mapping *f:A to B* defined by *f(1)= r, f(2)=s, f(3) = p , f(4)=q.* Check whether *f* is an one to one function or not. | | CO1 | U | 1 |
| 3. | The value of projection function is ……. | | CO2 | U | 1 |
| 4. | The value of Predecessor function *P(10)* is …….. | | CO2 | R | 1 |
| 5. | The letters of the word "*SPAIN*" taken all at a time can be written in ….. number of ways. | | CO3 | U | 1 |
| 6. | Compute *C(6,6).* | | CO3 | U | 1 |
| 7. | The Dual of the statement *(PV Q) ᴧ (P ᴧꭋQ)* is --------- | | CO4 | U | 1 |
| 8. | The inverse of *(P→Q)* is -------- | | CO4 | R | 1 |
| 9. | In a Boolean Algebra, *a\*a* = ………. | | CO5 | R | 1 |
| 10. | The chromatic number of complete graph *K3* is ……… | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | For *S= {1,2,3,4,5,6,7,8,9,10},* let *A={xS / x is an even number}* and  *B={ xS/ x is multiple of 3}.* Find *(A ∆ B).* | | CO1 | U | 3 |
| 12. | Find *LCM of (105, 35)* using *prime factorization*. | | CO2 | U | 3 |
| 13. | If 7 colors are used to paint 50 bicycles, atleast how many bicycles will have the same color? | | CO3 | U | 3 |
| 14. | If *A= {1,2,3,4,5,6},* then determine the truth value of  (i) (ii) (iii). | | CO4 | U | 3 |
| 15. | Show that in a Boolean Algebra +c*)= ac+b+bc.* | | CO5 | U | 3 |
| 16. | Construct the graph *G* with vertices *{a, b, c, d}* , from the following adjacency matrix of G: . | | 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. |  | Let *A={a,b,c,d}.* If *R* and *S* are two relations defined on A represented  by MR= and MS= , then compute i) *MRUS* ii) *MRՈS*  iii) *MRoS*iv) *MSoR* v) vi) Matrix of complement of R, . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Prove that the number theoretic function *f(x,y)=x\*y* is primitive recursive function, where \* denotes usual multiplication. | CO2 | A | 6 |
|  | b. | Find *GCD of (1575,231)* using Euclidean Algorithm and hence find Bezout constants. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prove that *1+2+3+…+n = n(n+1)/2* using Mathematical Induction. | CO3 | A | 6 |
|  | b. | How many bit strings of length 8 contain (i) atmost four 1’s (ii) atleast four 1’s (iii) equal number of zeros and ones. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Check whether *((P ∨* Q*) ∧ (P→R) ∧ (* Q*→R) )→R* is tautology or not. | CO4 | A | 6 |
|  | b. | Prove that *P* is equivalent to *(i) P∧(P ∨ Q) (ii) PV(P ∧Q) .* | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Let A =  and ,  be permutations of A.   1. Find , , . 2. Find o ). 3. Find. 4. Express as product of disjoint cycles. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Prove that *G= {1,3,7,9}* is a Group under multiplication *modulo 10*. | CO5 | A | 6 |
|  | b. | Find i) Principal Disjunctive Normal Form ii.) Principal Conjunctive Normal Form for the following statement: *(P ∨ Q) ∧ ( ꭋP ∨ (Q ∨ R)).* | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find minimum spanning tree of the graph given below using i) Prim’s Algorithm ii) Kruskal’s Algorithm | CO6 | A | 6 |
|  | b. | i. Find Euler circuit of the graph given below :    ii. Find Hamiltonian circuit of the graph given below: | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the Prefix, Infix, Postfix Expressions of the following Tree: | CO6 | An | 6 |
|  | b. | Evaluate the following expressions:   1. *7 4 – 4 2 + 3 / \*.* 2. *\* – 7 5 + 5 / 2 2.* | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to solve the problems using the concepts of sets, functions, and relations. |
| CO2 | The student will be able to apply number theory in data encryption. |
| CO3 | The student will be able to demonstrate knowledge in counting techniques |
| CO4 | The student will be able to establish truth values using mathematical logic |
| CO5 | The student will be able to Understand algebraic structures and morphisms. |
| CO6 | The student will be able to Model network problems using graph and trees. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 5 | 12 | - | - | - | 17 |
| CO2 | 1 | 4 | 12 | - |  |  | 17 |
| CO3 | - | 5 | 12 | - | - | - | 17 |
| CO4 | 1 | 4 | 12 | - |  |  | 17 |
| CO5 | 1 | 3 | 24 | - | - | - | 28 |
| CO6 | - | 4 | 12 | 12 | - | - | 28 |
|  | | | | | | | **124** |



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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the probability of getting 2 heads when a coin is tossed 2 times. | | CO1 | U | 1 |
| 2. | If and  are mutually exclusive events then P(AB) = \_\_\_\_\_ | | CO1 | R | 1 |
| 3. | A random variable X follows the PDF  find 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. | | CO3 | R | 1 |
| 6. | The mean of the binomial distribution is \_\_\_\_\_. | | CO3 | R | 1 |
| 7. | If X and Y are two independent random variables thenX+Y() = \_\_\_\_. | | CO4 | R | 1 |
| 8. | What is the nature of, if both ‘T’ and ‘S’ is continuous? | | CO5 | R | 1 |
| 9. | If the process X(t) and Y(t) are orthogonal, then Rxy() = \_\_\_\_ | | 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. | A random variable X has a mean μ = 12 and variance σ2 = 9 and an unknown distribution. Find P(6<X<18) using Tchebycheff''s Inequality. | | 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 . Find 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) atleast 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,What is the probability that it is defective? If a bolt chosen at random is found to be defective, 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. (i) What is the probability that the repair time exceeds 2 hrs? (ii) What is the conditional probability that the repair time takes atleast 10 hrs given that its duration exceeds 9 hrs? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Show that the distribution for which the characteristic function is has the density function. | 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. If (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 Find (i) Marginal density function (ii) Conditional density function and also check whether x and y are Independent random variable. | 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 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, 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, find the transition probability matrix P of the Markov chain and also find and 6).  Question No.24 from Module 6 | CO6 | A | 6 |

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

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 6 | 9 | - | - | 17 |
| CO2 | 1 | 1 | -- | - | 27 | - | 29 |
| CO3 | 2 | - | 9 | - | 6 | - | 17 |
| CO4 | 1 | - | 6 | 9 | 12 | - | 28 |
| CO5 | 2 | - |  | 12 | 3 | - | 17 |
| CO6 | 1 | - | 6 | 9 | - | - | 16 |
|  | | | | | | | **124** |



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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If F(x) is the CDF of a random variable X , then | | CO1 | U | 1 |
| 2. | If X is a random variable such that, E(X) = 4 and E(X2) =20 then find variance of X. | | CO1 | R | 1 |
| 3. | The mean of Poisson distribution is ------ | | CO2 | U | 1 |
| 4. | If X follows exponential distribution, then P(X>15/X>10) = | | CO2 | R | 1 |
| 5. | Define a large sample. | | CO3 | U | 1 |
| 6. | The tabulated value of Z for two tailed test at 5% Level of Significance  is \_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | The test statistic formula of ‘t’ test of single small sample mean is --- | | CO4 | U | 1 |
| 8. | In order to test, equality of variance ---- test is used. | | CO4 | R | 1 |
| 9. | If > then the test statistic of F is -------- | | CO5 | U | 1 |
| 10. | If ‘s’ and ‘t’ are variables then X(s,t) is ------- | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If the joint probability density function of (X,Y) is f(x,y)=4xy 0<x<1,0<y<1 then find marginal density function of X . | | CO1 | U | 3 |
| 12. | Six coins are thrown simultaneously find probability of getting exactly four heads. | | CO2 | U | 3 |
| 13. | Define Type I error. | | CO3 | U | 3 |
| 14. | The average score of 200 students is 74 with standard deviation 2.5. In order to test that average score of the students in the city is 75, Define null hypothesis and alternative hypothesis | | CO4 | U | 3 |
| 15. | Give an example of Latin square design of experiment | | CO5 | U | 3 |
| 16. | The transition probability matrix of a Markov chain with states {1,2,3} is given below. Sketch the state transition diagram | | 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 continuous random variable X has the probability density function  (i)Find the value of k  (ii) Find P(X<4) (iii) Find mean of X. | CO1 | A | 6 |
|  | b. | 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 K (ii) Evaluate *P(X<2)* (iii) Find CDF, cumulative distribution function (iv) Find mean of X | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | The joint probability mass function of (X,Y) is P(x,y)=K(2x+3y);  x = 0,1,2 and y = 1,2,3 (i) Tabulate the probability distribution(ii) Find K (iii) Find marginal distributions of X and Y (iv) Find conditional distributions of X given Y (v) Find conditional distributions of Y given X. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19 |  | Find (i) correlation coefficient (ii)the two Lines of Regression   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | In test of 2000 electric bulbs, it was found that the life of a  particular make, was normally distributed with an average life of 2040 hours and standard deviation of 60 hrs. Estimate the number of bulbs likely to burn for (i) More than 2160 hrs (ii) Less than1980 hrs. | CO2 | A | 6 |
|  | b. | Fit a Binomial Distribution to the following data and find theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 4 | 29 | 36 | 25 | 6 | | CO2 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | In a city a sample of 1000 persons from 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 different between the two cities so for as the proportion of wheat consumers are concerned. | CO3 | A | 6 |
|  | b. | From the following data, find whether the two mean marks differ significantly   |  |  |  |  | | --- | --- | --- | --- | |  | Sample size | Mean marks | Standard deviation | | Sample I | 100 | 73.4 | 8 | | Sample II | 100 | 70.3 | 10 | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | The nicotine contents in milligrams in two samples of tobacco were found to be as follows.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Sample A | 24 | 27 | 26 | 23 | 25 | | Sample B | 27 | 30 | 28 | 31 | 22 | 36 |   Find if the variances are significantly different. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are tabulated. Analyze the variance and discuss the difference between (a)doctors (b) treatments   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Doctor | Treatment | | | | | I | II | III | IV | | A | 10 | 14 | 19 | 20 | | B | 11 | 15 | 17 | 21 | | C | 9 | 12 | 16 | 19 | | D | 8 | 13 | 17 | 20 | | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The transition probability matrix of a Markov chain {Xn} , n=1,2,3,… having three states 1,2,3 is and the initital distribution is p(0) = (0.7,0.2,0.1)  Find (i) P(X1 = 3, X0 = 2)  (ii) P(X2 = 3, X1 = 3, X0 = 2)  (iii) P(X3=2, X2 = 3, X1 = 3, X0 = 2) | CO6 | A | 6 |
|  | b. | Find mean and variance of the Random process whose autocorrelation function is given by | CO6 | A | 6 |

