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| **Course Code** | **11MA04 / 12MA204** | **Duration** | **3hrs** |
| **Course Name** | **MATRICES, DIFFERENTIAL EQUATIONS AND CALCULUS II** | **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. | Identify the sum of the Eigen values of . | | CO1 | R | 1 |
| 2. | Show the third Eigen value of the matrix  if 3 and 15 are the other Eigen values. | | CO1 | U | 1 |
| 3. | Identify the complementary function of. | | CO1 | R | 1 |
| 4. | Trace the particular integral of . | | CO1 | U | 1 |
| 5. | State the formula for the volume of a region of space V. | | CO1 | R | 1 |
| 6. | Show the region of integration. | | CO1 | U | 1 |
| 7. | Identify the value of , if Curl= 0 | | CO1 | R | 1 |
| 8. | Describe solenoid vector. | | CO1 | U | 1 |
| 9. | Identify , if | | CO1 | R | 1 |
| 10. | Differentiate. | | CO1 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Describe Cayley Hamilton theorem. | | CO1 | U | 3 |
| 12. | Differentiate for | | CO1 | U | 3 |
| 13. | Estimate. | | CO1 | U | 3 |
| 14. | Identify grad at (1, 1, 1), if . | | CO1 | U | 3 |
| 15. | Identify , if and . | | CO1 | U | 3 |
| 16. | Show , if . | | CO | 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. |  | Interpret Cayley-Hamilton theorem and hence find A−1 if  A= | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Determine Eigen values and eigenvectors of the matrix . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Solve (x2D2 – xD + 4) y = x2 sin (logx). | CO1 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Solve the equation , by the method of variation of parameters. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate  where V is the volume of the rectangular parallelepiped bounded by , , , , , . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Evaluate and indicate the region of integration. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Show that is irrotational and hence find its scalar potential. | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write  in Taylor’s Series about (0,π/2) upto third degree. | 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 | 5 | 23 | 94 | - | - | - | 124 |
|  | | | | | | | **124** |



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| **Course Code** | **11MA346** | **Duration** | **3hrs** |
| **Course Name** | **STATISTICAL QUALITY CONTROL** | **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 the importance of Statistical Quality Control. | CO1 | | U | 10 |
|  | b. | Explain the two causes of variations in quality control. | CO1 | | U | 10 |
|  |  | **(OR)** |  | |  |  |
| 2. | a. | Explain the (i) process capability index (ii) Cp index (iii) Cpk index in quality control. | CO1 | | A | 15 |
|  | b. | The relative humidity in a greenhouse is expected to be between 65 to 85%. Random samples taken over a span of one week yield the following values: 60,78,70,84,81,80,85,60,88,75. Find the process capability index. | CO1 | | A | 5 |
|  |  |  |  | |  |  |
| 3. | a. | The following table gives the measurement of 10 samples each of size 5 in the production process taken in an interval of 2hours. Calculate sample mean and range. Construct the control charts of mean, and range R. Comment on nature of control of the process.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample Number | | | | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Observed Measurements | | | | | | | | | | | 49 | 50 | 50 | 48 | 47 | 52 | 49 | 55 | 53 | 54 | | 55 | 51 | 53 | 53 | 49 | 55 | 49 | 55 | 50 | 54 | | 54 | 53 | 48 | 51 | 50 | 47 | 49 | 50 | 54 | 52 | | 49 | 46 | 52 | 50 | 44 | 56 | 53 | 53 | 47 | 54 | | 53 | 50 | 47 | 53 | 45 | 50 | 45 | 57 | 51 | 56 | | CO1 | | A | 20 |
|  |  | **(OR)** |  | |  |  |
| 4. | a. | 10 samples of 400 items each were drawn from the output of a process. The number of defective items in the samples are given below. Construct ‘p’ chart and ‘np’ chart. Comment on state of control of the process.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Number of defectives | 19 | 4 | 9 | 12 | 9 | 15 | 26 | 14 | 15 | 17 | | CO1 | | A | 20 |
|  |  |  |  | |  |  |
| 5. | a. | Explain (i) Producer’s Risk (ii) Consumer’s Risk (iii) Average outgoing quality (vi) AOQL (v) IQL in quality control. | CO1 | | U | 10 |
|  | b. | Explain the acceptance criteria and construct the flowchart of single sampling plan. | CO1 | | U | 10 |
|  |  | **(OR)** |  | |  |  |
| 6. | a. | Describe: (i) the ideal OC curve (ii) Type A, Type B operating characteristic curve of acceptance sampling plan. | CO1 | | U | 10 |
|  | b. | Explain the unity value and search procedure in acceptance sampling plans. | CO1 | | U | 10 |
|  |  |  |  | |  |  |
| 7. | a. | Derive the probability of acceptance based on the power series approach of summing probabilities in acceptance sampling plans. | CO1 | | E | 10 |
|  | b. | Construct the transition probability matrix of single sampling plan based on Markov Chain. | CO1 | | E | 10 |
|  |  | **(OR)** |  | |  |  |
| 8. | a. | Construct the transition probability matrix of double sampling plan based on Markov Chain. | CO1 | | E | 10 |
|  | b. | Explain the algorithm and construct the flow chart of Sequential sampling plan. | CO1 | | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | |
| 9. | a. | Determine the probability of acceptance of of single sampling plan with N = 1400, n = 50, c = 1. for the following lots (i) 0.5% defectives  (ii)1% defectives (iii)4% defectives (iv) 7% (v)10% defectives  Construct the operating characteric curve. | | CO1 | E | 15 |
|  | b. | Interpret the double sampling plan, N = 2000, n1 = 60, c1 = 2, n2 = 70 and c2 = 5. | | CO1 | A | 5 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge in applications of SQC. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | CO1 |  | 60 | 75 |  | 45 |  |
|  | | | | | | | **180** |



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| **Course Code** | **11MA347** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED ACCEPTANCE CONTROL** | **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 the algorithm, flow chart, and measures of a double-sampling plan. | CO1 | A | 10 |
|  | b. | Sketch the flow chart of the sequential sampling plan. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write down the designing procedure, flow chart, and measures of a single sampling plan in brief. | CO1 | An | 10 |
|  | b. | Describe MAAOQ Plans and Incentive Index Plans. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the variable unknown sigma plans and write the advantages of the plan. | CO1 | An | 10 |
|  | b. | Suppose that in a variable single sampling plan, p1=0.018, p2=0.18, α=0.05 and β=0.10. Evaluate the parameters n, and k for the plan when (i)the standard deviation is known. (ii) the standard deviation is unknown. | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the variable known sigma plans and write the disadvantages of the plan | CO1 | An | 10 |
|  | b. | Suppose that in a variable single sampling plan, p1=0.015, p2=0.15, α=0.05 and β=0.10. Evaluate the parameters n, and k for the plan when(i)the standard deviation is known. (ii) the standard deviation is unknown. | CO1 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the algorithm of the CSP-I sampling plan. | CO1 | A | 10 |
|  | b. | Explain the algorithm of the CSP-II sampling plan. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the algorithm and measures of CSP-III | CO1 | A | 10 |
|  | b. | Sketch the flow chart and explain the algorithm of Multilevel Continuous Sampling Plans | CO1 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Construct the flow chart and explain the acceptance criteria of the Chain sampling plan | CO1 | An | 10 |
|  | b. | Consider the Chsp I plan with n=10, c=0, i=2. Calculate the probability of acceptance for (i) p=0.01 (ii) p= 0.03 (iii)p= 0.1 (iv) p= 0.5 (v) p = 0.8 | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare the procedure of CSP-I and SkSP-1 sampling plans. | CO1 | A | 10 |
|  | b. | Explain the algorithm of Demerit Rating Plans. | CO1 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the algorithm and operating procedure of the mixed sampling plan with QSS-1 as an attribute plan. | CO1 | An | 15 |
|  | b. | Explain the importance of tightened inspection in MIL-STD- 414. | CO1 | U | 5 |

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

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|  | **COURSE OUTCOME** |
| CO1 | Knowledge in applications of sampling plans. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 15 | 80 | 55 | 30 | - |  |
|  | | | | | | | **180** |



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| **Course Code** | **12MA302** | **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. | Show that p ∨ (q ∧ r) and (p ∨ q) ∧ (p ∨ r) are logically equivalent. | CO1 | U | 10 |
|  | b. | Let P(x, y) be the statement “x + y = y + x.” What are the truth values of the quantifications ∀x∀yP(x, y) and ∀y∀xP(x, y), where the domain for all variables consists of all real numbers? | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Find the values of the Boolean function represented by | CO1 | A | 10 |
|  | b. | Find the K-maps for  (a)  (b)  (c) . | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Show that if n is a positive integer, then . | CO2 | A | 10 |
|  | b. | State and prove the Lame’s theorem. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Prove the relation R on a set A is transitive if and only if Rn ⊆ R for  n = 1, 2, 3,…. | CO2 | U | 10 |
|  | b. | Let R be the relation on the set of real numbers such that xRy if and only if x and y are real numbers that differ by less than 1, that is, |x − y| < 1. Show that R is not an equivalence relation. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Prove that an undirected graph has an even number of vertices of odd degree. | CO3 | A | 10 |
|  | b. | Show that a connected multigraph with at least two vertices has an Euler circuit if and only if each of its vertices has even degree with an example. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let *G* be a connected planar simple graph with *e* edges and *v* vertices. Let *r* be the number of regions in a planar representation of *G*. Prove that *r* = *e* − *v* + 2. | CO4 | A | 12 |
|  | b. | State Four Color theorem. What is the chromatic number of the complete bipartite Km,n, where m and n are positive integers ? Give an example. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | Prove that a tree with *n* vertices has *n* − 1 edges. | CO4 | U | 10 |
|  | b. | Prove that an undirected graph is a tree if and only if there is a unique simple path between any two of its vertices. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Prove that there are at most *mh* leaves in an *m*-ary tree of height *h*. | CO5 | U | 10 |
|  | b. | Use depth-first search to find a spanning tree for the graph G | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Prove that a set is generated by a regular grammar if and only if it is a regular set. | CO6 | A | 10 |
|  | b. | Find a Turing machine that recognizes the set . | CO6 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Construct and solve problem using Logic |
| CO2 | Understand basic concepts in sequences and summations |
| CO3 | Use graph models in diverse fields |
| CO4 | Model network problems |
| CO5 | Apply Trees to construct wide range of algorithms |
| CO6 | Use Finite automata logically and competent in writing computer programs |

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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 |  | 30 | 10 |  |  |  | 40 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  | 10 | 30 |  |  |  | 40 |
| CO5 |  | 10 | 10 |  |  |  | 20 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **12MA336** | **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. | Draw the Hasse diagram of the poset | CO1 | U | 5 |
|  | b. | Let  be an algebraic lattice. If we define  then prove that  is a lattice ordered set. | CO1 | A | 7 |
|  | c. | State and prove De Morgan’s law. | CO1 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let B be a Boolean algebra. An ideal M in B is maximal if and only if for any  either  or  but not both, hold. | CO1 | A | 10 |
|  | b. | Find a Boolean polynomial that induces the function f. | CO1 | U | 5 |
|  | c. | Find the disjunctive normal form of | CO1 | U | 5 |
|  |  |  |  |  |  |
| 3. | a. | Explain the parallel connection in switching circuit with an example. | CO1 | A | 10 |
|  | b. | Draw the switching circuit for the polynomial | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain half adders in switching circuit with an example. | CO1 | A | 10 |
|  | b. | Determine the symbolic representation of the circuit given by | CO1 | U | 5 |
|  | c. | Determine the Boolean polynomial p of the following circuit. | CO1 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Let F be a field and let g be an arbitrary polynomial of positive degree in F[x]. Then show that there is an extension field K of F such that g has a zero in K. | CO1 | A | 10 |
|  | b. | Prove that up to isomorphism, all distinct prime fields are given by  and  p prime. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let F be a finite field with q elements. Prove that  (i) The multiplicative group (F\*, ·) of the nonzero elements of F is cyclic of order q- 1.  (ii) All elements a of F satisfy aq - a = 0. | CO1 | A | 10 |
|  | b. | Draw a diagram of all subfields of | CO1 | U | 5 |
|  | c. | Calculate the degree of  over | CO1 | U | 5 |
|  |  |  |  |  |  |
| 7. | a. | Let F be a field. If  and deg(f(x) ) = 2 or 3, then f(x) is reducible over F if and only if f(x) has a zero in F. | CO1 | A | 10 |
|  | b. | Check whether (i)  is irreducible over Q,  (ii)  is irreducible over | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Prove that the product of two primitive polynomials is primitive. | CO1 | A | 10 |
|  | b. | Let  If f(x) is reducible over Q, then prove that it is reducible over Z. | CO1 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Let  be a parity-check matrix of the (7, 4) Hamming code. If y = 1101011 is received, determine the coset leader and codeword which was most likely sent. | CO1 | A | 7 |
|  | b. | If u = 1101010, v = 0101001, x = 1110001 and y = 0011001 are vectors, then find the (i) Hamming distance d(x,y), d(u,y), d(u,v), d(v,x) and (ii) Hamming weight w(u), w(v), w(x) and w(y). | CO1 | U | 5 |
|  | c. | A generator matrix of (6,3) linear block codes is given as  (i) Find the codeword for the message 011.  (ii) Decode the received sequence 101101. | CO1 | A | 8 |

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

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|  | **COURSE OUTCOMES** | | | | | | | | |
| CO1 | Knowledge in applications of lattices | | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | | | - | 40 | 140 | - | - | - | 180 |
|  | | | | | | | | | **180** |



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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. | Let G be a graph with v-1 edges. Show that the following three statements are equivalent: (i) G is connected; (ii) G is acyclic; (iii) G is a tree. | CO1 | A | 8 |
|  | b. | In any graph, prove that the number of vertices of odd degree is even. | CO1 | A | 8 |
|  | c. | Write the adjacency matrix for the following graph G. | CO1 | U | 4 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let T be a spanning tree of a connected graph G and let e be an edge of G not in T. Then T + e contains a unique cycle. | CO1 | A | 8 |
|  | b. | Show that if  then | CO1 | A | 8 |
|  | c. | Draw all the trees with six vertices. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 3. | a. | Show that if G is simple and 3-regular, then | CO1 | A | 10 |
|  | b. | If G is a block with v ≥ 3, then any two edges of G lie on a common cycle. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A connected graph has an Euler trail if and only if it has at most two vertices of odd-degree. | CO1 | A | 10 |
|  | b. | Let G be a simple graph with degree sequence where  and  Suppose that there is no value of m less than v/2 for which and  Then G is Hamiltonian. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | 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  for all | CO1 | A | 10 |
|  | b. | Let M be a matching and K be a covering such that |M| = |K|. Then prove that M is a maximum matching and K is a minimum covering. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | If G is bipartite, then prove that | CO1 | A | 10 |
|  | b. | Prove that every 3-regular graph without cut edges has a perfect matching. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Prove that | CO1 | A | 10 |
|  | b. | In a bipartite graph G with δ > 0, show that the number of vertices in a maximum independent set is equal to the number of edges in a minimum edge covering. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Show that if G is simple, then  for any edge e of G. | CO1 | A | 10 |
|  | b. | Prove that for any positive integer k, there exists a k-chromatic graph containing no triangle. | CO1 | A | 7 |
|  | c. | Calculate the chromatic polynomial for the following graph. | CO1 | U | 3 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Prove that K3, 3 is nonplanar. | CO1 | A | 10 |
|  | b. | If G is a connected plane graph, then prove that | CO1 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge in trees, vertex colorings, plane and planar graphs. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 11 | 169 |  |  |  | 180 |
|  | | | | | | | **180** |



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| **Course Code** | **12MA347** | **Duration** | **3hrs** |
| **Course Name** | **GRAPH THEORY AND NETWORKS** | **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. | For a graph G with at least three vertices, prove the following conditions are equivalent   1. G is connected and has no cut-vertex 2. For all , there are internally disjoint *x, y* – paths. 3. For all , there is a cycle through *x* and *y*. 4. , and every pair of edges in G lies on a common cycle. | CO1 | U | 12 |
|  | b. | Prove that a graph has strong orientation if and only if it is 2 edge-connected. | CO1 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prove the families  and have a common system of distinct representatives if and only if  for each pair . | CO2 | A | 10 |
|  | b. | State and prove Max-flow Min cut-theorem. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Prove that a graph is perfect if and only if its complement is perfect. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Prove that a graph is chordal if and only if it has an intersection representation using subtrees of a tree. | CO3 | A | 12 |
|  | b. | State and prove Star-Cutset lemma. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 5. | a. | A graph G is planar if and only if its bond matroid M\*(G) is graphic. | CO4 | A | 15 |
|  | b. | Given matroids on disjoint sets , then prove the direct sum . | CO4 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | State and prove Matroid Intersection theorem. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Given  and  there exists a graph with girth at least g and chromatic number at least m. | CO5 | A | 12 |
|  | b. | When p is constant, prove almost every Gp has diameter 2. | CO5 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | If  is a martingale with  , then . | CO5 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Prove that every regular bipartite graph of degree  is 1 – factorable. | CO6 | A | 10 |
|  | b. | Prove the complete graph Kn () is graceful and harmonious if and only if  . | CO6 | A | 10 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Know about different levels of connectivity |
| CO2 | Apply the connectivity condition in Networking |
| CO3 | Understand different classes of graphs and their nature |
| CO4 | Apply the knowledge of hereditary systems on different graphs |
| CO5 | Apply the knowledge of Random graphs in the field of Engineering |
| CO6 | Factorize and Decompose graphs for some applications |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 |  |  | 20 |  |  |  | 20 |
| CO3 |  | 28 | 12 |  |  |  | 40 |
| CO4 |  | 20 | 20 |  |  |  | 40 |
| CO5 |  |  | 40 |  |  |  | 40 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **180** |



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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. | State the value *of L* | | CO1 | U | 1 |
| 2. | Define convolution of Laplace Transform. | | CO1 | R | 1 |
| 3. | Identify the value of | | CO2 | R | 1 |
| 4. | Identify the value of | | CO2 | U | 1 |
| 5. | If f(x) = f(-x) then it is known as \_\_\_\_\_\_\_\_\_\_ function | | CO3 | R | 1 |
| 6. | Identify the value of | | CO3 | R | 1 |
| 7. | State the formula. | | CO4 | R | 1 |
| 8. | Identify the value Z((-a)n). | | CO4 | R | 1 |
| 9. | Identify the value of=\_\_\_\_\_\_\_\_ | | CO5 | R | 1 |
| 10. | Identify the value of  .=\_\_\_\_\_\_\_\_\_\_ | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Estimate the value of . | | CO1 | E | 3 |
| 12. | Evaluate | | CO2 | E | 3 |
| 13. | Write the finite Fourier sine transform of *f(x) = eax in (0, l).* | | CO3 | A | 3 |
| 14. | Solve . | | CO4 | A | 3 |
| 15. | Solve Z. | | CO4 | A | 3 |
| 16. | Evaluate . | | 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. | Estimate the value of . | CO1 | E | 6 |
|  | b. | Estimate the value of . | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate the value of . | CO2 | E | 6 |
|  | b. | Solve using partial fraction. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Estimate the Fourier Transform of and hence deduce that . | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve the Fourier transform of and hence find. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Estimate . | CO4 | E | 6 |
|  | b. | Find | CO4 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Evaluate by using convolution. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate  using partial fraction | CO5 | A | 6 |
|  | b. | Evaluate  using residue method to | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve, given and | CO6 | An | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students discriminate &learn all the properties of Laplace Transform. |
| CO2 | Students apply Laplace Transforms in mechanical & signal system engineering problems. |
| CO3 | Students evaluate certain definite integrals with infinite limits using Fourier Transform. |
| CO4 | Students categorize Z-Transform of sequence and series. |
| CO5 | Students list the formulas & properties of Z-Transform & Inverse Z-Transform. |
| CO6 | Students 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 | 1 | 1 | - | - | 15 | - | 17 |
| CO2 | 1 | 1 | 6 | - | 9 | - | 17 |
| CO3 | 2 | - | 15 | 12 | - | - | 29 |
| CO4 | 2 | - | 6 | - | 12 | - | 20 |
| CO5 | 1 | 1 | 12 | - | 15 | - | 29 |
| CO6 | - | - | - | 12 | - | - | 12 |
|  | | | | | | | **124** |



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| **Course Code** | **14MA2006 / 17MA2006** | **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)**  **(Answer all the questions)** | | | | | |
| 1. | What is the Octal form of (2576)10? | | CO2 | U | 1 |
| 2. | Find the nested form of . | | CO1 | U | 1 |
| 3. | The error occurred in Newton Raphson method is of order \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 4. | If a root of the equation  lies between and , the next approximation to the root using bisection method is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 5. | Find the second divided difference for the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 1 | 0 | -2 | 4 | |  | 4 | 51 | 71 | 98 | | | CO4 | E | 1 |
| 6. | Lagrange’s Interpolation formula is applied, when the given x values are  \_\_\_\_\_\_\_\_\_\_ intervals. | | CO4 | U | 1 |
| 7. | Write down the error term obtained in Trapezoidal rule. | | CO5 | R | 1 |
| 8. | In Numerical Integration, Simpson’s 3/8th rule is applied when n is a multiple of \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 9. | In linear spline function, degree of each polynomial pieces should be \_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| 10. | A cubic spline is said to be natural cubic spline if \_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the Taylor series expansion of f(x)=sinx at x= | | CO1 | A | 3 |
| 12. | Write down the Pseudocode for Newton Raphson Method. | | CO3 | U | 3 |
| 13. | Using the Newton algorithm, find the interpolating polynomial for the table given below:   |  |  |  |  | | --- | --- | --- | --- | |  | 0 | 1 | -1 | |  | -5 | -3 | -15 | | | CO4 | E | 3 |
| 14. | From the following table, find the area bounded by the curve and the x-axis from x = 7.47 to x = 7.52.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | 7.47 | 7.48 | 7.49 | 7.5 | 7.51 | 7.52 | |  | 1.93 | 1.95 | 1.98 | 2.01 | 2.03 | 2.06 | | | CO5 | A | 3 |
| 15. | Define a spline of degree. | | CO6 | U | 3 |
| 16. | Using Newton Raphson method, find an iterative formula to calculate , and hence find . | | CO3 | 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. | Expand in powers of h. Then compute and | CO1 | An | 6 |
|  | b. | Convert the number (100011001.100011101)2 into the decimal number. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find a positive real root of by Newton Raphson method, correct upto 4 decimal places between 0 and 1. | CO3 | E | 6 |
|  | b. | Write down the Pseudocode for Bisection Method. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Using Lagrange’s formula find, given   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 7 | 8 | 9 | 10 | |  | 3 | 1 | 1 | 9 | | CO4 | E | 6 |
|  | b. | Construct a divided difference table for the following data and find the newton’s interpolating polynomial.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 3/2 | 0 | 2 | | y | 3 | 13/4 | 3 | 5/3 | | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Use Romberg Algorithm to approximate by evaluating R(1,1). | CO5 | A | 6 |
|  | b. | Determine the quadrature formula of when the interval is  [-3, 3] and the nodes are 0, 1 and 2. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Define a spline of degree one and hence check whether the function  is a first degree spline function. | CO6 | An | 6 |
|  | b. | Determine whether the following function is a quadratic spline: | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Computeusing (i)Trapezoidal rule (ii) Simpson’s one third rule (iii) Simpson’s three eight rule . Also check the result by using direct integration. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Derive the Taylor series for the function at and prove that it converges to using Taylor’s theorem. | CO1 | An | 6 |
|  | b. | Convert the binary number N = (1101101101)2 to decimal form by using nested multiplication. | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find the cubic spline function given that   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 2 | 4 | 6 | |  | 1 | 9 | 41 | 41 |   And , and | CO6 | E | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | To identify the uses of Taylor’s series in engineering fields. |
| CO2 | To extend the uses of representation of numbers in different bases in engineering fields. |
| CO3 | To produce numerical solution for transcendental equations in engineering fields. |
| CO4 | To illustrate the interpolation techniques in other branches |
| CO5 | To evaluate integration using numerical methods |
| CO6 | To 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 | 3 | 12 | - | - | 16 |
| CO2 | = | 1 | 12 | - | - | - | 13 |
| CO3 | 1 | 4 | 3 | 6 | 6 | - | 20 |
| CO4 | - | 1 | 6 | - | 10 | - | 17 |
| CO5 | 2 | - | 9 | 12 | - | 6 | 29 |
| CO6 | 4 | 1 | 6 | 6 | 12 | - | 29 |
|  | | | | | | | **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** | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | | |
| 1. | If A = {1, 2, 4, 7, 8, 10}, and B = {2, 5, 8}, then (A – B) = | | CO1 | | A | | | 1 | |
| 2. | A relation R is said to be transitive on a set A, if it satisfies the condition \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | 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 *d* in the graph is \_\_\_\_\_\_\_. | | CO3 | | U | | | 1 | |
| 7. | A path of length 2 from vertex *d* to b is \_\_\_\_\_\_\_\_. | | CO4 | | U | | | 1 | |
| 8. | A Hamilton path is a path that contains each \_\_\_\_\_\_exactly once. | | CO4 | | A | | | 1 | |
| 9. | The least element and greatest element of the poset, whose Hasse diagram given below are \_\_\_\_\_\_\_  C:\Users\ADMIN\Pictures\graph6.png | | CO5 | | U | | | 1 | |
| 10. | A connected graph is a graph in which there is a path from any vertex to\_\_\_\_\_\_\_\_\_\_ other vertex of the graph. | | 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. | Write the degree of all the vertices of the graph shown below.    3  4  5  1  2 | | CO5 | | | U | | 3 | |
| 16. | Find all the possible spanning trees for the graph shown below.  C:\Users\ADMIN\Pictures\Graph3.png | | 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 *GCD (190, 34)* and express it in the form of d = *sa + tb*. | CO1 | | | A | | 6 | |
|  | b. | Show that  is a tautology. | CO1 | | | E | | 6 | |
|  |  |  |  | | |  | |  | |
| 18. | a. | Use Warshall’s algorithm to find the transitive closure of S, whose matrix is given below, on the set {1,2,3,4}, | CO2 | | | An | | 12 | |
|  |  |  |  | | |  | |  | |
| 19. | a. | Consider the Hasse diagram given below. Prove that it is a lattice and bounded lattice. | CO3 | | | An | | 12 | |
| 20. | a. | Find the minimal spanning tree for the graph given below.  v1  v2  v5  v4  v6  v3  19  21  18  14  11  6  5  10  16  33 | | CO4 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 21. |  | Define Euler path and Euler circuit. Use Fluery’s algorithm to construct an Euler circuit for the following graph.  C:\Users\ADMIN\Pictures\Graph11.png | | CO5 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 22. | a. | Let *A ={1, 2, 3, 4, 5, 6}* and the relation *R* on *A* is defined by R={ (1, 1), (1, 2), (1, 3), (2, 6), (3, 3), (3, 4), (3, 5), (4, 2), (4, 3), (5, 6), (6, 4)}. (i) Draw the digraph of R, and find the in-degrees and out degrees of all elements of A. (ii) Find MR and MR2 (iii) Is R reflexive, symmetric, or transitive? | | 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. | Define tree and spanning tree. Construct all spanning tree of the graph given below.  C  B  D  A  Graph G1  E | | CO5 | | | An | | 6 |
|  |  |  | |  | | |  | |  |
| **COMPULSORY QUESTION** | | | | | | | | | |
| 24. | a. | 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 |

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|  | **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 | 3 | 1 | 1 | 12 |  | - | 17 |
| CO5 |  | 3 | 1 | 12 |  | - | 16 |
| CO6 |  |  | 1 | 12 | 3 | - | 16 |
|  | | | | | | | **100** |