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

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|  | **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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 24 | - | - | - | 29 |
| CO2 | 1 | 4 | 24 | - |  |  | 29 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 1 | 4 | 12 | - |  |  | 17 |
| CO5 | - | 4 | - | 12 | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA2009** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY AND STATISTICS USING R PROGRAMMING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | If is the cumulative distribution function of then F (∞) =\_\_\_. | | CO1 | R | 1 |
| 2. | Define continuous random variable. | | CO1 | U | 1 |
| 3. | The standard deviation of a binomial distribution with parameters (n,p) is \_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Give an example of a negative correlation. | | CO2 | A | 1 |
| 5. | In sampling techniques, if the sample size (n) is small then the value of n is \_\_\_\_\_. | | CO3 | R | 1 |
| 6. | What is the conclusion of the test of significance, when Zcal >Ztab? | | CO3 | U | 1 |
| 7. | Determine the table value for a ’F’ test (two-tailed test) on a samples of 7 and 9 observations at 5% level of significance. | | CO4 | A | 1 |
| 8. | Which test is used to compare the average values of the two small sample or large data sets? | | CO4 | U | 1 |
| 9. | What does ANOVA stand for? | | CO5 | R | 1 |
| 10. | The Poisson process is a \_\_\_\_\_\_\_ process. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compute the value of and , If ‘’ is a discrete random variable with the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | p(x) | K | 2k | 3k | 4k | 5k | 6k | | | CO1 | E | 3 |
| 12. | The probability of bomb hitting a target is 1/5. Two bombs are enough to destroy a bridge. If 6 bombs are aimed at the bridge, find the probability that the bridge is destroyed using the binomial distribution. | | CO2 | An | 3 |
| 13. | A sample of 50 cows in a herd has average lactation yield 1290 liters. Test whether the sample has been drawn from the population having herd average lactation yield of 1350 liters with a standard deviation of 65 liters. | | CO3 | A | 3 |
| 14. | In an experiment of cattle from tuberculosis, the following were obtained:   |  |  |  | | --- | --- | --- | | Implant a vaccine | Affected | Not Affected | | Inoculated | 4 | 20 | | Not inoculated | 50 | 56 |   Using test at 5% level of significance, test the independence of attributes of an implanted vaccine anddiscuss the effect of vaccine in controlling susceptibility to tuberculosis. | | CO4 | A | 3 |
| 15. | Explain the layout of Randomized Block Design. | | CO5 | R | 3 |
| 16. | Find the mean and variance of the stationary process , whose autocorrelation is given by . | | 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. |  | A continuous random variable has a probability density function, . Find (i) (ii) mean and variance of. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | The bivariate probability distribution of given below:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | 1 | 2 | 3 | 4 | 5 | 6 | | 0 | 0 | 0 | 1/32 | 2/32 | 2/32 | 2/32 | | 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 |   Find (i) (ii) (iii)  (iv) (v) (vi) | CO1 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | The following mistakes per page were observed in a book:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | No of mistakes(per page) | 0 | 1 | 2 | 3 | 4 | | No of Pages | 211 | 90 | 19 | 5 | 0 |   Fit a Poisson distribution and estimate the expected frequencies. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Before an increase in excise duty on tea, 400 people out of a sample of 500 persons were found to be tea drinkers. After an increase in excise duty, 400 people were observed to be tea drinkers in a sample of 600 people. Test whether there is a significant change in the number of tea drinkers after increase in excise duty on tea. | CO3 | A | 6 |
|  | b. | Explain the working rule of hypothesis testing. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 21. |  | **Researchers want to examine the effect of perceived control on health complaints of geriatric patients in a long-term care facility. Seven patients are randomly selected to participate in the study. Half are given a plant to care for and half are given a plant but the care is conducted by the staff. Numbers of health complaints are recorded for each patient over the following seven days. Compute the appropriate t-test for the data provided below.**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Control over plant | 23 | 12 | 6 | 15 | 18 | 5 | 21 | | No Control over plant | 35 | 21 | 8 | 12 | 16 | 3 | 32 | | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | 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. | CO2 | E | 6 |
|  | b. | Calculate the correlation coefficient for the following height of father and their sons   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | 65 | 66 | 68 | 69 | 71 | 70 | 62 | 63 | |  | 68 | 70 | 67 | 71 | 69 | 72 | 60 | 62 | | CO2 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Four doctors each test four treatment for a certain disease and observed the number of days each patients takes to recover the results are as follows (Recovery time in days):   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Doctor | Treatment | | | | | 1 | 2 | 3 | 4 | | A | 10 | 14 | 19 | 20 | | B | 11 | 15 | 17 | 21 | | C | 9 | 12 | 16 | 19 | | D | 8 | 13 | 17 | 20 |   Using randomized block design, discuss the difference between the doctor and treatment. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | 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) | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify probability models and solve using discrete and continuous random variables. |
| CO2 | Classify the problems using probability distributions. |
| CO3 | Test the hypothesis for large samples. |
| CO4 | Analyze the parameters and attributes of small samples. |
| CO5 | Construct the experimental designs using Analysis of Variance. |
| CO6 | Examine ergodicity of random process. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 |  |  | 27 |  | 29 |
| CO2 | 1 |  | 1 | 21 | 6 |  | 29 |
| CO3 | 7 | 1 | 9 |  |  |  | 17 |
| CO4 |  | 1 | 16 |  |  |  | 17 |
| CO5 | 4 |  | 12 |  |  |  | 16 |
| CO6 | 1 |  | 12 |  | 3 |  | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA2012** | **Duration** | **3hrs** |
| **Course Name** | **BUSINESS STATISTICS WITH R** | **Max. Marks** | **100** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | | |
| 1. | a. | | Construct a multiple and percentage bar diagram for the following data.   |  |  |  |  | | --- | --- | --- | --- | | Year | Sales  (‘000) | Gross Profit  (‘000) | Net Profit  (‘000) | | 2004 | 100 | 30 | 10 | | 2005 | 120 | 40 | 15 | | 2006 | 130 | 45 | 25 | | 2007 | 150 | 50 | 25 | | CO1 | U | 10 |
|  | b. | | Represent the following data by a pie diagram.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Items | Food | Clothing | Recreation | Education | Rent | Others | | Expenses  (in ₹) | 87 | 24 | 11 | 13 | 25 | 20 | | CO1 | A | 10 |
|  |  | | **(OR)** |  |  |  |
| 2. | a. | | Marks scored by 30 students are given below.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 41 | 55 | 48 | 47 | 53 | 48 | 33 | 32 | 42 | 55 | | 44 | 38 | 60 | 65 | 71 | 80 | 41 | 53 | 47 | 48 | | 55 | 20 | 31 | 34 | 42 | 51 | 35 | 30 | 26 | 25 |   Convert the marks into a frequency distribution with class interval of 10. Also draw the histogram, frequency polygon and frequency curve for the distribution. | CO1 | R | 10 |
|  | b. | | The following data gives the weekly wages of 100 workers in a factory. Draw less than and more than ogive curves and hence read the value of median.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Weekly  Wages  (Rs.‘00) | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 | | No. of Workers | 7 | 11 | 24 | 32 | 9 | 14 | 2 | 1 | | CO1 | A | 10 |
|  |  | |  |  |  |  |
| 3. | a. | | Compute the mean and median for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Profits per shop  (Rs. in lakhs) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No. of shops | 12 | 18 | 27 | 20 | 17 | 6 | | CO2 | A | 12 |
|  | b. | | Find out the mode from the following data showing frequency with which profits are made in lakhs of rupees.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Profits  (Rs. in lakhs) | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 | | Frequency | 13 | 27 | 25 | 50 | 75 | 38 | 18 | | CO2 | A | 8 |
|  |  | | **(OR)** |  |  |  |
| 4. | a. | | Determine the inter-quartile range, quartile deviation and its coefficient from the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Value | 8 | 10 | 13 | 16 | 19 | 22 | | Frequency | 4 | 7 | 8 | 3 | 5 | 4 | | CO3 | A | 10 |
|  | b. | | Compute the mean deviation and the coefficient of mean deviation from the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Class Intervals (C.I) | 2-4 | 4-6 | 6-8 | 8-10 | | Frequency (f) | 3 | 4 | 2 | 1 | | CO3 | A | 10 |
|  |  | |  |  |  |  |
| 5. | a. | | For the given data.   |  |  |  | | --- | --- | --- | |  | Sample 1 | Sample 2 | | Sample size | 35 | 65 | | Mean | 80 | 70 | | Standard Deviation | 4 | 5 |  1. Find out which sample is having greater variation? 2. Compute the combined mean? 3. What is the combined standard deviation? | CO3 | U | 10 |
|  | b. | | Prices of a particular commodity in five years in two cities are as follows.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Price in city A | 20 | 22 | 19 | 23 | 16 | | Price in city B | 10 | 20 | 18 | 12 | 15 |   From the above data find the city which had more stable prices. | CO3 | E | 10 |
|  |  | | **(OR)** |  |  |  |
| 6. | a. | | Calculate Karl Pearson’s correlation coefficient for the given data.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 100 | 101 | 102 | 102 | 100 | 99 | 97 | 98 | 96 | 95 | | Y | 98 | 99 | 99 | 97 | 95 | 92 | 95 | 94 | 90 | 91 | | CO4 | An | 10 |
|  | b. | | Rankings of ten trainees at the beginning (X) and at the end (Y) of a certain course are given below:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Trainees | A | B | C | D | E | F | G | H | I | J | | X | 1 | 6 | 3 | 9 | 5 | 2 | 7 | 10 | 8 | 4 | | Y | 6 | 8 | 3 | 7 | 2 | 1 | 5 | 9 | 4 | 10 |   Compute rank correlation coefficient. | CO4 | An | 10 |
|  |  | |  |  |  |  |
| 7. | a. | | From the following information about rainfall and production.   |  |  |  | | --- | --- | --- | |  | Rainfall in inches (X) | Production in Quintals (Y) | | Mean | 40 | 60 | | Standard Deviation | 10 | 15 | | Coefficient of correlation | 0.7 | |  1. Calculate the regression equation of Y on X. 2. Find the likely production when the rainfall is 30 inches? | CO5 | An | 10 |
|  | b. | | Calculate the mean of variables X and Y and correlation coefficient for the regression equations 2Y - X = 50 and 3Y - 2X = 10. | CO5 | U | 10 |
|  |  | | **(OR)** |  |  |  |
| 8. | a. | | Fit a trend line to the following data by (i) graphic method and  (ii) method of semi-averages.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | | Sales  (‘000 Units) | 65 | 95 | 85 | 115 | 110 | 120 | 130 | | CO6 | An | 6 |
|  | b. | | Calculate the trend values by the method of least squares from the given data and estimate the sales for the year 2010.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | Sales  (Rs. in crores) | 12 | 10 | 14 | 11 | 13 | 15 | 16 | | CO6 | An | 14 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | | |
| 9. | a. | | Calculate the seasonal indices for the following time series.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 2016 | 60 | 65 | 62 | 69 | | 2017 | 62 | 68 | 65 | 68 | | 2018 | 65 | 70 | 64 | 62 | | 2019 | 70 | 75 | 68 | 67 | | 2020 | 72 | 80 | 70 | 78 | | CO6 | An | 10 |
|  | b. | | Compute a price index for the following by the  (i) simple aggregate method  (ii) average of price relative method using both arithmetic mean and geometric mean.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Commodity | A | B | C | D | E | F | | Price in 2005 (Rs.) | 20 | 30 | 10 | 25 | 40 | 50 | | Price in 2006 (Rs.) | 25 | 30 | 15 | 35 | 45 | 55 | | CO6 | An | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Present the data in tabular and graphical representation. |
| CO2 | Determine the central tendency of the data. |
| CO3 | Evaluate the dispersion of the data and associate with real time. |
| CO4 | Analyze the relationship between the business parameters. |
| CO5 | Model the regression lines to predict and analyze the future. |
| CO6 | Analyze the trend and forecast the business development. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 20 | - | - | - | 40 |
| CO2 | - | - | 20 | - | - | - | 20 |
| CO3 | - | 10 | 20 | - | 10 | - | 40 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 10 | - | 10 | - | - | 20 |
| CO6 | - | - | - | 40 | - | - | 40 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA2012** | **Duration** | **3hrs** |
| **Course Name** | **BUSINESS STATISTICS WITH R** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain briefly the four types of classification of data. | CO1 | R | 10 |
|  | b. | Marks scored by 30 students are given below.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 41 | 55 | 48 | 47 | 53 | 48 | 33 | 32 | 42 | 55 | | 44 | 38 | 60 | 65 | 71 | 80 | 41 | 53 | 47 | 48 | | 55 | 20 | 31 | 34 | 42 | 51 | 35 | 30 | 26 | 25 |   Convert the marks into a frequency distribution with class interval of 10. Also draw the histogram, frequency polygon and frequency curve for the distribution. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Represent the following data by a pie diagram.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | Food | Clothing | Rent | Medicare | Entertainment | | Expenditure (in ₹) | 2400 | 200 | 800 | 150 | 450 | | CO1 | A | 10 |
|  | b. | Draw less than and more than ogive curves and estimate the median.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Profits  (Rs.Crores) | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | No. of companies | 8 | 12 | 20 | 24 | 15 | 11 | 10 | | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compute the mean and median for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Profits per shop  (Rs. In lakhs) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No. of shops | 12 | 18 | 27 | 20 | 17 | 6 | | CO2 | A | 10 |
|  | b. | Find out the mode from the following data showing frequency with which profits are made:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Profits  (Rs.’000) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | | Frequency | 4 | 18 | 30 | 42 | 24 | | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Determine the quartile deviation and its coefficient from the following.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Age in years | 20 | 30 | 40 | 50 | 60 | 70 | 80 | | No. of members | 3 | 61 | 132 | 153 | 140 | 51 | 3 | | CO3 | A | 10 |
|  | b. | Compute the mean deviation and its coefficient from the following series.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 10 | 15 | 20 | 30 | 40 | 50 | | Frequency | 8 | 12 | 15 | 10 | 3 | 2 | | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | For the given data.   |  |  |  | | --- | --- | --- | |  | Sample 1 | Sample 2 | | Sample size | 15 | 22 | | Mean | 3.5 | 4.7 | | Standard Deviation | 3 | 4 |  1. Find which sample is having greater variation? 2. Compute the combined mean? 3. What is the combined standard deviation? | CO3 | E | 10 |
|  | b. | Prices of a particular commodity in five years in two cities are as follows.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Price in city A | 20 | 22 | 19 | 23 | 16 | | Price in city B | 10 | 20 | 18 | 12 | 15 |   From the above data find the city which had more stable prices. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate Karl Pearson’s correlation coefficient for the given data.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 100 | 101 | 102 | 102 | 100 | 99 | 97 | 98 | 96 | 95 | | Y | 98 | 99 | 99 | 97 | 95 | 92 | 95 | 94 | 90 | 91 | | CO4 | An | 10 |
|  | b. | Rankings of ten trainees at the beginning (X) and at the end (Y) of a certain course are given below:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Trainees | A | B | C | D | E | F | G | H | I | J | | X | 1 | 6 | 3 | 9 | 5 | 2 | 7 | 10 | 8 | 4 | | Y | 6 | 8 | 3 | 7 | 2 | 1 | 5 | 9 | 4 | 10 |   Compute rank correlation coefficient. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | From the following information about rainfall and production.   |  |  |  | | --- | --- | --- | |  | Rainfall in inches (X) | Production in Quintals (Y) | | Mean | 40 | 60 | | Standard Deviation | 10 | 15 | | Coefficient of correlation | 0.7 | |  1. Calculate the regression equation of Y on X. 2. Find the likely production when the rainfall is 30 inches? | CO5 | An | 10 |
|  | b. | Two random variables have the following regression equations:  3X + 2Y = 26  6X + Y = 31  Find the mean values of X and Y and the correlation coeeficient. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Calculate the 3-yearly moving average of the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | | Production  (in ‘000) | 17 | 20 | 23 | 25 | 29 | 33 | | CO6 | An | 5 |
|  | b. | The following are the annual profits, in lakhs of rupees in a certain business.  (i) Use method of least squares to calculate trend values.  (ii) Also estimate the profits for the year 2017.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | | Profits (Rs.) | 60 | 72 | 75 | 65 | 80 | 85 | 95 | | CO6 | An | 15 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Calculate the seasonal indices for the following time series.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 2013 | 40 | 35 | 38 | 40 | | 2014 | 42 | 37 | 39 | 38 | | 2015 | 41 | 35 | 38 | 40 | | 2016 | 45 | 36 | 36 | 41 | | 2017 | 44 | 38 | 38 | 42 | | CO6 | An | 10 |
|  | b. | Compute a price index for the following by the  (i) simple aggregate method  (ii) average of price relative method using both arithmetic mean and geometric mean.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Commodity | A | B | C | D | E | F | | Price in 2005 (Rs.) | 20 | 30 | 10 | 25 | 40 | 50 | | Price in 2006 (Rs.) | 25 | 30 | 15 | 35 | 45 | 55 | | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Present the data in tabular and graphical representation. |
| CO2 | Determine the central tendency of the data. |
| CO3 | Evaluate the dispersion of the data and associate with real time. |
| CO4 | Analyze the relationship between the business parameters. |
| CO5 | Model the regression lines to predict and analyze the future. |
| CO6 | Analyze the trend and forecast the business development. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 20 | - | - | - | 40 |
| CO2 | - | - | 20 | - | - | - | 20 |
| CO3 | - | - | 20 | - | 20 | - | 40 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 10 | - | 10 | - | - | 20 |
| CO6 | - | - | - | 40 | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **20MA2014** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR DIGITAL SCIENCES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Solve the following system of linear equations by using Cramer’s Method: x + y + z = 6; y +3z = 11 and x - 2y +z = 0. | CO1 | E | 10 |
|  | b. | Find the inverse of the matrix. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Differentiate  with respect to x. | CO2 | E | 8 |
|  | b. | If  find . | CO2 | An | 8 |
|  | c. | Evaluate | CO2 | E | 4 |
|  |  |  |  |  |  |
| 3. | a. | If U={1,2,3,4,5,6,7,8,9,10,11,12,13}, A={1,2,4,6,8}, B={2,3,4,5,6} and C={3,6,9,12,13}. Show that (i) (A∪B)’= A’∩B’  (ii) A-(B∩C) = (A-B)∪(A-C). | CO3 | An | 8 |
|  | b. | If P and Q are the multisets {4 ⋅ a, 1 ⋅ b, 2 ⋅ c} and {3 ⋅ a, 4 ⋅ b, 2 ⋅ c} then find P ∪ Q, P∩Q, P+Q and P - Q. | CO3 | E | 8 |
|  | c. | Determine whether the function f from {a, b, c, d} to {1, 2, 3} defined by f (a) = 3, f (b) = 2, f (c) = 1, and f (d) = 3 is an onto function. | CO3 | An | 4 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | In a group of 8 boys and 5 girls, three children are to be selected. In how many different ways they can be selected if at least one boy should be in the group of children? | CO4 | E | 8 |
|  | b. | The license plates consist of 4 letters followed by 3 numbers. How many different license plates are possible if:   1. if there are NO Restrictions 2. if the letters must be DIFFERENT 3. if the letters are different and the first digit can't be 0 | CO4 | An | 8 |
|  | c. | Find the number of distinguishable permutations of the letters in MATHEMATICS. | CO4 | An | 4 |
|  |  |  |  |  |  |

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| 5. | a. | Show that the following statements are logically equivalent   1. (p ∨ q) ∨ r p ∨ (q ∨ r) 2. (p ∧ q) ∧ r p ∧ (q ∧ r) 3. ¬ (p ∧ q) ¬ p ∨ ¬ q | CO5 | An | 8 |
|  | b. | Prove that the following statements:   1. (p → q) ∧ (p → ¬ q) ∧ p is a contradiction 2. ¬ q ∧ (p → q) → ¬ p is a tautology | CO5 | An | 8 |
|  | c. | Find the bitwise OR, bitwise AND, and bitwise XOR of the bit strings 101 1110, 010 0001. | CO5 | E | 4 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Find the Eigen values and the Eigen vectors of the matrix A= | CO1 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Find the values of a1, a2, a3, a4 and a5 for the following sequence {an} that satisfies the recurrence relation   1. an = an-1 + 5 for n = 1, 2, 3… and a0 = 1. 2. an = for n = 1, 2, 3… 3. an = an−1 + an−2 for n = 1, 2, 3… where a0 = 2 and a1 = 7. | CO2 | An | 8 |
|  | b. | If A = {2,4,6} and B = {1,3,5,7}, find the Cartesian product A x B, B x A, A x A and B x B | CO2 | E | 8 |
|  | c. | Write the power set of {0, 1, 2}. | CO2 | E | 4 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Construct an Euler and Hamilton Path and circuit for the graph shown below: | CO6 | A | 10 |
|  | b. | Define spanning tree and construct the spanning trees for the following graph. | CO6 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Show that the following two graphs are isomorphic. | CO6 | A | 10 |
|  | b. | Using Kruskal’s algorithm, find the minimal spanning tree for the graph given below. | CO6 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Apply the matrix techniques in solving simultaneous equations. |
| CO2 | Recognize different calculus methods. |
| CO3 | Use sets in computer representation. |
| CO4 | Make decision using permutation and combination. |
| CO5 | Construct and solve problems using Logic. |
| CO6 | Model network problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | - | - | 30 | 10 | - | 40 |
| CO2 | - | - | - | 16 | 24 | - | 40 |
| CO3 | - | - | - | 12 | 8 | - | 20 |
| CO4 | - | - | - | 12 | 8 | - | 20 |
| CO5 | - | - | - | 16 | 4 | - | 20 |
| CO6 | - | - | 40 | - | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **20MA2015** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF STATISTICS AND PROBABILITY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Draw a multiple bar diagram for the following data:   |  |  |  |  | | --- | --- | --- | --- | | Years | Sales (Rs.000) | Gross Profit (Rs.000) | Net Profit (Rs.000) | | 2016 | 100 | 30 | 10 | | 2017 | 120 | 40 | 15 | | 2018 | 130 | 45 | 25 | | 2019 | 150 | 50 | 25 | | 2020 | 175 | 65 | 30 | | CO1 | A | 10 |
|  | b. | Calculate the Mean, Median and Mode of the following data:   |  |  |  |  | | --- | --- | --- | --- | | Class | 20-40 | 40-60 | 60-80 | | Freq | 6 | 9 | 11 |      |  |  |  |  |  | | --- | --- | --- | --- | --- | | Class | 80-100 | 100-120 | 120-140 | 140-160 | | Freq | 14 | 20 | 15 | 10 | | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Construct a subdivided bar diagram for the following data:   |  |  |  |  | | --- | --- | --- | --- | | Year | Public Companies | Private Companies | Total | | 1992 | 5000 | 20000 | 25000 | | 1993 | 4000 | 16000 | 20000 | | 1994 | 6000 | 18000 | 24000 | | 1995 | 7000 | 21000 | 28000 | | 1996 | 5000 | 15000 | 20000 | | CO1 | A | 10 |
|  | b. | From the following price of gold in a week, find the city in which the price was more stable.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Day | Mon | Tue | Wed | Thu | Fri | Sat | | City A | 498 | 500 | 505 | 504 | 502 | 509 | | City B | 500 | 505 | 502 | 498 | 496 | 505 | | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. |  | From the following data, find the   1. Two regression line equations. 2. The most likely marks in Statistics, when the marks in Economics is 38. 3. The most likely marks in Economics, when the marks in Statistics is 18.  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Marks in Economics | 22 | 26 | 29 | 30 | 31 | 31 | 34 | 35 | | Marks in Statistics | 20 | 20 | 21 | 29 | 27 | 24 | 27 | 31 | | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Ten competitors in a musical test were ranked by three judges A, B and C in the following order:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 1 | 6 | 5 | 10 | 3 | 2 | 4 | 9 | 7 | 8 | | B | 3 | 5 | 8 | 4 | 7 | 10 | 2 | 1 | 6 | 9 | | C | 6 | 4 | 9 | 8 | 1 | 2 | 3 | 10 | 5 | 7 |   Using rank correlation method, discuss which pair of judges has the nearest approach to common likings in music. | CO3 | An | 20 |
|  |  |  |  |  |  |
| 5. | a. | Using three year moving averages determine the trend and short-term fluctuation.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | | Production | 21 | 22 | 23 | 25 | 24 | 22 | 25 | 26 | 27 | 26 | | CO4 | E | 12 |
|  | b. | Draw a trend line by the method of semi-averages.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | Net Profit (Rs. Lakhs) | 38 | 39 | 41 | 43 | 40 | 39 | 35 | 25 | | CO4 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate the seasonal indices by the method of simple average for the following data:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 1997 | 20 | 24 | 28 | 32 | | 1998 | 28 | 30 | 32 | 36 | | 1999 | 32 | 32 | 34 | 36 | | 2000 | 32 | 36 | 36 | 40 | | 2001 | 36 | 36 | 40 | 40 | | CO4 | E | 10 |
|  | b. | Fit a straight line trend equation to the following data by the method of least squares and estimate the value of sales for the year 1985.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 1979 | 1980 | 1981 | 1982 | 1983 | | Sales (in Rs.) | 100 | 120 | 140 | 160 | 180 | | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | A coin is tossed three times. Find the probability of getting  (i) at least two heads (ii) at most 2 heads (iii) exactly 2 heads (iv) at least two tails (v) exactly 3 tails. | CO5 | E | 10 |
|  | b. | In a bolt factory, machines A, B, C produces 25%, 35%, 40% of the total output. Of their outputs 5%, 4%, 2% are defectives. If a bolt is chosen at random is found to be defective, estimate the probability that it was produced by the machine B. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. Evaluate the probability for the product to be positive. | CO5 | E | 10 |
|  | b. | The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean of 3. Out of 1000 taxi drivers, find approximately the number of drivers with probability of (i) no accidents in a year (ii) more than 3 accidents in a year. | CO6 | E | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | A set of 8 symmetrical coins tossed 256 times and their frequencies of throws observed were as follows:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | No. of heads | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Frequency | 2 | 6 | 24 | 63 | 64 | 50 | 36 | 10 | 1 |   Fit a binomial distribution to this data. | CO6 | A | 10 |
|  | b. | An aptitude test for selecting engineers in an industry is conducted on 100 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the scores find  (i) the number of candidates whose score is more than 60.  (ii) the number of candidates whose score lie between 30 and 60. | CO6 | E | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the different types of presentation of data. |
| CO2 | Measure the central tendency and dispersion of data. |
| CO3 | Analyze the linear relationship. |
| CO4 | Identify the different methods of Time series analysis and forecasting. |
| CO5 | Utilize the concepts of probability. |
| CO6 | Apply the probability models to fit the data. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | - | 10 | 10 | - | 20 |
| CO3 | - | - | - | 40 | - | - | 40 |
| CO4 | - | - | 18 | - | 22 | - | 40 |
| CO5 | - | - | 10 | - | 20 | - | 30 |
| CO6 | - | - | 10 | - | 20 | - | 30 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20MA2015** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF STATISTICS AND PROBABILITY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | |  |  |  |  | | --- | --- | --- | --- | | Years | Sales (Rs.000) | Gross Profit (Rs.000) | Net Profit (Rs.000) | | 2016 | 100 | 30 | 10 | | 2017 | 120 | 40 | 15 | | 2018 | 130 | 45 | 25 | | 2019 | 150 | 50 | 25 | | 2020 | 175 | 65 | 30 |   Draw a subdivided bar diagram for the following data: | CO1 | A | 10 |
|  | b. | Calculate the Mean, Median and Mode for the following data:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Class | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 | | Freq | 4 | 14 | 20 | 51 | 32 | 17 | 6 | 4 | | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Construct a percentage bar diagram for the following data:   |  |  |  |  | | --- | --- | --- | --- | | Year | Public Companies | Private Companies | Total | | 1992 | 5000 | 20000 | 25000 | | 1993 | 4000 | 16000 | 20000 | | 1994 | 6000 | 18000 | 24000 | | 1995 | 7000 | 21000 | 28000 | | 1996 | 5000 | 15000 | 20000 | | CO1 | A | 10 |
|  | b. | The scores of two batsmen A and B in ten innings during a certain season are:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 32 | 28 | 47 | 62 | 71 | 39 | 10 | 60 | 96 | 15 | | B | 19 | 31 | 48 | 53 | 67 | 90 | 10 | 62 | 40 | 80 |   Find which of the two batsmen A or B (a) is more efficient and (b) is more consistent in scoring. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. |  | From the following data, find the   1. Two regression line equations 2. The most likely marks in Statistics, when the marks in Economics is 30 3. The most likely marks in Economics, when the marks in Statistics is 40.  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Marks in Economics | 25 | 28 | 35 | 32 | 32 | 36 | 29 | 38 | 34 | 32 | | Marks in Statistics | 43 | 46 | 49 | 41 | 36 | 32 | 31 | 30 | 33 | 39 | | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Ten competitors in a beauty contest are ranked by three judges in the following order:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 1 | 5 | 4 | 8 | 9 | 6 | 10 | 7 | 3 | 2 | | B | 4 | 8 | 7 | 6 | 5 | 9 | 10 | 3 | 2 | 1 | | C | 6 | 7 | 8 | 1 | 5 | 10 | 9 | 2 | 3 | 4 |   Use rank correlation coefficient to discuss which pair of judges has the nearest approach to common tastes in beauty. | CO3 | An | 20 |
|  |  |  |  |  |  |
| 5. | a. | Calculate 5 yearly moving average and short-term fluctuation of number of students studying in a Commerce College as shown by the following figures:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | | No. of Students | 332 | 311 | 357 | 392 | 402 | 405 | 410 | 427 | 405 | 438 | | CO4 | E | 12 |
|  | b. | Draw a trend line by the method of semi-averages.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | | Sales | 280 | 300 | 280 | 280 | 270 | 240 | 230 | 230 | 220 | 200 | | CO4 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate the seasonal indices by the method of simple average for the following data:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 1994 | 78 | 66 | 84 | 80 | | 1995 | 76 | 74 | 82 | 78 | | 1996 | 72 | 68 | 80 | 70 | | 1997 | 74 | 70 | 84 | 74 | | 1998 | 76 | 74 | 86 | 82 | | CO4 | E | 10 |
|  | b. | Fit a straight line trend equation to the following data by the method of least squares and estimate the net profit for the year 2003.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | | Net profit | 32 | 36 | 44 | 37 | 71 | 72 | 109 | | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen from the lot at random (without replacement). Find the probability that (i) both are good (ii) both have major defects (iii) at least 1 is good (iv) at most 1 is good (v) exactly 1 is good. | CO5 | E | 10 |
|  | b. | The chance of A, B, C becoming G.M are in the ratio 4:2:3. The probability that bonus scheme will be introduced in the company if A, B, C becomes G.M are 0.3, 0.7, 0.8 respectively. If the bonus scheme has been introduced what is the probability that Mr. A has become appointed as G.M? | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Four persons are chosen at random from a group consisting of 4 men, 3 women and 2 children. Find the chance of that the selected group contains at least 1 child. | CO5 | E | 10 |
|  | b. | Ten coins are thrown simultaneously. Find the probability of getting at least 7 heads. | CO6 | E | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Fit a Poisson distribution to the following data and calculate the theoretical frequencies   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Deaths | 0 | 1 | 2 | 3 | 4 | | Frequency | 122 | 60 | 15 | 2 | 1 | | CO6 | A | 10 |
|  | b. | If the heights of 300 students are normally distributed with mean 172cm and S.D. 8cm, how many students have heights  (i) more than 184cm?  (ii) less than or equal to 160cm? | CO6 | E | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the different types of presentation of data |
| CO2 | Measure the central tendency and dispersion of data |
| CO3 | Analyze the linear relationship |
| CO4 | Identify the different methods of Time series analysis and forecasting |
| CO5 | Utilize the concepts of probability |
| CO6 | Apply the probability models to fit the data |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 20 | - | - | - | 20 |
| CO2 | - | - | - | 10 | 10 | - | 20 |
| CO3 | - | - | - | 40 | - | - | 40 |
| CO4 | - | - | 18 | - | 22 | - | 40 |
| CO5 | - | - | 10 | - | 20 | - | 30 |
| CO6 | - | - | 10 | - | 20 | - | 30 |
|  | | | | | | | **180** |