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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. | Define Mutually Exclusive events. | | CO1 | U | 1 |
| 2. | If P(A) = 1/8, P(B)=1/4 and  P(AՈB)= 1/16 , find P(A/B). | | CO1 | U | 1 |
| 3. | The mean of Poisson distribution is -------. | | CO2 | R | 1 |
| 4. | State Memoryless property of the exponential distribution. | | CO2 | R | 1 |
| 5. | If F(x) is the CDF of a random variable X, then | | CO2 | U | 1 |
| 6. | In a random process X{(s,t)},if s is fixed then X{(s,t)}is a---------. | | CO3 | R | 1 |
| 7. | If X and Y are two independent random variables thenX+Y() =--- | | CO3 | R | 1 |
| 8. | Define strict –sense stationary process. | | CO3 | U | 1 |
| 9. | What is the order of error in Trapezoidal rule? | | CO5 | R | 1 |
| 10. | Find from the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | y | 10 | 22 | 26 | 29 | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If p(A∪B) = 5/6, p(A∩B) = 1/3 and p(B)=1/2. Prove that the events A and B are independent. | | CO1 | U | 3 |
| 12. | A continuous random variable X has a probability density function given by f(x)=. Find mean of X. | | CO2 | E | 3 |
| 13. | If a random variable X has the moment generating function obtain the variance of X. | | CO3 | E | 3 |
| 14. | Find the mean and variance of the stationary process {X(t)}, whose autocorrelation is given by | | CO4 | A | 3 |
| 15. | Using Taylor’s series method, find y(1.1) given that y| = 1+y; y(1) =0. | | CO5 | E | 3 |
| 16. | Determine the values of y(0.1), y(0.2) using Euler’s method, given  y| = 2y, y(0) = 1 | | 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. | Players X and Y roll a pair of dice alternately. The player who rolls 11 first wins. If X starts the game, find the chance of Y wins the game. | CO1 | An | 6 |
|  | b. | The chance that a doctor A will diagonise a disease x correctly is 60%. The chance that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. A patient of doctor A who had disease x died. Calculate the chance that his disease was diagnosed correctly? | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Fit a Poisson distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 43 | 38 | 22 | 9 | 1 | | CO2 | A | 6 |
|  | b. | 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 |   Find (i) k (ii) P(1.5 < X < 4.5 / X > 2) (iii) mean . | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Find the Moment Generating Function of binomial distribution and hence find its mean and variance. | CO3 | A | 8 |
|  | b. | 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. | CO4 | E | 4 |
|  |  |  |  |  |  |
| 20. | a. | Two random processes {X(t)} and {Y(t)} given by X(t) = A cost+Bsint and Y(t) = B cost + A sint. where A and B are independent random variables with E(A) =0=E(B); E(A2) = E(B2) = 1 Show that {X(t)} and {Y(t)} are individually WSS but not jointly WSS. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate , by dividing the range into 10 equal parts using (i)Trapezoidal rule (ii)Simpson’s 1/3 rd rule (iii) Simpson’s 3/8th rule. Also compare the results by direct integration. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | If the random variable X follows normal distribution with mean 8 and standard deviation 4 then find (i)P(X>12) (ii) P(X<16). | CO2 | E | 6 |
|  | b. | Fit a Binomial distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | |  | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | 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 colour?  (ii) What is the probability that they are not same colour? | CO1 | E | 6 |
|  | b. | In 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) None of them hit the target (ii) atleast one of them hits the target (iii) exactly one of them hits target | CO1 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Given that , find *y(0.1)* and *y(0.2)* by using the fourth order Runge – Kutta method . | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | To develop the skills of the students in the area of Probability and Random Process. |
| CO2 | To equip the students with the basic concepts of various distributions. |
| CO3 | To equip the students with the basic concepts of Random process. |
| CO4 | To equip the students to solve the problems based on central limit theorem. |
| CO5 | To learn numerical methods. |
| CO6 | To develop the skills of solving first and second order 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 | -- | 5 | 6 | 12 | 6 | -- | 29 |
| CO2 | 2 | 1 | 12 | -- | 15 | -- | 30 |
| CO3 | 2 | 1 | 8 | 12 | 3 | -- | 26 |
| CO4 | -- | -- | 3 | -- | 4 | -- | 7 |
| CO5 | 1 | -- | -- | 12 | 3 | -- | 16 |
| CO6 | -- | 1 | 3 | -- | 12 | -- | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **14MA2018** | **Duration** | **3hrs** |
| **Course Name** | **OPERATIONS RESEARCH-II** | **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 classifications of inventory. | | CO 1 | U | 1 |
| 2. | Compare ‘Inventory holding cost’ with ‘inventory ordering cost’. | | CO 1 | R | 1 |
| 3. | State the error in the following network. | | CO 1 | An | 1 |
| 4. | Distinguish between ‘normal duration’ and ‘crash duration’. | | CO2 | A | 1 |
| 5. | Compare FCFS with LCFS | | CO2 | An | 1 |
| 6. | Articulate the concept of mixed strategy in game theory. | | CO2 | A | 1 |
| 7. | Determine the saddle point in the following pay-off matrix   |  |  |  | | --- | --- | --- | | Players | B1 | B2 | | A1 | -3 | 3 | | A2 | -3 | 4 | | A3 | 2 | 3 | | | CO2 | An | 1 |
| 8. | List some examples Infinite population size in queuing models. | | CO3 | R | 1 |
| 9. | Compare FCFS with LCFS. | | CO3 | An | 1 |
| 10. | State group replacement policy. | | CO3 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Cite about 1) Re order point 2) VED analysis3) Buffer Stock | | CO1 | R | 3 |
| 12. | Determine the critical path of the following project using a network diagram   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-3 | 2-4 | 3-4 | | Duration(Weeks) | 3 | 4 | 5 | 2 | | | CO1 | An | 3 |
| 13. | Develop balance in the following transportation table .In the table I, II are sources and A,B are destinations. Availability and requirements are given in the table.   |  |  |  |  | | --- | --- | --- | --- | |  | A | B | Availability | | I | 2 | 3 | 25 | | II | 7 | 9 | 45 | | Requirement | 20 | 30 |  | | | CO2 | A | 3 |
| 14. | Compare ‘series service channel’ with ‘parallel service channel’. | | CO2 | An | 3 |
| 15. | State the advantages and limitations of simulation. | | CO3 | R | 3 |
| 16. | Articulate the importance of ‘Time value of money’ in replacement models. | | CO3 | 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. | The demand for a computer monitor cable is 1050 cables per month and shortages are allowed; if the cost per cable is Rs 125, cost of making one purchase is Rs 700, the holding cost of one cable is Rs 3 per year and cost of one shortage is Rs 50/year determine the following   1. Optimum purchase quantity 2. Optimum number of shortages 3. Optimum total yearly cost 4. Number of orders per year 5. Optimum ordering cost per year 6. Time between order | CO 1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | The normal cost and duration, crash cost and duration of activities of a project are given in the table. If the overhead cost is Rs.45 Per day, Develop the optimal cost schedule for the project by drawing the project schedule vs total cost.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Activity** | **Normal** | | **Crash** | | | Cost | Duration | Cost | Duration | | 1-2 | 360 | 3 | 440 | 1 | | 2-3 | 240 | 4 | 320 | 2 | | 2-4 | 100 | 7 | 140 | 3 | | 3-4 | 80 | 5 | 140 | 2 | | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Arrivals at a public telephone booth are considered to be Poisson with an average time of 8 minutes between one arrival and the next. The length of the telephone calls is assumed to be exponentially distributed with a mean value of 2 minutes.  i) What will be the probability that a person arriving at the booth will have to wait?  ii) Determine the average queue length that is formed from time to time.  iii) The telephone department is interested to install a second booth if convinced that an arrival would expect to have to wait atleast 5 minutes for the phone. Determine the increase in flow of arrivals which will justify a second booth. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Determine the inference of the game whose pay off matrix is as follows: (Player A vs Player B).   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | B1 | B2 | B3 | B4 | | A1 | 3 | 2 | 4 | 0 | | A2 | 2 | 4 | 2 | 4 | | A3 | 4 | 2 | 4 | 0 | | A4 | 0 | 4 | 0 | 8 | | CO2 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Compute ABC analysis and construct the graph for the following 10 items consumed in company.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | 1 | 2 | 3 | 4 | 5 | | Annual Usage(units) | 200 | 3000 | 25 | 1100 | 60 | | Unit Cost(Rs) | 11 | 14 | 9 | 6 | 5 |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | 6 | 7 | 8 | 9 | 10 | | Annual Usage(units) | 250 | 140 | 850 | 550 | 80 | | Unit Cost(Rs) | 90 | 6 | 6 | 15 | 9 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | The various time estimates of activities involved in a project are given below   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-3 | 2-4 | 2-3 | 3-4 | 3-5 | 4-6 | 5-6 | | Optimistic Time  (Days) | 2 | 4 | 2 | 2 | 0 | 3 | 6 | 1 | | Normal  Time  (Days) | 6 | 8 | 3 | 4 | 0 | 6 | 10 | 3 | | Pessimistic  Time  (Days) | 10 | 12 | 4 | 6 | 0 | 9 | 14 | 5 |   Draw the network and determine the expected completion time of the project  ii) Find the variance and SD of project.  iii) Determine the total probability of completing the project within 25 days  iv) What due date has about 75% of chances of being met(completion)?  v) What is the probability of not completing the project within 23 days? | CO3 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | The demand per day for a belt used in the engine of an automobile has the following probability distribution. Experiment the Simulation of the demand for 20 days.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Demand/day** | 3 | 4 | 5 | 6 | 7 | | **Probability** | 0.10 | 0.30 | 0.30 | 0.20 | 0.10 |   Assume your own Random numbers. | CO 3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The owner of a stone crushing machine determines from his past records that the cost per year for operating the machine is as shown in the table. The purchase price of this machine was Rs.65000 when new.   |  |  |  |  | | --- | --- | --- | --- | | **Age** | 1 | 2 | 3 | | **Operating cost in Rs** | 10000 | 12000 | 14000 |   After 3 years, the operating cost is Rs.4000 B, where B=4, 5, 6 (B indicating age in years). If the resale value decreases by 15 percent of the purchase price every year, what is the optimal replacement policy? | CO 3 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to relate their subject knowledge with the engineering subjects |
| CO2 | Students will be able to apply their knowledge in Analysis and Modeling |
| CO3 | Students will be able to use Monte Carlo technique to solve their engineering problems |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 4 | 1 | 12 | 28 | - | - | 45 |
| CO2 | 0 | 0 | 17 | 29 | - | - | 46 |
| CO3 | 5 | 0 | 27 | 1 | - | - | 33 |
|  | | | | | | | **124** |



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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. | a. | Define research and explain the types of research. | CO1 | R | 10 |
|  | b. | Enumerate the factors to be considered while selecting a research problem. With a neat flowchart, explain the procedure to arrive at a research problem statement. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss the problems encountered by researchers in India. | CO1 | U | 10 |
|  | b. | Discuss the significance of a review of related literature. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Classify the different types of variables in research. Explain the importance of each of them with suitable examples. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the different types of sample designs. | CO1 | U | 15 |
|  | b. | What are the criteria for good research work? | CO1 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between research design and experiment Design. | 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. | The marks of 12 students in two subjects Mathematics and Computer Science are given below.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Mathematics X | 72 | 60 | 88 | 58 | 49 | 38 | 66 | 81 | 80 | 40 | 62 | 71 | | Computer Science Y | 86 | 40 | 58 | 45 | 70 | 48 | 65 | 90 | 92 | 60 | 72 | 76 |   Find   1. the correlation coefficients of X and Y. 2. Regression lines. 3. the mark of Mathematics when the mark in Computer Science is 75. 4. the mark of Computer Science when the mark in Mathematics is 90. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Find the mean median and mode of the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | | f | 15 | 9 | 15 | 14 | 17 | 19 | | CO2 | A | 10 |
|  | b. | Discuss the different types of graphical representation of data. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | 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. | CO2 | A | 15 |
|  | b. | Discuss the types of hypothesis. | CO1 | U | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write about your understanding of (i) the impact factor and (ii) h-index. | CO3 | U | 10 |
|  | b. | Explain the steps involved in writing a research report and thesis. | CO3 | U | 10 |

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

|  |  |
| --- | --- |
|  | **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 | 55 | 20 | - | - | - | 95 |
| CO2 | 10 | - | 25 | 20 | - | - | 55 |
| CO3 | - | 30 | - | - | - | - | 30 |
|  | | | | | | | **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. | Expand . | | CO1 | U | 1 |
| 2. | Write the expansion of log2. | | CO1 | R | 1 |
| 3. | Find the value of in . | | CO2 | R | 1 |
| 4. | Expand  in terms of . | | CO2 | U | 1 |
| 5. | . | | CO3 | R | 1 |
| 6. | I, find . | | CO3 | U | 1 |
| 7. | Evaluate | | CO3 | R | 1 |
| 8. |  | | CO4 | U | 1 |
| 9. | If A and B are mutually exclusive events, then is\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 10. | A coin is tossed two times, then n(S)=\_\_\_\_\_\_\_\_\_ . | | CO4 | U | 1 |
| 11. | If A is any event, then = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 12. | Write down the probability of an impossible event. | | CO5 | R | 1 |
| 13. | The standard deviation of the standard normal distribution is \_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 14. | The mean of the Poisson distribution is \_\_\_\_\_. | | CO5 | R | 1 |
| 15. | Write down the probability function P(x) of a binomial distribution. | | CO5 | U | 1 |
| 16. | The total area bounded by the normal curve and x- axis is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| 17. | If the sample size is less than 30, then the sample is known as\_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| 18. | Write down the standard value of Z for two-tailed test at 5% level of significance. | | CO6 | U | 1 |
| 19. | The statistical constants of the sample in a population are known as\_\_\_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| 20. | State the formula to find the test statistic for goodness of fit. | | CO6 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Split into partial fractions. . | | CO1 | A | 5 |
| 22. | Find the sum of the series. . | | CO1 | A | 5 |
| 23. | If y= find . | | CO2 | A | 5 |
| 24. | Evaluate . | | CO2 | A | 5 |
| 25. | 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 |
| 26. | If P(A) = 0.4, P(B) = 0.7 and P(A∩B) =0.3, Find . | | CO3 | A | 5 |
| 27. | Eight coins are thrown simultaneously . Find the probability of getting exactly 7 heads? | | CO4 | A | 5 |
| 28. | If X is normally distributed with mean 12 and standard deviation 4.  Find (i) P(X20).  (ii) P(X20). | | CO5 | A | 5 |
| 29. | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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. | | | CO6 | A | 5 |
| 30. | The mean production of wheat in a sample of 100 fields comes to 200kg per acre and another sample of 150 fields gives the mean of 220kg. Assuming the standard deviation of field is 11kgs for the universe .Test if there is a significant difference between the means of the samples. | | CO6 | A | 5 |
| 31. | In an experiment on the immunization of cattle against a disease the following results are obtained:   |  |  |  | | --- | --- | --- | |  | affected | unaffected | | Inoculated | 40 | 70 | | Not inoculated | 60 | 30 |   Check whether the effect of the vaccine is independent of controlling the incidence of the disease using the Chi-square Test. | | CO6 | A | 5 |
| 32. | A sample of 20 items has mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units. | | CO5 | E | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Prove that | CO1 | A | 8 |
|  | b. | Evaluate  using Bernoulli’s formula. | CO2 | A | 7 |
|  |  |  |  |  |  |
| 34. | a. | Find the maxima / minima of the following function f(x) = 2x3 – 3x2–36x +10. | CO2 | E | 8 |
|  | b. | Fit a Poisson distribution to the given data and calculate the theoretical frequencies.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | f | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO3 | A | 7 |
|  |  |  |  |  |  |
| 35. | a. | Two independent samples of sizes 8 and 7 contain the following values:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample I | 19 | 17 | 15 | 21 | 16 | 18 | 16 | 14 | | Sample II | 15 | 14 | 15 | 19 | 15 | 18 | 16 |  |   Conclude using student’s t – test to check whether the two samples come from normal populations having same mean at 5 % level of significance. | CO6 | An | 15 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to 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 | 1 | 1 | 18 | - | - | - | 20 |
| CO2 | 1 | 1 | 17 | - | 8 | - | 27 |
| CO3 | 2 | 1 | 17 | - | - |  | 20 |
| CO4 | 1 | 3 | 5 | - | - | - | 9 |
| CO5 | 3 | 1 | 5 | - | 5 |  | 14 |
| CO6 | - | 5 | 15 | 15 | - |  | 35 |
|  | | | | | | | **125** |



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| --- | --- | --- | --- |
| **Course Code** | **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)**  **(Answer all the questions)** | | | | | |
| 1. | The expansion of is\_\_\_\_\_. | | CO1 | U | 1 |
| 2. |  | | CO1 | R | 1 |
| 3. | Find the characteristic equation of a matrix . | | CO2 | U | 1 |
| 4. | Find the sum of eigen values of the matrix . | | CO2 | U | 1 |
| 5. | Differentiate with respect to x. | | CO3 | R | 1 |
| 6. | If then find . | | CO3 | R | 1 |
| 7. | *\_\_\_\_\_\_\_\_.* | | CO4 | U | 1 |
| 8. | dx=\_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | If the roots are imaginary, then write the complementary function of the differential equation. | | CO5 | R | 1 |
| 10. | Solve . | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Separate into real and imaginary parts of | | CO1 | A | 3 |
| 12. | Find the rank of the matrix =. | | CO2 | A | 3 |
| 13. | Differentiate with respect to x. | | CO3 | A | 3 |
| 14. | Integrate . | | CO4 | A | 3 |
| 15. | Evaluatedx. | | CO5 | A | 3 |
| 16. | Find the particular integral of . | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Express in terms of . | CO1 | A | 6 |
|  | b. | If , then prove that | CO1 | A | 6 |
| 18. | a. | 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. | a. | Evaluateby using Integration by parts. | CO4 | E | 6 |
|  | b. | Evaluate | CO4 | E | 6 |
| 21. | a. | Prove that . | CO1 | A | 6 |
|  | b. | Prove that(cos. | CO1 | A | 6 |
| 22. | a. | Verify Cayley Hamilton theorem for the matrix . | CO2 | An | 12 |
| 23. | a. | Integratecoswith respect to x. | CO5 | A | 6 |
|  | b. | Evaluate | CO5 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve +12. | CO6 | A | 6 |
|  | b. | Solve . | CO6 | A | 6 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 27 | - | - |  | 29 |
| CO2 | - | 2 | 15 | 12 | - |  | 29 |
| CO3 | 2 | - | 15 | - | - |  | 17 |
| CO4 | - | 2 | 3 | - | 12 |  | 17 |
| CO5 | 1 | - | 9 | - | 6 |  | 16 |
| CO6 | - | 1 | 15 | - | - |  | 16 |
|  | | | | | | | **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 u and v are functions of x and y then | | CO1 | R | 1 |
| 2. | State Euler’s theorem on homogenous function. | | CO1 | R | 1 |
| 3. | Write complementary function of. | | CO2 | A | 1 |
| 4. | Solve the particular integral of | | CO2 | A | 1 |
| 5. | Convert  as a Legendre polynomial. | | CO3 | U | 1 |
| 6. | Identify the value of | | CO3 | U | 1 |
| 7. | State the complete integral of the equation z = px + qy + f(p, q). | | CO4 | R | 1 |
| 8. | Write complementary function of | | CO4 | A | 1 |
| 9. | State the one dimensional wave equation. | | CO5 | R | 1 |
| 10. | Evaluate  for the Fourier series | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the first and second partial derivatives of the function. with respect to *x.* | | CO1 | A | 3 |
| 12. | Solve (D2 - 6DD + 5D2) z = 0 | | CO2 | A | 3 |
| 13. | Evaluate. | | CO3 | A | 3 |
| 14. | Solve. | | CO4 | A | 3 |
| 15. | Write the Root Mean Square Value of f(x) = x in . | | CO6 | A | 3 |
| 16. | Identify the boundary conditions for an infinitely long plate of width  with insulated surfaces has its temperature zero on both long sides and are of the short sides. The side y = 0 is maintained at a temperature 3x. | | 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. | a. | If Write the value of | CO1 | A | 6 |
|  | b. | Solve if , , and  then compute | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Estimate. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate to obtain series solution of the equation | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve (x – y) p + (y – x – z) q = z. | CO4 | A | 6 |
|  | b. | Solve z = p2 + q2. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate when in a Fourier series of periodicity. | CO6 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve , using method of variation of parameter. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Estimate the first three harmonics of the Fourier series for f(x) from the following data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  |  |  |  |  |  | | f(x) | 1.0 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 | | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve to find the resulting temperature function u(x, t) taking x = 0 at A. A rod 30 cm long has its ends A and B kept at 20°C and 80°C respectively until steady state conditions prevail. The temperature at each end is suddenly reduced to 0°C and kept so. | CO5 | A | 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 understands 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 | 2 |  | 15 |  |  |  | 17 |
| CO2 |  |  | 17 |  | 12 |  | 29 |
| CO3 |  | 2 | 3 |  | 12 |  | 17 |
| CO4 | 1 |  | 16 |  |  |  | 17 |
| CO5 | 4 |  | 12 |  |  |  | 16 |
| CO6 |  |  | 4 | 12 | 12 |  | 28 |
|  | | | | | | | **124** |



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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: 25, 12, 2, 45, and 5. | | CO1 | U | 1 |
| 2. | Compute the mode for the following data: 1, 2, 3, 1, 5, 1, 9, 2, 1 and 1. | | CO1 | U | 1 |
| 3. | Determine the coefficient of variation, If 25 and σ = 4. | | CO1 | U | 1 |
| 4. | State the relation between mean, median and mode. | | CO1 | R | 1 |
| 5. | Compute the value of median if mean and mode of the data are 4 and 10. | | CO1 | U | 1 |
| 6. | Compute the correlation coefficient if the two regression coefficients are 0.6 and 0.4. | | CO2 | U | 1 |
| 7. | Define positive correlation. | | CO2 | R | 1 |
| 8. | The minimum value of correlation coefficient is \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 9. | Write the general equations of the two regression lines. | | CO2 | R | 1 |
| 10. | Define small sample. | | CO4 | R | 1 |
| 11. | Define alternative hypothesis. | | CO4 | R | 1 |
| 12. | Write the test statistic for Student’s t test for difference of means. | | CO4 | R | 1 |
| 13. | Identity the error type when the hypothesis is true, but is rejected. | | CO4 | R | 1 |
| 14. | Calculate the degrees of freedom for a sample size of 10 in student’s t – test. | | CO4 | U | 1 |
| 15. | What do you mean by factorial experiment? | | CO5 | U | 1 |
| 16. | What do you mean by ANOVA? | | CO5 | R | 1 |
| 17. | Mention the statistical test used in ANOVA. | | CO5 | R | 1 |
| 18. | Mention the appropriate statistical test for factorial design. | | CO5 | R | 1 |
| 19. | Define the term confounding. | | CO5 | R | 1 |
| 20. | Mention one difference between RBD and LSD. | | CO5 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the mean and mean deviation for the following data:  12, 25, 21, 31, 20, 17, 22, 19, 23, 27 | | CO1 | E | 5 |
| 22. | Find the quartile deviation for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Height (in inches) | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | Frequency | 10 | 12 | 15 | 10 | 14 | 18 | 6 | | | CO1 | E | 5 |
| 23. | Find the standard deviation for the following data:  78, 98, 85, 65, 48, 86, 112, 57, 98, 99, 67, 76 | | CO1 | A | 5 |
| 24. | Find the rank correlation coefficient for the data below   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | Y | 12 | 9 | 6 | 10 | 3 | 5 | 4 | 7 | 8 | 2 | 11 | 1 | | | CO2 | E | 5 |
| 25. | Find the correlation coefficient for the following data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Production (in crores) | 25 | 26 | 27 | 28 | 30 | 32 | 35 | | Exports (in crores) | 20 | 22 | 24 | 25 | 26 | 27 | 34 | | | CO2 | E | 5 |
| 26. | The two lines of regression are x *= – 0.87y + 19.93* and *y= – 0.50 x+ 11.64*. Find the mean of x and y series. Also find the correlation coefficient. | | CO2 | An | 5 |
| 27. | The nine items of a sample had the following values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of the nine items differ significantly from the assumed population mean 47.5. | | CO3 | An | 5 |
| 28. | Two independent samples of sizes 8 and 7 from a normal population had the following values: Sample I: 22 25 18 48 32 26 37 12  Sample II: 13 17 35 46 22 29 21  Do the population variances differ significantly at 1% level of significance? | | CO5 | A | 5 |
| 29. | The following data gives the number of aircraft accidents that occurred during the various days of a week. Find whether the accidents are uniformly distributed over the week.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Days | Sun | Mon | Tue | Wed | Thu | Fri | Sat | | No. of accidents | 14 | 16 | 8 | 12 | 11 | 9 | 14 | | | CO5 | A | 5 |
| 30. | 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 | 5 | 4 | 3 | 7 | 5 | 1 | 3 | 4 | 1 | 7 |   Analysis the results for treatment effects. | | CO5 | An | 5 |
| 31. | Explain Split plot design briefly. | | CO5 | U | 5 |
| 32. | Write short notes on 23 factorial experiments. | | CO5 | U | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | The following frequency distribution gives the number of mangoes per tree:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. of mangoes /Tree | 10-25 | 25-40 | 40-55 | 55-70 | 70-85 | 85-100 | | No. of Trees | 6 | 20 | 44 | 26 | 3 | 1 |   Calculate mean, median and mode. | CO1 | E | 15 |
|  |  |  |  |  |  |
| 34. | a. | The nicotine content in milligrams of two samples of tobacco were found as follows.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Sample A | 24 | 27 | 26 | 21 | 25 | - | | Sample B | 27 | 30 | 28 | 31 | 22 | 36 |   Use ‘t’ test to find whether the two samples differ significantly. | CO4 | An | 15 |
|  |  |  |  |  |  |
| 35. | a. | A farmer wishes to test the effect of 4 fertilizers A, B, C and D on the yield of wheat. The fertilizers are used in a Latin Square Design and the result are tabulated here. Perform Analysis of Variance and draw your conclusions.   |  |  |  |  | | --- | --- | --- | --- | | A 18 | C 21 | D 25 | B 11 | | D 22 | B 12 | A 25 | C 19 | | B 15 | A 20 | C 23 | D 24 | | C 22 | D 21 | B 10 | A 17 | | CO5 | A | 15 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to understand basic statistics and the technique, methodology. |
| CO2 | The students will be able to use the applications of statistics. |
| CO3 | The students will be able to apply statistical methods to solve Agricultural problems. |
| CO4 | The students will be able to knowledge in technique and methodology of solving problems in testing of hypothesis |
| CO5 | The students will be able to 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 | 4 | 5 | - | 25 | - | 35 |
| CO2 | 3 | 1 | - | 5 | 10 | - | 19 |
| CO3 | - | - | - | 5 | - | - | 5 |
| CO4 | 4 | 1 | - | 15 | - | - | 20 |
| CO5 | 4 | 12 | 25 | 5 | - | - | 46 |
|  | | | | | | | **125** |



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| **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. | What is called the ‘order’ of a partial differential equation? | | CO1 | R | 1 |
| 2. | The notation ‘’ in partial differential equations represents \_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 3. | The one - dimensional Heat equation is given by \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | The equation , is of order ­­\_\_\_\_\_\_ and degree \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | If A and B are 2 mutually exclusive events such that *P(A)=1/2* and *P(B)=1/3*, find | | CO3 | E | 1 |
| 6. | What is the probability that there will be 53 Sundays in a leap year? | | CO3 | U | 1 |
| 7. | If F(x,y) is the CDF of a two dimensional random variable (X,Y) then | | CO4 | R | 1 |
| 8. | What is the mean of Binomial distribution? | | CO4 | R | 1 |
| 9. | The mode of the numbers 8, 3, 8, 9, 11, 11, 8, 9, 12, 8, 3, 6, 8 is \_\_\_\_\_ | | CO5 | U | 1 |
| 10. | Define null hypothesis. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | The Subsidiary Equations in Lagrange’s method are \_\_\_\_\_\_\_\_\_. | | CO1 | U | 3 |
| 12. | State the possible solutions of one dimensional heat equation. | | CO2 | U | 3 |
| 13. | A pen is picked from a box containing 8 Red, 7 Green and 6 Blue pens. What is the probability that it is neither Red nor Blue? | | CO3 | U | 3 |
| 14. | For a Binomial distribution, mean is 6 and S.D is . Find ,  and | | CO4 | E | 3 |
| 15. | Find the mean median and mode of the following data 45, 36, 28, 42, 45, 40, 44. | | CO5 | U | 3 |
| 16. | Define Type I and Type II errors. | | 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 | 4 |
|  | b. | Solve . | CO1 | A | 8 |
|  |  |  |  |  |  |
| 18. |  | A tightly stretched string of length  has its ends fixed at and  is initially in equilibrium position. It is set to vibrate by giving each point a velocity . Find the displacement . | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | A and B alternately throw a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, show that his chance of winning is 30/61. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A continuous RV X has a pdf. Find , mean and variance. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | In a large consignment of electric bulbs 10% are defective. A sample of 20 is taken for inspection. Find the probability that  (i) all are good bulbs  (ii) exactly two are defective  (iii) at least two are defective  (iv) at most two are defective. | CO4 | A | 6 |
|  | b. | Fit a Poisson distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | 0 | 1 | 2 | 3 | 4 | |  | 109 | 65 | 22 | 3 | 1 | | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Obtain the lines of regression for the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | A random variable is normally distributed with mean 12 and S.D 4. Find , , . | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Below is the table on the weight gain (in kgs) of pigs fed on two diets A and B   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 25 | 32 | 30 | 34 | 24 | 14 | 32 | 24 | 30 | 31 | 35 | 25 |  |  | | Diet B | 44 | 34 | 22 | 10 | 47 | 31 | 40 | 32 | 35 | 18 | 21 | 35 | 29 | 22 |   Test if the two diets differ significantly with regard to their effect on increase in weight gain. | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge in solution of PDE |
| CO2 | Apply solution of PDE in heat and wave equations |
| CO3 | Calculate the central tendency of statistical data |
| CO4 | Measure the relation between variables |
| CO5 | Test of hypothesis for 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 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | - | 12 | - | - | 17 |
| CO3 | 2 | 2 | 12 | - | 13 | - | 29 |
| CO4 | 1 | 1 | 12 | - | 15 | - | 29 |
| CO5 | 2 | 2 | - | - | 12 | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **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)**  **(Answer all the questions)** | | | | | |
| 1. | If A is a set with three objects, then the cardinality of power set of A is -------. | | CO1 | U | 1 |
| 2. | If A={e,f,g} and B={4,5}, then find (*AXB*). | | CO1 | U | 1 |
| 3. | The value of the projection function, = ---------. | | CO2 | U | 1 |
| 4. | The value of the predecessor function P(7) = ----. | | CO2 | R | 1 |
| 5. | The letters of the word "ROME" taken all at a time can be written in ----- ways. | | CO3 | U | 1 |
| 6. | Compute C(5,1). | | CO3 | U | 1 |
| 7. | A nonempty set M together with binary operation \* is called --- if \* satisfies closure, associative, identity and inverse properties. | | CO4 | U | 1 |
| 8. | The inverse of (P→Q) is -------. | | CO4 | R | 1 |
| 9. | In a Boolean Algebra, = ----------. | | CO5 | R | 1 |
| 10. | The Dual of (PV Q) is ---------. | | CO4 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If A= {a, b, c, d} and B= {d, c} are two sets, then find (A∆B). | | CO1 | U | 3 |
| 12. | Find LCM of (45,75). | | CO2 | U | 3 |
| 13. | A committee of 7members is formed from a group of 9men and 10 women.  Find the number of ways of selecting the committee members with 3men,  4women. | | 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. | Give an example of a Monoid that is not a Group. | | CO5 | U | 3 |
| 16. | Compute the incidence matrix of the graph given below: | | 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 R and S are two relations defined on A={a,b,c} represented by  MR= and MS= ,then compute i)***MRUS*** ii)***MRՈS***  iii) ***MRoS***iv) v) Matrix of complement of R, . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | If f(x) = 5x+2 and g(x)=3x+2 are two functions defined on the set of real numbers, then find i. (fog)x ii. (gof)x iii. (fof)x. | CO1 | A | 6 |
|  | b. | Find GCD of (1575, 231) using Euclidean algorithm and express the GCD as a linear combination of 1575 and 231. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prove by mathematical induction :  (1+3+5+.....+(2n-1))= n2.  for n = 1,2,3, .... | CO2 | A | 6 |
|  | b. | How many permutations of the letters A,B,C,D,E,F,G (i) contain the  string BCD (ii) contain the string CFGA (iii) contain the strings ABC  and DE (iv)contain the strings ABC and CDE (v) begin with C and  end with A (vi) C and A occupy the end places. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Check whether ((P→Q) **ᴧ**(Q→R)) → (P→R) is a Tautology. | CO4 | A | 6 |
|  | b. | Find i)Principal Disjunctive Normal Form PDNF and  ii.) Principal Conjunctive Normal Form PCNF of  . | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Prove that G={1,2,3,4 } is a Group under multiplication modulo 5. | CO5 | A | 6 |
|  | b. | Find Euler path and Hamiltonian path: | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Let A =  and =  =  be permutations of A.   1. Compute . 2. Compute . 3. Is  even or odd. 4. Find . 5. Express as product of disjoint cycles. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Construct the spanning tree of the graph given below using Kruskal’s Algorithm and find minimum weight. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the Prefix, Infix, Postfix expressions of the following Tree: | CO6 | An | 6 |
|  | b. | Evaluate the following expression: *+ –* **^ 3 2 ^ 2 3 / 8 – 4 2**. | CO6 | An | 6 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to gain knowledge in sets, relation and function |
| CO2 | The student will be able to analyze using Mathematical induction |
| CO3 | The student will be able to understand basic counting techniques |
| CO4 | The student will be able to understand propositional logic |
| CO5 | The student will be able to understand algebraic structures and morphisms. |
| CO6 | The student will be able to classify different types of graphs. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 5 | 18 | - | - | - | 23 |
| CO2 | 1 | 4 | 12 | - | - | - | 17 |
| CO3 | - | 5 | 6 | - | - | - | 11 |
| CO4 | 1 | 4 | 12 | - | - | - | 17 |
| CO5 | 1 | 4 | 18 | - | - | - | 23 |
| CO6 | - | 3 | 18 | 12 | - | - | 33 |
|  | | | | | | | **124** |



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| **Course Code** | **18MA3002** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE** | **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. | Explain Fleury’s algorithm. Using Fleury’s algorithm find the Euler circuit of the following graph: | CO1 | An | 6 |
|  | b. | Find the Chromatic number and Chromatic polynomial for the following graphs | CO1 | A | 10 |
|  |  |  |  |  |  |
| 2. | a. | State and prove Euler formulae. Also explain the Euler formula using the following graph: | CO1 | A | 10 |
|  | b. | Define the following with an Example:  (i) Complete graph (ii) Chromatic Polynomial (iii) Linear graph | CO1 | U | 6 |
|  |  |  |  |  |  |
| 3. | a. | Draw an Expression tree for the following expression.  ((7+2)/3) - (3\*5+9). Traverse in Pre-order, in-order and post-order, hence find its prefix, infix and postfix notation. | CO2 | A | 12 |
|  | b. | Evaluate \* / 9 3 + \* 3 4 – 8 6 | CO2 | E | 4 |
|  |  |  |  |  |  |
| 4. | a. | Explain Prim’s and Krushkal’s Algorithm. Find the minimal Spanning tree using Prims and Krushkal’s algorithm for the following graph.  Minimum Spanning Tree — Prim's and Kruskal's algorithm | by Sethuram.S.V |  Medium | CO2 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Find GCD of 268 and 172 using Euclidean Algorithm and find its Bezout’s identity and Bezout’s Coefficients. | CO5 | A | 10 |
|  | b. | Let *a, b,* and *c* be integers, where *a* = 0. Then prove that (*i*) if *a* | *b* and *a* | *c*, then *a* | *(b* + *c)*; (*ii*) if *a* | *b,* then *a* | *bc* for all integers *c*; (*iii* ) if *a* | *b* and *b* | *c*, then *a* | *c*. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 6. | a. | Find the output strings generated by the finite state machine given in the following table if the input strings are 101010, 01010, 00100, 10001, 110011. Also draw the state diagram.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | State | f | | g | | | Input | | Input | | | 0 | 1 | 0 | 1 | | S0 | S1 | S3 | 1 | 0 | | S1 | S1 | S2 | 1 | 1 | | S2 | S3 | S4 | 0 | 0 | | S3 | S1 | S0 | 0 | 0 | | S4 | S3 | S4 | 0 | 0 | | CO4 | E | 10 |
|  | b. | Let N = {S, A, B} T={0,1} Find the language generated by the grammar G=(N,T,P,S) when the set P of productions consists of   1. S→ AB, A→ 01, B →11 2. S → AB, S →0A, A →0, B →10 3. S → AB, S → AA, A → 0B, A → 01, B → 1 | CO4 | A | 6 |
|  |  |  |  |  |  |
| 7. | a. | Two random processes {X(t)} and {Y(t)} are defined by  X(t) = Acos 5t + B sin 5t and Y(t) = B cos 5t – A sin5t. Show that {X(t)} and {Y(t)} are jointly WSS if A and B are uncorrelated RVs with zero mean and the same variances. | CO5 | A | 10 |
|  | b. | Find the mean and variance of the autocorrelation function , | CO5 | E | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | In a municipality hospital patients arrival are considered to be Poisson with an arrival interval time of 10mins. The doctors (examination and dispensing) time many be assumed to be  ED with an average of 6mins find :  i) What is the chance that a new patient directly sees the doctor?  ii) For what proportion of the time the doctor is busy?  iii) What is the average number of patients in the system?  iv) What is the average waiting time of the system? | CO3 | A | 10 |
|  | b. | A Commercial bank has 3 cash paying assistants customers are found to arrive in a Poisson fashion at an average rate of 6/hr for business transaction. The service time is found to have an E.D with a mean of 18 mins. The customers are processed on FCFS basis. Calculate  i) Average number of customers in the system  ii) Average time a customer spends in the system  iii) Average queue length  iv) How many hours a week can a cash paying assistant spend with the customers | CO3 | A | 10 |