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| **Course Code** | **20MA2017** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | A survey has been taken on methods of commuter travel. Each respondent was asked to check BUS, TRAIN or AUTOMOBILE as a major method of traveling to work. More than one answer was permitted. The results reported were as follows: BUS, 30 people; TRAIN , 35 people; AUTOMOBILE, 100 people; BUS & TRAIN, 15 people; BUS and AUTOMOBILE, 15 people; TRAIN and AUTOMOBILE, 20 people; and all the three methods 5 people. How many people completed the survey form? | CO1 | A | 10 |
| b. | Compute , and for the given matrices A and B:  , . | CO1 | A | 10 |
| **(OR)** | | | | | |
| 2. | a. | Show that for *n ≥ 1* by using Mathematical induction. | CO1 | An | 10 |
| b. | Using Euclidean algorithm, find the G.C.D of (108, 60) and express it in the form of . | CO1 | A | 10 |
|  | | | | | |
| 3. | a. | Show that . | CO2 | A | 8 |
| b. | Construct truth table for . | CO2 | U | 7 |
| c. | Show that is a tautology. | CO2 | U | 5 |
| **(OR)** | | | | | |
| 4. | a. | A student can choose a computer project from one of three lists. The three lists contain 23, 15 &19 projects respectively. How many possible projects are there to choose from? | CO3 | U | 5 |
| b. | There are 38 different time periods during which classes at a university can be scheduled. If there are 677 different classes, what is the minimum number of different rooms that will be needed? | CO3 | A | 5 |
| c. | A valid computer password consists of seven characters, the first of which is a letter chosen from the set {A, B, C, D, E, F, G} and the remaining six characters are letters chosen from the English alphabet or a digit. How many different passwords are possible? | CO3 | A | 5 |
| d. | How many distinguishable permutations of the letters in the word “MISSISSIPPI”. | CO3 | U | 5 |
|  | | | | | |
| 5. | a. | Let A = {1,2,3,4,8} = B; aRb if and only if Find the domain, range, matrix and draw the digraph of the relation R. Also list all in degree and out degree of all vertices. | CO4 | A | 10 |
| b. | Let A = {1,2,3,4,5,6} and the digraph of R is given.    Find and draw the digraph of . | CO4 | An | 10 |
| **(OR)** | | | | | |
| 6. | a. | Find the transitive closure using Warshall’s algorithm.  on A = {1,2,3,4}. | CO4 | A | 10 |
| b. | Let R and S be the relations from A to B whose matrices are given.      Compute. | CO4 | An | 10 |
|  | | | | | |
| 7. | a. | Let A = {3, 6, 12, 36, 72} and the relation be such that if x divides y. Draw the Hasse diagram of (A, ). | CO5 | U | 8 |
|  | b. | Determine the matrix of the partial order whose Hasse diagram is given | CO5 | A | 6 |
|  | c. | Show that is a bounded Lattice. | CO5 | A | 6 |
| **(OR)** | | | | | |
| 8. | a. | Consider the rooted tree given below:  i) List all level - 3 vertices.  ii) List all leaves.  iii) What are the siblings of *o*?  iv) What are the descendants of *b*?  v) Compute the tree T(*b*).  vi) Compute the tree T(*c*). | CO6 | U | 6 |
| b. | Construct the tree of the algebraic expression | CO6 | A | 7 |
| c. | Draw a binary tree whose postorder search produces the string SEARCHING. | CO6 | A | 7 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Use Fluery’s algorithm to construct an Euler circuit for the following graph. | CO6 | A | 8 |
| b. | Construct a spanning tree with 4 as a root using Prim’s Algorithm for the given graph: | CO6 | A | 12 |

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

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| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the various set operations and arithmetic algorithms |
| CO2 | Describe the logical equivalence relations |
| CO3 | Make decisions using permutation and combination |
| CO4 | Recognize the different types of relations |
| CO5 | Build their knowledge in Lattices |
| CO6 | Analyze the properties of graphs |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | - | 30 | 10 | - | - | 40 |
| CO2 | - | 12 | 8 | - | - | - | 20 |
| CO3 | - | 10 | 10 | - | - | - | 20 |
| CO4 | - | - | 20 | 20 | - | - | 40 |
| CO5 | - | 8 | 12 | - | - | - | 20 |
| CO6 | - | 6 | 34 | - | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **20MA2018** | **Duration** | **3hrs** |
| **Course Name** | **FUZZY SETS AND LOGIC** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Let. Given and  are the fuzzy sets of . Find  (i),, ,  (ii),, ,  (iii) | CO1 | A | 10 |
|  | b. | Let. Given  and are the fuzzy sets of.  Find,, ,,. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | 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) | CO2 | A | 10 |
|  | b. | State first decomposition theorem. Demonstrate the first decomposition theorem using the given fuzzy set . | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | Let. Given  and are the fuzzy sets of.  Find Standard Union, Algebraic Sum, Bounded Sum, Drastic Sum. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Given A = [2, -6] and B = [1,5] are two fuzzy numbers. Find  A + B, A - B, A • B and A / B. | CO3 | A | 10 |
|  | b. | Given A = {(5, 1), (6, 0.5)} and B = {(4, 1), (6, 0.5)} are two fuzzy numbers. Find A + B and A - B | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. |  | Find the solution of the equation A + X = B, where A and B are two fuzzy numbers defined by | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Find the membership function of the given triangular number A = (-5, 2, 1). | CO3 | A | 5 |
|  | b. | Find addition, subtraction and symmetric image of given two triangular numbers A = (-2, 2, 4) and B = (-2, 0, 5). | CO3 | A | 5 |
|  | c. | Construct a truth table for (P → Q) ˄(Q → R). | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. |  | Verify whether the given logical statement  is a tautology. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the architecture of a fuzzy expert system | CO5 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Draw the general scheme of a fuzzy controller and explain its components. | CO6 | U | 20 |

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

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| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the different types of fuzzy sets. |
| CO2 | Identify the operations of fuzzy sets. |
| CO3 | Solve the problems using fuzzy arithmetic operations. |
| CO4 | Differentiate classical logic and fuzzy logic. |
| CO5 | Develop fuzzy expert systems. |
| CO6 | Create rule base fuzzy systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 |  | 10 | 30 |  |  |  | 40 |
| CO3 |  |  | 50 |  |  |  | 50 |
| CO4 |  | 10 |  | 20 |  |  | 30 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA2021** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR ALGEBRA FOR DATA SCIENCE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | An automobile company uses three types of steels S1, S2 and S3 for producing three types of cars C1, C2 and C3. Steel requirement (in tons) for each types of cars are given below.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Cars | | | | | Steels |  | C1 | C2 | C3 | | S1 | 2 | 3 | 4 | | S2 | 1 | 1 | 2 | | S3 | 3 | 2 | 1 |   Using Cramer’s rule, determine the number of cars of each type which can be produced using 29, 13 and 16 tons of steel of three types respectively. | CO1 | A | 10 |
|  | b. | Solve the following system of equations by Gauss- elimination method  2x + y + z = 10  3x + 2y + 3z =18  x + 4y + 9z = 16. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Test for consistency and solve  x + 2y + 3z = 3  2x - y + z = 6  3x + y - z = 4. | CO1 | A | 10 |
|  | b. | Solve by Jacobi’s iteration method (corrected to 2 decimal places) the equations  20x + y -2z = 17  3x + 20y - z = -18  2x - 3y + 20z = 25. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Find the eigenvalues and eigenvectors of the matrix . | CO2 | A | 10 |
|  | b. | Verify Cayley-Hamilton theorem for the matrix and hence find A-1 and A3. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Two eigenvalues of the matrix are 2 and 3. Find the third eigenvalue. | CO2 | A | 5 |
|  | b. | Reduce the quadratic form to canonical form by orthogonal reduction . Also find the rank, index, signature and nature of the quadratic form. | CO2 | A | 15 |
|  |  |  |  |  |  |
| 5. | a. | Show that the vectors (1,1,0), (2,1,1) and (3,0,3) are linearly dependent. | CO3 | U | 5 |
|  | b. | Find the bases for Col A, Row A and Nul A. Also list rank A and  dim Nul A, if . | CO3 | A | 15 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Find the distance between the vectors and . | CO4 | A | 5 |
|  | b. | Show that the set S ={**u**1,**u**2,**u**3}, where,  and  is an orthogonal set for R3. Express the vector  as a linear combination of the vectors in S. | CO4 | A | 15 |
|  |  |  |  |  |  |
| 7. | a. | Letwhere; and . Using Gram-Schmidt process find the orthogonal basis and orthonormal bases for *w*. | CO4 | A | 15 |
|  | b. | Let V be ℙ2 with the inner product defined by , where , and . Compute the length of the vectors and . | CO4 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The transformation is defined as  Prove that T is a linear transformation. | CO5 | U | 10 |
|  | b. | Verfiy that *r(T) + n(T) = dimT* for the linear map defined by | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Define sparse matrix and its uses. Explain the linked list representation of sparse matrix with an example. | CO6 | R | 10 |
|  | b. | 1. Find the addition of sparse matrices  and . 2. Determine the transpose of the sparse matrix P in triplet form.   . | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Solve system of linear equations. |
| CO2 | Determine the Eigen values and Eigen vectors. |
| CO3 | Differentiate the independence and dependence of vectors. |
| CO4 | Describe the concepts of Inner product spaces. |
| CO5 | Recognize the properties of linear transformation. |
| CO6 | Solve data science problems using sparse matrices. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | - | 40 | - | - | - | 40 |
| CO2 | - | - | 40 | - | - | - | 40 |
| CO3 | - | 5 | 15 | - | - | - | 20 |
| CO4 | - | - | 40 | - | - | - | 40 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | 10 | - | 10 | - | - | - | 20 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA2023** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY, RANDOM VARIABLES AND STATISTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | In any random experiment, P(S) = \_\_\_\_ | | CO1 | U | 1 |
| 2. | What is the probability of an even number when a die is thrown? | | CO1 | R | 1 |
| 3. | If F(x) is cumulative distribution of a random variable X, then F(-∞) = \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Find k if the probability density function of the continuous random variable X is f(x) = kx; 0 < x < 1. | | CO2 | U | 1 |
| 5. | If (X,Y) is two dimensional random variables, F(x,y) is a cumulative distribution of (X, Y) then f(x,y) = \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The marginal density function pi\*= \_\_\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 7. | Variance of the Poisson Distribution is \_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | The mean of the standard normal variate is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | For the normal distribution, the relationship between mean, median and mode is \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | The correlation coefficient takes the values from \_\_\_\_\_\_ to \_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If P(A) = 0.4, P(B) = 0.7 and 𝑃(𝐴 ∩ 𝐵) = 0.3 find (i) 𝑃(𝐴 ∪ 𝐵)(ii)𝑃(𝐵/A). | | CO1 | An | 3 |
| 12. | Write any two properties of cumulative distribution function. | | CO2 | U | 3 |
| 13. | Find the marginal density function of the following distribution   |  |  |  |  | | --- | --- | --- | --- | | X\Y | 0 | 1 | 2 | | 0 | 0.1 | 0.04 | 0.06 | | 1 | 0.2 | 0.08 | 0.12 | | 2 | 0.2 | 0.08 | 0.12 | | | CO3 | An | 3 |
| 14. | A Random variable X is normally distributed with mean 16 and S.D is 2 Then the standard normal variate at x=20 is \_\_\_\_\_\_\_\_\_. | | CO4 | Ap | 3 |
| 15. | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **x** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | f | 5 | 9 | 12 | 17 | 14 | 10 | 6 |   Find the median of the above distribution. | | CO5 | An | 3 |
| 16. | Find β2 when μ1=0, μ2=1.5, μ3=0, μ4=6. Also classify which type of kurtic. | | 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. | In a shooting test, the probability of hitting a target is 1/2 for A, 2/3 for B and 3/4 for C. If all of them fire at the target, find the probability of (i) None of them hit the target (ii) Atleast one of them hit the target (iii) Atleast two of them hit the target | CO1 | Ev | 6 |
|  | b. | The chances of A, B and C becoming a general manager of a certain company are in the ratio 4: 2: 3. The probability that the bonus scheme will be introduced in the company if A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus has been introduced what is the probability that B has been appointed as general manager. | CO1 | Ev | 6 |
|  |  |  |  |  |  |
| 18. |  | The probability function of an infinite discrete distribution is given by P(x=j)= 1/2 j . Verify that the total probability is 1, find also P(X is odd), P(X ≥ 7), P(X multiple of 5) and mean of X. | CO2 | Ap | 12 |
|  |  |  |  |  |  |
| 19. |  | The joint probability mass function of (X, Y) is p(x,y) =k(3x+2y); x=0,1,2; y=1,2,3. Find (i) k (ii) All Marginal Probability distribution (iii) Conditional probability distributions | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a binomial distribution to the given details and calculate the theoretical frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **x** | **0** | **1** | **2** | **3** | **4** | | f | 5 | 29 | 36 | 25 | 5 | | CO4 | E | 6 |
|  | b. | The time required to repair a machine is exponentially distributed with parameter λ=½.  (i) What is the probability that the repair time exceeds 2 hours (ii) What is the conditional probability that repair atleast 10 hrs given that its deviations exceeds 9 hours. | CO4 | Ap | 6 |
|  |  |  |  |  |  |
| 21. |  | Find the mean, median, mode and Quartile deviation for the following distribution   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | | f | 7 | 8 | 12 | 13 | 10 | | CO5 | Ev | 12 |
|  |  |  |  |  |  |
| 22. |  | Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 black balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn. Find the joint distribution of (X,Y). Find all marginal and conditional density functions of the above random variables. | CO3 | Ap | 12 |
|  |  |  |  |  |  |
| 23. |  | A random variable X has the following probability distribution. (i) Find the value of k. (ii) P(1.5 < X < 4.5 / X > 2) and (iii) the smallest value of λ for which P(X≤λ) > ½. (iv) Cumulative distribution of X (v) Find the mean   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **X** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | P(x) | 0 | k | 2k | 2k | 3k | k2 | 2k2 | 7k2+k | | CO2 | Ev | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the correlation coefficient of the following:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index**  **Of the production** | **100** | **102** | **104** | **107** | **105** | **112** | **103** | **99** | | No. of Unemployed | 15 | 12 | 13 | 11 | 12 | 12 | 19 | 26 | | CO6 | Ev | 6 |
|  | b. | Heights of fathers and sons are given in cms. Find the two lines of regression   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Heights of fathers** | **150** | **152** | **155** | **157** | **160** | **161** | **164** | **166** | | Heights of Sons | 154 | 156 | 158 | 159 | 160 | 162 | 161 | 164 | | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 0 | 3 | 12 | 0 | 17 |
| CO2 | 1 | 4 | 12 | 0 | 12 | 0 | 29 |
| CO3 | 2 | 0 | 12 | 15 | 0 | 0 | 29 |
| CO4 | 0 | 2 | 9 | 0 | 6 | 0 | 17 |
| CO5 | 0 | 1 | 0 | 3 | 12 | 0 | 16 |
| CO6 | 0 | 4 | 0 | 6 | 6 | 0 | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20MA2024** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If A and B are independent events, then | | | CO1 | R | 1 |
| 2. | If  and  find | | | CO1 | R | 1 |
| 3. | Write down the value of | | | CO2 | R | 1 |
| 4. | A random variable X has the following probability distribution:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | p(x) | 0.1 | 0.3 | k | 0.2 | 0.1 |   Find the value of k. | | | CO2 | R | 1 |
| 5. | If f(x,y) is the joint pdf of a 2-dimensional continuous random variable (X,Y), then write the formula for the marginal density function of X. | | | CO3 | R | 1 |
| 6. | Write down the value of . | | | CO3 | R | 1 |
| 7. | Write the formula to find variance of a binomial distribution. | | | CO4 | R | 1 |
| 8. | Write the formula to find mean of a Poisson distribution. | | | CO4 | R | 1 |
| 9. | Calculate the range for the following data: 23, 16, 34, 29, 13, 65. | | | CO5 | R | 1 |
| 10. | Write down the regression equation of X on Y. | | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | A bag contains 7 white, 6 red and 5 black balls. Two balls are drawn at random. Find the probability that both are white. | | | CO1 | U | 3 |
| 12. | A continuous random variable X has the pdf Find the value of k. | | | CO2 | U | 3 |
| 13. | If X and Y have joint pdf , then find the value of | | | CO3 | U | 3 |
| 14. | In a certain factory turning razor blades there is a small chance of 1/500 for any blade to be defective. The blades are in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing one defective blade in a consignment of 10000 packets. | | | CO4 | U | 3 |
| 15. | If then find the value of a Quartile deviation. | | | CO5 | U | 3 |
| 16. | If  and  then calculate the correlation coefficient r. | | | 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. | In a bolt factory, machines A, B and 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, what is the probability that it is defective? | CO1 | A | 6 |
|  | | b. | A problem is given to 3 students whose chances of solving it are ½, 1/3 and ¼. What is the probability that (i) only one of them solves the problem and (ii) the problem is solved. | CO1 | A | 6 |
|  | |  |  |  |  |  |
| 18. | |  | A random variable X has the following probability distribution:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | p(x) | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |   Evaluate (i) the value of a, (ii) p(X<3), (iii) p(2<X<6) , (iv) cdf of X, (v) mean of X. | CO2 | A | 12 |
|  | |  |  |  |  |  |
| 19. | |  | The joint pdf of a bivariate random variable (X,Y) is given by . Compute (i) the value of k, (ii) , (iii)  and (iv) Are X and Y independent. | CO3 | A | 12 |
|  | |  |  |  |  |  |
| 20. | |  | Fit a binomial distribution for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6­­­­­­­­­ | | f | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO4 | A | 12 |
|  | |  |  |  |  |  |
| 21. | |  | Evaluate the mean, median and mode for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class interval | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | Frequency | 14 | 17 | 22 | 26 | 23 | 18 | | CO5 | A | 12 |
|  | |  |  |  |  |  |
| 22. | | a. | The mean weight of 500 students is 151 lb and standard deviation is 15 lb. Assuming that the weights are normally distributed. Find how many students weight between (i) 120 lb and 155 lb and (ii) less than 120 lb. | CO4 | A | 6 |
|  | | b. | A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen from the lot at random (without replacement). Find the probability that (i) both have major defects, (ii) both are good and (iii) neither is good. | CO1 | A | 6 |
|  | |  |  |  |  |  |
| 23. | |  | The scores of two players A and B in seven rounds are given below:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | A | 74 | 75 | 78 | 72 | 78 | 77 | 79 | | B | 87 | 84 | 80 | 88 | 89 | 85 | 86 |   Who is the better player and who is the more consistent player? | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | |  | Estimate the coefficient of correlation by Karl Pearson’s method from the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 6 | 2 | 10 | 4 | 8 | | Y | 9 | 11 | 5 | 8 | 7 | | CO6 | A | 12 |