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Write efficient Programme |
| CO2 | Develop Algorithms |
| CO3 | Apply Queuing models |
| CO4 | Knowledge in Grammar and languages |
| CO5 | Examine the characteristics of random process |
| CO6 | Knowledge in number theory concepts |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 6 | 20 | 6 |  |  | 32 |
| CO2 |  |  | 28 |  | 4 |  | 32 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  |  | 6 |  | 10 |  | 16 |
| CO5 |  |  | 10 |  | 6 |  | 16 |
| CO6 |  |  | 10 | 6 |  |  | 16 |
|  | | | | | | | **132** |



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| **Course Code** | **18MA3005** | **Duration** | **3hrs** |
| **Course Name** | **FOUNDATIONS OF MATHEMATICS AND STATISTICS** | **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 sum to infinity of the series using the binomial theorem. | CO1 | A | 8 |
|  | b. | Sum the series using the logarithmic series. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | Prove that . Then evaluate . | CO2 | U | 8 |
|  | b. | Find the maxima and minima of . Also find the maximum and minimum value. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate using integration by parts. | CO3 | U | 8 |
|  | b. | Evaluate the definite integral | CO3 | U | 8 |
|  |  |  |  |  |  |
| 4. | a. | Out of 800 families with 4 children each, how many families would be expected to have   1. 2 boys and 2 girls 2. At least 1 boy 3. At most 2 girls 4. Children of both sexes   Assume equal probabilities for boys and girls. | CO4 | A | 8 |
|  | b. | Fit a Poisson distribution for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | Total | | f | 142 | 156 | 69 | 27 | 5 | 1 | 400 | | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | The mean breaking strength of the cables supplied by a manufacturer is 1800 with a standard deviation of 100. By a new technique in the manufacturing process, it is claimed that the breaking strength of the cable has increased. In order to test this claim, a sample of 50 cables is tested and it is found to that the mean breaking strength is 1850. Can we support the claim at 1% level of significance. | CO6 | An | 8 |
|  | b. | Theory predicts that the proportion of beans in 4 groups A, B, C, D should be 9:3:3:1. In an experiment among 1600 beans the numbers in 4 groups were 882, 313, 287, 118. Does the experiment support the theory? | CO6 | An | 8 |
|  |  |  |  |  |  |
| 6. | a. | A simple sample of heights of 6400 English men has a mean of 170 cm and a standard deviation of 6.4 cm while a simple sample of heights of 1600 Americans has a mean of 172 cm and a standard deviation of 6.3 cm. Do the data indicate that Americans are on the average taller than the Englishmen? | CO6 | E | 8 |
|  | b. | Two random samples give the following data:   |  |  |  |  | | --- | --- | --- | --- | |  | Size | Mean | Variance | | Sample I | 8 | 9.6 | 1.2 | | Sample II | 7 | 16.5 | 2.5 |   Can we conclude that the two samples have been drawn from the same population? | CO6 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | In an engineering exam, a student is considered to have failed, secured second class, first class and distinction according as he scores <45%, between 45% and 60%, between 60% and 75% and above 75% respectively. In a particular year 10% of the students failed in the exam and 5% of the students got distinction. Find the mean and standard deviation.(Assume normal distribution of marks) | CO5 | E | 8 |
|  | b. | It is known that the probability of an item produced by a certain machine with defective is 0.05. If the produced items are sent to the market in packets of 20, find the number of pockets containing   1. No defectives 2. At least 2 defectives 3. Exactly 2 defectives 4. At most 2 defectives   using binomial distribution. | CO5 | E | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | A car rental agency which uses 5 different brands of tyres in the process of deciding the brand of tyre to purchase as standard equipment for its fleet find that each of 5 tyres of each brand lost the following number of kilometers (in thousands):   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | A | 36 | 37 | 42 | 38 | 47 | | B | 46 | 39 | 35 | 37 | 43 | | C | 35 | 42 | 37 | 43 | 38 | | D | 45 | 36 | 39 | 35 | 32 | | E | 41 | 39 | 37 | 35 | 38 |   Test the hypothesis that the 5 brands have almost the same average life. | CO6 | E | 10 |
|  | b. | The following data resulted from an experiment to compare burners . 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 | B1 - 16 | B2 -17 | B3 -20 | | Day 2 | B2 – 16 | B3 -21 | B1 -15 | | Day 3 | B3-15 | B1-12 | B2 -13 |   Test the hypothesis that there is no difference between the burners. | CO6 | E | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of binomial theorem. |
| CO2 | Classify the linear and quadratic equations. |
| CO3 | Apply the concept of integration in their engineering subjects**.** |
| CO4 | Apply the concept of probability in real life. |
| CO5 | Understand the properties of various distributions. |
| CO6 | Test the hypothesis of large sample problems |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | - | 16 | - | - | - | 16 |
| CO2 | - | 8 | 8 | - | - | - | 16 |
| CO3 | 16 | - | - | - | - | - | 16 |
| CO4 | - | - | 16 | - | - | - | 16 |
| CO5 | - | - | - | - | 16 | - | 16 |
| CO6 | - | - | - | 16 | 36 | - | 52 |
|  | | | | | | | **132** |



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| **Course Code** | **19MA3007** | **Duration** | **3hrs** |
| **Course Name** | **TOPOLOGY** | **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 X be a topological space and let  Show that A is open in X. | CO1 | A | 5 |
|  | b. | Define topological space. Find any five topologies for X = {a, b, c}. | CO1 | A | 5 |
|  | c. | Show that every order topology is Hausdorff. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let and be the basis for the topologies and respectively on X.  Then prove that the following are equivalent:  (i)  is finer than .  (ii) For each and each basis element containing x, there is a basis element such that. | CO1 | An | 10 |
|  | b. | Let X be a topological space and let have the subspace topology. Then prove that is closed in Y if and only if for same closed set D in X. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | State and prove intermediate value theorem. | CO2 | An | 10 |
|  | b. | Show that finite Cartesian product of connected spaces is connected. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Show that the image of a connected space under a continuous map is connected. | CO2 | An | 10 |
|  | b. | Prove that the union of a collection of connected subspaces of X that have a point in common is connected. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Prove that the product of a finitely many compact spaces is compact. | CO3 | A | 10 |
|  | b. | Prove that every closed subspace of a compact space is compact. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Characterize the compact subspace of . | CO3 | A | 10 |
|  | b. | Show that a finite Cartesian product of connected spaces is connected. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Prove that a subspace of a regular space is regular. | CO4 | An | 10 |
|  | b. | Prove that every regular space with countable basis is normal. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | State and prove the fundamental theorem of algebra | CO5 | An | 20 |
|  |  |  |  |  |  |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | State and prove Brouwer fixed-point theorem for the disc. | CO6 | An | 10 |
|  | b. | If n ≥ 2, show that the n-sphere is simply connected. | CO6 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to recognize the concepts of topological space, Basis, subspaces and continuity |
| CO2 | The students will be able to differentiate connected and disconnected spaces |
| CO3 | The students will be able to characterize new ideas in compactness using the basic concepts of topology |
| CO4 | The students will be able to demonstrate the relationship among all the separation axioms |
| CO5 | The students will be able to construct the ideas of separation axioms |
| CO6 | The students will be able to recognize the basic concepts of algebraic topology |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 30 | 20 |  |  | 50 |
| CO2 |  |  |  | 50 |  |  | 50 |
| CO3 |  |  | 30 |  |  |  | 30 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  | 10 |  |  | 10 |
| CO6 |  |  | 10 | 10 |  |  | 20 |
|  | | | | | | | **180** |



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| **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. | The average of four consecutive even numbers is 23. Find the smallest of these numbers. | CO1 | R | 4 |
|  | b. | One-fourth of 60% of a number is equal to two-fifths of 20% of another number. Find the respective ratio of the first number to the second number. | CO1 | U | 6 |
|  | c. | Find the number of bullets that can be made out of a lead cylinder 28cm high and 6cm radius, each bullet being 1.5cm in diameter. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 2. | a. | Simplify . | CO2 | U | 4 |
|  | b. | If the amount of ₹64 in 2 years becomes ₹83.20, then find the amount of ₹86 in 4 years at the same rate of interest. | CO2 | A | 6 |
|  | c. | Find the least number of six digits which is a perfect square. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 3. | a. | In how many different ways can the letters of the word ‘MATHEMATICS’ be arranged so that the vowels always come together? | CO4 | R | 4 |
|  | b. | A man and his wife appear in an interview for two vacancies in the same post. The probability of husband’s selection is 1/7 and the probability of wife’s selection is 1/5. Find the probability that only one of them is selected. | CO4 | U | 6 |
|  | c. | A, B and C enter into partnership. A advances ₹1200 for 4 months, B ₹1400 for 8 months, and C ₹1000 for 10 months. They gain ₹585 altogether. Find the share of each. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 4. | a. | The ages of Ram and Mukta are in the ratio 3:5. After 9 years, the ratio of their ages will become 3:4. Find the sum of their present ages. | CO3 | A | 4 |
|  | b. | A, B and C can do a piece of work in 36, 54 and 72 days respectively. They started the work but A left 8 days before the completion of the work while B left 12 days before the completion. Find the number of days that C alone complete the work. | CO3 | A | 6 |
|  | c. | Two trains A and B are 110km apart on a straight line. One train starts from A at 7 AM and travels towards B at 20km/hr. Another train starts from B at 8 AM and travels towards A at 25km/hr. Calculate the time when they will meet. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 5. | a. | The shadow of a vertical pole is of its height. Find the angle of elevation. | CO5 | U | 4 |
|  | b. | Two villages are 2kms apart. If the angles of depression of these villages when observed from a plane are found to be and respectively. Find the height of the plane. | CO5 | A | 6 |
|  | c. | A boy walks from his house to school at the rate of 4km/hr, he reaches the school 10 mins earlier than the scheduled time. However if he walks at the rate of 3km/hr, he reaches 10 mins late. Find the distance between his school and house. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 6. | a. | Raman’s salary was decreased by 50% and subsequently increased by 50%. Find the percentage loss. | CO1 | U | 4 |
|  | b. | Find the greatest integer that divides 358, 374, 334 leaving the same remainder in each case. | CO1 | U | 6 |
|  | c. | A boat takes 4 hours for travelling downstream from point A to point B and coming back to point A upstream. If the velocity of the stream is 2km/hr and the speed of the boat in still water is 4km/hr, then find the distance between A and B. | CO3 | A | 6 |
|  |  |  |  |  |  |
|  | a. | Suresh bought a table for ₹1640 and sold it with 35% profit. Find the selling price of the table. | CO3 | U | 4 |
| 7. | b. | In three cans containing equal amount of solutions, ratios of milk and water are 4:1, 5:2 and 6:1 respectively. If all the three solutions are mixed, then find the ratio of milk and water in the new solution. | CO3 | A | 6 |
|  | c. | Two pipes A and B can fill a tank in 12 min and 15 min respectively. If both the pipes are opened simultaneously and pipe A is closed after 3 min, then find the time taken by pipe B to fill the tank. | CO3 | A | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Study the following table and answer the questions given below it:  **Number of students who go abroad for study from different states over the years**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Year**  **State** | **1995** | **1996** | **1997** | **1998** | **1999** | | **Maharashtra** | 723 | 840 | 900 | 920 | 925 | | **Kerala** | 1035 | 940 | 1200 | 1400 | 1500 | | **Karnataka** | 750 | 600 | 830 | 575 | 900 | | **West Bengal** | 500 | 550 | 450 | 600 | 525 | | **Delhi** | 1500 | 1625 | 1700 | 1475 | 1800 | | **Andhra Pradesh** | 800 | 840 | 875 | 925 | 785 |   1. Find the state in which the least number of students go abroad over the years.  2. Find the year in which Kerala contribute approximately one-fifth of the total number of students in that year.  3. Find the state in which there is a continuous increase in the number of students over the given years.  4. Find the percentage increase in number of students from West Bengal from 1997 to 1998.  5. Find the percentage decrease in number of students from Andhra Pradesh from 1998 to 1999. | CO6 | An | 10 |
|  | b. | Study the following graph carefully and answer the following questions:  1. The production of company D is approximately \_\_\_\_\_ times of the production of the company A.  2. Find the ratio of companies having more demand than production to those having more production than the demand.  3. If company A desires to meet the demand by purchasing surplus refrigerators from a single company, then find which company can meet the need adequately.  4. Find the difference between average demand and average production of the five companies taken together.  5. The demand for company B is approximately \_\_\_\_ percentage of the demand for company C. | CO6 | An | 10 |

**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 | 4 | 16 | 6 | - | - | - | 26 |
| CO2 | - | 10 | 6 | - | - | - | 16 |
| CO3 | - | 4 | 34 | - | - | - | 38 |
| CO4 | 4 | 6 | 6 | - | - | - | 16 |
| CO5 | - | 4 | 12 | - | - | - | 16 |
| CO6 | - | - | - | 20 | - | - | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **19MA3027** | **Duration** | **3hrs** |
| **Course Name** | **FUZZY SET THEORY AND ITS 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 A and B be fuzzy sets defined on the set X. Let then prove that  (i) ii) | CO1 | A | 10 |
|  | b. | Consider the fuzzy sets A, B and C defined on X = [0,10] of real numbers by the membership grade functions ,  . Compute (i) (ii) (iii) iii) (iv). | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let be an arbitrary crisp function. Then show that for any fuzzified by the extension principal satisfies the equation | CO1 | A | 10 |
|  | b. | State and prove the Second Decomposition Theorem. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Let A be a fuzzy set defined on the set X where . Represent A using First decomposition Theorem. | CO1 | E | 10 |
|  | b. | Let  Prove that  i)  ii) | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Show that if c is a continuous fuzzy complement, then c has a unique equilibrium. | CO2 | A | 10 |
|  | b. | Let a function satisfy the axioms of monotonicity and is involutive then prove that c satisfies axioms of boundary condition and continuity and also show that c is a bijective function. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Prove that the standard fuzzy intersection is the only idempotent t – norm. | CO3 | A | 10 |
|  | b. | Let denote the class of Yagar t-norms then prove that *min (a,b)* for all | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Verify the commutative and associative operations for addition, multiplication and sub - distributivity for A = [1 , 2], B = [-1, 1] and  C = [3, 5]. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 7. | a. | Write a note on fuzzy neural networks. | CO4 | An | 10 |
|  | b. | Let \* ∈ {+, −, ., /} and let A, B denote continuous fuzzy numbers. Then, prove that the fuzzy set (A \* B)(z) = sup min[A(x), B(y)], z = x \* y is a continuous fuzzy number. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain fuzzy controllers in detail. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write short notes on multicriteria decision making. | CO6 | An | 20 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to recognize the basic concepts of fuzzy sets, fuzzy numbers and fuzzy systems |
| CO2 | Students will be able to classify the various operations on fuzzy sets |
| CO3 | Students will be able to solve the arithmetic operations on fuzzy numbers |
| CO4 | Students will be able to design the fuzzy systems using the basic concepts |
| CO5 | Students will be able to apply the concepts of fuzzification in decision making |
| CO6 | Students will be able to recognize and justify the best fuzzy decision making techniques |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 40 |  | 20 |  | 60 |
| CO2 |  |  | 10 |  |  |  | 10 |
| CO3 |  |  | 30 |  | 20 |  | 50 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 |  |  |  | 20 |  |  | 20 |
| CO6 |  |  |  | 20 |  |  | 20 |
|  | | | | | | | **180** |



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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 (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | If A=, then find the following using MATLAB.   1. Dimensions of a matrix 2. Inverse of the matrix 3. Determinant of matrix | CO1 | U | 6 |
|  | b. | Compute the factorial of 7 using for loop in MATLAB. | CO1 | A | 5 |
|  | c. | Create a MATLAB programme for the following mathematical function using the elseif statement : | CO1 | R | 5 |
|  |  |  |  |  |  |
| 2. | a. | Create a MATLAB code to find the derivatives for following function with respect to x. | CO2 | A | 6 |
|  | b. | Solve using MATLAB. | CO2 | U | 5 |
|  | c. | Create two vectors to represent the polynomial: and and also find the derivative of the product of the polynomial using MATLAB. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | Manipulate the string " Hello, 2023!” using the following methods in python and also write the output:   1. Replace 2. Upper 3. Case fold | CO3 | U | 6 |
|  | b. | Explain arithmetic operators in python with an example. | CO3 | R | 5 |
|  | c. | Write a python program to create an array of 5 elements and display all the array items. Also use slicing operator to display 1st to 4th element. | CO3 | A | 5 |
| 4. | a. | Create a python program using while loop to display the following output:   1. Print i as long as i is less than 5 2. Stop the loop when i is 3 3. Print a message once the condition is false | CO4 | A | 6 |
|  | b. | Explain the factorial and also write a python program to find the factorial of 8. | CO4 | A | 5 |
|  | c. | To find the greater of any two numbers in python, use the elif condition. | CO4 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | If A = and B= then add the two matrices using nested list. | CO4 | A | 8 |
|  | b. | Explain the following built in functions in list with an example:   1. Delete 2. Pop 3. Clear 4. Insert | CO4 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Write the detailed LaTeX script for the following output. | CO5 | A | 8 |
|  | b. | Write the program for the following table using LaTeX code with line width (0.5mm) and cell padding: | CO5 | A | 8 |
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| 7. | a. | Write the detailed LaTeX code for the following table: | CO5 | A | 8 |
|  | b. | Create a LaTeX Code for the following mathematical equations: | CO5 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Prepare a 5 slide presentation about the uses of LaTeX using beamer class. | CO6 | A | 10 |
|  | b. | Write a detailed curriculum vitae using LaTeX. | CO6 | A | 10 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 5 | 6 | 5 |  |  |  | 16 |
| CO2 |  | 5 | 11 |  |  |  | 16 |
| CO3 | 5 | 6 | 5 |  |  |  | 16 |
| CO4 |  | 13 | 19 |  |  |  | 32 |
| CO5 |  | 8 | 24 |  |  |  | 32 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **132** |



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| **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. | Write down the equation of the straight line passing through the points (x1,y1) and (x2,y2). | CO1/R | 1 |
| 2. | Define greatest circle. | CO1/R | 1 |
| 3. | If the eigen values of the matrix A =  is -2,3,6 find the eigen values of | CO2/R | 1 |
| 4. | Find the sum of the eigen values of matrix | CO2/R | 1 |
| 5. | Examine the convergence of the sequence | CO3/R | 1 |
| 6. | If p>1, the series = \_\_\_\_\_\_\_\_\_\_\_. | CO3/R | 1 |
| 7. | Write down Fourier series expansion of f(x) in the interval | CO4/R | 1 |
| 8. | Write down half range Fourier sine series expansion of f(x) in the interval | CO4/R | 1 |
| 9. | Find | CO5/R | 1 |
| 10. | Evaluate | CO5/R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Check whether the lines  and  are coplanar. | CO1/A | 3 |
| 12. | Express A as the sum of a symmetric and skew symmetric matrix where | CO2/U | 3 |

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| 13. | Show that the series  diverges if . | CO3/U | 3 |
| 14. | Write down half range Fourier cosine series expansion of f(x) = x in the interval | CO4/U | 3 |
| 15. | Evaluate | CO5/U | 3 |
| 16. | If  then find . | 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. |  | Find the shortest distance between the lines and | CO1/A | 12 |
| 18. |  | Find the eigen values and eigen vectors of the matrix A= | CO2/A | 12 |
| 19. |  | Test the convergence of the series | CO3/A | 12 |
| 20. |  | Evaluate the Fourier series expansion of f(x) = e-x in the interval | CO4/A | 12 |
| 21. | a. | Evaluate | CO5/U | 6 |
| b. | Evaluate | CO5/A | 6 |
| 22. | a. | Solve the system of equations.. | CO2/A | 6 |
| b. | Verify Cayley Hamilton theorem for thematrix. | CO2/A | 6 |
| 23. |  | Discuss the convergence of the series | CO3/A | 12 |
|  |  | **Compulsory** | | |
| 24. | a. | Find the values of and such that the surface  and  cut orthogonally at (1,-1,2). | CO6/A | 6 |
| b. | Find and where | CO6/U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to  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 Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 |  |  |  | 17 |
| CO2 | 2 | 3 | 24 |  |  |  | 29 |
| CO3 | 2 | 3 | 24 |  |  |  | 29 |
| CO4 | 2 | 3 | 12 |  |  |  | 17 |
| CO5 | 2 | 9 | 6 |  |  |  | 17 |
| CO6 |  | 9 | 6 |  |  |  | 15 |
|  | | | | | | | **100** |



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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)** | | | | | | | | |
| 1. | If when find | | | CO1/U | | | 1 | |
| 2. | The double point is called an isolated point if the tangent is \_\_\_\_\_\_ | | | CO1/R | | | 1 | |
| 3. | Legendre polynomial P3(x) is \_\_\_\_\_\_\_. | | | CO1/R | | | 1 | |
| 4. | Solve | | | CO2/E | | | 1 | |
| 5. | The function  is not analytic at \_\_\_\_\_\_\_\_\_\_\_. | | | CO4/U | | | 1 | |
| 6. | The C-R equations in Cartesian form are \_\_\_\_\_\_\_\_\_. | | | CO4/R | | | 1 | |
| 7. |  | | | CO5/E | | | 1 | |
| 8. | . | | | CO5/R | | | 1 | |
| 9. | Solve. | | | CO3/E | | | 1 | |
| 10. | Obtain the complete solution for | | | CO3/E | | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | |
| 11. | | Find the asymptotes of the curve | | | CO1/An | | 3 | |
| 12. | | Solve the Cauchy Euler equations | | | CO2/E | | 3 | |
| 13. | | Find the Centre and radius of the circle | | | CO4/U | | 3 | |
| 14. | | Find *L (.* | | | CO5/E | | 3 | |
| 15. | | Solve | | | CO3/U | | 3 | |
| 16. | | Write the three possible solutions of the one-dimensional wave equation. | | | CO3/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. | Expand ex cos y about (0, π/2) up to the third term using Taylor Series. | | | CO1/E | | 12 |
|  | |  |  | | |  | |  |
| 18. | | a. | Using method of variation of parameter, Solve | | | CO2/A | | 12 |
|  | |  |  | | |  | |  |
| 19. | | a. | Show that u = x3 – 3xy2 + 3x2 – 3y2 + 1 is harmonic. Find the corresponding analytic function f(z) and hence find the conjugate harmonic of ‘u’. | | | CO4/An | | 8 |
| b. | Find the value of a, b, c if f(z) = x-2ay + i (bx-cy) is analytic. | | | CO4/U | | 4 |
|  | |  |  | | |  | |  |
| 20. | | a. | Find the Laplace Transform of the Triangular wave function of period 2a, given by | | | CO5/An | | 6 |
| b. | Find *L ().* | | | CO5/E | | 6 |
|  | |  |  | | |  | |  |
| 21. | | a. | Solve | | | CO3/E | | 6 |
| b. | Solve | | | CO3/E | | 6 |
|  | |  |  | | |  | |  |
| 22. | | a. | Expand  in a Laurent’s series if (i)  (ii)  (iii) . | | | CO4/A | | 6 |
| b. | Evaluate using contour integration. | | | CO4/A | | 6 |
|  | |  |  | | |  | |  |
| 23. | | a. | Solve | | | CO2/E | | 12 |
|  | | **Compulsory:** | | | | | | |
| 24. | | a. | A tightly stretched string with fixed end points  and is initially at rest in its equilibrium position. If each of its points is given a velocity, find the displacement of the string at any distance  from one end at any time. | | | CO3/A | | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to evaluate surface area and volume using definite integral. |
| CO2 | The student will be able to understand solution of first and second order ODE. |
| CO3 | The student will be able to classify different types of higher order ODE and their solution. |
| CO4 | The student will be able to construct harmonic and bilinear transformations. |
| CO5 | The student will be able to evaluate definite integral using complex integration. |
| CO6 | The student will be able to apply MATLAB tools to solve mathematical problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 1 | - | 3 | 12 | - | 18 |
| CO2 | - | - | 12 | - | 28 | - | 40 |
| CO3 | 3 | 3 | 12 | 2 | - | - | 20 |
| CO4 | 1 | 8 | 12 | 8 | - | - | 29 |
| CO5 | 1 | - | - | 6 | 10 | - | 17 |
| CO6 | - | - | - | - | - | - | 0 |
|  | | | | | | | **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. | Define the relationship among the averages. | | CO1 | U | 1 |
| 2. | Find the mode of the following data 4,8,15, 12, 10, 18, 3, 11, 4, 11. | | CO1 | E | 1 |
| 3. | If X and Y are independent then covariance between X and Y defined as --------- | | CO2 | R | 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. | Define Conditional probability distribution. | | CO4 | R | 1 |
| 8. | State the properties of the cdf of a two- dimensional RV( X,Y) | | CO4 | U | 1 |
| 9. | Define types of continuous distribution. | | CO5 | U | 1 |
| 10. | State F-test formula. | | 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 | An | 3 |
| 12. | Define Spearman’s rank correlation. | | CO2 | U | 3 |
| 13. | From a well shuffled deck of 52 playing cards, find the probability of getting (a) a spade (b) 2 kings. | | CO3 | An | 3 |
| 14. | X is continuous random variable with probability density function given by f(x) = kx2 (0≤x≤1),Find the value of K. | | CO4 | U | 3 |
| 15. | Determine the binomial distribution with mean 4 and variance 3. | | CO5 | An | 3 |
| 16. | Define Null and 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. | 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 | 6 |
|  | b. | Find the Geometric mean for the following distribution of data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Age in years | 20 | 30 | 40 | 50 | 60 | 70 | 80 | | No.of members | 3 | 61 | 132 | 153 | 140 | 51 | 3 | | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | 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 | 6 |
|  | b. | Calculate the rank correlation coefficient for the following data:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Y | 2 | 4 | 1 | 5 | 3 | 8 | 7 | 6 | | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | In a coin tossing experiment, if the coin shows head, 1 die is thrown and the result is recorded. But if the coin shows tail, 2 dice are thrown and their sum is recorded. What is the probability that the recorded number will be 2? | CO3 | E | 6 |
|  | 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 |   (a)Find K, (b) Evaluate P(X< 3) (d) Evaluate the mean of X | CO3 | E | 6 |
|  |  |  |  |  |  |
| 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 | 6 |
|  | b. | The joint pdf of two –dimensional RV (X,Y) is given below by  *f(x,y)* = , 0<x<1 , 0 < y <2  = 0 , elsewhere  Compute (i)(X>1/2),(ii)P() | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | If X is normally distributed with mean 6 and standard deviation 5 find P (0≤X≤9). | CO5 | E | 6 |
|  | b. | If X is Poisson variable with parameter λ and if 3P(X = 2). | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | 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 | 6 |
|  | b. | In 120 throws of a single die, the following distribution of faces was observed.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Face | 1 | 2 | 3 | 4 | 5 | 6 | | Frequency | 30 | 25 | 18 | 10 | 22 | 15 |   Can you say that the die is biased? | CO6 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | In a city of sample 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% loss. | CO6 | An | 6 |
|  | b. | A sample of ten house owners is drawn and the following values of their incomes are obtained, mean Rs.6000 and S.D.650, test the hypothesis that the average income of house owners of the town is Rs.5500. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The following data relates to the daily income in an urban area.  Find the modal income of the following families.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Income | 0-100 | 100-200 | 200-300 | 300-400 | 400-500 | 500-600 | 600-700 | | No.of persons | 5 | 7 | 12 | 18 | 16 | 10 | 5 | | CO1 | A | 6 |
|  | 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 | | CO1 | A | 6 |

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|  | **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 | 12 | 3 | 13 |  | 29 |
| CO2 | 2 | 3 | 12 | - | - |  | 17 |
| CO3 | 1 | - | 1 | 3 | 12 |  | 17 |
| CO4 | 1 | 4 | - | 6 | 6 |  | 17 |
| CO5 | - | 1 | - | 3 | 12 |  | 16 |
| CO6 | 1 | 3 | - | 24 | - |  | 28 |
|  | | | | | | | **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 1, 2, 3 are Eigen values of matrix A, what are the Eigen values of 5A. | | CO1 | U | 1 |
| 2. | Every square matrix satisfies its own ------------ | | CO1 | R | 1 |
| 3. | Find the degree of the following homogeneous equation.  U =. | | CO2 | R | 1 |
| 4. | What is the value of  if ? | | CO2 | R | 1 |
| 5. | If then find | | CO3 | E | 1 |
| 6. | Write the derivative of a constant vector. | | CO3 | R | 1 |
| 7. | Compute the complementary function (C.F) for *(D2 – 4D + 4)y = 0* . | | CO4 | E | 1 |
| 8. | A ballistic pendulum is a device used to measure the ------------ | | CO5 | R | 1 |
| 9. | Write down the formula for kinetic energy of a body. | | CO5 | U | 1 |
| 10. | Define elastic collisions. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If the canonical form of the quadratic form is +-3 then find the Signature, Index and Nature of the quadratic form. | | CO1 | A | 3 |
| 12. | Evaluate  *dy dx.* | | CO2 | E | 3 |
| 13. | Find the gradient ϕ at (1,-2, 1), if ϕ = 3x2y−y3z2. | | CO3 | E | 3 |
| 14. | Evaluate the particular integral (P.I) for *(D2 +7D + 10) y = 5.* | | CO4 | E | 3 |
| 15. | Determine the mathematical representation of linear and Nonlinear vibration. | | CO5 | U | 3 |
| 16. | State the laws of Dynamic friction. | | 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. | Evaluate (i) characteristic equation (ii) Eigen value (iii) Eigen vector of the matrix A. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | If *x = u (1-v), y = uv,* then compute J1 and J2 and prove that *J1 J2 = 1.* | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Verify Gauss Divergence theorem for  taken over the cube bounded by the planes  and | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve (D2 + 4D + 3) y =. | CO4 | E | 6 |
|  | b. | Solve *(D2 + 9) = cos 3x.* | 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. How long the ball is in Air? 2. How far will it travel horizontally before it hits the ground? 3. How long does it take the golf ball to reach a height of 10 meter’s? | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the tangent and normal plane to the surface  *x* at (1,-3,2). | CO3 | E | 8 |
|  | b. | Evaluate where c is the curve x2 + y2 = 4 and  z = 2 using stokes theorem. | CO3 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Solve *(D2 – 2D + 2)y = x.* | CO4 | E | 8 |
|  | b. | A particle of mass 0.2kg undergoes simple harmonic motion according to the equation x (t) = 3sin πt +). [ t is in s and x in m].   1. What is the amplitude of oscillation? 2. What is the time period of oscillation? 3. What is the initial value of *x*? | CO4 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A body of weight 500 N is lying on a rough plane inclined at an angle of 250 with the horizontal. It is supported by an effort (P) parallel to the plane as shown in Fig.    Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 200. | CO6 | An | 9 |
|  | b. | Write the radon transform general form of the discrete and continuous functions *f(x, y).* | CO6 | R | 3 |