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

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 18 | - | - | - | 23 |
| CO2 | 2 | 3 | 12 | - | - | - | 17 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 2 | 3 | 18 | - | - | - | 23 |
| CO5 | 1 | 3 | 24 | - | - | - | 28 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA2025** | **Duration** | **3hrs** |
| **Course Name** | **STATISTICAL DATA ANALYSIS AND RELIABILITY ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | The best fitting equation of the straight line is \_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | The number of normal equations in fitting a curve y=axb is \_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The hypothesis which states there is no difference between population and sample is known as \_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 4. | The table value of Zα for two tailed tests at 5% level of significance is \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Write the degrees of freedom to perform t-test, for two samples A and B with sizes 9 and 11 respectively. | | CO3 | U | 1 |
| 6. | Determine the F-ratio for the population variances, S12=3.7 and S22=4.5. | | CO3 | U | 1 |
| 7. | The formula used to find the correction factor in the design of experiments is \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | Which layout in design of experiments allows repetitions in rows and columns? | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_ is a graphical device mainly used for the study and control of the manufacturing process. | | CO5 | R | 1 |
| 10. | If the failure of a system is 0.3 then the reliability of the system is \_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Determine the values of a,b and c from the given normal equations in fitting a parabola.  5a+10b+30c = 19; 10a+30b+100c = 50; 30a+100b+354c = 160. | | CO1 | An | 3 |
| 12. | Define Type I error and Type II error. | | CO2 | U | 3 |
| 13. | Two random samples are of sizes 11 and 9. Given the sample standard deviation of their weights are 0.8 and 0.5 respectively. Find the F- ratio. | | CO3 | E | 3 |
| 14. | Explain the layout of Randomized Block Design. | | CO4 | U | 3 |
| 15. | Ten juice bottles are selected at random from a manufacturing process. The number of air bubbles (defects) observed from the bottles is given in the table below. Draw c- chart and comment on the state of control of the process.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | No of defects | 3 | 4 | 5 | 6 | 3 | 3 | 5 | 3 | 6 | 2 | | | CO5 | An | 3 |
| 16. | 300 cars have accumulated 45000 hours, 10 failures are observed. What is the MTBF? | | 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. | Fit a straight line to the data given below. Also estimate the value of y at x = 25.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 5 | 10 | 15 | 20 | | y | 7 | 11 | 16 | 20 | 26 | | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | The mean production of wheat from a sample of 100 fields comes to 200 kg/acre and another sample of 150 fields gives a mean of 220 kg/acre. The standard deviation of the population is 11 kg. Test if there is any significant difference between the mean production of two samples. | CO2 | An | 7 |
|  | b. | Write the procedure for testing of hypothesis. | CO2 | R | 5 |
|  |  |  |  |  |  |
| 19. | a. | A group of 10 rats were fed on diet A and another group of 8 rats were fed on diet B. Find if the variances are significantly different using F test at 5% level of significance.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | - | - | | CO3 | An | 7 |
|  | b. | The manager of a PIZZA hut is interested to determine whether sales is greater on one day that of another. His records from the past year shows the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Days of the week | Mon | Tue | Wed | Thur | Fri | | No. of Pizza’s sold | 66 | 57 | 54 | 48 | 75 |   Test whether the sales is uniformly distributed over the week. | CO3 | An | 5 |
|  |  |  |  |  |  |
| 20. | a. | The following data gives monthly sales (in thousand rupees) of a certain firm in three states by its four salesman. Using analysis of variance test whether there is any significant difference.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Salesman | | | | | States | I | II | III | IV | | A | 6 | 5 | 3 | 8 | | B | 8 | 9 | 6 | 5 | | C | 10 | 7 | 8 | 7 |  1. between sales by the firm salesman. 2. between sales in three states. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | The following are the values of sample meanand sample range R for 10 samples, each of size 5. Draw and R chart and comment on the state of control of the process.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Mean | 43 | 49 | 37 | 44 | 45 | 37 | 51 | 46 | 43 | 47 | | Range | 5 | 6 | 5 | 7 | 7 | 4 | 8 | 6 | 4 | 6 | | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | In a factory producing spark plugs, the number of defectives found in the inspection of 10 lots of 100 each is given below.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Lot Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | No of defective (np) | 4 | 11 | 9 | 8 | 6 | 4 | 6 | 3 | 4 | 5 |   Draw the control chart for fraction defectives and number of defectives with comments on the state of control. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | 20 units are put on test and run at their normal operating conditions for 1000 hours. If 6 of those units fail at the following hours 550, 480, 680, 790, 860, 620. What is the failure rate and mean time to failure of the product? | CO6 | A | 6 |
|  | b. | Trial data shows that 105 items failed during a test with a total operating time of 1000000 hours. Using exponential distribution,  (i) Find the reliability of the product after 1000 hours.  (ii) Determine the MTBF. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The density function of time to failure in years of a product is given by , t > 0 in years.  (i) Derive the Reliability function R(t).  (ii) Find the failure rate.  (ii) Compute the mean time to failure rate (MTTF). | CO6 | A | 7 |
|  | b. | Calculate the reliability of the system for the given block diagram. | CO6 | A | 5 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply the concept of curve fitting to analyze the given data. |
| CO2 | Test hypothesis for large samples. |
| CO3 | Test hypothesis for small samples. |
| CO4 | Construct design of experiments. |
| CO5 | Analyze data using statistical quality control. |
| CO6 | Understand the reliability engineering problems. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | - | - | 3 | 12 | - | 17 |
| CO2 | 6 | 4 | - | 7 | - | - | 17 |
| CO3 | - | 2 | - | 12 | 3 | - | 17 |
| CO4 | 2 | 3 | - | 12 | - | - | 17 |
| CO5 | 1 | - | - | 27 | - | - | 28 |
| CO6 | - | 1 | 27 | - | - | - | 28 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Convert the decimal number 3783 to binary form using division algorithm. | | CO1 | U | 1 |
| 2. | If , find | | CO1 | U | 1 |
| 3. | The process of finding the value of corresponding to any value of between and is called -------------. | | CO2 | U | 1 |
| 4. | Newton’s form of the interpolating polynomial is -------------. | | CO2 | R | 1 |
| 5. | In Simpson’s one third rule *y(x)* is a polynomial of degree -------. | | CO3 | R | 1 |
| 6. | Write the Gaussian three point formula | | CO3 | R | 1 |
| 7. | For a natural cubic spline function S, | | CO4 | R | 1 |
| 8. | Write any one property of spline of degree one. | | CO4 | R | 1 |
| 9. | Write the second order Adams-Moulton (AM2), implicit technique formula to solve the differential equation. | | CO5 | R | 1 |
| 10. | Write the explicit form of Crank Nicholson formula to solve the parabolic equation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Convert the number (0.36207)8 to decimal system. | | CO1 | U | 3 |
| 12. | Convert to nested form and evaluate | | CO2 | U | 3 |
| 13. | Write the Pseudocode for Simpson’s one-third rule. | | CO3 | R | 3 |
| 14. | Define a quadratic spline function. | | CO4 | R | 3 |
| 15. | Using Euler’s method determine of the equation  , for | | CO5 | A | 3 |
| 16. | Classify the following PDE: . | | 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. | Find the real root of the equation by bisection method correct to four decimal places. | CO1 | A | 6 |
|  | b. | Find the root of the equation using Regula-Falsi method correct to 4 decimal places. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | By means of Newton’s divided difference formula, find the values of and from the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | *x* | 1 | 2 | 7 | 8 | | *f(x)* | 1 | 5 | 5 | 4 | | CO2 | E | 6 |
|  | b. | Using Lagrange’s interpolation formula, find from the following table:   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 5 | 6 | 9 | 11 | |  | 12 | 13 | 14 | 16 | | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | Examine using (i) Trapezoidal rule  (ii) Simpson’s one-third rule and  (ii) Simpson’s three-eighth rule. Also check up by direct integration. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | From the following table, compute and (1), using cubic spline   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | f | -8 | -1 | 18 | | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Solve , given and get the values of and by Taylor series method. | CO5 | A | 8 |
|  | b. | Compute given by taking h=0.1 using fourth order Runge-Kutta method correct to four decimal places. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Using the Newton algorithm, find the interpolating polynomial of least degree for this table:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | -1 | 2 | -2 | | y | -5 | -3 | -15 | 39 | -9 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Using Romberg’s method, evaluate correct to 3 decimal places. Hence evaluate | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find by Liebmann’s method the values at the interior lattice points of a square region of the harmonic function *u* whose boundary values are as shown in the following figure. | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **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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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 5 | 12 | - | - | - | 17 |
| CO2 | 1 | 4 | 12 | - | 12 | - | 29 |
| CO3 | 5 | - | - | 12 | 12 | - | 29 |
| CO4 | 5 | - | - | - | 12 | - | 17 |
| CO5 | 1 | - | 15 | - | - | - | 16 |
| CO6 | 1 | 3 | - | - | 12 | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

**SUPPLEMENTARY EXAMINATION – JUNE 2023**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** |  | **QUESTIONS** | **CO** | **BL** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen at random. Find the probability that (i) both are good (ii) both have major defects (iii) atleast one is good (iv) exactly one is good | CO1 | An | 8 |
|  | b. | The chances of A, B and C becoming the general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company. If A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as general manager? | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | A manufacturer knows that the condensers he makes contain on the average 1% defectives. He packs them in boxes of 100. Using Poisson distribution, find the probability that a box picked at random will contain (i) no defective (ii) atleast 3 defective (iii) atmost 3 defective. | CO2 | An | 8 |
|  | b. | 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. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | The following table shows the ages(X) and blood pressure (Y) of 8 persons.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 52 | 63 | 45 | 35 | 70 | 65 | 43 | 27 | | y | 60 | 55 | 51 | 25 | 79 | 43 | 60 | 38 |   Obtain the regression equations and find the expected blood pressure of a person who is 49 years old. | CO3 | E | 8 |
|  | b. | If =0.23, and =0.60 then find the second order partial correlation coefficient. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | In large city A, 20% of random sample of 900 school boys had a slight physical defect. In another large city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? | CO4 | An | 8 |
|  | b. | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B recorded the following increase in weight(gms)   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 10 | 1 | 2 | 8 | - | - |   Does it show superiority of diet A over diet B. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | The following data relate to the daily production of cement a large plant for 30 days.  11.5 10.0 11.2 10.0 12.3 11.1 10.2 9.6 8.7 9.3  9.3 10.7 11.3 10.4 11.4 12.3 11.4 10.2 11.6 9.5  10.8 11.9 12.4 9.6 10.5 11.6 8.3 9.3 10.4 11.5  Use sign test to test the null hypothesis that the plants average daily production of cement is 11.2 against alternative hypothesis u<11.2 at the 5% level of significance | CO5 | An | 8 |
|  | b. | A total of 15 patients are randomly assigned to a study or no-study group. **Use the Mann-Whitney U test to find whether there is a difference in the test scores for the study vs. no-study group for 5% level of significance.**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Study | 89 | 92 | 94 | 96 | 91 | 99 | 84 | 90 | | No Study | 88 | 93 | 95 | 75 | 72 | 80 | 81 | 85 | | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | Acontinuous random variable X has a probability density function,. Find (i) k (ii) Mean and Variance. | CO1 | E | 8 |
|  | b. | A discrete random variable x takes the values –1, 0 and 1 with probabilities respectively. Evaluate and compare it with the upper bound given by Tchebycheff’s inequality. | CO2 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | On a commuter train, the conductor wants to determine whether passengers board the train in a random manner. He observes the first 25 people, with the following sequence of males and females. F F F M M F F F F M F M M M F F F F M M F F F M M. Test for randomness at the 5 % level of significance using run test. | CO4 | An | 8 |
|  | b. | Calculate thetest of goodness of fit for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | O | 14 | 56 | 110 | 88 | 40 | 12 | | E | 10 | 50 | 100 | 100 | 50 | 10 | | CO5 | E | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | In the table given below are the yields of 6 varieties of a crop in a 4 replicate RBD experiment. Analyze the data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Replication | Varieties | | | | | | | V1 | V2 | V3 | V4 | V5 | V6 | | I | 30 | 23 | 34 | 25 | 20 | 23 | | II | 39 | 22 | 28 | 25 | 28 | 32 | | III | 36 | 34 | 32 | 31 | 35 | 27 | | IV | 38 | 30 | 36 | 35 | 32 | 27 | | CO6 | A | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Solve problems on discrete and continuous random variable. |
| CO2 | Classify the problems using probability distributions and apply appropriate distributions. |
| CO3 | Compare variables using partial and multiple correlations. |
| CO4 | Test hypothesis for large and small samples. |
| CO5 | Test hypothesis using non-parametric tests. |
| CO6 | Construct Design of experiments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 8 | 8 | 8 |  | 24 |
| CO2 |  |  | 8 | 8 | 8 |  | 24 |
| CO3 |  |  |  |  | 16 |  | 16 |
| CO4 |  |  | 8 | 16 |  |  | 24 |
| CO5 |  |  | 8 | 8 | 8 |  | 24 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **132** |



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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Mr. A and Mr. B throws alternatively a pair of dice. Mr. A wins the game, if he throws 6 before B throws 7. Mr. B wins the game, if he throws 7 before A throws 6. If Mr. A begins the game, what is the probability of his winning? | CO1 | An | 8 |
|  | 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. What is the probability that it is defective? If a bolt chosen at random is found to be defective, what is the probability that it was produced by machine B? | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | The weekly wages of 1000 workmen are normally distributed around a mean of Rs. 70 with a S.D of Rs.5. Estimate the number of workers whose weekly wages will be (i) between Rs.69 and Rs.72 (ii) less than Rs.69 (iii) More than 72 | CO2 | E | 10 |
|  | b. | Six coins are thrown. Find the probability of getting (i) exactly two heads (ii) at least two heads. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. |  | The following table shows the ages(X) and blood pressure (Y) of 8 persons.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 52 | 63 | 45 | 36 | 72 | 65 | 47 | 25 | | Y | 62 | 53 | 51 | 25 | 79 | 43 | 60 | 33 |   Obtain the regression equations and find the expected blood pressure of a person who is 49 years old. | CO3 | E | 16 |
|  |  |  |  |  |  |
| 4. | a. | On the basis of observations made on 39 cotton plants, the total correlation of yield of cotton (X1) number of seed vessels (X2) and height(X3) are found to be :r12= 0.8 r13= 0.4 r23= 0.56 comment on the partial correlation between yield of cotton and number of the seed vessels, eliminating the effect of height ( r12.3) and also find R2.13 | CO3 | An | 10 |
|  | b. | Give any five limitation of Multiple Correlation Coefficient. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 5. |  | The nicotine contents in milligrams in two samples of tobacco were found to be as follows. Test whether the samples have come from the same normal population using F test.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Sample A | 24 | 27 | 26 | 21 | 25 | - | | Sample B | 27 | 30 | 28 | 31 | 22 | 36 | | CO4 | An | 16 |
|  |  |  |  |  |  |
| 6. | a. | Use the sign test to see if there is a difference between the number of days until collection of an account receivable before and after a new collection policy. Use 5% level of significance.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Before | 30 | 28 | 34 | 35 | 40 | 42 | 33 | 38 | 34 | 45 | 41 | 36 | | After | 32 | 29 | 33 | 32 | 37 | 43 | 40 | 41 | 37 | 44 | 38 | 36 | | CO5 | An | 8 |
|  | b. | Use the Mann whitney U-test to determine whether there was a difference in the scores of the two groups. Use 5% level of significance.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Group A | 7 | 11 | 9 | 4 | 8 | 6 | 12 | 11 | 9 | 10 | 11 | 11 | | Group B | 8 | 9 | 13 | 14 | 11 | 10 | 12 | 14 | 13 | 9 | 10 | 8 | | CO5 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Calculate the correlation coefficient from the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 115 | 109 | 112 | 87 | 98 | 98 | 120 | 100 | 98 | 118 | | B | 75 | 73 | 85 | 70 | 76 | 65 | 82 | 73 | 68 | 80 | | CO3 | E | 8 |
|  | b. | For a certain X and Y series which are correlated, the two lines of regression are: 5X-6Y+90 = 0 and 15X–8Y– 130 = 0  Find the mean of the two series and the correlation coefficient. | CO3 | E | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | The following data resulted from an experiment to compare three burners A, B and C. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.   |  |  |  |  | | --- | --- | --- | --- | |  | Engine 1 | Engine 2 | Engine 3 | | Day 1 | A(16) | B(17) | C(20) | | Day 2 | B(16) | C(21) | A(15) | | Day 3 | C(15) | A(12) | B(13) | | CO6 | An | 20 |

CO – COURSE OUTCOME BL – BLOOMS’ LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Solve problems on discrete and continuous random variable. |
| CO2 | Classify the problems using probability distributions and apply appropriate distributions. |
| CO3 | Compare variables using partial and multiple correlations. |
| CO4 | Test hypothesis for large and small samples. |
| CO5 | Test hypothesis using non-parametric tests. |
| CO6 | Construct Design of experiments. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 8 | 8 | 16 |  | 32 |
| CO2 |  |  | 8 |  | 8 |  | 16 |
| CO3 | 6 |  |  | 10 | 16 |  | 32 |
| CO4 |  |  |  | 16 |  |  | 16 |
| CO5 |  |  |  | 16 |  |  | 16 |
| CO6 |  |  |  | 20 |  |  | 20 |
|  | | | | | | | **132** |



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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Calculate the mean, median and mode of the marks from the following table,   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No of students | 12 | 18 | 27 | 20 | 17 | 06 | | CO1 | E | 10 |
|  | b. | Construct a frequency distribution table for the following discrete data: 25, 32, 45, 8, 24, 42, 22, 12, 9, 15, 26, 35, 23, 41, 46, 18, 44, 37, 27, 46, 38, 24, 43, 46, 10, 21, 36, 45, 22, 18. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write a note on Measures of dispersion. | CO2 | U | 10 |
|  | b. | What is Histogram? Draw a histogram for the following data.   |  |  | | --- | --- | | Seed yield (g) | No of plants | | 2.5-3.5 | 04 | | 3.5-4.5 | 06 | | 4.5-5.5 | 10 | | 5.5-6.5 | 26 | | 6.5-7.5 | 24 | | 7.5-8.5 | 15 | | 8.5-9.5 | 10 | | 9.5-10.5 | 05 | | CO1 | C | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain t-test in detail. | CO4 | U | 10 |
|  | b. | Define raw and central moments. Explain skewness and kurtosis. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write the steps for testing of hypothesis. Define Type I and Type II errors. | CO3 | R | 10 |
|  | b. | An analysis of monthly wages paid to the worker of two firms A and B belonging to the same industry gives the following results:   1. Which firm, A or B has a large wage bill? 2. In which firm, A or B is there greater variability in individual wages?  |  |  |  | | --- | --- | --- | | Firms | Firm A | Firm B | | Number of workers | 500 | 600 | | Average monthly wage | Rs. 186.00 | Rs. 175.00 | | Variance of distribution of wages | 81 | 100 | | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the randomization procedure for 4 treatments in 5 blocks. | CO5 | A | 10 |
|  | b. | i) Write the difference between parameter and statistic. | CO3 | R | 05 |
| ii) Define null and alternative hypothesis? Write the null and alternative hypothesis for testing two sample means. | CO3 | U | 05 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write a note on sampling. | CO5 | U | 10 |
|  | b. | A random sample of 10 boys had the following IQ’s : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Apply t-test and interpret whether this data support the assumption of a population mean IQ of 100? | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a note on F test. | CO6 | R | 10 |
|  | b. | Explain basic principles of design with example. | CO6 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Life times (in months) of five different types of bulbs are given below, use F-test and interpret results.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Bulbs | Replication | | | | | 1 | 2 | 3 | 4 | | A | 10 | 12 | 11 | 13 | | B | 15 | 13 | 16 | 12 | | C | 9 | 11 | 10 | 12 | | D | 11 | 10 | 14 | 15 | | E | 8 | 6 | 5 | 7 | | CO6 | E | 15 |
|  | b. | Write the difference between primary data and secondary data. | CO5 | R | 05 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Find out the correlation coefficient between seed yields per plant and plant height of sesame using data in the following table.   |  |  | | --- | --- | | Seed yield per plant (in g) (y) | Plant height (in cms) (x) | | 5.22 | 94.2 | | 8.13 | 69.3 | | 6.52 | 115.3 | | 4.16 | 83.3 | | 8.98 | 85.4 | | 3.05 | 68.1 | | 3.49 | 50.7 | | 5.40 | 96.2 | | 2.39 | 76.1 | | 2.71 | 52.0 | | 3.97 | 82.1 | | 7.56 | 81.3 | | CO4 | E | 10 |
|  | b. | The number of yeast cells counted in a hemocytometer is compared to the theoretical value is given below. Does the experimental result support the theory?   |  |  |  | | --- | --- | --- | | No. of Yeast cells  in the square | Observed  Frequency | Expected  Frequency | | 0 | 103 | 106 | | 1 | 143 | 141 | | 2 | 98 | 93 | | 3 | 42 | 41 | | 4 | 8 | 14 | | 5 | 6 | 5 | | CO3 | An | 10 |

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

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| --- | --- |
|  | **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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | - | 10 | 10 | 10 | 30 |
| CO2 | 10 | 10 | 10 | - | - | 10 | 30 |
| CO3 | 15 | 05 | - | 10 | - | - | 30 |
| CO4 | - | 10 | 10 | - | 10 | - | 30 |
| CO5 | 05 | 10 | 10 | - | - | - | 25 |
| CO6 | 10 | 10 | - | - | 15 | - | 35 |
|  | | | | | | | **180** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the techniques involved in defining a research problem. | CO1 | U | 10 |
|  | b. | How do you define a research problem? Discuss the points a researcher must consider while selecting a research problem. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Illustrate and describe the research process with a flowchart. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Explain the need for a Literature Review in a research work. List a few resources for carrying out a literature survey. | CO2 | A | 10 |
|  | b. | Categorize and describe the different research designs. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Enumerate the basic principles of experimental design. Elaborate on the principles in detail. | CO2 | A | 10 |
|  | b. | Define ‘Sample Design’. Discuss the different types of sample designs. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Articulate the importance of Measure of Central Tendency. Derive the process of finding mean, median and mode. | CO3 | E | 10 |
|  | b. | Differentiate between Simple Regression Analysis and Multiple Regression Analysis. Explain the application of both techniques with a suitable example. | CO4 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | A car covered a distance of 80 miles with four different speeds of 10, 20, 30 and 40 miles/hour for the first, second, third and fourth quarter of the distance. Using harmonic mean, find the average speed in miles/hour. | CO5 | A | 10 |
|  | b. | What is a hypothesis? Explain basic concepts concerning the hypothesis. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Find the range and quartile deviation for the following distribution:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Intervals | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | | Frequency | 8 | 15 | 20 | 25 | 13 | 9 | 1 | | CO4 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | With a neat sketch explain the structure of a Project Proposal. Draft a model project proposal based on your research work. | CO5 | C | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the process of patenting and development. | CO6 | U | 10 |
|  | b. | Draw a flowchart and explain the patenting procedure followed in India. | CO6 | U | 10 |