**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 | 2 | - | 12 | - | 3 | - | 17 |
| CO3 | 1 | - | - | 16 | 12 | - | 29 |
| CO4 | - | - | - | 4 | 24 | - | 28 |
| CO5 | 1 | 4 | - | 12 | - | - | 17 |
| CO6 | 7 | - | - | 9 | - | - | 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)**  **(Answer all the questions)** | | | | | |
| 1. | Find the determinant of the matrix A=. | | CO1 | U | 1 |
| 2. | Find the rank of the matrix. | | CO1 | U | 1 |
| 3. | If the Eigen values of the matrix A are -1, 2, 3 then the Eigen values of the matrix 3A are ------------. | | CO2 | R | 1 |
| 4. | The Eigen values of a Hermitian matrix are -------. | | CO2 | R | 1 |
| 5. | Evaluate. | | CO3 | U | 1 |
| 6. | Evaluate (7. | | CO3 | U | 1 |
| 7. | Evaluate . | | CO4 | U | 1 |
| 8. | Compute | | CO4 | R | 1 |
| 9. |  | | CO5 | R | 1 |
| 10. | If the function f(x) is even, then the Euler constant in the Fourier series is ------. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Solve the equations using Cramer’s rule. | | CO1 | A | 3 |
| 12. | Find the sum and product of the Eigenvalues of the matrix . | | CO2 | A | 3 |
| 13. | Evaluate | | CO3 | E | 3 |
| 14. | Evaluate | | CO4 | E | 3 |
| 15. | Evaluate using beta function. | | CO5 | E | 3 |
| 16. | Find the Fourier constant for the function in the interval. | | 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. | Find the inverse of the matrix | CO1 | E | 6 |
|  | b. | Test the consistency of the system of equations ;  ; . | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Reduce the quadratic form to canonical form by an orthogonal reduction. Also find its rank, index, signature and nature. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | If find the Jacobian of with respect to | CO3 | A | 6 |
|  | b. | Find the maxima and minima of Also find the maximum and minimum value. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate | CO4 | E | 6 |
|  | b. | Evaluate using beta and gamma functions. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and evaluate | CO5 | A | 6 |
|  | b. | Find the volume of tetrahedron bounded by the planes | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Using Gauss-Jordan elimination method, solve the system of equations: | CO1 | A | 6 |
|  | b. | Determine if the given function is continuous or discontinuous at the indicated points: , | CO3 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Diagonalise the matrix by means of an orthogonal transformation. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Obtain the Fourier series for in the interval | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Solve linear systems of equations using matrices. |
| CO2 | Find the Eigen values, Eigen vectors of matrices and diagonalise the matrices. |
| CO3 | Apply differentiation techniques to find extreme values of functions. |
| CO4 | Demonstrate knowledge in integration. |
| CO5 | Evaluate area and volume using definite integral. |
| CO6 | Express periodic functions as a series of sine and cosine functions. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 2 | 9 | 6 | 6 | - | 23 |
| CO2 | 2 | - | 27 | - | - | - | 29 |
| CO3 | - | 2 | 12 | 6 | 3 | - | 23 |
| CO4 | 1 | 1 | - | - | 15 | - | 17 |
| CO5 | 1 | - | 12 | - | 3 | - | 16 |
| CO6 | 1 | - | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **CO/BL** | | **Marks** | | |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | | | | |
| 1. | The radius of curvature of a circle is equal to its ------------ | | | CO1 / R | | 1 | | |
| 2. | The locus of the center of curvature is known as ------------- | | | CO1 / R | | 1 | | |
| 3. | The series | | | CO2 / U | | 1 | | |
| 4. | What is the value of | | | CO2 / R | | 1 | | |
| 5. | The number of elements in the basis of a vector space is called as ------ | | | CO3 / R | | 1 | | |
| 6. | State Rank-Nullity theorem. | | | CO3 / U | | 1 | | |
| 7. | If , then find div. | | | CO4 / U | | 1 | | |
| 8. | What is the torsion of a plane curve? | | | CO4 / R | | 1 | | |
| 9. | Given U=,find . | | | CO5 / U | | 1 | | |
| 10. | Find L(t2). | | | CO6 / U | | 1 | | |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | | | | |
| 11. | | Find the area of the region bounded by y=2x+1, y=3,y=5, and the y-axis. | | CO1 / U | | 3 | | |
| 12. | | If, find . | | CO2 / E | | 3 | | |
| 13. | | Let T:V3 V2 be a linear transformation defined by T(x, y, z)=(x-y,x+y). Find the value of T(u+v) for u=(1,2,3) and v=(4,2,0) | | CO3 / U | | 3 | | |
| 14. | | Find the value of ‘a’ if is solenoidal. | | CO4 / E | | 3 | | |
| 15. | | Compute the distance between the two vectors u=(7,1) and v=(3,2). | | CO5 / U | | 3 | | |
| 16. | | Find L(e2tsint). | | 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 evolute of the parabola y2=4ax. | | CO1 / A | | 12 |
|  | |  |  | |  | |  |
| 18. | | a | Test the convergence of the series by using Cauchy’s Root test. | | CO2 /A | | 6 |
| b | Evaluate . | | CO2 /E | | 6 |
|  | |  |  | |  | |  |
| 19 | | a | Find the range, rank, kernel, and nullity of the linear transformation  T: V2 V3 is defined as T(x, y) =(x-y, x+y,y). | | CO3 / A | | 6 |
| b | Define T: V3 V2 as T(x1, x2, x3) =(x1-x2, x1+x2).Prove that T is a Linear Transformation. | | CO3 / A | | 6 |
|  | |  |  | |  | |  |
| 20. | |  | Find the curvature and torsion of the curve x=acost, y=asint, z=bt. | | CO4 /An | | 12 |
|  | |  |  | |  | |  |
| 21. | | a. | A particle moves along the curve, where  is the time period. Find the component of velocity and acceleration atin the direction . | | CO4 / A | | 8 |
| b. | Find the directional derivative of  at  in the direction of. | | CO4 / A | | 4 |
|  | |  |  | |  | |  |
| 22. | |  | Let W=Span{x1,x2},where x1=,x2=,construct an orthogonal basis{v1,v2} of W. | | CO5 / A | | 12 |
|  | |  |  | |  | |  |
| 23. | | a. | Show that {u1,u2,u3}is an orthogonal set, where, u1=,u2= and  u3=. | | CO5 / A | | 6 |
| b. | Find ). | | CO6 / A | | 6 |
|  | |  | **Compulsory:** | | | | |
| 24. | |  | Solve by using Laplace Transforms y’’-3y’+2y=e3t, given y(0)=y’(0)=0. | | CO6 / A | | 12 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 1 | 1 | 6 | - | 9 |  | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 1 | 1 | 12 | 12 | 3 |  | 29 |
| CO5 | - | 4 | 18 | - | - | - | 22 |
| CO6 | - | 4 | 18 | - | - | - | 22 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | |
| 1. | Find the distance between the points (-2,-3) and (-4,4). | | CO1 | R | 1 |
| 2. | The equation of a straight line parallel to y-axis at a distance of 20 units on the right hand side of y- axis is \_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Find the slope and y-intercept of the straight line 4x-7y+1 =0. | | CO1 | U | 1 |
| 4. | Write the normal form of the line. | | CO2 | R | 1 |
| 5. | If 5 is the slope of a line AB, then find the slope of a line perpendicular to AB. | | CO2 | U | 1 |
| 6. | The equation of the bisector of the angles between the lines and is \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 7. | The parametric form of the equation of the circle is \_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 8. | = \_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | Check whether the function is continuous at x=3. | | CO4 | U | 1 |
| 10. | The value of | | CO4 | R | 1 |
| 11. | Find the critical points of the function . | | CO4 | A | 1 |
| 12. | If f(x) is odd, then the value of . | | CO5 | R | 1 |
| 13. | Evaluate | | CO5 | U | 1 |
| 14. | If , where u and v are functions of x, then | | CO4 | R | 1 |
| 15. | A line segment that goes from one point to another on the circle’s circumference is \_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 16. | Find the transpose of the matrix . | | CO6 | U | 1 |
| 17. | The matrix A is skew-symmetric if and only if \_\_\_\_\_\_. | | CO6 | R | 1 |
| 18. | Find the determinant of the matrix . | | CO6 | U | 1 |
| 19. | If A is singular then | | CO6 | R | 1 |
| 20. | If then find 4A. | | CO6 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the equation of the line passing through A(1,2) and B(-1,3). | | CO1 | A | 5 |
| 22. | Find the value of k so that the line passing through the points (3,k) and (2,7) is parallel to the line through the points (-1,4) and (0,6). | | CO1 | A | 5 |
| 23. | Calculate the area of the triangle whose vertices are A(1,2), B(4,2) and C(3,5). | | CO2 | A | 5 |
| 24. | If is a tangent to the circle , then find the value of ‘c’. | | CO3 | A | 5 |
| 25. | Differentiate the function . | | CO4 | A | 5 |
| 26. | If then find . | | CO4 | A | 5 |
| 27. | Evaluate using integration by parts. | | CO5 | A | 5 |
| 28. | Solve. | | CO5 | A | 5 |
| 29. | Evaluate . | | CO5 | A | 5 |
| 30. | If and B then find A+B, A-B and 5A-2B. | | CO6 | A | 5 |
| 31. | If and B then find AB and BA. | | CO6 | A | 5 |
| 32. | Find the inverse of . | | CO6 | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | If P(3,1), Q(2,3) and R(3,4) are three points, then find the angle between the straight lines PQ and QR. | CO1 | A | 5 |
|  | b. | Find the equation of the circle passing through the points (1, -6), (2, 1) and (5, 2). Also find its centre and radius. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 34. | a. | Evaluate | CO4 | U | 5 |
|  | b. | Find the maximum and minimum values of . | CO4 | A | 10 |
|  |  |  |  |  |  |
| 35. | a. | If , then find | CO4 | A | 7 |
|  | b. | Find the area of the quadrilateral whose vertices are (-9,-2), (-8,-4), (2,2) and (1,-3). | CO2 | A | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 1 | 15 | - | - | - | 18 |
| CO2 | 2 | 1 | 13 | - | - | - | 16 |
| CO3 | 2 | - | 15 | - | - | - | 17 |
| CO4 | 3 | 1 | 33 | - | - | - | 37 |
| CO5 | 1 | 1 | 15 | - | - | - | 17 |
| CO6 | 2 | 3 | 15 | - | - | - | 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 distance between the points (2, 3) and (4, 5). | | CO1 | A | 1 |
| 2. | The point which present exactly at the centre of a segment is called ......... | | CO1 | R | 1 |
| 3. | The intercept form of the equation of a line is ........... | | CO1 | R | 1 |
| 4. | Write the equation of a line in slope-intercept form with a slope of – 5 and  *y*-intercept of 3. | | CO1 | A | 1 |
| 5. | The product of the slope of perpendicular lines is ........... . | | CO2 | R | 1 |
| 6. | The general form of equation of the circle is .......... | | CO3 | R | 1 |
| 7. | If a person walk around a circle of diameter 100*m,* then how far did the person walk? | | CO3 | U | 1 |
| 8. | Write the equation of the tangent at to the circle . | | CO3 | U | 1 |
| 9. | Write the equation of the circle whose centre is (-1, 2) and radius is 5. | | CO3 | A | 1 |
| 10. | Evaluate . | | CO4 | An | 1 |
| 11. | =? | | CO4 | A | 1 |
| 12. |  | | CO4 | U | 1 |
| 13. | Evaluate . | | CO5 | E | 1 |
| 14. | Solve . | | CO5 | A | 1 |
| 15. | =? | | CO5 | R | 1 |
| 16. | Write a 3x3 identity matrix. | | CO6 | R | 1 |
| 17. | What is an upper triangular matrix? | | CO6 | R | 1 |
| 18. | If , find . | | CO6 | E | 1 |
| 19. | Find the determinant of . | | CO6 | E | 1 |
| 20. | What is the condition of a symmetric matrix? | | CO6 | U | 1 |
|  |  | |  |  |  |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the acute angle between the two lines *y* = 2*x* + 1 and *y* = - 3*x*. | | CO1 | A | 5 |
| 22. | Find the equation of the line that is parallel to *y* = 2*x* + 1 and passes though the point (5, 4). | | CO2 | A | 5 |
| 23. | Find out the point of intersection of two lines *x* - 2*y* = 8 and 2*x* + *y* = 5*.* | | CO2 | A | 5 |
| 24. | Find the equation of the circle passing through the points (1, 0), (-1, 0) and (0, 1). Find its centre and radius. | | CO3 | An | 5 |
| 25. | Determine whether the function  is continuous at *x* = -1. | | CO4 | E | 5 |
| 26. | If , find . | | CO4 | E | 5 |
| 27. | Find i) and ii) . | | CO4 | E | 5 |
| 28. | Solve . | | CO5 | E | 5 |
| 29. | Solve  and . | | CO5 | E | 5 |
| 30. | If  and , find **A-**2**B**. | | CO6 | C | 5 |
| 31. | Prove (k**A**)T = k**A**T, if and *k =* 2. | | CO6 | A | 5 |
| 32. | Find (**AB**)T, if and . | | CO6 | C | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | If the area of a quadrilateral is 19 sq. units whose vertices are A(−3, *a*), B(−1, 4), C(3, 2), D(1, −2), find *a*. | CO1 | E | 5 |
|  | b. | Find the equation of the bisector of the acute angle between the straight lines 3*x* + 4*y* -11 = 0 and 12*x* - 5*y* -2 = 0. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 34. | a. | Find *a* and *b*. | CO4 | E | 7 |
|  | b. | Solve . | CO5 | E | 8 |
|  |  |  |  |  |  |
| 35. | a. | Find the value of *p*, if the line 3*x* + 4y – *p* = 0 is a tangent to the circle . | CO3 | A | 5 |
|  | b. | Find **A**-1, if . | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 |  | 7 |  | 5 |  | 14 |
| CO2 | 1 |  | 10 | 10 |  |  | 21 |
| CO3 | 1 | 2 | 6 | 5 |  |  | 14 |
| CO4 |  | 1 | 1 | 1 | 22 |  | 25 |
| CO5 | 1 |  | 1 |  | 19 |  | 21 |
| CO6 | 2 | 1 | 5 |  | 2 | 20 | 30 |
|  | **7** | **4** | **30** | **16** | **48** | **20** | **125** |



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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | |
| 1. | In a 2D coordinate plane, the distance (*d*)between two points *A(x1, y1)* and *B(x2, y2)* is ................ | | CO1 | R | 1 |
| 2. | Find the midpoint between the following points (1, 1) and (7, 9). | | CO1 | A | 1 |
| 3. | Find the equation of a straight line parallel to *x*-axis at a distance of 10 units above the *x*-axis. | | CO1 | A | 1 |
| 4. | Rewrite the given linear equation in standard form, -*y* = 3*x* + 6. | | CO1 | U | 1 |
| 5. | If two straight lines lie in the same plane, and if they never intersect each other, then they are called ................. | | CO2 | R | 1 |
| 6. | The equation of the circle with origin (0, 0) is ........... | | CO3 | R | 1 |
| 7. | The distance from from centre to any point of the circle is ............ | | CO3 | U | 1 |
| 8. | Write down the equation of the circle whose centre is at the origin and radius is 3 units. | | CO3 | A | 1 |
| 9. | Find the equation of the tangent to the circle at (-4, 3). | | CO3 | A | 1 |
| 10. | Evaluate . | | CO4 | E | 1 |
| 11. |  | | CO4 | A | 1 |
| 12. | Evaluate . | | CO4 | E | 1 |
| 13. | Solve . | | CO5 | E | 1 |
| 14. |  | | CO5 | R | 1 |
| 15. | =? | | CO5 | R | 1 |
| 16. | Is symmetric? Why? | | CO6 | U | 1 |
| 17. | If , then trace of **A** is ........... | | CO6 | E | 1 |
| 18. | Give an example for a column matrix. | | CO6 | U | 1 |
| 19. | If , find 2**A**. | | CO6 | C | 1 |
| 20. | If **A**, **B** and **C** are three matrices, **A**(**B**+**C**) = ......... | | CO6 | R | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | The line 3*x* + 7*y* - 42 = 0 forms a triangle with the coordinate axes. Find the area of the triangle. | | CO1 | An | 5 |
| 22. | Prove that the lines 3*x* - 2*y* – 1 = 0 and 9*x* - 6*y* + 5 = 0 are parallel. | | CO2 | E | 5 |
| 23. | Find the area of a triangle with the vertices: A(3, 4), B(4, 7), and C(6, −3). | | CO2 | A | 5 |
| 24. | Find the equation of the circle passing through the point (2, 1) and having its centre at (-3, -4). | | CO3 | An | 5 |
| 25. | Find . | | CO4 | E | 5 |
| 26. | If , find . | | CO4 | E | 5 |
| 27. | Find . | | CO4 | A | 5 |
| 28. | Evaluate . | | CO5 | A | 5 |
| 29. | Evaluate . | | CO5 | A | 5 |
| 30. | and . Prove (**A**+**B**)T = **A**T + **B**T. | | CO6 | E | 5 |
| 31. | Evaluate the determinant . | | CO6 | E | 5 |
| 32. | Find the **A**-1 of. | | CO6 | C | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Find the acute angle between the two lines 3*x -* 2*y* + 7 = 0and  2*y +* 4*x* -3=0. | CO1 | A | 5 |
|  | b. | Find the equation of the obtuse angle bisector of lines 4*x* - 3*y* + 10 = 0 and 8*y* - 6*x* - 5 = 0. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 34. | a. | Solve . | CO5 | E | 5 |
|  | b. | Find the maxima and minima of and find maximum value and minimum value. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 35. | a. | If one end of diameter of the circle is (8, 9), find the other end. | CO3 | A | 5 |
|  | b. | If , prove **AA**-1 = **A**-1**A** = **I.** | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 7 | 5 |  |  | 14 |
| CO2 | 1 |  | 5 | 10 | 5 |  | 21 |
| CO3 | 1 | 1 | 7 | 5 |  |  | 14 |
| CO4 |  |  | 16 |  | 12 |  | 28 |
| CO5 | 2 |  | 10 |  | 6 |  | 18 |
| CO6 | 1 | 2 |  |  | 11 | 16 | 30 |
|  | **6** | **4** | **45** | **20** | **34** | **16** | **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)**  **(Answer all the questions)** | | | | | |
| 1. | For the p-series  is …….. | | CO1 | R | 1 |
| 2. | Taylor series expansion reduces to Maclaurin series when a = ……. | | CO1 | U | 1 |
| 3. | and | | CO2 | R | 1 |
| 4. | Curvature of a straight line is ………. | | CO2 | A | 1 |
| 5. | Explain the root mean square value of a function f(x) defined in | | CO3 | U | 1 |
| 6. | Define a solenoidal vector. | | CO4 | R | 1 |
| 7. | If , find the value of . | | CO4 | U | 1 |
| 8. | State Green’s theorem. | | CO5 | U | 1 |
| 9. | Solve | | CO6 | A | 1 |
| 10. | Find the particular integral of | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Test the convergence of the sequence whose general term is . | | CO1 | A | 3 |
| 12. | Compute the value of | | CO2 | A | 3 |
| 13. | What are the values of and  in the Fourier expansion of an even function in | | CO3 | U | 3 |
| 14. | For a given function  find the value of | | CO4 | An | 3 |
| 15. | Evaluate | | CO5 | E | 3 |
| 16. | Find the complete solution 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. | Test the convergence of the series | CO1 | A | 6 |
|  | b | Test for convergence of the alternating series | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Show that the evolute of the parabola  is the curve | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the Fourier series of | CO3 | An | 6 |
|  | b | Compute the first two harmonics for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 30 | 60 | 90 | 120 | 150 | 180 | | f(x) | 2.34 | 3.01 | 3.68 | 4.15 | 3.69 | 2.20 | | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | If , then evaluate . | CO3 | An | 6 |
|  | b | Find the maxima and minima of the function | CO3 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Prove that  is solenoidal as well as irrotational. Also find the scalar potential of  . | CO4 | E | 6 |
|  | b | Find the area between the curves | CO4 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Verify Gauss’s divergence theorem for  over the cube bounded by. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Solve | CO6 | A | 6 |
|  | b. | Solve | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24 | a. | Solve | CO6 | E | 6 |
|  | b | Solve by , by the method of variation of parameters. | CO6 | E | 6 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to evaluate surface area and volume using definite integral. |
| CO2 | The student will be able to express functions as infinite series. |
| CO3 | The student will be able to apply differentiation techniques to find extreme values of functions. |
| CO4 | The student will be able to calculate gravity and mass using integration techniques. |
| CO5 | The student will be able to relate vector spaces with magnetic field and moving fluid. |
| CO6 | The student will be able to solve linear partial differential equations of first order. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 15 |  |  |  | 17 |
| CO2 | 1 |  | 16 |  |  |  | 17 |
| CO3 |  | 4 |  | 24 |  |  | 28 |
| CO4 | 1 | 1 |  | 3 | 15 |  | 18 |
| CO5 |  | 1 |  | 12 | 3 |  | 16 |
| CO6 |  | 4 | 12 |  | 12 |  | 28 |
|  | | | | | | | **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. | If 1, 2, 3 are Eigen values of matrix A, what are the Eigen values of 2A. | | CO1 | U | 1 |
| 2. | Determine the nature of the Canonical form 2x2+3 y2+6z2. | | CO1 | E | 1 |
| 3. | Write the formula used in Regula Falsi method. | | CO2 | R | 1 |
| 4. | (i) Simpson’s 1/3rd rule is applicable only when the number ordinates n is ------  (ii) Simpson’s 3/8th rule is applicable only when the number ordinates n is multiple of ------------ | | CO2 | R | 1 |
| 5. | Classify the equation uxx +2uxy+ uyy = 0. | | CO3 | R | 1 |
| 6. | Evaluate | | CO3 | A | 1 |
| 7. | L (1) = --------------- | | CO4 | U | 1 |
| 8. | Z (an) = ----------------- | | CO5 | R | 1 |
| 9. | The Hamiltonian path of the graph is \_\_\_\_\_\_\_\_\_.  **C**  **A**  **D**  **B** | | CO6 | U | 1 |
| 10. | Define Regular graph. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the sum and product of all the Eigen values of the matrix. | | CO1 | A | 3 |
| 12. | Construct the forward difference table for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 40 | 50 | 60 | 70 | 80 | | y | 184 | 204 | 226 | 250 | 276 | | | CO2 | A | 3 |
| 13. | Write down (i) Diagonal five point formula. (ii) Standard five point formula. | | CO3 | R | 3 |
| 14. | Evaluate L (+ t +sin2t). | | CO4 | E | 3 |
| 15. | Determine Z (3n + 5). | | CO5 | A | 3 |
| 16. | Draw the complete graph of and | | 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. | State Cayley Hamiltonian theorem and verify for the matrix  . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the real positive root of 3x – cosx − 1 = 0 by Newton’s method correct to three decimal places. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Using Taylor’s series method, Compute y (0.1) given = x + y and  y (0) = 0. | CO3 | A | 4 |
|  | b. | Solvegiven Assume h = 1, find the values of u up to t = 5. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 20. | a. | Find the Fourier transform of for hence Evaluate dx . | CO4 | An | 8 |
|  | b. | Find the inverse Laplace transform of . | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Solve – 5 +6 = with = 0, = 1 using Z transform. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the inverse Z transform of . | CO5 | A | 8 |
|  | b. | Show that Z = hence evaluate Z. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Solve for a positive root of – 4x +1= 0. by Regula Falsi method . | CO2 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | i. Find Euler circuit and Hamiltonian circuit from the following figure.    ii. From diagram below find the following (a) G1∪ G2 (b) G1∩G2  (c) G1G2 | CO6 | An | 12 |

**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 | 3 | - | 13 | - | 17 |
| CO2 | 2 | - | 15 | - | 12 | - | 29 |
| CO3 | 4 | - | 5 | 8 | - | - | 17 |
| CO4 | - | 1 | 4 | 8 | 3 | - | 16 |
| CO5 | 1 | - | 15 | - | 12 | - | 28 |
| CO6 | 1 | 1 | - | 15 |  |  | 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)**  **(Answer all the questions)** | | | | | |
| 1. | Find  if . | | CO1 | E | 1 |
| 2. | Find , if . | | 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  and , then find the Wronskian of and . | | CO2 | E | 1 |
| 5. | The generator function for Rodrigue’s Formula is given by \_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The value of the Bessel function  \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Find the complementary function of the PDE if the roots of the auxiliary equation are 0,2,5,7. | | CO4 | U | 1 |
| 8. | The notation ‘’ in partial differential equation represents \_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 9. | In finding the Fourier series expansion of the function in the interval , the value of  is \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | The one-heat wave equation is given by \_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Is a homogenous function? What is its order? | | CO1 | E | 3 |
| 12. | Solve . | | CO2 | E | 3 |
| 13. | Test the convergence of the logarithmic series. | | CO3 | An | 3 |
| 14. | Solve . | | CO4 | E | 3 |
| 15. | Find the value of in the Fourier series expansion of the function, in the interval. | | 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. |  | A rectangular box open at the top is to have volume of 108 cubic ft. Find the dimension of the box requiring least material for its construction. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Using method of variation of Parameter solve . | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Express , in terms of Legendre Polynomials. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve | CO4 | E | 6 |
| b. | Solve | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. |  | Obtain a half range cosine series for .  Deduce the sum of the series . | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Express the function in a Fourier series expansion in the interval. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A tightly stretched string with fixed end points at and  is initially in equilibrium position. It is set to vibrate by giving each point a velocity. Find the displacement of the string at any distance  from one end at any point. | CO6 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | An insulated rod of length  has its ends A and B maintained at 00 C and 1000 C respectively until steady state condition prevails. If B is suddenly reduced to 00 C and A is maintained at 00 C, find the temperature at a distance  from A at time ‘’. | 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | - | - | 16 | - | 17 |
| CO2 | - | - | 1 | - | 16 | - | 17 |
| CO3 | 2 | - | 12 | 3 | - | - | 17 |
| CO4 | - | 1 | 1 | - | 15 | - | 17 |
| CO5 | 4 | - | 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  and are in a system of linear equation, find the value of . | | CO1 | R | 1 |
| 3. | The roots of the characteristic equation are called \_\_\_\_\_\_\_\_\_\_. | | 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 , using Euler’s method is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 6. | The formula to solve the partial differential equation  using Bender-Schmidt recurrence equation is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Evaluate \_\_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 8. | \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | What is a complete 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. | Given , , determine the value of at taking  by Euler’s 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. | a. | Find the inverse of the matrix  using Gauss–Jordan elimination method. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Reduce the quadratic form  to canonical form by orthogonal reduction and hence find its nature. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Compute , given , , by taking  using fourth order Runge-Kutta Method. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve the differential equation, when ,  at , using Laplace transforms. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | 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. | a. | Solve the difference equation using Z – transforms, given . | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | 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 | 1 | - | 12 | - | 15 | - | 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)**  **(Answer all the questions)** | | | | | |
| 1. | Find the inverse of the matrix A=. | | CO1 | U | 1 |
| 2. | What are the Eigen values of matrix A-1 if 2, 4, 6 are the Eigen values of matrix A? | | CO1 | U | 1 |
| 3. | The general solution of the Clairaut’s equation  is \_\_\_\_ | | CO2 | R | 1 |
| 4. | Find the complementary function of | | CO2 | E | 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. | When a function has neither maximum nor minimum, then the stationary point is known as\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Evaluate = | | CO4 | A | 1 |
| 8. | Evaluate β | | CO5 | A | 1 |
| 9. | In integral calculus, represents\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| 10. | = \_\_\_\_\_\_. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the sum and product of all Eigen values of | | CO1 | A | 3 |
| 12. | Solve . | | CO2 | E | 3 |
| 13. | If u=cos (5x+7y) find the partial derivative Ux ,Uy ,Uxy . | | CO3 | U | 3 |
| 14. | If , then =\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | A | 3 |
| 15. | Compute | | CO6 | E | 3 |
| 16. | Evaluate | | 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. | Evaluate (i) Characteristic equation (ii) Eigen values (iii) Eigen vectors of the matrix  A= | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Using method of variation of parameter, solve | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | If .Compute the Jacobian and prove that | CO4 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate (i) ∫ 𝑥2 𝑒3x 𝑑𝑥. (ii) | CO3 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration in and hence evaluate. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve . | CO2 | E | 12 |
|  |  |  |  |  |  |
| 23. | a. | Find the maxima and minima of 𝑓(𝑥) = 2𝑥3 − 3𝑥2 − 36𝑥 + 10. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the volume of the sphere *x*2 + *y*2 + *z*2 = *a*2. | CO6 | E | 12 |

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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **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 Taxonomy** | | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| CO1 | |  | 2 | 3 | - | 12 | - | 17 | |
| CO2 | | 1 | - | 13 | - | 15 |  | 29 | |
| CO3 | | 2 | 3 | - | - | 12 | - | 17 | |
| CO4 | | - | - | 4 | - | 12 |  | 16 | |
| CO5 | | - | - | 1 | 12 | - | - | 13 | |
| CO6 | | 1 | - | 1 | 12 | 18 | - | 32 | |
|  | | | | | | | | **124** | |



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| --- | --- | --- | --- |
| **Course Code** | **20MA1016** | **Duration** | **3hrs** |
| **Course Name** | **NUMERICAL COMPUTING USING MATLAB** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **CO/BL** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If one root of the algebraic equation is , then another root is \_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 / U | | 1 |
| 2. | If a number is correct to decimal places, the absolute error is \_\_\_\_\_\_\_\_\_\_. | | | CO1 / R | | 1 |
| 3. | The order of the convergence of Newton-Raphson method is \_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 / R | | 1 |
| 4. | The condition for the convergence of the iteration method to solve algebraic equation is \_\_\_\_\_\_\_\_\_\_\_. | | | CO3 / R | | 1 |
| 5. | Solve the system of equations and , find the value of c. | | | CO2 / U | | 1 |
| 6. | The Gauss-Elimination method is used to solve the system of \_\_\_\_\_\_\_\_\_ equations. | | | CO3 / U | | 1 |
| 7. | The Newton’s forward difference formula is used to find the \_\_\_\_\_\_\_\_\_\_\_ of the function y = f(x). | | | CO4 / R | | 1 |
| 8. | ------------- interpolation formula is used to find the value of x when the value of y is given. | | | CO4 / U | | 1 |
| 9. | The Simpson’s 3/8th rule is applicable if the subinterval n is \_\_\_\_\_\_\_\_\_\_. | | | CO5 / U | | 1 |
| 10. | Write Euler’s formula. | | | CO6 / R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | | Round off the number 865250 to 4 significant figures and then compute the absolute error. | | | CO1 / A | 3 |
| 12. | | Find the first iteration value of the algebraic equation using bisection method. | | | CO1 / A | 3 |
| 13. | | Solve the system of equations x+2y+z=3; 2x+3y+3z=10; 3x-y+2z=13 using the Gauss elimination method. | | | CO3 / A | 3 |
| 14. | | Fit a parabola of the form passing through the points (0,0), (1,1), (2,20) | | | CO4 / A | 3 |
| 15. | | From the following table find the area bounded by the curve and the x-axis from x=7.47 to x=7.52 using the Trapezoidal rule.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 7.47 | 7.48 | 7.49 | 7.50 | 7.51 | 7.52 | | y | 1.93 | 1.95 | 1.98 | 2.01 | 2.03 | 2.06 | | | | CO5 / A | 3 |
| 16. | | Write Runge-Kutta fourth order formulas. | | | 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. | Form the third-degree equation two of whose roots are 1-i and 2. | | CO1 / A | 6 |
| b. | Solve given -1+i is a root. | | CO1 / A | 6 |
|  | |  |  | |  |  |
| 18. | |  | Find a positive root of correct to four decimal places by using the bisection method. | | CO1 / A | 12 |
|  | |  |  | |  |  |
| 19. | |  | Solve the system of equations 8x-3y+2z=20; 4x+11y-z=33; 6x+3y+12z=35 using the Gauss-Seidal method | | CO3 / A | 12 |
|  | |  |  | |  |  |
| 20. | | a. | Use Lagrange’s interpolation formula, find y(10) from the following table:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 5 | 6 | 9 | 11 | | y | 12 | 13 | 14 | 16 | | | CO4 / A | 6 |
| b. | Find the value of y at x=21 from the following table using the suitable Newton’s difference formula   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 20 | 23 | 26 | 29 | | y | 0.3420 | 0.3907 | 0.4384 | 0.4848 | | | CO4 / A | 6 |
|  | |  |  | |  |  |
| 21. | |  | The population of a certain town is given below. Find the rate of growth of the population in the year 1931 and 1971.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year (x) | 1931 | 1941 | 1951 | 1961 | 1971 | | Population (in thousands) y | 40.62 | 60.80 | 79.95 | 103.56 | 132.65 | | | CO5 / A | 12 |
|  | |  |  | |  |  |
| 22. | |  | Find a root of the equation by using the Secant method. | | CO1 / A | 12 |
|  | |  |  | |  |  |
| 23. | |  | Evaluate using (i) Trapezoidal rule (ii) Simpson’s 1/3rd rule (iii) Simpson’s 3/8th rule | | CO5 / A | 12 |
|  | |  | **Compulsory:** | | | |
| 24. | |  | Solve given y(1)=0 and find y(1.1), y(1.2) by using Taylor’s series method. | | CO6 / A | 12 |