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

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|  | **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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 20 | 20 | - | - | - | 40 |
| CO2 | - | 10 | 30 | - | - | - | 40 |
| CO3 | - | - | - | - | 10 | - | 10 |
| CO4 | - | - | 10 | - | 20 | - | 30 |
| CO5 | - | - | 20 | - | 20 | - | 40 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Narrate Research Ethics and nature of moral judgments and reactions. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Intellectual honesty and research integrity are essential – Evaluate the statement. | CO2 | E | 20 |
|  |  |  |  |  |  |
| 3. |  | Explain the usage of plagiarism software in scientific writings. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Narrate how the Indexing data bases and Citation databases play a significant role in publication practices | CO6 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | Predatory publications have become quite common - Elaborate the Software tools to identify predatory publications with its process flow. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Differentiate the Conflicts of interest and Publication misconduct with particular reference to unethical behavior &violation of publication ethics. | CO5 | R | 20 |
|  |  |  |  |  |  |
| 7. |  | Apply the use of various tools that are helpful in checking similarity index. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Analyze the online resources to check publisher copy right and self-archiving policies. | CO4 | An | 20 |
|  |  |  |  |  |  |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Illustrative the initiatives that are available to identify journals based on their research metrics. | CO6 | E | 20 |

CO – COURSE OUTCOME BL – BLOOMS’ LEVEL

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|  | **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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  | 20 | 20 |  |  |  | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 | 20 | 20 |  |  |  |  | 40 |
| CO6 |  | 20 |  |  | 20 |  | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **22MA1001** | **Duration** | **3hrs** |
| **Course Name** | **BASIC MATHEMATICS AND NUMERICAL COMPUTING USING PYTHON** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the eigen values of the matrix | | CO1 | U | 1 |
| 2. | If the eigen values of the matrix are , find the index of . | | CO1 | U | 1 |
| 3. | If the roots of an ordinary differential equation are then write its complementary function. | | CO2 | R | 1 |
| 4. | Find the order of the ordinary differential equation  . | | CO2 | U | 1 |
| 5. | Gauss Seidel method is a \_\_\_\_\_\_method. | | CO3 | R | 1 |
| 6. | In Gauss Jordon method the coefficient matrix is transformed to \_\_form. | | CO3 | R | 1 |
| 7. | What is the value of ? | | CO4 | E | 1 |
| 8. | Write . | | CO4 | R | 1 |
| 9. |  | | CO5 | R | 1 |
| 10. | In order to apply Simpson’s three eighth rule, the number of  intervals must be ----------. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the characteristic equation of the matrix . | | CO1 | E | 3 |
| 12. | Find the complementary function of | | CO2 | E | 3 |
| 13. | What are the normal equations to fit a straight line? | | CO3 | An | 3 |
| 14. | Find the value of . | | CO4 | E | 3 |
| 15. |  | | CO5 | E | 3 |
| 16. | Write Newton’s forward and backward difference formula. | | 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. |  | Find the eigen values and eigen vectors of the matrix | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Solve | CO2 | E | 6 |
|  | b | Solve | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | Solve the system of equations by Gauss elimination method | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a straight line for the following data by the method of least square.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X: | 0 | 2 | 3 | 4 | 5 | | Y: | 1 | 1.8 | 3.3 | 4.5 | 6.3 | | CO4 | An | 6 |
|  | b. | Evaluate  by the integration by parts formula. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of the integration and evaluate | CO5 | An | 6 |
|  | b | Find the area between the curves and . | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. |  | Find the first two derivatives of  at x= 50 and x=56 for the following table values.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | y | 3.6840 | 3.7084 | 3.7325 | 3.7563 | 3.7798 | 3.8030 | 3.8259 | | CO6 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Solve the system of equations by Gauss seidel method | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate using (i) Trapezoidal rule (ii) Simpson’s 1/3 rule  (iii) Simpson’s 3/8 rule (iv) Compare with exact integration. | CO6 | E | 12 |

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

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|  | **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 integrations using beta and gamma functions. |
| CO5 | Gain knowledge in multiple integrals. |
| CO6 | Evaluate differentiations and integrations using numerical techniques. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 2 | - | - | 15 | - | 17 |
| CO2 | 1 | 1 | -- | - | 15 | - | 17 |
| CO3 | 2 | - | 24 | 3 | - | - | 29 |
| CO4 | 1 | - | - | 6 | 10 | - | 17 |
| CO5 | 1 | - |  | 6 | 9 | - | 16 |
| CO6 | 4 | - | - | - | 24 | - | 28 |
|  | | | | | | | **124** |



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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Find the first four terms in an A.P if the first term is 7 and the common difference is -4. | CO1 | An | 5 |
|  | b. | Determine the sum of series 1+2+3+ . . . +200. | CO1 | U | 5 |
|  | c. | A man borrows ₹1200 at the total interest of ₹168. He repays the entire amount in 12 instalments each instalment being less than the preceding one by ₹20. Find the first instalment. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Find the 7th term of a geometric progression 3, 6, 12, …. | CO1 | An | 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. | Find the rate of interest at which ₹5000 yield ₹750 in simple interest in 3 years. | CO2 | E | 5 |
|  | b. | Find the compound amount and compound interest of ₹5000 for 3 years at 8% converted   1. annually and 2. semiannually | CO2 | E | 8 |
|  | c. | An Industrialist wants to set up a sinking fund to accumulated ₹60000 by the end of 5 years. What monthly deposit is required, if the fund earns interest at 10.5% compounded monthly. | CO2 | A | 7 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Find the effective rate of interest percent per annum equivalent to a nominal rate 12% per annum, the interest being payable half yearly. | CO2 | E | 5 |
|  | b. | A sum of ₹1000 is to be paid at the end of every year for a period of 5 years at the rate of 10% p.a. compound interest. Find the present value of immediate annuity. | CO2 | E | 7 |
|  | c. | A bill of ₹800 due 3 months, at 8% per annum. Calculate the Banker’s discount, True discount and Banker’s gain. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | If U = {1,2,3,4,5,6,7,8,9,10} and A= {1,2, 4,7,8,10} and B = {2,5,8}. Find , , *A - B, B- A, A’*. | CO3 | U | 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. | CO4 | E | 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. | Find . | CO5 | U | 5 |
|  | c. | A firm sells a product at ₹3 per unit. The total cost of the firm for producing ‘*x*’ units is given by .  (i) Verify that the condition for maximum is satisfied.  (ii) How many units should be made to achieve maximum profit? | CO5 | An | 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 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | If Roger can do a piece of work in 8 days and Antony can complete the same work in 5 days, in how many days will both of them together complete it? | CO6 | A | 5 |
|  | b. | Find the number of distinguishable permutations of the letters in  (i) ECONOMICS (ii) BUTTER. | CO6 | An | 5 |
|  | c. | A basketball team consists of 2 center players, 5 forward players, and 4 defence players. In how many ways can the coach select a team of one center, two forwards and two defence players? | CO6 | An | 5 |
|  | d. | Mansi purchased a car for ₹2,50,000 and sold it for ₹3,48,000. What is the percent profit she made in the car? | CO6 | A | 5 |

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

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|  | **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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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | 10 | 20 | - | - | 40 |
| CO2 | - | - | 15 | - | 25 | - | 40 |
| CO3 | - | 10 | - | - | - | - | 10 |
| CO4 | - | - | 10 | - | 20 | - | 30 |
| CO5 | - | 20 | - | 20 | - | - | 40 |
| CO6 | - | - | 10 | 10 | - | - | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **22MA2002** | **Duration** | **3hrs** |
| **Course Name** | **BUSINESS STATISTICS WITH R** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Draw a Histogram, frequency polygon and frequency curve for the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Class | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | | Freq. | 3 | 7 | 13 | 25 | 40 | 14 | 10 | 7 | 4 | 2 | | CO1 | U | 10 |
|  | b. | Draw the less than and more than Ogives for the following distribution:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Class interval | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | | frequency | 10 | 25 | 36 | 46 | 52 | 31 | 28 | 22 | | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Calculate the standard deviation of the following data   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | 1 | 2 | 3 | 4 | 5 | | *f* | 3 | 7 | 10 | 3 | 2 | | CO2 | E | 10 |
|  | b. | From the following data find out which series is more consistent:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 55 | 54 | 52 | 53 | 56 | 58 | 52 | 50 | 51 | 49 | | B | 108 | 107 | 105 | 105 | 106 | 107 | 104 | 103 | 104 | 101 | | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. |  | Calculate the Mean Median and Mode for the following data:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | Freq | 3 | 5 | 8 | 10 | 11 | 13 | 6 | 4 | | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean of 3 . Out of 1000 taxi drivers, find the probability that the number of drivers with probability i) No accident in a year ii) More than three accidents in a year. | CO3 | E | 10 |
|  | b. | An aptitude test for selecting engineers in an industry is conducted on 100 candidates. The average score is 42 and S.D. of score is 24. Assuming normal distribution for the scores find (i) the number of candidates whose score is more than 60 (ii) the number of candidates whose score lie between 30 & 60. | CO3 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Calculate the correlation coefficient for the following data   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 78 | 89 | 97 | 69 | 59 | 79 | 68 | 57 | | *y* | 125 | 137 | 156 | 112 | 107 | 138 | 123 | 108 | | CO4 | A | 7 |
|  | b. | Find the correlation coefficient and regression line of y on x for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | 2 | 4 | 6 | 8 | 10 | | *y* | 5 | 7 | 9 | 8 | 11 | | CO5 | A | 13 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | A coin is tossed 3 times .What is the probability of getting i) at most 2 heads ii)at least 2 heads iii)exactly 3 tails | CO3 | E | 10 |
|  | b. | Four coins were tossed simultaneously .What is the probability of getting i) exactly 2 heads ii) at least 2 heads iii) at most 2 heads | CO3 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | Ten participants in a contest are ranked by 2 judges   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 1 | 6 | 5 | 10 | 3 | 2 | 4 | 9 | 7 | 8 | | *y* | 6 | 4 | 9 | 8 | 1 | 2 | 3 | 10 | 5 | 7 |   Calculate the rank correlation | CO4 | A | 10 |
|  | b. | Calculate 5 yearly moving averages and short-term fluctuation   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | Production | 203 | 220 | 231 | 245 | 253 | 264 | 260 | 248 | 273 | | CO6 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Determine the seasonal fluctuation in time series given below, indicating clearly the procedure followed.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter I | Quarter II | Quarter III | Quarter IV | | 1951 | 30 | 81 | 62 | 119 | | 1952 | 33 | 104 | 86 | 171 | | 1953 | 42 | 133 | 99 | 221 | | 1954 | 56 | 172 | 129 | 335 | | 1955 | 67 | 201 | 136 | 302 | | CO6 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 9. | a. | Fit a straight line trend equation to the following data by the method of least squares and estimate the net profit for the year 2003.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | | production | 32 | 36 | 44 | 37 | 71 | 72 | 109 | | CO6 | A | 10 |
|  | b. | From the following data construct an index for 1998 taking 1997 as base:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Commodities | A | B | C | D | E | | Price in 1997(Rs.) | 20 | 35 | 50 | 10 | 5 | | Price in 1998(Rs.) | 22 | 42 | 70 | 10 | 4 | | CO6 | An | 10 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Present the data in tabular and graphical representations. |
| CO2 | Determine the central tendency and dispersion to associate the data in real time. |
| CO3 | Model the data using probability distributions. |
| CO4 | Analyze the relationship between the business parameters. |
| CO5 | Construct the regression lines to predict and analyze the future. |
| CO6 | Examine the trends and forecast the business developments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | - | - | 30 | - | 10 | - | 40 |
| CO3 | - | - | - | - | 40 | - | 40 |
| CO4 | - | - | 17 | - | - | - | 17 |
| CO5 | - | - | 13 | - | - | - | 13 |
| CO6 | - | - | - | 50 |  | - | 50 |
|  | | | | | | | **180** |