CO – COURSE OUTCOME BL-BLOOMS’ LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Infer the knowledge with different kind of numerical methods for solving the problems in Biotechnology. |
| CO2 | Develop knowledge in curve fitting. |
| CO3 | Solve the system of linear algebraic equations using iterative process. |
| CO4 | Build the knowledge in interpolation. |
| CO5 | Evaluating integration using numerical techniques. |
| CO6 | Solve ordinary differential equations using numerical techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 42 | - | - | - | 44 |
| CO2 | - | 1 | - | - | - | - | 1 |
| CO3 | 2 | 1 | 15 | - | - | - | 18 |
| CO4 | 1 | 1 | 15 | - | - | - | 17 |
| CO5 | - | 1 | 27 | - | - | - | 28 |
| CO6 | 1 | - | 15 | - | - | - | 16 |
|  | | | | | | | **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)**  **(Answer all the questions)** | | | | | |
| 1. | If  and then calculate A+B. | | CO1 | U | 1 |
| 2. | What is the value of the determinant if any two rows or columns are identical? | | CO1 | R | 1 |
| 3. | Determine the sum and product of the eigenvalues of the matrix . | | CO2 | U | 1 |
| 4. | If  is one of the eigenvectors of a 3 x 3 matrix. What is the normalized eigenvector of X? | | CO2 | U | 1 |
| 5. | Evaluate . | | CO3 | U | 1 |
| 6. | Differentiate  with respect to x. | | CO3 | U | 1 |
| 7. | = \_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | Integrate cos3x with respect to x. | | CO4 | R | 1 |
| 9. | Write the relation between Beta and Gamma functions. | | CO5 | R | 1 |
| 10. | The Fourier coefficient bn for the half range Sine series in the interval  (0, π) is \_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the inverse of the matrix . | | CO1 | U | 3 |
| 12. | Two eigenvalues of the matrix are 1 and 2. Find the third eigenvalue. | | CO2 | U | 3 |
| 13. | Find . | | CO3 | A | 3 |
| 14. | Evaluate . | | CO4 | A | 3 |
| 15. | Change the order of integration in . | | CO5 | U | 3 |
| 16. | Obtain the value of a0 in the Fourier series expansion for the function . | | 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. | Find the trace and determinant value of the matrix . | CO1 | A | 4 |
|  | b. | Solve the system of equations using Cramer’s rule  . | CO1 | A | 8 |
|  |  |  |  |  |  |
| 18. | a. | Find the rank of the matrix . | CO1 | A | 4 |
|  | b. | Solve the following system of equations by Gauss elimination method.  . | CO1 | A | 8 |
|  |  |  |  |  |  |
| 19. | a. | Find the eigenvalues and eigenvectors of the matrix . | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Using Cayley-Hamilton theorem, find A3 and A-1 for the matrix | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Determine if the given function  is continuous or discontinuous at the indicated points (i) x = 0 and (ii) x =3. | CO3 | An | 6 |
|  | b. | If  and , find the Jacobian of x and y with respect to u and v. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Integrate xlogx with respect to x. | CO4 | E | 6 |
|  | b. | Using Bernoulli’s formula, calculate . | CO4 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Calculate the volume of the solid bounded by the planes x = 0, y = 0,  x + y + z = a and z = 0. | CO5 | A | 6 |
|  | b. | Express  in terms of gamma function. | CO5 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Compute the first two harmonics of the Fourier series of f(x) given in the following table.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  |  |  |  |  |  | | y | 1 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1 | | CO6 | An | 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 24 |  |  |  | 29 |
| CO2 |  | 5 | 24 |  |  |  | 29 |
| CO3 |  | 2 | 9 | 6 |  |  | 17 |
| CO4 | 2 |  | 3 |  | 12 |  | 17 |
| CO5 | 1 | 3 | 6 |  | 6 |  | 16 |
| CO6 | 1 |  | 3 | 12 |  |  | 16 |
|  | | | | | | | **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)** | | | | |
| 1. | Solve *(D2+6D+9)y=0.* | CO1 | U | 1 |
| 2. | Determine the order and degree of the DE: | CO1 | U | 1 |
| 3. | The complete solution of is \_\_\_\_\_\_\_. | CO2 | R | 1 |
| 4. | Solve | CO2 | U | 1 |
| 5. | One dimensional wave equation is \_\_\_\_\_\_\_\_\_. | CO3 | R | 1 |
| 6. | Write the two dimensional heat equation. | CO3 | R | 1 |
| 7. |  | CO4 | R | 1 |
| 8. |  | CO4 | R | 1 |
| 9. |  | CO5 | R | 1 |
| 10. | Fourier sine transform of a function *f(x)* is \_\_\_\_\_\_\_\_\_\_. | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Find P.I. of. | CO1 | U | 3 |
| 12. | Solve | CO2 | U | 3 |
| 13. | Write all the possible solutions of one dimensional heat equation. | CO3 | R | 3 |
| 14. | Find | CO4 | E | 3 |
| 15. | Find | CO5 | E | 3 |
| 16. | Find if FFCT | 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. | CO1 | U | 12 |
| 18. | Solve. | CO2 | U | 12 |
| 19. | A tightly stretched string with fixed end points x=0 and x=l is initially in a position given by If it is released from rest from this position, find the displacement of the string at any time t. | CO3 | A | 12 |
| 20. | Evaluate | CO4 | E | 12 |
| 21. | Evaluate using partial fraction method. | CO5 | E | 12 |
| 22. | Solve given that using Laplace Transforms. | CO5 | A | 12 |
| 23. | Solve *x*( | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | |
| 24. | Find FFCT and FFST of in (0, | CO6 | A | 12 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 17 | - | - | - | - | 17 |
| CO2 | 1 | 28 | - | - | - | - | 29 |
| CO3 | 5 | - | 12 | - | - | - | 17 |
| CO4 | 2 | - | - | - | 15 | - | 17 |
| CO5 | 1 | - | 12 | - | 15 | - | 28 |
| CO6 | 1 | - | 15 | - | - | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20MA1019** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR DATA SCIENCE AND MACHINE LEARNING IN CIVIL 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. | Find the mode from the following data of monthly income of employees of a company in Rs.4391, 4565, 8976, 114, 4564, 23098, 1234, 4564. | | CO1 | U | 1 |
| 2. | Calculate the mean for the following data:  7,19,21,18,23,12,28. | | CO1 | R | 1 |
| 3. | Determine the rank correlation coefficient if and n = 10. | | CO2 | U | 1 |
| 4. | The line of regression of y on x is \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | Find the probability that a non-leap year selected at random consists of 53 Sundays. | | CO3 | U | 1 |
| 6. | The probability of getting an odd number when a fair die is thrown is \_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | If X is a random variable which takes finite values then X is called \_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | Find mean of a continuous RV X. The pdf of X is given by | | CO4 | R | 1 |
| 9. | The variance of an exponential distribution is \_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Define Type II error in sampling. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | The heights of sports persons are listed below. Find the mean and median.  142,140,130,150,160,135,158,132. | | CO1 | A | 3 |
| 12. | 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 |   Find the rank correlation coefficient. | | CO2 | A | 3 |
| 13. | If the probability that a communication system has high selectivity is 0.54 and the probability that it will have high fidelity is 0.81 and the probability that it will have both is 0.18. What is the probability that:  (i) a system with high fidelity will also have high selectivity?  (ii) a system with high selectivity will also have high fidelity? | | CO3 | A | 3 |
| 14. | Find the mean of a random variable X, when a fair die is thrown. | | CO4 | A | 3 |
| 15. | The number of monthly breakdowns of a computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month without a breakdown. | | CO5 | A | 3 |
| 16. | In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers? | | 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. | The following table shows the marks obtained by 100 candidates in an examination. Calculate the mean, median and mode.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | | Number of students | 3 | 16 | 26 | 31 | 16 | 8 | | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the correlation coefficient from the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 68 | 64 | 75 | 50 | 64 | 80 | 70 | 40 | 55 | 64 | | Y | 62 | 58 | 68 | 45 | 81 | 60 | 68 | 48 | 50 | 70 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | In a shooting test, the probability of hitting the target is ½ for A, 2/3 for B and 3/4 for C. If all of them fire at the target, find the probability that (i) at least 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 | 8 | | **p(x)** | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |  1. Find the value of a. 2. Evaluate P(X<3). 3. Find the mean of the distribution X. 4. Find the variance of the distribution X. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 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 Rs.72. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Fit a Poisson distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 16 | |  | 5 | 18 | 28 | 12 | 7 | 6 | 4 | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | The joint probability mass function of (X,Y) is given by 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. | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B have 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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to determine the statistical measures of data. |
| CO2 | The students will be able analyze the linear relationship of variables using correlation and regression models. |
| CO3 | The students will be able to apply the concept of probability in machine learning problems. |
| CO4 | The students will be able to understand the randomness in date in real time application. |
| CO5 | The students will be able to model the data using probability distributions. |
| CO6 | The students will be able to develop the knowledge in decision making. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 15 | - | - | - | 17 |
| CO2 | 1 | 1 | 15 | - | - | - | 17 |
| CO3 | 1 | 1 | 15 | - | - | - | 17 |
| CO4 | 1 | 1 | 15 | - | 12 | - | 29 |
| CO5 | - | 1 | 27 | - | - | - | 28 |
| CO6 | 1 | - | 3 | 12 | - | - | 16 |
|  | | | | | | | **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. | If the eigen values of A are 1, 3, 4, then the eigen values of are \_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Write any two properties of Jacobian. | | CO2 | R | 1 |
| 3. | Surface area generated by revolving the curve y = f(x) about x axis is given by \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | A vector is said to be irrotational if \_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 5. | State Stokes theorem. | | CO3 | R | 1 |
| 6. | If then the complementary function is | | CO4 | R | 1 |
| 7. | The number of normal equations to fit the curve is \_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 8. | \_\_\_\_\_\_\_\_\_ method is a numerical method to solve simultaneous linear algebraic equations. | | CO5 | R | 1 |
| 9. | The order of error in trapezoidal rule is \_\_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| 10. | Simpson’s 1/3 rule is applicable if the number of intervals is \_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the rank of matrix A= | | CO1 | A | 3 |
| 12. | Find ux and uy for the function | | CO2 | A | 3 |
| 13. | Integrate | | CO2 | E | 3 |
| 14. | Find the unit normal vector to the surface . | | CO3 | An | 3 |
| 15. | Find the particular integral of | | CO4 | A | 3 |
| 16. | Write the normal equations to fit a straight line y = ax +b | | 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. | a. | Find the eigenvalues and eigenvectors of the matrix | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the surface area generated by revolving the curve between the lines x = 1 and x = 2 about the x axis. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | State and verify Green’s theorem given  where  is the boundary of the region defined by x = 0, x = a, y = 0, y = b. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Fit a second degree parabola curve for the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | | Y | 1 | 1.3 | 1.6 | 2.6 | 2.7 | 3.4 | 4.1 | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Using Newton-Raphson method, find the root of the equation, correct to six decimal places. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Find the first two derivatives of y at x =1.05 given the table below.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 1.05 | 1.10 | 1.15 | 1.20 | 1.25 | 1.30 | | Y | 1 | 1.048 | 1.024 | 1.048 | 1.095 | 1.118 | 1.140 | | CO6 | An | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Dividing the range into 10 equal parts, find the approximate value of  using i) Trapezoidal rule ii) Simpson rules. | 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 | 2 |  | 3 | 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 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO2 / U | 1 |
| 2. | The logarithmic series when is \_\_\_\_\_\_\_\_. | | CO2 / R | 1 |
| 3. |  | | CO1 / U | 1 |
| 4. | The value of | | CO1 / U | 1 |
| 5. | The function is a periodic function with period \_\_\_\_\_\_\_\_ | | CO2 / R | 1 |
| 6. | If is a function in the interval then | | CO2 / U | 1 |
| 7. | The limit value of is \_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 / U | 1 |
| 8. | If then the partial derivative  is \_\_\_\_\_\_\_\_\_\_ | | CO3 / U | 1 |
| 9. | The value of | | CO4 / U | 1 |
| 10. | If , then the Wronskian | | CO6 / U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | For the infinite series find | | CO2 / A | 3 |
| 12. |  | | CO1 / A | 3 |
| 13. | If is a function in the interval then | | CO2 / A | 3 |
| 14. | If then find | | CO3 / A | 3 |
| 15. | Find the value of the triple integral | | CO4 / A | 3 |
| 16. | Find the solution of the differential equation | | CO6 / A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Determine whether the series is convergent. | CO2 / A | 6 |
| b. | Prove that the trigonometric series is convergent for all values of x. | CO2 / A | 6 |
|  |  |  |  |  |
| 18. | a. | Prove that . | CO1 / A | 6 |
| b. | Evaluate . | CO1 / A | 6 |
|  |  |  |  |  |
| 19. | a. | Compute the first three harmonics of the Fourier series of f(x) given in the following table:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  |  |  |  |  |  | | f(x) | 1 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1 | | CO2 / A | 12 |
|  |  |  |  |  |
| 20. | a. | Find the maximum and minimum value of . | CO3 / A | 12 |
|  |  |  |  |  |
| 21. | a. | Evaluate by changing the order of the integration | CO4 / A | 6 |
| b. | Evaluate | CO4 / A | 6 |
|  |  |  |  |  |
| 22. | a. | Find the volume of the rectangular parallelopiped that can be inscribed by the ellipsoid using the Lagrange’s method of undetermined multiplier. | CO3 / A | 12 |
|  |  |  |  |  |
| 23. | a. | Find the directional derivative of at the point (2,-1,1) in the direction of the vector . | CO5 / A | 6 |
| b. | If then show that  (i)  (ii) . | CO5 / A | 6 |
|  |  | **Compulsory** | | |
| 24. | a. | Solve using variation of parameters method. | CO6 / A | 6 |
| b. | Solve the Lagrange’s linear equation xp + yq= 3z | CO6 / A | 6 |

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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. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 2 | 15 | - | - | - | 17 |
| CO2 | 2 | 2 | 30 | - | - | - | 34 |
| CO3 | - | 2 | 27 | - | - | - | 29 |
| CO4 | - | 1 | 15 | - | - | - | 16 |
| CO5 | - | - | 12 | - | - | - | 12 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Find the Eigen values of  . | | CO1 | U | | 1 |
| 2. | If the Eigen values of the matrix are , find the index of . | | CO1 | R | | 1 |
| 3. | In Bisection method, if f(0) = -1, f(1) = -2, f(2) = -3 and f(3) = 4, then the root lies between\_\_\_\_\_. | | CO2 | U | | 1 |
| 4. | In order to apply Simpson’s one third rule, the number of  intervals should be\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | Write the Euler’s formula to solve a first order ordinary differential equation. | | CO3 | U | | 1 |
| 6. | Mention the condition for a second order partial differential equation to be elliptic. | | 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 the value of | | CO4 | | A | 3 |
| 15. | Write the Fourier sine transform pair. | | CO5 | | An | 3 |
| 16. | Find the value of | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Find the Eigen values and Eigen vectors of | CO1 | | E | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Evaluate .Using (i).Trapezoidal rule (ii).Simpson’s 1/3 rd rule (iii)Simpson’s 3/8 th rule by taking h=1. | CO2 | | E | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Apply fourth order Runge-Kutta method to find given that | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Find | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Find the Fourier transform of | CO5 | | E | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Find using inverse Laplace transform. | CO2 | | E | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Verify Cayley-Hamilton theorem and find its inverse of | CO3 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | 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 | - | - | 15 | - | 17 |
| CO2 | 1 | 1 | - | - | 27 | - | 29 |
| CO3 | 1 | 1 | 12 | 15 | - | - | 29 |
| CO4 | 1 | 1 | 3 | - | 12 | - | 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. | The mean of the data 40, 41, 30, 40, 43, 42, 44 is ---------. | | CO1 | U | 1 |
| 2. | What is the median of: 6, 12, 15, 13, 9, 3, 2, 9, 10. | | CO1 | U | 1 |
| 3. | The weights of some students are given: 55Kg, 50Kg, 45Kg, 38Kg, 57Kg & 42Kg. What is the range of the weights? | | CO1 | U | 1 |
| 4. | Find the interquartile range of the data: 21, 23, 24, 28, 30. | | CO2 | R | 1 |
| 5. | The third quartile of the data 12, 15, 21, 23, 23, 48, 60 is ---------. | | CO2 | R | 1 |
| 6. | The regression line of y on x is -------------. | | CO2 | R | 1 |
| 7. | State the correlation between the number of hours spent in the mall and amount of money spent. | | CO2 | U | 1 |
| 8. | If then the correlation coefficient is ---------. | | CO2 | U | 1 |
| 9. | If the regression line of *x* on y is x*=4.5y+6.7*, then find | | CO2 | U | 1 |
| 10. | The two regression lines are *x+2y=6* and *x+y=4* then find the mean of x and y. | | CO2 | U | 1 |
| 11. | A regular 6-sided die is to be rolled one time. What is the probability that the number less than 5 is rolled? | | CO3 | U | 1 |
| 12. | There are 6 red marbles, 5 blue marbles, 2 green marbles and 4 clear marbles in a bag. One marble is randomly pulled from the bag. What is the probability that the marble was green? | | CO3 | U | 1 |
| 13. | There are 7 boys and 8 girls in a classroom. What is the probability that the teacher randomly selects a girl? | | CO3 | U | 1 |
| 14. | A set of all possible outcomes is known as -----------. | | CO3 | R | 1 |
| 15. | Probability of Type – I error is known as ----------- risk. | | CO4 | R | 1 |
| 16. | Mention the degrees of freedom for a chi-square test in a 3x3 contingency table. | | CO4 | R | 1 |
| 17. | The degrees of freedom for an independent samples t-test with 18 participants in each group is -------. | | CO5 | R | 1 |
| 18. | ----------- test is used to compare the mean of three or more samples. | | CO5 | R | 1 |
| 19. | What is the formula to find correction factor in design of experiments? | | CO5 | R | 1 |
| 20. | If n units are selected with SRSWR, then the probability of drawing a sample is ------ | | CO6 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the mean, median and mode of the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | *f* | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | | CO3 | A | 5 |
| 22. | Find the range, quartiles, quartile deviation, inter-quartile range and coefficient of quartile deviation for the following data: 9, 6, 8, 4, 3, 6, 10, 12 and 15. | | CO2 | A | 5 |
| 23. | Calculate the standard deviation of the data: 4, 11, 13, 6, 0, 21, 14, 8, 22 and 1. | | CO3 | A | 5 |
| 24. | The two lines of regression are *40x*–*18y*–*214=0* & *8x*–*10y+66=0 and* the variance of *x* is 9. Find (i) the mean of *x* and *y* (ii) Correlation co-efficient between *x & y.* | | CO4 | A | 5 |
| 25. | 8 coins are thrown simultaneously. Find the probability of getting at least 6 tails. | | CO1 | E | 5 |
| 26. | The mean and standard deviation of a binomial distribution are 8 and. Determine the distribution. | | CO3 | E | 5 |
| 27. | If 4% of the bulbs manufactured by a company are defective, find the probability that in a sample of 100 exactly 4 bulbs are defective. | | CO2 | E | 5 |
| 28. | A spare part manufacturer is making spare parts with average axle diameter of 0.700inch. A random sample of 10 parts shows a mean diameter of 0.742inch with a S.D. of 0.040inch. Verify whether the work satisfies specifications | | CO6 | An | 5 |
| 29. | Two random samples of 10 & 8 items show the sample S.D of their weights 10.24 & 10.25 respectively. Assuming that the weight distributions are normal, test the hypothesis that the two variances are equal. | | CO2 | An | 5 |
| 30. | The following data is collected on two characters. Based on this, can you say that there is no relation between smoking and literacy?   |  |  |  | | --- | --- | --- | |  | Smokers | Non-Smokers | | Literates | 80 | 60 | | Illiterates | 40 | 73 | | | CO3 | An | 5 |
| 31. | **The following table gives the number of road accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week.**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Days | Mon | Tue | Wed | Thu | Fri | Sat | | Number of Accidents | 17 | 13 | 11 | 14 | 13 | 16 | | | CO5 | An | 5 |
| 32. | Write a short note on Simple Random Sampling (SRS). | | CO6 | R | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. | a. | Find the mean, median and mode of the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class | 10-25 | 25-40 | 40-55 | 55-70 | 70-85 | 85-100 | | Freq | 6 | 20 | 44 | 26 | 3 | 1 | | CO | E | 15 |
|  |  |  |  |  |  |
| 34. | a. | Calculate the correlation coefficient for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO | A | 15 |
|  |  |  |  |  |  |
| 35. | a. | In order to determine whether there is any significant difference in the durability of three makes of computers, samples of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | A | 5 | 6 | 8 | 9 | 7 | | B | 8 | 10 | 11 | 12 | 4 | | C | 7 | 3 | 5 | 4 | 1 |   In view of the above data, what conclusion can you draw? | CO | An | 15 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 3 | - | - | 5 | - | 8 |
| CO2 | 3 | 4 | 20 | 5 | 5 | - | 37 |
| CO3 | 1 | 3 | 10 | 5 | 5 | - | 24 |
| CO4 | 2 | - | 5 | - | 15 | - | 22 |
| CO5 | 3 | - | - | 20 | - | - | 23 |
| CO6 | 5 | 1 | - | 5 | - | - | 11 |
|  | | | | | | | **125** |



|  |  |  |  |
| --- | --- | --- | --- |
| **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. | To find the \_\_\_\_\_\_\_\_ you put all numbers in order from least to greatest and find the number that is in the middle. | | CO1 | U | 1 |
| 2. | The mean of the data 2, 0, 0, 18, 0 is ---------. | | CO1 | U | 1 |
| 3. | Find the standard deviation for the following data: 86, 95, 78, 67, and 85. | | CO1 | U | 1 |
| 4. | State the midpoint of the class interval (3.8 – 5.2). | | CO2 | R | 1 |
| 5. | The third quartile (UQ) of the data: 33, 25, 42, 25, 31, 37, 46, 29, 38 is -------. | | CO2 | R | 1 |
| 6. | The two regression lines are x+2y=6 and x+y=4 then find the mean of x and y. | | CO2 | R | 1 |
| 7. | If byx = −2 and r = −1 then bxy is ---------. | | CO2 | U | 1 |
| 8. | If the two regression lines are y = –10x+2 and x = –0.1y–5, then the correlation coefficient r is equal to ------. | | CO2 | U | 1 |
| 9. | State the correlation between number of days absent from school and mathematics marks. | | CO2 | U | 1 |
| 10. | The regression equation always passes through ----------. | | CO2 | U | 1 |
| 11. | A regular 6-sided die is to be rolled one time. What is the probability that the number less than 3 is rolled? | | CO3 | U | 1 |
| 12. | There are 4 red balls, 3 blue balls, 2 green balls and 5 white balls in a bag. One ball is randomly pulled from the bag. What is the probability that the ball was white? | | CO3 | U | 1 |
| 13. | There are 8 boys and 7 girls in a classroom. What is the probability that the teacher randomly selects a boy? | | CO3 | U | 1 |
| 14. | If the probability of it raining today is 30% then the probability that it will NOT rain is -------. | | CO3 | R | 1 |
| 15. | Define Type II error. | | CO4 | R | 1 |
| 16. | Mention the degrees of freedom for a chi-square test in a 3x2 contingency table? | | CO4 | R | 1 |
| 17. | The degrees of freedom for an independent samples t-test with 15 participants in each group is -------. | | CO5 | R | 1 |
| 18. | The main objective of an ANOVA test is -------- | | CO5 | R | 1 |
| 19. | The level of significance commonly used in ANOVA is --------. | | CO5 | R | 1 |
| 20. | Write the test statistic of F-test. | | CO6 | U | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | |
| 21. | Find the mean, median and mode of the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 5 | 10 | 15 | 20 | 25 | 30 | 35 | | *f* | 5 | 8 | 12 | 10 | 5 | 7 | 6 | | | CO3 | A | 5 |
| 22. | Find the range, quartiles, quartile deviation, inter-quartile range and coefficient of quartile deviation for the following data: 9, 6, 8, 4, 3, 6, 10, 12 and 15. | | CO2 | A | 5 |
| 23. | The weights (in kg) of 10 randomly selected watermelons from a farm are given: 6, 7, 8, 6, 7, 9, 8, 6, 7, 8. Calculate the standard deviation for this sample of watermelon weights. | | CO3 | A | 5 |
| 24. | The two lines of regression are *8x*–*10y+66=0 & 40x*–*18y*–*214=0* and the variance of *x* is 9. Find (i) the mean of *x* and *y* (ii) Correlation co-efficient between *x & y.* | | CO4 | A | 5 |
| 25. | Ten coins are thrown simultaneously. Find the probability of getting at least 8 heads. | | CO1 | E | 5 |
| 26. | The mean and standard deviation of a binomial distribution are 6 and. Determine the distribution. | | CO3 | E | 5 |
| 27. | If 2% of the screws manufactured by a company are defective, find the probability that in a sample of 100 exactly 5 screws are defective. | | CO2 | E | 5 |
| 28. | The mean lifetime of a sample of 20 bulbs is found as 1500hrs with a standard deviation of 115 hrs. The company manufacturing the bulbs claims that the average life of their bulbs is 1550 hrs. Is the claim acceptable at 5% LOS? | | CO6 | An | 5 |
| 29. | Two random samples of 10 & 8 items show the sample S.D of their weights 0.7 & 0.4 respectively. Assuming that the weight distributions are normal, test the hypothesis that the two variances are equal. | | CO2 | An | 5 |
| 30. | The following table gives a classification of a sample of 150 plants of their flower colour and flatness of leaf.   |  |  |  | | --- | --- | --- | |  | Flat leaves | Curled leaves | | White flower | 95 | 34 | | Red flower | 18 | 03 |   Test whether the flower colour is independent of the flatness of leaf. | | CO3 | An | 5 |
| 31. | **The following table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week.**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Days | Mon | Tue | Wed | Thu | Fri | Sat | | Number of Accidents | 17 | 13 | 14 | 12 | 13 | 15 | | | CO5 | An | 5 |
| 32. | Explain the advantages and the types of Simple Random Sampling (SRS). | | CO6 | R | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | |
| 33. |  | Calculate the mean, median and mode marks of students from the following distribution.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Marks | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | No. of students | 7 | 10 | 10 | 20 | 20 | 15 | 8 | | CO4 | E | 15 |
| 34. |  | Calculate the correlation coefficient for the marks in Economics and marks in Statistics obtained by 10 students:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Marks in Eco. | 25 | 28 | 35 | 32 | 31 | 36 | 29 | 38 | 34 | 32 | | Marks in Stat. | 43 | 46 | 49 | 41 | 36 | 32 | 31 | 30 | 33 | 39 | | CO2 | A | 15 |
|  |  |  |  |  |  |
| 35. |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A completely randomized design experiments 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 | 6 | 3 | 3 | 6 | 4 | 2 | 1 | 4 | 3 | 8 |   Analyze the result for treatment’s effect. | | CO5 | An | 15 |

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

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 3 | - | - | 5 | - | 8 |
| CO2 | 3 | 4 | 20 | 5 | 5 | - | 37 |
| CO3 | 1 | 3 | 10 | 5 | 5 | - | 24 |
| CO4 | 2 | - | 5 | - | 15 | - | 22 |
| CO5 | 3 | - | - | 20 | - | - | 23 |
| CO6 | 5 | 1 | - | 5 | - | - | 11 |
|  | | | | | | | **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)**  **(Answer all the questions)** | | | | | |
| 1. | What is the nested multiplication form of *f(x) = 23x3+x2 -7 x +21*? | | CO1 | U | 1 |
| 2. | *(4B3.121)16 = (…..) 2* | | CO1 | U | 1 |
| 3. | If *R(4, 0) = 10* and *R(3, 0) = 5*, then *R(4, 1)* = … | | CO3 | U | 1 |
| 4. | Write the Trapezoidal rule to evaluate | | CO3 | R | 1 |
| 5. | In fourth order Runge-Kutta method, while finding *y(x1), k3 =* … | | CO4 | R | 1 |
| 6. | Write the Taylor’s series expansion of *y(x2).* | | CO4 | R | 1 |
| 7. | What is the classification of | | CO5 | U | 1 |
| 8. | Crank-Nicolson process is used to solve ….. type of equation. | | CO5 | R | 1 |
| 9. | The probability of sure event is ….. | | CO6 | U | 1 |
| 10. | In F-test, if *S2X > S2Y*, then *Cal F = …..* | | CO2 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | |  |  |  |  | | --- | --- | --- | --- | | *x* | 1 | 2 | 3 | | *f(x)* | 5 | 8 | 13 |   Find the polynomial that interpolate the below data by using Lagrange interpolation. | | CO1 | AN | 3 |
| 12. | Evaluate using Gaussian quadrature formula by taking 2 points. | | CO3 | E | 3 |
| 13. | Find *y(0.1)* by using Euler’s method given that | | CO5 | AN | 3 |
| 14. | Write the standard five point and diagonal five point formals? | | CO6 | R | 3 |
| 15. | A continuous random variable X that can assume any values between *x=2* and *x=5* has a density function given by *f(x)=(1+x).* Find the value of K and *P(X < 3).* | | CO2 | A | 3 |
| 16. | In a Poisson distribution *P(X=0)=P(X=1),* find the value of λ. | | CO2 | 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. | Using Bisection Method, find a root of the equation *x3 – 3x + 1 = 0* correct to 4 decimal places. | CO 1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | 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. | CO 3 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Given that , find *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | CO 5 | A | 6 |
|  | b. | Solve the system of equations using the Gauss-seidel method.  *45x + 2y + 3z = 58; - 3x + 22y + 2z = 47; 5x + y + 20z = 67.* | CO 2 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Solve given that *u(x,0) = 20, u(0,t) = 0, u(5, t) = 100.* Compute *u* for one time –step with *h = 1* by *Crank-Nicolson’s method.* | CO 6 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | In a bolt factory machines A, B and C produce 20%, 30% and 50% of the total output respectively. Of their outputs, 7%, 3%, and 5% are defective bolts. If a bolt is chosen from the combined output, find the probability that it is defective. If a bolt chosen at random is found to be defective, find the probability that it was produced by machine A. | CO 2 | An | 6 |
|  | b. | Let X be a normal variant with mean 30 and standard deviation 5. Find (i) *P(26<X<40)* (ii) *P(X > 45)* (iii) *P(X<45 ).* | CO 2 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | A random variable X has the following probability distribution   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | *0* | *1* | *2* | *3* | *4* | | *P(x)* | *K* | *3K* | *5K* | *7K* | *9K* |   Find (i) the value of *K* (ii) Mean of *X* (iii) Variance of *X*  (iv) P(1<X<3). | CO 2 | An | 6 |
|  | b. | Fit a Poisson distribution for the below data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | f | 13 | 25 | 52 | 68 | 32 | 16 | 4 | | CO 2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find the two regression line equations for the below data, and find the value of y when x = 57. Also, find the correlation coefficient of X & Y.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 51 | 68 | 73 | 46 | 50 | 65 | 47 | | Y | 49 | 72 | 74 | 44 | 58 | 66 | 50 | | CO 2 | An | 8 |
|  | b. | Determine whether the below function is a first degree spline function . | CO 4 | An | 4 |
| **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 | | CO 2 | An | 6 |
|  | b. | The following table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week by using Chi-square test.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Days | Mon | Tue | Wed | Thus | Fri | Sat | | No. of accidents | 15 | 19 | 10 | 11 | 17 | 19 | | CO 2 | A | 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 2 | - | 15 | - | - | 17 |
| CO2 | - | 1 | 18 | 38 | - | - | 57 |
| CO3 | 1 | 1 | - | - | 15 | - | 17 |
| CO4 | 2 | - | - | 4 | - | - | 6 |
| CO5 | 1 | 1 | 6 | 3 | - | - | 11 |
| CO6 | 3 | 1 | 12 | - | - | - | 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)**  **(Answer all the questions)** | | | | | |
| 1. | = …………. | | CO1 | U | 1 |
| 2. | L () = ………….. | | CO1 | R | 1 |
| 3. | Find the nature of the following function f(x) = sin x + x2. | | CO2 | R | 1 |
| 4. | Evaluate | | CO2 | E | 1 |
| 5. | The fourier sine transform of f(x) = --------. | | CO3 | R | 1 |
| 6. | Form a partial differential equation by eliminating the arbitrary constants a and b from *z = ax + by +* | | CO4 | E | 1 |
| 7. | Find the order and degree: 3 + 2 = 0. | | CO4 | R | 1 |
| 8. | Formulate the 1D Wave equation. | | CO5 | U | 1 |
| 9. | Classify the partial differential equation : + + = 0. | | CO5 | U | 1 |
| 10. | Explain quasi harmonic equation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the inverse laplace transform of. | | CO1 | E | 3 |
| 12. | Calculate the root mean square (RMS) value of f*(x) = x* in (0, 2π). | | CO2 | E | 3 |
| 13. | Find the fourier sine transform of . | | CO3 | A | 3 |
| 14. | Solve Z = 0 | | CO4 | A | 3 |
| 15. | Define the various possible solutions of one dimensional heat equation  = . | | CO5 | E | 3 |
| 16. | Express the equations of water dynamics in terms of specific water expenditures. | | 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. | Evaluate L . | CO1 | E | 6 |
|  | b. | . | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | Calculate the first three harmonics of the Fourier series of f(x) given by the following table   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  |  |  |  |  | | f(x) | 1 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the Fourier Transform of f(x) = Show that dt = dt = . | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve the following legrange pde x(y-z)p + y(z-x)q = z(x-y). | CO4 | A | 6 |
|  | b. | Solve + = x + y. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Represent f(x) = , 0 < x < by half-range Fourier sine series. | CO5 | E | 6 |
|  | b. | If F(s) is Fourier transform of f(x) then,  F [f(x) cos ax] = [F(s+a) + F (sa)]. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Solve Z = + Cos (x + 2y) + Sin (2x + 3y). | CO4 | E | 8 |
|  | b. | Find the inverse laplace transform of. | CO1 | E | 4 |
|  |  |  |  |  |  |
| 23. | a. | A string is stretched and fastened two points ‘l’ apart motion is started by displacing the string in the form u = a sin from which it is released at time t =0. Show that the displacement at any point at a distance ‘x’ from one end at time ‘t’ is given by  u(x,t) = a sin | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Determine the model of average depth concentration of suspended particles and the concentrations of the Ingredient Transport. | CO6 | An | 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 analyze Fourier transform and apply them 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 |  |  | 19 |  | 21 |
| CO2 | 1 |  |  |  | 16 |  | 17 |
| CO3 | 1 |  |  |  | 21 |  | 22 |
| CO4 | 1 |  | 9 |  | 15 |  | 25 |
| CO5 |  | 2 |  | 12 | 9 |  | 23 |
| CO6 | 1 |  |  | 15 |  |  | 16 |
|  | | | | | | | **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 between and is given by\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 5. | To apply Simpson’s three-eight rule the number of intervals n must be \_\_. | | CO5 | R | 1 |
| 6. | In numerical integration for the interval (0,1), if n = 5 then h = \_\_\_\_\_\_. | | CO5 | U | 1 |
| 7. | In solving using fourth order RK method, | | CO3 | R | 1 |
| 8. | Modified Euler’s solution of the equation is given by \_\_\_\_. | | CO3 | R | 1 |
| 9. | The solution of a hyperbolic partial differential equation is \_\_\_\_if . | | CO3 | R | 1 |
| 10. | The one 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(1). | | CO4 | U | 3 |
| 13. | If R(3,2) = -54 and R(4,2) = 72, find R(4,3) using Romberg Algorithm. | | CO5 | U | 3 |
| 14. | Using Euler’s method determine of the equation , y(0) =1 for x=0.01. | | CO3 | A | 3 |
| 15. | Find the nature of the PDE . | | CO3 | U | 3 |
| 16. | Show that y(x) = 1 is the solution of the Fredhlom 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. | a. | Find the real root of 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* | 2 | 4 | 9 | 10 | | *f(x)* | 4 | 56 | 711 | 980 | | CO4 | A | 6 |
|  | b. | Compute the value of *f(x)* for x=3 from the following table using Lagrange’s interpolation method.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 1 | 2 | 5 | |  | 2 | 3 | 12 | 147 | | CO4 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the integral using trapezoidal and Simpson’s rule. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | 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. | a. | 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 Regula Falsi method to obtain the root of the equation that lies in the interval (0,1). | CO1 | A | 8 |
|  | b. | Write the pseudocode for Secant Method. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Apply Gaussian three point formula to evaluate and . | CO5 | A | 8 |
|  | b. | Write the pseudocode for Romberg’s Method. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Show that is a solution of the Volterra integral equation . | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **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)**  **(Answer all the questions)** | | | | | |
| 1. | Solve the partial differential equation. | | CO1 | U | 1 |
| 2. | Find a set of multipliers to solve the Lagrange's equation  *x(y-z)p+y(z-x)q=z(x-y).* | | CO1 | U | 1 |
| 3. | The value of a2 in one dimensional wave equation is ----. | | CO2 | R | 1 |
| 4. | Classify the partial differential equation. | | CO2 | U | 1 |
| 5. | 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 none hits the target. | | CO3 | U | 1 |
| 6. | A die is tossed. Find the probability of getting one, given that an odd number has been obtained. | | CO3 | U | 1 |
| 7. | If eight coins are thrown simultaneously, then find the probability of getting exactly five heads. | | CO3 | U | 1 |
| 8. | If the second moment and the fourth moment about the mean are  and   then find the measure of kurtosis. | | CO3 | U | 1 |
| 9. | The first moment about the mean is -------. | | CO4 | U | 1 |
| 10. | Define Type II error. | | CO5 | R | 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 | U | 3 |
| 12. | A tightly stretched string of length *l* cm with fixed ends is initially in equilibrium position.  It is set vibrating by giving each point a velocity  (*lx-x2)*.  State the boundary conditions to find the displacement u(x,t). | | CO2 | U | 3 |
| 13. | 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 the value of K (ii) Find P(X<2). | | CO3 | U | 3 |
| 14. | If the joint probability density function of (X,Y) given by  f(x,y)= ; 0<x<2, 0<y<1 then find P(Y<1/2). | | CO3 | U | 3 |
| 15. | Two judges rank seven participants in a competition. Find Rank correlation coefficient.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *Rank by X* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | *Rank by Y* | 5 | 4 | 3 | 1 | 2 | 6 | 7 | | | CO4 | U | 3 |
| 16. | A sample of 600 persons selected 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 population is ½. In order to test, whether the belief is confirmed by the observation, construct null hypothesis and alternative hypothesis. | | 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 the partial differential equation*:*  *z = px+qy+.* | CO1 | A | 6 |
|  | b. | Solve the partial differential equation:  . | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | An insulated rod 10cm 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. | Two players ‘A’ and ‘B’ alternately throw a pair of dice. A wins if he throws 6, before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, then find his chance of winning the game. | CO3 | U | 6 |
|  | b. | In a bolt factory, machines A, B and C produce 20%, 30% and 50% of the total output respectively. Of their outputs, 7%, 3%, and 5% are defective bolts. If a bolt is chosen from the combined output, then find the probability that it is defective. If a bolt chosen at random is found to be defective, then find the probability that it was produced by machine B. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Fit a Binomial distribution to the given data and calculate the expected frequencies.     |  |  |  |  |  | | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | |  | 36 | 40 | 22 | 2 | | CO3 | A | 6 |
|  | b. | A continuous random variable X has a probability density function given by f(x)=. (i) Find the value of K.  (ii) Find mean of X | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | If X follows normal distribution with mean 8 and standard deviation 4 then find (i)P(X>12) (ii) P(X<16) (iii) P(12<X<16). | CO3 | A | 6 |
|  | b. | Fit a straight line to the following data, using method of least squares.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | | Y | 1.7 | 1.8 | 2.3 | 3.2 | | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | The joint probability mass function of (X,Y) is P(x,y)=K(3x+2y);  x = 0,1,2 and y = 1,2,3.   1. Find the value of K. 2. Find the marginal distribution of X 3. Find the marginal distribution of Y. 4. Find the conditional distributions of X given Y.   (v) Find the conditional distributions of Y given X. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | From the following data:  (i) Find correlation coefficient  (ii)Find the two lines of Regression  (iii) Estimate the value of ‘y’ , when x= 12.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 2 | 4 | 6 | 8 | 10 | | y | 6 | 5 | 4 | 3 | 2 | | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A group of five persons were treated with diet A.  Their weights were  found to be 42,39,48,60 and 41 kg.  Another group of seven persons  were treated with diet B, their weights were 38,42,56,64,68,69 and 62  kg. Test the claim that on the average, diet B increases weight  significantly. | CO5 | A | 6 |
|  | b. | The following table gives the number of accidents that occurred during various days of the week. Test whether accidents are uniformly distributed over the days of a week.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Day | Mon | Tue | Wed | Thurs | Fri | Sat | | Number of accidents | 15 | 13 | 13 | 12 | 16 | 15 | | 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 |  | 5 | 12 |  |  |  | 17 |
| CO2 | 1 | 4 |  | 12 |  |  | 17 |
| CO3 |  | 28 | 18 |  | 6 |  | 52 |
| CO4 |  | 10 |  |  | 12 |  | 22 |
| CO5 | 1 | 3 | 6 |  |  |  | 10 |
| CO6 |  |  |  | 6 |  |  | 6 |
|  | | | | | | | **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 ={c,d}, B={1,2}, C= {2,3},* then find *AX*(BUC). | | CO1 | U | 1 |
| 2. | If *A ={a,b,c},* then list all the subsets of *A.* | | CO1 | U | 1 |
| 3. | The value of the projection function is……. . | | CO2 | U | 1 |
| 4. | The value of Successor function *S(9)*is …….. . | | CO2 | R | 1 |
| 5. | The letters of the word "*MALAYALAM*" taken all at a time can be written in ----- number of ways. | | CO3 | U | 1 |
| 6. | Compute *P(8,2).* | | CO3 | U | 1 |
| 7. | True/False: Given that *P: 3\*5=15. Q: 2+5=8. If 3\*5=15, then 2+5=8.* | | CO4 | U | 1 |
| 8. | The contrapositive of (P→Q) is …… | | CO4 | R | 1 |
| 9. | In a Boolean Algebra, a\*1= \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | 1 |
| 10. | The number of edges in a tree with 10 vertices is …… . | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If *A= {1,2,3,4,5,6,7,8,9,10}, B={ 2,4,6,8,10,12,14,16,18,20},* then find  A-B, B-A, (A∆B). | | CO1 | U | 3 |
| 12. | Find *LCM of (120,72)* using *prime factorization.* | | CO2 | U | 3 |
| 13. | A committee of 7 is formed from a group of 9men and 10 women. Find the number of ways of selecting the committee consisting of atleast 4 men. | | CO3 | U | 3 |
| 14. | From the following statements:  P: I will study discrete mathematics.  Q: I will watch TV.  R: I am in good mood.  Symbolize:   1. If I am not in a good mood then I will watch TV or I will study discrete mathematics. 2. I will study discrete mathematics if and only if I am in good mood. 3. If I do not study discrete mathematics and I watch TV then I am in good mood. | | CO4 | U | 3 |
| 15. | Show that in a Boolean Algebra  *=0 if a = b.* | | CO5 | U | 3 |
| 16. | Construct the graph *G* with vertices *{a,b,c,d}* and edges {e1, e2 ,e3 ,e4} whose incidence matrix is . | | 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 *R* is a relation defined on *A ={a,b,c},* defined by  *R= {(a,a),(b,b),(c,c),(b,c),(c,b)}* (i) Find Matrix of R (ii) Check whether *R* is an equivalence relation on *A.* | CO1 | A | 6 |
|  | b | If *f* and *g* are two functions defined on the set of real numbers, such that *f(x) = x2+2 , g(x)=x-4* and *h(x) = 3x-5* and then compute *(i)fog(x)*  *(ii) ((fog)oh)(x) (iii) (fo(goh))(x) (iv)(gof)(x ).* | CO1 | A | 6 |
|  |  |  |  |  |  |
| 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 (414,662)* and express the GCD as the linear combination of 414 and 662. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prove that *3n-1* is a multiple of *2* for n=1,2,3,… using mathematical induction. | CO3 | A | 6 |
|  | b. | In a survey of 200 persons, it was found that 50 can speak English, 54 can speak Hindi, 55 can speak Telugu, 10 can speak all the three languages. 30 can speak English and Hindi, 15 can speak Hindi and Telugu, 25 can speak English and Telugu. i) How many can speak none of the three languages. ii)How many can speak only English. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Check whether *((P →Q) →R) V ꭋ P)* is tautology or not. | CO4 | A | 6 |
|  | b. | Prove that *P* is equivalent to (*P∧Q)V(P∧ ꭋQ)* using truth table. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Let A = {1,2,3,4,5,6,7,8} and ,  be permutations of A.   1. Find . 2. Find 3. Check whether are even or odd permutations. 4. Find . | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Prove that G= {1,5,7,11} is an abelian group under multiplication *modulo 12.* | CO5 | A | 6 |
|  | b. | Find i)Principal Disjunctive Normal Form ii.) Principal Conjunctive Normal Form of the following statement: *(PᴧR)V (Pᴧ ꭋQ).* | 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 and Hamiltonian circuit for the graph: | 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. *\* - 8 5 / + 4 2 3* 2. *7 4 – 5 2 2 / + \** | CO6 | An | 6 |

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

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| --- | --- |
|  | **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)**  **(Answer all the questions)** | | | | | |
| 1. | Find the probability that a leap year selected at random has 53 mondays. | | CO1 | U | 1 |
| 2. | If A and B are mutually exclusive events, then P(AB) = ----------. | | CO1 | R | 1 |
| 3. | A visual inspection of allocation on wafers from a semiconductor manufacturing process resulted in the following table. Find the value of ‘a’.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Number of contamination Particles (X) | 0 | 1 | 2 | 3 | 4 | 5 | | Proportion of Wafers P(x) | a | 2a | 3a | 4a | 3a | 2a | | | CO2 | U | 1 |
| 4. | If the joint pdf of (X, Y) is f (x, y) = find the value of k. | | CO2 | U | 1 |
| 5. | The variance of Exponential distribution is ---------.\_\_\_\_ | | CO3 | R | 1 |
| 6. | The probability density function of the Gamma distribution is --------. | | CO3 | R | 1 |
| 7. | If X and Y are uncorrelated random variables, then E (XY) = -------------. | | CO4 | U | 1 |
| 8. | Define a wide-sense stationary process. | | CO5 | U | 1 |
| 9. | The mean of the Poisson process is ---------. | | CO6 | R | 1 |
| 10. | If a Gaussian process is wide-sense stationary, it is also ------------. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | If (A) = 1/2, P (B) =1/3 and P (AՈB) = 1/12 then find P (A/B) and P(B/A). | | CO1 | U | 3 |
| 12. | The joint probability density function of (X, Y) is f(x, y)=4xy; 0≤ x,y ≤1.  Find the marginal probability density function of X. | | CO2 | U | 3 |
| 13. | Find the probability of getting 7 heads in 10 tosses of a coin. | | CO3 | U | 3 |
| 14. | If the pdf of x is fx(x) = x/12, 1 < x < 5, find the pdf of y = 2x - 3. | | CO4 | U | 3 |
| 15. | If ,then compute (i) (ii) | | 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 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) exactly 1 is good  (iv) neither is good (v) at most 1 is good (vi) neither has major defects. | CO1 | A | 6 |
|  | b. | In a bolt manufacturing company, 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? 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. | a. | A continuous random variable X has the probability density function  f(x) = kx2, 0<x< 2 (i)Find the value of k (ii) Find P(X<1) (iii) Find the mean of X. | CO2 | A | 6 |
|  | b. | A random variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | 5 | | *p(x)* | k | k | 2k | 4k | 2k | k |   (i) Find the value of K (ii) Evaluate P(X<3*)* (iii) Find the CDF, cumulative distribution function (iv)Find the mean of X. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | The joint probability mass function of (X, Y) is P (x, y)=K(2x+y);  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 (iii) Find conditional distributions of X given Y(v) Find conditional distributions of Y given X. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | The weekly wages of 1000 workmen are normally distributed with a mean of Rs.70 and a standard deviation of Rs 5. Estimate the number of workers, whose weekly wages will be (i) less than Rs. 60. (ii) more than Rs.75. (iii) between Rs 60 and Rs 75. | 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. | If X1, X2, X3……… Xn, are Poisson variates with parameter λ = 2, use the central limit theorem to estimate P (120 ≤ Sn ≤ 160), where  Sn = X1+ X2+ ………. Xn and n = 75. | CO4 | A | 6 |
|  | b. | Find the characteristic function of Poisson distribution and hence find its mean and variance. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Two Random processes are defined as X(t)=Acost+Bsint and  Y(t)= Bcost+Asint, where A and B are independent random variables such that E(A)=E(B)=0, E(A2) =E(B2) =1.Show that X(t) and Y(t) are individually WSS,but not jointly WSS. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Find the mean and variance of the random process whose autocorrelation function is given by | CO5 | A | 6 |
|  | b. | If the PSD of a WSS process is ,find the autocorrelation function | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | If {x(t)} is a Gaussian process with μ(t) = 10 and C (t1, t2) = 16 , find the probability that (i)x (10) ≤ 8 (ii) | x (10) – x (6) | ≤ 4. | CO6 | A | 6 |
|  | b. | The transition probability matrix of a Markov chain {Xn} , n=1,2, 3,… having three states 1,2,3 is and the initial distribution is p(0) = (0.3,0.3,0.4)  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 | An | 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 | Knowledge in functions of random variables. |
| CO5 | Determine the characteristics of random processes |
| CO6 | Understand propagation of random signals in linear systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | - | 5 | 12 | - | 12 | - | 29 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | - | 4 | 12 | - | 6 | - | 16 |
| CO5 | - | 4 | 12 | 12 | - | - | 28 |
| CO6 | 2 | 3 | 6 | 6 | - | - | 17 |
|  | | | | | | | **124** |



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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | A random variable X has the following probability distribution.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | p(x) | 0.2 | k | 0.3 | 0.1 |   Find the value of k. | | CO1 | R | 1 |
| 2. | If (X,Y) is a two dimensional random variable, then the value of the cdf | | CO1 | R | 1 |
| 3. | The variance of a gamma distribution with parameter k is \_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Write the regression equation of Y on X. | | CO2 | R | 1 |
| 5. | Define Type II error. | | CO3 | R | 1 |
| 6. | The tabulated value of Z for two tailed test at 1% Level of Significance is \_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | In Student’s t-test, if d.f = 7, then the tabulated value | | CO4 | R | 1 |
| 8. | Write the formula for degrees of freedom used in test for goodness of fit. | | CO4 | R | 1 |
| 9. | In one factor of classification, degrees of freedom within classes is \_\_\_\_. | | CO5 | R | 1 |
| 10. | Define the cross-correlation of two random processes {X(t)} and {Y(t)}. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | The joint probability distribution of (X,Y) is given below.   |  |  |  | | --- | --- | --- | | X | Y | | | 1 | 2 | | 1 | 0.1 | 0.2 | | 2 | 0.3 | 0.4 |   Find the marginal distributions of X and Y. | | CO1 | U | 3 |
| 12. | The regression coefficients are given by  and  Find the coefficient of correlation ‘r’. | | CO2 | U | 3 |
| 13. | A random sample of 500 apples was taken from a large consignment and 60 were found to be bad. Obtain the 98% confidence limits for the percentage number of bad apples in the consignment. | | CO3 | U | 3 |
| 14. | In F-test, if and , then find the test statistic value. | | CO4 | U | 3 |
| 15. | In two factor of classification, if  and  then find | | 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 a pdfFind the (i) value of k, (ii) mean of X and (iii) variance of X. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate the correlation coefficient and lines of regression for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 6 | 2 | 10 | 4 | 8 | | Y | 9 | 11 | 5 | 8 | 7 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | In a certain district A, 450 persons were considered regular consumers of tea out of a sample of 1000 persons. In another district B, 400 were regular consumers of tea out of a sample of 800 persons. Do these facts reveal a significant difference between the two districts as far as tea drinking habit is concerned? | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | On the basis of information given below about the treatment of 200 patients suffering from a disease, state whether the new treatment is comparatively superior to the conventional treatment.   |  |  |  | | --- | --- | --- | |  | Favourable | Not favourable | | New | 60 | 30 | | Conventional | 40 | 70 | | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Verify whether there is significant difference in the durability of 3 makes of computers. A sample of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed, the results are as follows:   |  |  |  | | --- | --- | --- | | Makes | | | | A | B | C | | 5 | 8 | 7 | | 6 | 10 | 3 | | 8 | 11 | 5 | | 9 | 12 | 4 | | 7 | 4 | 1 |   In view of the above data, what conclusion can you draw? | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Fit a Poisson distribution for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | f | 142 | 156 | 69 | 27 | 5 | 1 | | CO2 | A | 7 |
|  | b. | In a binomial distribution, mean is 6 and the variance is 2. Find the first two terms of the distribution. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 23. | a. | In one sample of 8 observations, the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations, the sum of the squares of deviations of the sample values from the sample mean was 102.6. Test whether this difference is significant at 5% level of significance using F-test. | CO4 | An | 8 |
|  | b. | Before an increase in excise duty on tea, 800 persons out of a sample of 1000 persons were found to be tea drinkers. After an increase in excise duty, 800 people were tea drinkers in a sample of 1200 people. What is the (i) null hypothesis (H0), (ii) alternative hypothesis (H1) and (iii) table value if there is a significant decrease in the consumption of tea after the increase in excise duty? | CO3 | R | 4 |
| **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 initial distribution is P(0) = (0.6, 0.3, 0.1).  Find (i) P(X1 = 2, X0 = 2),  (ii) P(X2 = 2, X1 = 1, X0 = 2),  (iii) P(X3=2, X2 = 3, X1 = 1, X0 = 2). | CO6 | A | 8 |
|  | b. | Find the mean and variance of the random process {X(t)}, whose autocorrelation function is given by | CO6 | A | 4 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to  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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | 24 | - | - | - | 29 |
| CO3 | 6 | 3 | - | 12 | - | - | 21 |
| CO4 | 2 | 3 | - | 20 | - | - | 25 |
| CO5 | 1 | 3 | - | 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)** | | | | | |
| 1. | The probability of impossible event is ….. | | CO1 | U | 1 |
| 2. | Let f(x) be a density function of a continuous random variable X. Then …. | | CO1 | R | 1 |
| 3. | Write the parameters of binomial distribution. | | CO2 | R | 1 |
| 4. | The shape of the normal curve is ….. | | CO2 | An | 1 |
| 5. | In large sample tests, the sample size should be ….. | | CO3 | R | 1 |
| 6. | In large two tailed test, at 1 % level of significance, tab z = …. | | CO3 | U | 1 |
| 7. | Define Type – I and Type – II errors. | | CO4 | R | 1 |
| 8. | In F-test, if S2X < S2Y , then Cal F = ….. | | CO4 | R | 1 |
| 9. | Anova table technique was developed by ……. | | CO5 | R | 1 |
| 10. | Define discrete random process. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the probability distribution function for the number of heads in a single toss of a coin. | | CO1 | An | 3 |
| 12. | In a Poisson distribution P(X=0)=P(X=1), find the value of ʎ. | | CO2 | Ap | 3 |
| 13. | Define null and alternative hypothesis. | | CO3 | R | 3 |
| 14. | In Chi-square test, write the expected frequencies for the below observed frequencies   |  |  |  | | --- | --- | --- | | 10 | 25 | 5 | | 15 | 30 | 8 | | 35 | 20 | 10 | | 20 | 15 | 9 | | | CO4 | An | 3 |
| 15. | In one-way ANOVA, if SSC = 30; SST = 55 and d.o.f between column  is 6, then MSC=...... and SSE = ...... | | CO5 | An | 3 |
| 16. | Check whether is a valid auto correlation. | | 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 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 k* (ii) *P(X <4)* (iii) *P(1 < X 5)* (iv) Mean *of X* (v) Variance of *X* (vi) Cumulative distribution of X. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the rank correlation for the below data.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 45 | 56 | 39 | 54 | 45 | 40 | 56 | 64 | 30 | | Y | 40 | 36 | 30 | 44 | 36 | 32 | 45 | 42 | 20 | | CO2 | Ap | 6 |
| b. | If *X* is a Poisson variant such that *P(x=1) = 3/10* and  *P(x= 2)=1/5.* Find *P(x=0)* and *P(x= 3).* | CO2 | Ap | 6 |
|  |  |  |  |  |  |
| 19. | a. | In a sample of 1000 people in Karnataka 540 are rice eaters and rest are wheat eaters. Can we assume that both rice and wheat eaters are equally popular in the state at 1% level of significant? | CO3 | An | 6 |
| b. | In a sample of 600 students of a certain college, 400 are found to use dot pens. In another college, from a sample of 900 students, 450 were found to use dot pens. Test whether the two colleges are significantly different with respect to the habit of using dot pens. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Based on the information given below about the treatment of 200 patients suffering from a disease, state whether the new treatment is comparatively superior to the conventional treatment by using Chi-square test.   |  |  |  | | --- | --- | --- | |  | Favorable | Not Favorable | | New Treatment | 60 | 30 | | Conventional Treatment | 40 | 70 | | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | A tea company appoints four salesmen A, B, C, D and observes their sales in three seasons – summer, winter, and monsoon. The figures (in lakhs) are given in the following table:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Seasons | Salesmen | | | | Salesmen’s total | |  | A | B | C | D | | Summer | 36 | 36 | 21 | 35 | 128 | | Winter | 28 | 29 | 31 | 32 | 120 | | Monson | 26 | 28 | 29 | 29 | 112 | | Salesmen’s Total | 90 | 93 | 81 | 96 | 360 |   Carry out an analysis of variance and test whether there is any significant difference in the salesman and in the seasons, so far as sales are concerned. | CO5 | Ev | 12 |
|  |  |  |  |  |  |
| 22. | a. | Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Test the hypothesis that the true variances are equal. | CO4 | An | 6 |
| b. | Find the two regression line equations, and also find the value of y when x = 57.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 40 | 50 | 30 | 60 | 65 | 55 | 47 | | Y | 38 | 65 | 54 | 72 | 60 | 49 | 45 | | CO2 | Ap | 6 |
|  |  |  |  |  |  |
| 23. | a. | The three samples below have been obtained from the normal population with equal variances. Using ANOVA table, test the hypothesis at 5% level that the population means are equal.   |  |  |  | | --- | --- | --- | | A | B | C | | 8 | 7 | 12 | | 10 | 5 | 9 | | 7 | 10 | 13 | | 14 | 9 | 12 | | 11 | 9 | 14 | | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | If where *Y* is uniformly distributed in *(0, 2π)*. Show that *X(t)* is wide sense stationary. | CO6 | Ap | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to identify probability models and solve using discrete and continuous random variables. |
| CO2 | The student will be able to classify the problems using probability distributions. |
| CO3 | The student will be able to test the hypothesis for large samples. |
| CO4 | The student will be able to analyze the parameters and attributes of small samples. |
| CO5 | The student will be able to construct the experimental designs using Analysis of Variance. |
| CO6 | The student will be able to examine ergodicity of random process. |

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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 | 1 | - | 21 | 1 | - | - | 23 |
| CO3 | 4 | 1 | - | 12 | - | - | 17 |
| CO4 | 2 | - | - | 21 | - | - | 23 |
| CO5 | 1 | - | - | 15 | 12 | - | 28 |
| CO6 | 1 | - | 12 | 3 | - | - | 16 |
|  | | | | | | | **124** |



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| **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. | The marks scored by 20 students in Statistics are 41, 80, 55, 42, 48, 53, 47, 74, 33, 20, 32, 31, 60, 65,71, 82, 99, 95, 87, 22. Represent the data into a continuous frequency distribution with a class interval of 10. | CO1 | U | 10 |
|  | b. | Represent the following data by a pie diagram.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | Food | Clothing | Rent | Medicare | Entertainment | | Expenditure (in ₹) | 2400 | 200 | 800 | 150 | 450 | | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Draw the histogram, frequency polygon and frequency curve for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | CI | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | | f | 2 | 7 | 15 | 20 | 10 | 3 | | 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, median and mode 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 | 20 |
|  |  | **(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. | The following data were obtained while observing the life span of a few neon lights of a company. Calculate mean deviation and its coefficient.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Life span (Years) | 4 - 6 | 6 - 8 | 8 - 10 | 10 - 12 | 12 - 14 | | No. of Neon Lights | 10 | 17 | 32 | 21 | 20 | | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Find Karl Pearson’s coefficient of correlation between advertisement expenditure and sales.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Advertisement Expenditure (Rs. in lakhs) | 10 | 12 | 18 | 8 | 13 | 20 | 22 | 15 | 5 | 17 | | Sales  (Rs. in lakhs) | 88 | 90 | 94 | 86 | 87 | 92 | 96 | 94 | 88 | 85 | | 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 as  3X + 2Y = 26 and 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. | Calculate trend values by the method of least square from the data given below. Also estimate the sales for 2020.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 2011 | 2012 | 2013 | 2014 | 2015 | | Sales of Company (Rs. in lakhs) | 70 | 74 | 80 | 86 | 90 | | CO6 | E | 15 |
| **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 | | 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 |

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

|  |  |
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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** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | 30 | - | - | - | 40 |
| CO2 | - | - | 20 | - | - | - | 20 |
| CO3 | - | - | 20 | - | 20 | - | 40 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 10 | - | 10 | - | - | 20 |
| CO6 | - | - | - | 25 | 15 | - | 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.** | **Sub Div.** | **Questions** | **CO / BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | |
| 1. | a. | Find the trace and determinant of the matrix. | CO1 / E | 4 |
|  | b. | Solve the system of equations by Cramer’s rule.  3x+y+2z=3  2x-3y-z =-3  x+2y+z=4. | CO1 / E | 8 |
|  | c. | Solve the following system of linear equations by matrix inversion method.  3x+2y=14  3x+3y=18 | CO1 / E | 8 |
| **(OR)** | | | | |
| 2. | a. | Find the rank of the matrix. | CO1 / E | 5 |
|  | b. | Find the eigenvalue and eigenvectors of the matrix. | CO1 / E | 15 |
|  |  |  |  |  |
| 3. | a. | If , find . | CO2 / An | 5 |
|  | b. | Find the derivatives of   1. (ii) . | CO2 / An | 5 |
|  | c. | Integrate  with respect to x. | CO2 / E | 5 |
|  | d. | Integrate . | CO2 / E | 5 |
| **(OR)** | | | | |
| 4. | a. | Determine the Cartesian product A × B × C, where A = {0, 1},  B = {1, 2}, and C = {0, 1, 2}? | CO3 / A | 3 |
|  | b. | Use a membership table to show that  A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C). | CO3 / U | 6 |
|  | c. | Suppose that the universal set is  U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. The bit strings for the sets {1, 2, 3, 4, 5} and {1, 3, 5, 7, 9} are 11 1110 0000 and 10 1010 1010 respectively. Use bit strings to find the union and intersection of these sets. | CO3 / A | 5 |
|  | d. | Suppose that P and Q are the multi-sets  P= {4 . a, 1. b, 3. c} and Q = {3. a, 4 .b, 2 .d}, respectively.  Find P ∪ Q, P ∩ Q, and P + Q. | CO3 / A | 6 |
|  |  |  |  |  |
| 5. | a. | Explain the types of function each with an example. | CO3 / R | 8 |
|  | b. | Find the Fibonacci numbers f2, f3, f4, f5, and f6. | CO3 / E | 6 |
|  | c. | Determine the values of these sums   1. ii)  iii) | CO3 / E | 6 |
| **(OR)** | | | | |
| 6. | a. | Ravi goes to a pet shop and finds that the pet shop has 33 reptiles, 44 birds, 55 rabbits, and 66 fish. If Ravi can only pick one animal as a pet, how many choices does Ravi have for a pet? | CO4 / An | 4 |
|  | b. | The chairs of an auditorium are to be labelled with an uppercase English letter followed by a positive integer not exceeding 100. What is the largest number of chairs that can be labelled differently? | CO4 / An | 3 |
|  | c. | 6 computers on a network are connected to at least 1 other computer. Show that there are at least two computers that are having the same number of connections. | CO4 / An | 3 |
|  | d. | Find the number of distinguishable permutations of the letters in  (a) OHIO and (b) MISSISSIPPI. | CO4 / An | 5 |
|  | e. | A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting lineup of one center, two forwards, and two guards? | CO4 / An | 5 |
|  |  |  |  |  |
| 7. | a. | Let p and q be the propositions  “p:Swimming at the New Jersey shore is allowed” and  “q:Sharks have been spotted near the shore,” respectively.  Express each of these compound propositions as an English sentence.   1. ¬q b) p ∧ q c) ¬ p ∨ q d) p → ¬ q | CO5 / U | 4 |
|  | b. | Construct a truth table for each of these compound propositions.  a) p ∧ ¬ p  b) (p ∨ ¬ q) → q | CO5 / A | 6 |
|  | c. | Find the contrapositive, the converse, and the inverse of the conditional statement.  “The home team wins whenever it is raining.” | CO5 / U | 4 |
|  | d. | Construct the truth tables of  i) conditional statements p → q  ii) biconditional statements p ↔ q. | CO5 / A | 6 |
| **(OR)** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8. | a. | Find the bitwise OR, bitwise AND, and bitwise XOR of the bit strings 01 1011 0110 and 11 0001 1101. | CO5 / A | 6 |
|  | b. | Define tautology and contradiction and construct its example with just one propositional variable. | CO5 / R | 6 |
|  | c. | Using truth table, show that p ∨ (q ∧ r) and (p ∨ q) ∧ (p ∨ r) are logically equivalent. | CO5 / U | 8 |
|  | | **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** |  |  |
| 9. | a. | Which of the undirected graphs in the following figure have an Euler circuit or Euler path ?  Euler example1.jpg  G1 G2 G3 | CO6 / A | 8 |
|  | b. | Determine whether the given graphs has a Hamilton path or Hamiltonian circuit?  hamiltongraph.jpg hamiltongraph.jpg  H1  H2 | CO6 / A | 8 |
|  | c. | Define spanning tree with an example. | CO6 / R | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply 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 |  |  |  |  | 40 | - | 40 |
| CO2 |  |  |  | 10 | 10 |  | 20 |
| CO3 | 8 | 6 | 14 |  | 12 | - | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 | 6 | 16 | 18 |  | - | - | 40 |
| CO6 | 4 |  | 16 |  | - | - | 20 |
|  | | | | | | | **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) | | 2020 | 110 | 40 | 20 | | 2021 | 120 | 30 | 25 | | 2022 | 140 | 35 | 25 | | 2023 | 150 | 50 | 30 | | 2024 | 170 | 60 | 40 | | CO1 | U | 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 subdivided bar diagram for the following data:   |  |  |  |  | | --- | --- | --- | --- | | Year | Public Companies | Private Companies | Total | | 2000 | 3000 | 20000 | 23000 | | 2001 | 5000 | 15000 | 20000 | | 2002 | 7000 | 18000 | 25000 | | 2003 | 6000 | 19000 | 25000 | | 2004 | 4000 | 15000 | 19000 | | CO1 | A | 10 |
|  | b. | The scores of two batsmen A and B in ten innings during a certain season are:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 30 | 27 | 45 | 60 | 70 | 38 | 11 | 60 | 94 | 15 | | B | 18 | 30 | 47 | 51 | 66 | 89 | 11 | 62 | 38 | 78 |   Find which of the two batsmen A or B (a) is more efficient and (b) is more consistent in scoring. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | 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 Eco. | 25 | 28 | 35 | 32 | 32 | 36 | 29 | 38 | 34 | 32 | | Marks in Stat. | 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 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | | No. of Students | 330 | 313 | 355 | 390 | 400 | 403 | 412 | 425 | 407 | 448 | | CO4 | E | 10 |
|  | b. | Draw a trend line by the method of semi-averages.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | | Sales | 270 | 300 | 270 | 280 | 270 | 230 | 250 | 230 | 220 | 200 | | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate the seasonal indices by the method of simple average for the following data:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 1993 | 78 | 66 | 84 | 80 | | 1994 | 76 | 74 | 82 | 78 | | 1995 | 72 | 68 | 80 | 70 | | 1996 | 74 | 70 | 84 | 74 | | 1997 | 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 | | production | 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 5:3:4. The probability that bonus scheme will be introduced in the company if A, B, C becomes G.M are 0.4, 0.8, 0.9 respectively. If the bonus scheme has been introduced what is the probability that Mr. B has become appointed as G.M? | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Four persons are chosen at random from a group consisting of 5 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 6 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.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Births | 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 170cm and S.D. 7cm, how many students have heights  (i) more than 183cm?  (ii) less than or equal to 159cm? | CO6 | E | 10 |

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

|  |  |
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|  | **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** |



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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. | In a survey of 260 college students, the following data were obtained: 64 watch football game, 94 watch hockey game, 58 watch basketball game, 28 watch both football and basketball, 26 watch both football and hockey, 22 watch both hockey and basketball and 22 do not watch any of the three kind of games. (i) How many students watch all the three games? (ii) How many students watch exactly one of the games? | CO1 | A | 10 |
|  | b. | Let , and .  Compute (i)  (ii)  (iii) A ⊙ B (iv)  (iv) prove that (A ⊙ B ) ⊙ C = A ⊙ (B ⊙ C ) | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prove by mathematical induction, for any positive integer n, is divisible by 3. | CO1 | A | 10 |
|  | b. | Using Euclidean algorithm, find the *GCD (190, 34)* and express it in the form of d = *sa + tb*. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Show that  is a tautology. | CO2 | A | 10 |
|  | b. | Using truth table, show that  and  are logically equivalent. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A freshman class consists of 40 students, 30 of which are women. The class needs to select a committee of 7 to represent them in the student senate. How many committees are possible if  (i) the committee must have exactly 5 women?  (ii) the committee must have at least 5 women? | CO3 | A | 8 |
|  | b. | Find the number of distinguishable permutations of the letters in the word  (a) BANANA and (b) ENGLISH. | CO3 | A | 5 |
|  | c. | Let A = {1,2,3,4,5,6,7,8} and , be the permutations of A. Find   1. , ) | CO3 | A | 7 |
| 5. | a. | Consider the set Z+ = {1, 2, 3, 4, …..} and be the relation defined on Z+. Show that *R* is an equivalence relation. Also draw the graph of *R.* | CO4 | An | 10 |
|  | b. | Use Warshall’s algorithm to find the transitive closure of S, whose matrix is given below, on the set {1,2,3,4}, | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Prove that (D12, | ) is a partially ordered set and draw its Hasse diagram. | CO5 | An | 10 |
|  | b. | Consider the Hasse diagram given below. Prove that it is a lattice and bounded lattice. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Consider the poset (P(S), ), where S={a, b, c}. Draw the Hasse diagram and prove that (P(S),), is a bounded lattice. | CO5 | An | 10 |
|  | b. | Consider the posets (D30, | ), and (P(S), ) where S={a, b, c}. Draw the hasse diagram and prove that theyare isomorphic posets. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define Euler circuit, and Hamilton circuit. Construct an Euler path, Euler circuit, Hamilton path, and Hamilton circuit for the graph given below if it exist. | CO6 | An | 10 |
|  | b. | Define tree and spanning tree. Construct all spanning tree of the graph given below.  E  C  B  D  A  Graph G1 | CO6 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Define chromatic number of a graph. What is the chromatic number of complete graph Kn? Determine the chromatic number of the following graphs.  C:\Users\ADMIN\Pictures\Graph3.png C:\Users\ADMIN\Pictures\planar graph.png | CO6 | An | 10 |
|  | b. | Find the minimal spanning tree for the graph given below.  v1  v2  v5  v4  v6  v3  19  21  18  14  11  6  5  10  16  33 | CO6 | An | 10 |

**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** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 40 |  |  |  | 40 |
| CO2 |  |  | 20 |  |  |  | 20 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  | 40 |  |  | 40 |
| CO6 |  |  |  | 40 |  |  | 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      (ii) , , ,  (iii),, ,  (iv) , and | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Check whether C(x) = 1 - x2 satisfies the axioms of fuzzy complement function. | CO2 | An | 10 |
|  | b. | Let. Given  and are the fuzzy sets of.  Find,, ,,. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | 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 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Let. Given  and are the fuzzy sets of.  Find Standard Union, Algebraic Sum, Bounded Sum, Drastic Sum. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Given A = [2, 5] and B = [1, 4] are two fuzzy numbers. Find A + B, A - B, A • B and A / B. | CO3 | A | 10 |
|  | b. | Find the solution of the equation A + X = B, where A and B are two fuzzy numbers defined by | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Prove that  is a tautology. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain fuzzy linguistic hedges. | CO4 | U | 10 |
|  | b. | Explain the different types of fuzzy propositions. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Draw the architecture of a fuzzy expert system and explain its components. | CO5 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the general scheme of a fuzzy controller. | CO6 | U | 10 |
|  | b. | Defuzzify the following fuzzy set on X using the Center of Gravity method.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | v | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | μ(v) | 0 | 0.23 | 0.6 | 1 | 0.91 | 0.43 | 0.18 | 0.62 | 0.82 | 0.11 | 0.48 | 0.20 | 0.1 | | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **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** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 |  |  | 50 | 10 |  |  | 60 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  | 20 |  | 20 |  |  | 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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is the probability of 53 Sundays in a leap year? | | CO1 | U | 1 |
| 2. | If X is a random variable when a fair die is tossed, find its distribution table. | | CO1 | R | 1 |
| 3. | If F(x) is cumulative distribution of a random variable X, then P(X=xi) = \_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | Find k if the probability density function of the continuous random variable X is f(x) = kx; 0 < x < 2. | | CO2 | R | 1 |
| 5. | Two continuous random variables X and Y with joint pdf *f*(*x*,*y*) and marginal densities fX(*x*) and fY(*y*) is said to be independent if \_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | The conditional density function f(Y/X) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | R | 1 |
| 7. | Mean of the Binomial Distribution is \_\_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | If X is an exponential random variate with parameter λ=0.2 then what is the mean of the variate? | | CO4 | R | 1 |
| 9. | If X takes the values 4, 5, 5, 4, 3, 3, 3, 2, 5, 7, 5, 8, 9 then the mode of the data is \_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Second order central moment is \_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If A and B are independent prove that A and ‾B are independent. | | CO1 | An | 3 |
| 12. | If X is random variables when a fair coin is tossed. Find its cumulative distribution. | | CO2 | U | 3 |
| 13. | Write any two properties of joint Cumulative distribution function of (X, Y). | | CO3 | An | 3 |
| 14. | For the normal distribution, the mean is 16 and the standard deviation is 8. Find the value of standard normal variate Z at X=24. | | CO4 | U | 3 |
| 15. | Find the median of the following frequency table:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **x** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | f | 17 | 6 | 10 | 13 | 17 | 5 | 9 | | | CO5 | An | 3 |
| 16. | Find β2 when μ1=0, μ2=3.5, 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. | 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? | CO1 | An | 6 |
|  | b. | The probability that a student passes a certain exam is 0.9, given that he studied. The probability that he passes the exam without studying is 0.2. Assume that the probability that the student studies for an exam is 0.75. Given that the student passed the exam, what is the probability that he studied? | CO1 | Ev | 6 |
|  |  |  |  |  |  |
| 18. | a. | 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 ≥ 5), P(X multiple of 5) and mean of X. | CO2 | Ap | 12 |
|  |  |  |  |  |  |
| 19. | a. | The joint probability mass function of a two dimensional discrete random variable (X,Y) is given by 𝑝( 𝑥, 𝑦) = 𝑘( 𝑥 + 𝑦) , *x* = 1,2,3 and *y* = 0, 1, 2, 3. Find (i)the value of k (ii)the marginal probability distribution of X and Y (iii)conditional probability distribution. (iv)probability distribution of X+Y. | CO3 | Ev | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a Poisson distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 43 | 38 | 22 | 9 | 1 | | CO4 | An | 6 |
|  | b. | Eggs laid by a particular chicken are known to have lengths normally distributed, with mean 6 cm and standard deviation 1.4 cm. What is the probability of:  (a) finding an egg bigger than 8 cm in length?  (b) finding an egg smaller than 5 cm in length?  (c) Find an egg length lying between 5 to 8 cm? | CO4 | Ap | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find the mean, median, mode and Quartile deviation for the following distribution   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | | f | 12 | 16 | 6 | 7 | 9 | | CO5 | Ap | 12 |
|  |  |  |  |  |  |
| 22. | a. | For the bivariate probability distribution of (X, Y) given below. Find P(X≤2), P(Y ≤4), P(X ≤2, Y ≤4), P(X≤2/Y≤4), P(Y≤4/X≤2) and P(X+Y ≤ 5).   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **X\Y** | **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 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | A random variable X has the following probability distribution. (i) Find k (ii) Estimate P(X < 1) (iii) P(-2 < X < 1) (iv) Find the cdf of X (v) Find mean and variance.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **x** | **-2** | **-1** | **0** | **1** | **2** | **3** | | P(x) | k | 0.1 | 2k | 0.2 | 3k | 0.3 | | CO2 | Ev | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the rank correlation of the following:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **X** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | Y | 5 | 4 | 2 | 3 | 7 | 6 | 1 | | CO6 | Ap | 6 |
|  | b. | Find the lines of regression for the following data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **X** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | Y | 10 | 9 | 11 | 10 | 9 | 8 | 12 | | CO6 | An | 6 |

|  |  |
| --- | --- |
|  | **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 | 9 | 6 | 0 | 17 |
| CO2 | 5 | 0 | 12 | 0 | 12 | 0 | 29 |
| CO3 | 1 | 1 | 0 | 15 | 12 | 0 | 29 |
| CO4 | 4 | 1 | 6 | 6 | 0 | 0 | 17 |
| CO5 | 0 | 1 | 12 | 3 | 0 | 0 | 16 |
| CO6 | 3 | 1 | 6 | 6 | 0 | 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)**  **(Answer all the questions)** | | | | | |
| 1. | Find the probability of getting 2 heads when a coin is tossed 2 times. | | CO1 | An | 1 |
| 2. | Given that P(A)=1/2 , P(B)=1/3,If and  are independent events, then find | | CO1 | U | 1 |
| 3. | If is the cumulative distribution function of one dimensional random variable X, then | | CO2 | R | 1 |
| 4. | If and are two independent random variables, then | | CO3 | R | 1 |
| 5. | Calculate the mean of a Poisson distribution which is approximately equivalent to | | CO4 | U | 1 |
| 6. | The area under normal curve is \_\_\_\_\_. | | CO4 | R | 1 |
| 7. | In a distribution, the maximum number of repeated values is called \_\_\_\_\_. | | CO5 | R | 1 |
| 8. | Find the mean for the following data: 30, 25, 20, 35, 45and 15. | | CO5 | An | 1 |
| 9. | If the correlation coefficient, then the correlation is said to be \_\_\_\_. | | CO6 | R | 1 |
| 10. | Estimate the regression coefficient of y on x, If. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | The bag contains 3 red and 2 black balls, and 2 balls are drawn at random. Find the probability that they are of the same colour. | | CO1 | An | 3 |
| 12. | Acontinuous random variable X has the following probability density function f(x) =k(x+3), 2<x<5. Find the value of k and P(x>3). | | CO2 | E | 3 |
| 13. | If (X, Y) are two dimensional continuous random variables, then provide the condition for the joint probability density of (X,Y). | | CO3 | R | 3 |
| 14. | The number of monthly breakdowns of a computer is a random variable with a Poisson distribution and a mean of 2. Determine the probability that this computer will operate for a month with only one breakdown. | | CO4 | An | 3 |
| 15. | Compute the median number of flowers per plant for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Flowers | 1 | 2 | 3 | 4 | 5 | 6 | | No of plants | 3 | 7 | 15 | 11 | 6 | 5 | | | CO5 | E | 3 |
| 16. | Calculate the mean of x and y for the two regression equation of y on x and x on y: 8x-10y+66=0 and 40x-18y-214=0. | | 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. | A lot consists of 8 good articles, 5 with minor defects and 3 with major defects. Two articles are chosen at random. Find the probability that (i) both are good (ii) atleast one is good (iii) exactly one is good. | CO1 | A | 6 |
|  | b. | Three students A, B and C are given a statistics problem. Their chances of solving the problem are 1/3,1/4, and 1/5 respectively. If all of them solve the problem independently, then find the probability that (i) atleast one of them solves the problem (ii) exactly two students solve the problem. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Acontinuous random variable X has a probability density function,. Find (i) k (ii) Mean and Variance. | CO2 | E | 6 |
|  | b. | A random variable X has a probability distribution as follows:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | p(x) | 3k | 4k | 5k | 8k | 7k | 3k |   Find the value of (i) ‘k’ (ii) P(X<4) , and (iii) mean of x. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Given the bivariate probability distribution of (X,Y), Find (i) P(X≤1) (ii) P(Y ≤ 3) (iii) P(X≤1, Y ≤ 3) (iv) P(X≤1/ Y ≤ 3) (v) P(Y ≤ 3 / X≤1) (vi) P(X+Y ≤ 4).   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X/Y | 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 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | The marks obtained by a number of students in a certain subject are approximately normally distributed with mean 65 and standard deviation 5. Find the probability that the students will score (i) more than 75 marks (ii) less than 60 marks. | CO4 | A | 6 |
|  | b. | 5 coins were tossed simultaneously. Using binomial distribution, find the probability of getting (i) exactly 3 heads (ii) at least 2 heads (iii) at most 2 heads. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | The daily wages of laborers in a farm are given below:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Wages (Rs.) | 0-100 | 100-200 | 200-300 | 300-400 | 400-500 | | No of Days | 5 | 8 | 21 | 12 | 4 |   Calculate the quartile deviation. | CO5 | E | 6 |
|  | b. | Data recorded on number of pods per plant in a variety of moth bean, Find mean and mode for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class interval | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No of plants | 3 | 9 | 15 | 30 | 18 | 5 | | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Machine A contributes for 25% of the items produced by a factory, 35% for Machine B, and 40% for Machine C. The percentages of satisfactory articles produced are 80% for A, 90% for B and 95% for C. An article is chosen at random. a) What is the probability that it is satisfactory? b) Assuming that the article is satisfactory, what is the probability that it was produced by Machine A? | CO1 | A | 4 |
|  | b. | The joint probability density function of a two dimensional random variable (X, Y) is given by Find the marginal distributions of X and Y , and verify whether X and Y are independent. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 23. | a. | The following mistakes per page were obtained in a book:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | No of mistakes per book | 0 | 1 | 2 | 3 | 4 | | No of time mistakes occurred | 211 | 90 | 19 | 5 | 0 |   Fit a Poisson distribution, and calculate the expected frequencies. | CO4 | E | 6 |
|  | b. | In a certain food preparation competition, two judges gave ranks for 10 entries as follows:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Judge A | 6 | 5 | 3 | 10 | 2 | 4 | 9 | 7 | 8 | 1 | | Judge B | 3 | 8 | 4 | 9 | 1 | 6 | 10 | 7 | 5 | 2 |   Compute the correlation coefficients between the ranks of the two judges. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find the regression equation of x on y and y on x for the following height in inches (*x*) and the weight in lb. (*y*) of a random sample of 10 students from a large group of students of age 17 years:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 61 | 68 | 68 | 64 | 65 | 70 | 63 | 62 | 64 | 67 | | y | 112 | 123 | 130 | 115 | 110 | 125 | 100 | 113 | 116 | 125 |   Compute the weight of a student whose height is 69 inches. | 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 1 | 10 | 10 |  |  | 21 |
| CO2 | 1 | - | - | - | 15 |  | 16 |
| CO3 | 4 | - | - | 8 | 12 |  | 24 |
| CO4 | 1 | 1 | 12 | 3 | 6 |  | 23 |
| CO5 | 1 | - | - | 1 | 15 |  | 17 |
| CO6 | 1 | - | 12 | 7 | 3 |  | 23 |
|  | | | | | | | **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. | \_\_\_\_\_\_\_\_ is the process of constructing mathematical relationships which possess closest proximity to the series of data. | | CO1 | R | 1 |
| 2. | The second degree equation of the parabola is \_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | The finite subset of the population is known as \_\_\_\_\_\_. | | CO2 | U | 1 |
| 4. | The table value of Zα for one tailed test at 1% level of significance is \_\_\_. | | CO2 | R | 1 |
| 5. | Write the table value of F-test at 5% level (Two tailed) from the two samples A and B with 12 and 9 sample observations. | | CO3 | U | 1 |
| 6. | Which test is used to test the independence of attributes ? | | CO3 | U | 1 |
| 7. | The amount of balancing, blocking and grouping of the experimental units refers to \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | The allocation of the treatments to the different experimental units in a random process is known as \_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | In a process, 18 out of 20 points are plotted above the CL but below the upper control limit, and only 2 of 20 are plotted between the center line and the lower control limit, what can we say about the process state? | | CO5 | R | 1 |
| 10. | Five oil pumps were tested with failure hours of 45, 33, 62, 94 and  105. Find the MTTF. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Convert y=aebx into linear form. | | CO1 | An | 3 |
| 12. | Define parameter and statistic. | | CO2 | U | 3 |
| 13. | Two sample of sodium vapour lamps were tested for length of life.   |  |  |  |  | | --- | --- | --- | --- | |  | Sample Size | Sample Mean | Sample S.D. | | Type I | 8 | 1234 hrs | 36 hrs | | Type II | 7 | 1030 hrs | 40 hrs |   Determine the test statistic for significant difference of means. | | CO3 | E | 3 |
| 14. | Explain the layout of Latin Square Design (LSD). | | CO4 | U | 3 |
| 15. | Construct a control chart of range for the following data on the basis of voltage, samples of 5 being taken every hour. Comment on whether the production seems to be under control.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Range | 45 | 48 | 62 | 48 | 36 | 81 | 78 | 42 | 69 | 72 | | | CO5 | An | 3 |
| 16. | Define reliability function and mean time to failure rate. | | 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 second degree parabola for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 2 | 4 | 6 | 8 | 10 | | y | 1 | 2 | 3 | 4 | 5 | | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | A machine produces 16 imperfect articles in a sample of 500. After the machine is overhauled, it gives 3 imperfect articles in a batch of 100. Has the machine improved due to overhauling? | CO2 | An | 7 |
|  | b. | Explain the following :  (i) Null and Alternative hypothesis  (ii) Type I and Type II Error  (iii) Level of Significance. | CO2 | R | 5 |
|  |  |  |  |  |  |
| 19. | a. | The mean weekly sales of 100 gm butter pack in departmental stores was 146.3 packs per store. After an advertising campaign, the mean weekly sales in 22 stores for a week increased to 153.7 with standard deviation 17.2. Was the advertising campaign successful? | CO3 | An | 5 |
|  | b. | A certain drug is claimed to be effective in curing cold. In an experiment on 500 person with cold, half of them were given the drug and half of them were given the sugar pills. The patients reaction to the treatment are recorded in the following table:   |  |  |  |  | | --- | --- | --- | --- | |  | Helped | Harmed | No effect | | Drug | 150 | 30 | 70 | | Sugar pills | 130 | 40 | 80 |   On the basis of this data, can it be concluded that the drug and sugar pills differ significantly in curing cold? | CO3 | An | 7 |
|  |  |  |  |  |  |
| 20. | a. | 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 |   Analyse the results for treatment effects. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Control on measurement of pitch diameter of thread in air-craft fittings is checked with five samples each containing 5 items at equal intervals of time. The measurements are given below. Construct  and R chart and comment on the state of control of the process.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Sample No. | 1 | 2 | 3 | 4 | 5 | | Measurements | 46 | 45 | 44 | 43 | 42 | | 41 | 41 | 44 | 42 | 40 | | 40 | 40 | 42 | 40 | 42 | | 42 | 43 | 43 | 42 | 45 | | 43 | 44 | 47 | 47 | 45 | | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | The samples of 10 observations, each of size 50 were inspected and the numbers of defectives in the inspection were 2,1,1,2,3,5,5,1,2,3. Construct p-chart, np-chart and comment on the state of control. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | 10 components were tested. The components (not repairable) failed as follows: Component 1,2,3,4 and 5 failed after 75,125, 130, 325, 525 hours. Find the failure rate and mean time to failure rate. | CO6 | A | 6 |
|  | b. | The data below shows operating time and breakdown time of a machine:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Operating Time | 20.2 | 6.1 | 24.4 | 35.3 | 46.7 | | Down Time | 2.5 | 7.1 | 4.2 | 1.8 | - |   Using exponential distribution  a) Determine the MTBF.  b) Find the system reliability for a machine time of 20 hours. | 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

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|  | **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** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Convert C7(hex) to binary form. | | CO1 | U | 1 |
| 2. | If f(a) and f(b) are of opposite signs of f(x) = 0, then what is the approximate value of the root when we use Regula Falsi method? | | CO1 | R | 1 |
| 3. | If E is a shifting operator, | | CO2 | A | 1 |
| 4. | What is the degree of Lagrange polynomial that interpolates n data points? | | CO2 | U | 1 |
| 5. | Simpson’s three-eighths rule can be applied only when n is a ………… | | CO3 | R | 1 |
| 6. | Using two points Gaussian quadrature | | CO4 | U | 1 |
| 7. | Taylor’s series formula is | | CO5 | U | 1 |
| 8. | Write Adam’s predictor formula. | | CO5 | U | 1 |
| 9. | is solved, using ………………….. method. | | CO6 | R | 1 |
| 10 | is a ……………….. equation. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Convert 1073 to base 5 | | CO1 | U | 3 |
| 12. | Write down Lagrange’s Interpolation formula | | CO2 | R | 3 |
| 13. | Explain Romberg method of integration. | | CO3 | U | 3 |
| 14. | Define a cubic spline S(x). | | CO4 | R | 3 |
| 15. | How do you classify  as  (i) elliptic (ii) parabolic (iii) hyperbolic | | CO6 | R | 3 |
| 16. | Give the standard five point formula and diagonal five point formula used in solving elliptic 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. | Find the positive root of correct to two decimal places by Bisection method. | CO 1 | A | 8 |
|  | b. | Add B4CF and 5A4D. | CO 1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | Using Newton’s divided difference formula, find f(6).   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 7 | 8 | | f(x) | 1 | 5 | 5 | 4 | | CO2 | A | 7 |
|  | b. | Rewrite the Newton form of the interpolating polynomial in nested form.  and use it to evaluate | CO2 | A | 5 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate  by using (i) Trapezoidal rule (ii) Simpson’s one-third rule and (iii) Simpson’s three-eighths rule | CO3 | An | 9 |
|  | b. | Define three points Gaussian quadrature. | CO3 | R | 3 |
|  |  |  |  |  |  |
| 20. | a. | Find the cubic spline given the table and   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 0 | 2 | 4 | 6 | | y | 1 | 9 | 41 | 41 | | CO4 | E | 9 |
|  | b. | Test whether the functions  are cubic splines or not. | CO4 | U | 3 |
|  |  |  |  |  |  |
| 21. | a. | Using Euler’s method, solve numerically the equation,  for x = 0.2,0.4 and 0.6 | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve using Taylor’s series method, correct to three decimal places, the value of y(0.1), given | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Solve , given u(0,t) = 0,u(4,t) = 0,u(x,0) = x(4-x). Assume  h = 1. Find the values of u up to t = 5. | CO6 | An | 10 |
|  | b. | Prove that  is a Parabolic equation. | CO6 | U | 2 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Obtain the values of y at x = 0.1, 0.2, 0.3 using Runge-Kutta method of fourth order for the differential equation y’= -y,y(0) = 1. | CO5 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to solve algebraic and transcendental equations occur in engineering fields, numerically. |
| CO2 | The students will be able to apply interpolation in forming polynomials to predict data. |
| CO3 | The students will be able to find solutions to complicated integrals arising in the field of engineering using numerical Integration techniques. |
| CO4 | The students will be able to approximate polynomials to find desired solution using spline functions |
| CO5 | The students will be able to apply different numerical techniques to solve ordinary differential equations. |
| CO6 | The students will be able to Find approximate solutions to partial 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 | 5 | 4 | 8 |  |  |  | 17 |
| CO2 | 3 | 2 | 12 |  |  |  | 17 |
| CO3 | 4 | 3 |  | 9 | 9 |  | 25 |
| CO4 | 3 | 4 |  | 9 |  |  | 16 |
| CO5 |  | 2 |  | 12 | 12 |  | 26 |
| CO6 | 4 | 6 |  | 10 |  |  | 20 |
|  | | | | | | | **124** |



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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. | Three students A, B and C are given a statistics problem. Their chances of solving the problem are 1/3, 1/4, and 1/5 respectively. If all of them solve the problem independently, then find the probability that (i) atleast one of them solves the problem (ii) exactly two students solve the problem. | CO1 | An | 8 |
|  | b. | Machine A contributes for 25% of the items produced by a factory, 35% for Machine B, and 40% for Machine C. The percentages of satisfactory articles produced are 80% for A, 90% for B and 95% for C. An article is chosen at random. a) What is the probability that it is satisfactory? b) Assuming that the article is satisfactory, what is the probability that it was produced by Machine A? | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | 7 coins were tossed simultaneously. Using binomial distribution, find the probability of getting (i) no heads (ii) exactly 3 heads (iii) at least 2 heads (iv) at most 2 heads. | CO2 | An | 8 |
|  | b. | In a test of 2000 electric bulbs, it was found that the life of specific brand was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs that are likely to burn for (i) more than 2170 hours (ii) less than 1850. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Calculate the two regression equation of x on y and y on x from the data given below:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Price (Rs) | 10 | 12 | 13 | 12 | 16 | 17 | | Amount demanded | 40 | 38 | 43 | 45 | 37 | 43 |   Estimate the likely demand when the price is Rs. 20. | CO3 | E | 8 |
|  | b. | The simple correlation coefficients between temperature (X1), Corn yield (X2) and rainfall (X3) are =0.70. Calculate partial coefficient of correlation and multiple correlation coefficients. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | In large city A, 20% of random sample of 900 school boys had a minor 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? Use 5% level of significance. | CO4 | An | 8 |
|  | b. | Two independent samples of 8 and 7 items respectively had the following values of the variable.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample 1 | 9 | 11 | 13 | 11 | 15 | 9 | 12 | 14 | | Sample 2 | 10 | 12 | 10 | 14 | 9 | 8 | 10 | - |   Do the estimates of population variance differ significantly at 5% level of significance? | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Use the Mann Whitney U-test to determine whether there is 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 |
|  | b. | Use the sign test to see if there is a difference between the number of days until the collection of an account receivable before and after a new collection policy at 5% significance level.  Before (1st) : 30 28 34 35 40 42 33 38 34 45 28 27 25 41 36  After (2nd : 32 29 33 32 37 43 40 41 37 44 27 33 30 38 36 | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | Acontinuous random variable X that can assume any value between x=2 and x=5 has a density function given by f(x) =k(1+x) . Find (i) k and (ii) P(x<4) (ii) Mean of x. | CO1 | E | 8 |
|  | b. | A random variable x has the mean µ=20 and variance =9 and an unknown probability distribution. Find 8). | CO2 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | 40 people were selected at random in the following order:  XXYYYYXYYXXYXXXXYYXXYXYYXXXXYYXYXXYYXXXY.  Is it true that the people were chosen at random using run test at 5 % level of significance, assuming the population has 50% men(X) and 50% women (Y)? | CO4 | An | 8 |
|  | b. | Theory predicts that the proportion of beans in four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Using chi square test, determine whether the experiment supports theory at 5% level of significance. | CO5 | E | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | A Latin Square Design varietal trial was conducted on wheat using varieties A, B, C and D. The plan of the experiment and the per plot yield are given below. Analyze the data and interpret the result  C(25) B(23) A(20) D(20)  A(19) D(19) C(21) B(18)  B(19) A(14) D(17) C(20)  D(17) C(20) B(21) A(15) | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S 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** | | **R** | **U** | **A** | **An** | **E** | **C** | **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** | **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 deviation and standard deviation for the following table giving the age distribution of 542 members.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Age (in years) | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | | No of members | 3 | 61 | 132 | 153 | 140 | 51 | 2 | | CO2 | An | 15 |
|  | b. | What is type I and type II error? | CO3 | R | 05 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | In one sample of 8 observations, the sum of squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. test whether this difference is significant at 5 per cent level, given that 5 per cent point of F for n1=7 and n2=9 degrees of freedom is 3.29. | CO6 | A | 10 |
|  | b. | Define Correlation. Write the assumptions and properties for correlation analysis. What is scatter Diagram? Explain the Karl Pearson’s coefficient formulae. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Write a note on analysis of variance. | CO6 | U | 10 |
|  | b. | Following is the distribution of marks obtained by 500 candidates in statistics paper of a civil service examination:  Calculate Q2 and D3   |  |  | | --- | --- | | Class intervals | Frequency(f) | | 0-10 | 40 | | 10-20 | 60 | | 20-30 | 200 | | 30-40 | 100 | | 40-50 | 70 | | 50 and above | 30 | | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Fit a straight line Y= a+bX to the following data. Also estimate Y when X =9   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Y | 2.4 | 3 | 3.6 | 4 | 4.6 | 5 | 5.4 | 6 | | CO3 | A | 10 |
|  | b. | Write a note on t-test and chi-square test. | CO4 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | What are all the ideal measures for dispersion? Which one is the ideal measure according to you? Give reason. | CO1 | U | 10 |
|  | b. | Based on field experiments, a new variety of green gram is expected to give a yield of 12.0 quintals per hectare. The variety was tested on 10 randomly selected farmer’s fields. The yield (quintals/hectare) was recorded as 14.3, 12.6, 13.7, 10.9, 13.7, 12.0, 11.4, 12.0, 12.6, and 13.1. Do the results confirm to the expectation? | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | An experiment in CRD with 8 treatments replicated 3 times. Give ANOVA table.   |  |  |  |  | | --- | --- | --- | --- | | Treatment | Replication | | | | R1 | R2 | R3 | | T1 | 12 | 14 | 16 | | T2 | 13 | 18 | 16 | | T3 | 12 | 14 | 17 | | T4 | 10 | 12 | 14 | | T5 | 15 | 13 | 13 | | T6 | 12 | 14 | 15 | | T7 | 11 | 10 | 12 | | T8 | 18 | 16 | 19 | | CO6 | An | 10 |
|  | b. | Write the testing procedure for testing more than two means. | CO3 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a note on positional values and O-give curve. | CO1 | R | 10 |
|  | b. | Draw a cumulative frequency curve and locate graphically any 2 positional values for the following distribution   |  |  | | --- | --- | | Interval | Frequency | | 0-10 | 4 | | 10-20 | 7 | | 20-30 | 6 | | 30-40 | 10 | | 40-50 | 2 | | CO2 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write the comparison between arithmetic mean, Harmonic mean and Geometric mean. | CO1 | U | 10 |
|  | b. | Write the formulae for all four central moments μ1, μ2, μ3, μ4 along with skewness and kurtosis. | CO2 | R | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write a note on Measures of Central tendancy. | CO1 | U | 10 |
|  | b. | In a fertilizer trial, the grain yield of paddy (kg/plot) was observed as follows. Under ammonium chloride, the grain yield of paddy (kg/plot) were 42,39,38,60 and 41 kg. Under urea, the grain yield of paddy (kg/plot) were 38, 42, 56, 64, 68 and 69 kg. Find whether there is any difference between the sources of nitrogen. | CO4 | 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 | 30 | - | 10 | - | - | 50 |
| CO2 | 10 | - | - | 15 | - | 10 | 35 |
| CO3 | 15 | - | 10 | - | - | - | 25 |
| CO4 | 10 | 10 | - | 20 | - | - | 40 |
| CO5 | - | - | - | - | - | - | - |
| CO6 | - | 10 | 10 | 10 | - | - | 30 |
|  | | | | | | | **180** |



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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | | | |
| 1. | If  is the complementary event of A, then P() = \_\_\_\_\_\_. | | | CO1 | U | | 1 |
| 2. | Find the probability of getting 2 heads when a coin is tossed 2 times. | | | CO1 | R | | 1 |
| 3. | Find from the following probability distribution of random variable   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | -3 | -2 | -1 | 0 | 1 | 2 | 3 | |  | 0.2 | 0.1 | K | 0.1 | 0.1 | k | 0.1 | | | | CO2 | U | | 1 |
| 4. | If is the cumulative distribution function of two dimensional random variable then. | | | CO2 | R | | 1 |
| 5. | The mean of the exponential distribution is\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 6. | What is the standard deviation of the standard normal distribution? | | | CO3 | R | | 1 |
| 7. | What is the nature of , if ‘T’ is continuous and ‘S’ are discrete? | | | CO4 | R | | 1 |
| 8. | The random process which is not stationary is called\_\_\_\_\_\_ process. | | | CO4 | R | | 1 |
| 9. | State mean ergodic theorem. | | | 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. | An urn contains 3 white balls, 4 red balls and 5 black balls. 2 balls are drawn at random. Find the probability that both of them are different colour. | | | CO1 | | An | 3 |
| 12. | The joint pdf of a 2 dimensional random variable is  f(x, y) = 4xy, 0 ≤ x ≤1, 0 ≤ y ≤1. Find the conditional distribution function f(y/x). | | | CO2 | | E | 3 |
| 13. | If the mean and variance of Binomial distribution are 6 and 3, then determine the distribution function. | | | 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 , 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. Find the probability that (i) both have major defects (iii) at most one is good (iv) exactly one is good | CO1 | | An | 6 |
|  | | 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 | 6 |
|  | |  |  |  | |  |  |
| 18. | | a. | The joint probability mass function of (X,Y) is  P(x,y)= K(5x+2y), x= 0,1,2, y = 1,2,3  Find (i) The value of K (ii) Marginal probability distribution (iii) Conditional probability distribution (iii) Probability distribution of X+Y | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 19. | | a. | Fit a Poisson distribution to the following data and calculate the theoretical frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 122 | 60 | 15 | 2 | 1 | | 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. | A fair dice is tossed 720 times. Use Chebyshev inequality to find a lower bound for the probability of getting 100 to 140 sixes. | CO4 | | E | 6 |
|  | | b. | Find the moment generating function of the Binomial distribution and evaluate its mean. | CO4 | | An | 6 |
|  | |  |  |  | |  |  |
| 21. | | a. | Two random processes and are defined by  and Show that and are jointly wide sense process, where‘’ and ‘’ are random variables and given (i) (ii) (iii) | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 22. | | a. | If the joint pdf of a two dimensional RV(X,Y) is given by . Find (i) the value of ‘k’(ii) P(X<1,Y<3) (iii) P(Y<3) (iv) P(X<1**/**Y<3). | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 23. | | 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 2150 hrs (ii) Less than 1950 hrs. | 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. | Suppose the customers arrive at a bank according to a Poisson process with a mean rate of 3 per minute. Find the probability that during a time interval of 2 min (i) exactly 4 customers arrive and (ii) more than 4 customers arrive | CO6 | | An | 6 |
|  | | b. | The transition probability matrix of a Markov chain having 3 states 1, 2 and 3 is and the initial distribution is = (0.7,0.2, 0.1)  Find (i) 3) and (ii) | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to recognize probability models. |
| CO2 | The students will be able to solve using discrete and continuous random variables. |
| CO3 | The students will be able to classify the problems using probability distributions. |
| CO4 | The students will be able to analyze the problems using statistical averages. |
| CO5 | The students will be able to determine the characteristics of random processes. |
| CO6 | The students will be able to identify the classification of random processes. |

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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 | - | 15 | - | 6 | - | 23 |
| CO4 | 2 | - | - | 9 | 12 | - | 23 |
| CO5 | 1 | - | - | 12 | 3 | - | 16 |
| CO6 | 1 | - | 6 | 9 | - | - | 16 |
|  | | | | | | | **124** |



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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. | Explain the different processes employed to carry out research problem formulation. | CO1 | E | 10 |
|  | b. | Describe the step-by-step process adopted to identify your research problem statement. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Categorize the types of research carried out in academia and industry. Classify your research in any one of the categories and justify. | CO1 | C | 10 |
|  | b. | Critically analyze the process of defining a research hypothesis. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Describe the importance of Literature Review in research. Enumerate a few resources that are available in KITS to carry out a literature review. | CO2 | U | 10 |
|  | b. | Categorize the research design and elaborate each case in detail. | CO2 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Articulate the basic principle of experimental design. Describe each component with suitable examples. | CO2 | An | 10 |
|  | b. | Categorize the types of sampling techniques with respect to research design. Estimate the implications of the poor sampling. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the Measure of Central Tendency with a suitable example. Describe the process of evaluating mean, median and mode. | CO3 | E | 10 |
|  | b. | Distinguish the Simple Regression Analysis with Multiple Regression Analysis with suitable examples. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Management of a Hotel Chain is interested in determining the percentage of the hotel’s guests who stay for more than 3 days. The reservation manager wants to be 95% confident that the percentage has been estimated to be within 3% of the true value. What is the most conservative sample size needed for this problem?  Value of p=0.5  z = 1.96 (as per the table of area under the normal curve for the given confidence level of 95%). | CO5 | E | 20 |
|  |  |  |  |  |  |
| 7. | a. | Find the range and quartile deviation for the following distribution:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Class Interval | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | | No. of Frequency | 15 | 23 | 18 | 31 | 23 | 13 | 7 | | CO4 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the necessity to write a project proposal. Describe the structure of a Project Proposal. Propose a model project based on your current research work. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Outline the importance of acquiring an IP for an invention or an innovation. Tabulate the different types of IPs in the country. | CO6 | A | 10 |
|  | b. | Explain the step-by-step process followed in India to write a patent disclosure form. | CO6 | U | 10 |

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

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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 | 10 |  |  |  | 10 | 10 | 30 |
| CO2 |  | 10 |  | 20 | 10 | 10 | 50 |
| CO3 |  |  |  |  | 10 |  | 10 |
| CO4 |  | 10 |  |  | 20 |  | 30 |
| CO5 |  |  |  | 20 | 20 |  | 40 |
| CO6 |  | 10 | 10 |  |  |  | 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. | a. | Describe the meaning of philosophy and the nature of it in terms of ethics and code of conduct. | CO1 | U | 10 |
|  | b. | Categorize the types of Philosophy and explain them with a real-world example. | CO1 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the importance of following ethical practices in ethics. Discuss cause and effect if ethics are not followed. | CO1 | E | 10 |
|  | b. | Enumerate the types of scientific misconduct by researchers with specific reference to Indian researchers. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Define salami slicing. Illustrate with an example, the reason to avoid salami slicing. | CO2 | An | 10 |
|  | b. | Explain the implications on the future of a researcher if he/she is involved in Selective Reporting. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Elaborate on the functions of COPE and WAME. List the steps taken by them to ensure ethical practices in research. | CO2 | U | 10 |
|  | b. | Enumerate the common reasons for the Conflict of Interest between authors of a technical report. Discuss the preventive measures to be taken to avoid it. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Distinguish between open-access journals and predatory journals. Articulate the steps followed by researchers to avoid predatory journals. | CO3 | An | 10 |
|  | b. | Enumerate the disciplinary actions taken by journals for violating copyrights. List a few tools that will help us avoid copyright violations. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate the procedure to be followed for submission of appeals and complaints to journal/book publishers. | CO5 | An | 10 |
|  | b. | List any 5 well known software for checking similarity. Explain the impact of such software in eliminating plagiarism. | CO5 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | List the types of precautionary measures to be taken writing a journal paper. Present the check list for journal paper submission. | CO4 | R | 10 |
|  | b. | Summarize the procedure followed to solve a dispute between authors during an author conflict. List the types of disputes that can occur between authors. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Illustrate with a real-world example, the types of publication frauds that has occurred in India. | CO5 | An | 10 |
|  | b. | Demonstrate the impact of self-citation and the damage it causes to the author credentials. | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the following tools used in research:   1. Web of Science 2. Scopus 3. SNIP 4. SJR 5. Scimago | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S 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 | Understand the importance of publication ethics |

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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 | 20 |  | 50 |
| CO3 |  |  |  | 10 |  |  | 10 |
| CO4 | 20 |  |  |  | 10 |  | 30 |
| CO5 |  |  | 10 | 20 | 10 |  | 40 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **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)**  **(Answer all the questions)** | | | | | |
| 1. | Find the eigenvalues of the matrix . | | CO1 | U | 1 |
| 2. | Determine the signature of the canonical form . | | CO1 | U | 1 |
| 3. | If the roots of an ordinary differential equation are 2 and 3, then write its complementary function. | | CO2 | R | 1 |
| 4. | Find the order of the ordinary differential equation. | | CO2 | U | 1 |
| 5. | Write an example of the iterative method applied for solving the system of equations. | | CO3 | R | 1 |
| 6. | In Gauss Jordan method the coefficient matrix is transformed to \_\_\_\_\_\_\_\_ matrix form. | | CO3 | R | 1 |
| 7. | Evaluate . | | CO4 | E | 1 |
| 8. | = \_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | Write the formula to find the area of a given region R in polar coordinates. | | CO5 | U | 1 |
| 10. | For applying Simpson’s 3/8th rule, the number of sub-intervals should be taken as\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Write the characteristic equation of the matrix . | | CO1 | U | 3 |
| 12. | Solve . | | CO2 | U | 3 |
| 13. | Solve the system of linear equations by matrix inversion method.  3x + 2y = 14  3x + 3y = 18. | | CO3 | A | 3 |
| 14. | Evaluate . | | CO4 | E | 3 |
| 15. | Calculate the value of . | | CO5 | E | 3 |
| 16. | Evaluate using Trapezoidal rule taking h = ¼. | | 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. | Find the eigenvalues and eigenvectors of the matrix . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the particular integral of . | CO2 | A | 4 |
|  | b. | Solve by the method of variation of parameters. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 19. | a. | Solve the following system of equations by Gauss elimination method. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | By the method of least squares find the best fitting a straight line to the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | | Y | 1 | 1.8 | 3.3 | 4.5 | 6.3 | | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Using the method of integration by parts evaluate . | CO4 | E | 6 |
|  | b. | Express  in terms of gamma function. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Change the order of integration and hence evaluate. | CO5 | An | 6 |
|  | b. | Find the area lying between the parabola y = x2 and the line x + y = 2. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find and  at x = 0 and x = 5 from the following table.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | y | 4 | 8 | 15 | 7 | 6 | 2 | | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate  by using   1. Trapezoidal rule 2. Simpson’s 1/3rd rule 3. Simpson’s 3/8th rule. | 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 Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 5 | 12 |  |  |  | 17 |
| CO2 | 1 | 4 | 12 |  |  |  | 17 |
| CO3 | 2 |  | 27 |  |  |  | 29 |
| CO4 | 1 |  |  |  | 16 |  | 17 |
| CO5 |  | 1 | 6 | 6 | 3 |  | 16 |
| CO6 | 1 |  | 3 | 12 | 12 |  | 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. | The sum of three numbers in Arithmetic progression is 24 and their product is 440. Find the numbers. | CO1 | An | 7 |
|  | b. | Find the sum of the series 2+7+12+17+……+152. | CO1 | U | 5 |
|  | c. | The savings of Mr.Smith increases each month by ₹50 more than the previous month. If his total savings for 2 years amounted to ₹25,800. Find out his saving for the first month. | CO1 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Find the 9th term of the geometric progression 1,4,16,64,…… | CO1 | An | 5 |
|  | b. | Find the sum of 10 terms of the G.P. . | CO1 | U | 7 |
|  | c. | The 4th and 9th term of a geometric progression are 54 and 13122 respectively. Find the geometric progression. | CO1 | An | 8 |
|  |  |  |  |  |  |
| 3. | a. | Find the time required to earn ₹400 as simple interest in the principal of ₹2000 at the rate of 10 %. | CO2 | E | 5 |
|  | b. | Calculate the compound interest and compound amount of the following investments  (i) ₹15000 @ 9% p.a., for 6 years and interest compounded annually.  (ii) ₹20000 @ 10% p.a., for 3 years and interest compounded half-yearly. | CO2 | E | 8 |
|  | c. | A person borrows ₹20000 at 4% compound interest and agrees to pay both the principal and interest in 10 equal instalments at the end of each year. Find the amount of these instalments under immediate annuity. | 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 compounded monthly. | CO2 | E | 5 |
|  | b. | In a company a machine costs ₹80000 and its life is estimated to be 20 years. Sinking fund is created for replacing the machine at the end of its life time when its scrap realizes a sum of ₹5000 only. Calculate the amount which should be provided every year for the sinking fund if it accumulates at 9% p.a. compounded annually. | CO2 | E | 7 |
|  | c. | A bill for ₹1825 was drawn on 22nd January at 6 months date and discounted on 16th April at the rate of 10% per annum. Find the banker’s discount, true discount, banker’s gain. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | If , and . Find (i) and (ii) .  Also prove that (iii)  (iv). | CO3 | U | 10 |
|  | b. | 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. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Use matrix inversion method to solve the system of equations  2x-y+3z = 1  x+y+z = 2  x-y+z = 4. | CO4 | A | 10 |
|  | b. | Solve graphically  Maximize Z = 3x + 4y  subject to constraints 4x + 2y ≤ 80  2x + 5y ≤ 180  and x ≥ 0, y ≥ 0. | CO4 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | Find the derivative of . | CO5 | U | 5 |
|  | b. | Differentiate with respect to x. | CO5 | U | 5 |
|  | c. | Find the maximum and minimum value of the function. | CO5 | 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 a certain product is . Find the total cost and the average cost function, if the fixed cost is 200. | CO5 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | A and B together can complete a piece of work in 15 days and B alone in 20 days. In how many days can A alone complete the work? | CO6 | A | 5 |
|  | b. | Find the number of distinguishable permutations of the letters in  (a) OHIO and (b) MISSISSIPPI. | CO6 | An | 5 |
|  | c. | In how many ways a committee consisting of 5 men and 3 women, can be chosen from 9 men and 12 women? | CO6 | An | 5 |
|  | d. | If the cost price is ₹2516 and selling price is ₹2272, find the loss percentage. | 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 | - | 12 | 8 | 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. | The following numbers gives the weights of 55 students of a class; 42,74, 40, 60, 82, 115, 41, 61, 75, 83, 63, 53, 110, 76, 84, 50, 67, 65, 78 ,77, 56, 95, 68, 69, 104, 80, 79, 79, 54, 73, 59, 81, 100, 66, 49, 77, 90, 84, 76, 42, 64,69, 70, 80, 72, 50, 79, 52, 103, 96, 51, 86, 78, 94, 71. Find the frequency table and hence draw the histogram and ogive curves. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | 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 |
|  | b. | Discuss the different types of bar diagrams with an example. | CO1 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Find the mean, median and mode for the following distribution.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | | f | 5 | 6 | 15 | 10 | 5 | 4 | 2 | 2 | | CO2 | A | 15 |
|  | b. | Determine the standard deviation of the following data:  18, 20, 22, 17, 20, 17, 22, 19, 23, 22. | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Calculate coefficient of variation of the following frequency distribution:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | CI | 0 -10 | 10 -20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60-70 | | Freq | 17 | 23 | 26 | 25 | 19 | 17 | 14 | | CO2 | A | 10 |
|  | b. | Find the range, quartiles, quartile deviation, inter-quartile range and coefficient of quartile deviation for the following data: 8, 6, 9, 3, 2, 4, 11, 13 and 10. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | 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 | E | 10 |
|  | 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 | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | A manufacturer knows that the condensers he makes contain on the average 1% defectives. He packs them in boxes of 100. What is the probability that a box picked at random will contain (i) at least 3 defectives (ii) at most 3 defectives | CO3 | A | 10 |
|  | b. | Two dice are thrown, what is probability of getting a sum as (i) 5 (ii) at most 7 (iii) at least 11. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Obtain the two regression equation for the following datadata:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Consumption (y) | 25 | 20 | 22 | 28 | 30 | | Price (x) | 96 | 95 | 85 | 90 | 86 | | CO5 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | In a certain crop production competition, two judges gave ranks for 10 entries as follows:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Judge x | 3 | 4 | 6 | 5 | 8 | 2 | 9 | 1 | 10 | 7 | | Judge y | 2 | 7 | 3 | 4 | 9 | 1 | 10 | 5 | 8 | 6 |   Compute the correlation coefficients between the ranks of the two judges. | CO4 | E | 10 |
|  | b. | Determine the trend line for the following:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 2005 | 2006 | 2007 | 2008 | 2009 | | Sales | 35 | 56 | 79 | 80 | 40 | | CO6 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | 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 | A | 10 |
|  | b. | 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 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to present the data in tabular and graphical representations. |
| CO2 | The student will be able to determine the central tendency and dispersion to associate the data in real time. |
| CO3 | The student will be able to model the data using probability distributions |
| CO4 | The student will be able to analyze the relationship between the business parameters |
| CO5 | The student will be able to construct the regression lines to predict and analyze the future |
| CO6 | The student will be able to examine the trends and forecast the business developments. |

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



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| **Course Code** | **23MA1001** | **Duration** | **3hrs** |
| **Course Name** | **MATRICES, CALCULUS AND ORDINARY 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. | Evaluate the Eigen values of the matrix . | | CO1 | R | 1 |
| 2. | Find the Eigen values of matrix 5 if 15, 25, 35 are the Eigen values of matrix A. | | CO1 | U | 1 |
| 3. | Is a linear function? | | CO2 | R | 1 |
| 4. | Evaluate . | | CO2 | U | 1 |
| 5. | If , then evaluate . | | CO3 | A | 1 |
| 6. | If , then evaluate divergence of . | | CO3 | A | 1 |
| 7. | Evaluat*e* . | | CO4 | A | 1 |
| 8. | Evaluate . | | CO4 | R | 1 |
| 9. | Find the value . | | CO5 | A | 1 |
| 10. | Find the order of the ordinary differential equation . | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Verify whether the matrix is Hermitian or not. | | CO1 | U | 3 |
| 12. | Differentiate y with respect to x given  . | | CO2 | E | 3 |
| 13. | Check if the vector is irrotational. | | CO3 | U | 3 |
| 14. | Evaluate . | | CO4 | E | 3 |
| 15. | Find the value of | | CO5 | A | 3 |
| 16. | Solve the ordinary differential equation . | | 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. | Reduce the quadratic form to the canonical form using orthogonal reduction and hence find its nature, signature and index. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Find the first order and second partial derivatives of the function | CO2 | A | 6 |
|  | b. | Find the Jacobian where ,  and *w.* | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the angle between the surfaces and  at the point (1, 1, 1). | CO3 | E | 6 |
|  | b. | A particle moves along the curve If where *t* is the time variable. Find the curvature and torsion of the curve. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Integrate (i) (ii)(iii) . | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Find the area bounded by the parabola and . | CO5 | A | 6 |
|  | b. | Evaluate . | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Verify Cayley – Hamilton theorem for the matrix A = and hence find its inverse. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Find the maximum of subject to the constraints *.* | CO3 | E | 6 |
|  | b. | A particle moves along the curve *, y ,*  *z*where *t* is the time variable. Find the velocity, speed and accelerations of the particle at *t = 1*. | CO3 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve the ordinary differential equation by the method of variation of parameters . | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to compute the Eigen values, Eigen vectors of matrices and diagonalize the matrices |
| CO2 | The students will be able to apply differentiation techniques to find extreme values of functions |
| CO3 | The students will be able to apply the knowledge in vector differentiation techniques |
| CO4 | The students will be able to demonstrate knowledge in integration |
| CO5 | The students will be able to evaluate area and volume using definite integrals |
| CO6 | The students will be able to apply the knowledge in ordinary differential equations |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 4 | 12 | - | 12 | - | 29 |
| CO2 | 1 | 1 | 12 | - | 3 | - | 17 |
| CO3 | - | 3 | 2 | - | 24 | - | 29 |
| CO4 | 1 | - | 1 | - | 15 | - | 17 |
| CO5 | - | - | 10 | - | 6 | - | 16 |
| CO6 | - | 1 | - | - | 15 | - | 16 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **23MA1003** | **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)**  **(Answer all the questions)** | | | | | |
| 1. | The sequence  is oscillatory through\_\_\_\_\_\_. | | CO1 | A | 1 |
| 2. | The geometric series  converges if\_\_\_\_. | | CO1 | R | 1 |
| 3. | What is the curvature of a straight line ?. | | CO2 | R | 1 |
| 4. | Write down the value of . | | CO2 | A | 1 |
| 5. | In a Fourier series of  in the value of is\_\_\_\_. | | CO3 | A | 1 |
| 6. | Write down the half range sine series in the interval | | CO3 | A | 1 |
| 7. | When a function has neither maximum nor minimum, then the stationary point is known as\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 8. | When is a vector said to be solenoidal? | | CO4 | R | 1 |
| 9. | In integral calculus,  represents\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Change the order of integration and find the limits of | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Test the convergence of the sequence | | CO1 | A | 3 |
| 12. | Compute the value of | | CO2 | An | 3 |
| 13. | Find the R.M.S value of  in | | CO3 | E | 3 |
| 14. | For a given function  find the value of | | CO4 | A | 3 |
| 15. | Find the value of  . | | CO5 | E | 3 |
| 16. | Find the particular integral of | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Test the convergence of the series | CO1 | An | 6 |
|  | b. | Test for convergence of the alternating series | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Find the center of curvature of the Parabola  at , hence show that its Evolute is | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the Fourier series of | CO2 | A | 6 |
|  | b. | Compute the first two harmonics for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 30 | 60 | 90 | 120 | 150 | 180 | | f(x) | 2.34 | 3.01 | 3.68 | 4.15 | 3.69 | 2.20 | | CO2 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | If . Compute the Jacobian and prove that | CO3 | A | 6 |
|  | b. | Find the maxima and minima of the function | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and evaluate | CO4 | E | 6 |
|  | b | Find the area between the curves | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Verify Green’s theorem for  where c is bounded by and . | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Verify Gauss divergence theorem for the function  bounded by the lines | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve | CO6 | A | 6 |
|  | b. | Solve , by the method of variation of parameters. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to express functions as infinite series. |
| CO2 | The student will be able to evaluate surface area and volume using definite integral. |
| CO3 | The student will be able to apply differentiation techniques to find extreme values of functions. |
| CO4 | The student will be able to calculate gravity and mass using integration techniques. |
| CO5 | The student will be able to relate vector spaces with magnetic field and moving fluid. |
| CO6 | The student will be able to solve ordinary differential equations. |

|  |  |  |  |  |  |  |  |
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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 | 1 |  | 19 | 9 |  |  | 29 |
| CO3 |  |  | 14 |  | 3 |  | 17 |
| CO4 | 2 |  | 9 |  | 6 |  | 17 |
| CO5 |  | 1 | 1 | 24 | 3 |  | 29 |
| CO6 |  |  | 15 |  |  |  | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **23MA1006** | **Duration** | **3hrs** |
| **Course Name** | **LINEAR ALGEBRA, CALCULUS AND ORDINARY 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. | If the matrix of a quadratic form is then the corresponding quadratic form is \_\_\_\_\_\_\_\_\_ | | CO1 | U | 1 |
| 2. | State Cayley-Hamilton theorem | | CO1 | R | 1 |
| 3. | Find the value of | | CO2 | A | 1 |
| 4. | The value of . | | CO2 | A | 1 |
| 5. | \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 6. | Test the convergence of sequence | | CO3 | U | 1 |
| 7. | A vector is said to be solenoidal if ----------- | | CO4 | R | 1 |
| 8. | =\_\_\_\_\_\_\_\_\_. | | CO4 | A | 1 |
| 9. | Write the formula to find the volume of a given region R by multiple integration. | | CO5 | R | 1 |
| 10. | Solve (D2-4D+4)y=0 | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Find the index, signature and rank of the quadratic form . | | CO1 | U | 3 |
| 12. | Evaluate. | | CO2 | A | 3 |
| 13. | Examine for convergence the series | | CO3 | U | 3 |
| 14. | If Find . | | CO4 | A | 3 |
| 15. | Evaluate | | CO5 | A | 3 |
| 16. | Find the particular integral of . | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Find the Eigen values and Eigen vectors of the matrix | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate ∫ 𝑥2 cosx 𝑑𝑥. | CO2 | E | 4 |
|  | b. | Evaluate | CO2 | E | 4 |
|  | c. | Find the area of the region bounded by y=2x+1, y=3 and the y axis. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | 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 | | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find the first and the second partial derivatives of the function | CO4 | A | 6 |
|  | b. | Find the Jacobian where x=u(1+v) and y=v(1+u). | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of integration and hence evaluate | CO5 | A | 6 |
|  | b. | Solve | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | A particle moves along the curve and where t is the time variable. Find the velocity, velocity component, speed acceleration and acceleration component at t=2 in the direction of . | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Obtain the Fourier series for in the interval | CO3 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve the ordinary differential equation by the method of variation of  parameters | CO6 | A | 12 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to compute the Eigen values, Eigen vectors of the matrices. |
| CO2 | The student will be able to evaluate definite and improper integrals. |
| CO3 | The student will be able to express functions as infinite series. |
| CO4 | The student will be able to apply the knowledge in vector differentiation techniques. |
| CO5 | The student will be able to evaluate area and volume of the given surface using Integration techniques. |
| CO6 | The student will be able to apply the knowledge in Ordinary Differential Equations. |

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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 | 1 |  | 9 |  | 8 |  | 18 |
| CO3 |  | 4 |  |  | 24 |  | 28 |
| CO4 | 1 |  | 16 | 12 |  |  | 29 |
| CO5 | 1 |  | 9 | 6 |  |  | 16 |
| CO6 |  |  | 16 |  |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **23MA1010** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL MODELLING FOR MEDIA** | **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 equation of the circle passing through the points (8, 7), (1, 8) and (0, 1). Find its centre and radius. | CO1 | E | 10 |
|  | b. | Find the equation of the circle passing through the points (4,1) and centre (1, -2). | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Find the equation of the ellipse whose centre is (1, 2), focus is (1, 3) and . | CO1 | E | 10 |
|  | b. | Find the equation of the parabola whose focus is (-1, 2) and the directrix is . | CO1 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | For the given matrices  and ,  find the following  (i)  (ii)  (iii)  (iv)  (v) Is ? | CO2 | E | 10 |
|  | b. | Find the inverse of the matrix . | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Find the rank of the matrix . | CO2 | A | 5 |
|  | b. | Solve the system of equation by Cramer’s rule      . | CO2 | E | 15 |
|  |  |  |  |  |  |
| 5. |  | Find the eigenvalues and eigenvectors of the matrix . | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Verify Cayley-Hamilton theorem for the matrix. | CO3 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | Draw the histogram, frequency polygon, frequency curve and ogive ‘less than’ and ‘more than’ for the following distribution of marks obtained by 49 students:   |  |  | | --- | --- | | Class (Mark group) | Frequency (No. of students) | | 5 - 10 | 6 | | 10 - 15 | 6 | | 15 - 20 | 14 | | 20 - 25 | 10 | | 25 - 30 | 5 | | 30 - 35 | 4 | | 35 - 40 | 2 | | 40 - 45 | 2 | | CO4 | A | 10 |
|  | b. | Represent the following data on the expenditure under Fifth Plan using a pie diagram:   |  |  | | --- | --- | | **Expenditure under Fifth Plan** | | | **Heads of Expenditure** | **Crores of Rupees** | | Agriculture | 380 | | Irrigation and Power | 637 | | Industry and Mining | 160 | | Transport and Communication | 557 | | Social Service | 553 | | Miscellaneous | 69 | | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Compute Mean, Median, Mode and Standard Deviation for the following distribution showing the number of marks of 59 students in Mathematics:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Mark - Group | 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 | | No. of Students | 4 | 8 | 11 | 15 | 12 | 6 | 3 | | CO5 | E | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Obtain the lines of regression for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO6 | E | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Analyze different geometrical structures and understand their properties. |
| CO2 | Apply matrix techniques in solving simultaneous equations. |
| CO3 | Determine the eigenvalues and eigenvectors. |
| CO4 | Present the data in tabular and graphical representations. |
| CO5 | Identify the central tendency and dispersion of data in real time. |
| CO6 | Analyze the relation between data for real-time application. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  |  |  | 40 |  | 40 |
| CO2 |  |  | 5 |  | 35 |  | 40 |
| CO3 |  |  |  | 20 | 20 |  | 40 |
| CO4 |  |  | 20 |  |  |  | 20 |
| CO5 |  |  |  |  | 20 |  | 20 |
| CO6 |  |  |  |  | 20 |  | 20 |
|  | | | | | | | **180** |



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| --- | --- | --- | --- |
| **Course Code** | **23MA1013** | **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)**  **(Answer all the questions)** | | | | | |
| 1. | Examine whether the following series is convergent or divergent. | | CO2 | U | 1 |
| 2. | State Raabe’s test. | | CO2 | R | 1 |
| 3. | Write down the relation between Gamma (Г) and Beta (β) function. | | CO4 | R | 1 |
| 4. | If Г(n) denotes Gamma function, then Г(n) Г(1-n) is -----. | | CO4 | U | 1 |
| 5. | Check whether the function f(x) = x3 is odd or even in (-3, 3). | | CO2 | U | 1 |
| 6. | Express Parseval’s Identity in terms of Fourier coefficients. | | CO2 | R | 1 |
| 7. | Evaluate | | CO3 | U | 1 |
| 8. | Find Div where . | | CO5 | A | 1 |
| 9. | Evaluate . | | CO1 | A | 1 |
| 10. | Find the Wronskian, if the complementary function of an ordinary differential equation is . | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Evaluate | | CO3 | E | 3 |
| 12. | Find the area of the square bounded by the lines x=0, y=0, x=a, y=a.. | | CO1 | U | 3 |
| 13. | Compute the Root mean square value of f(x) =x in (0,2π). | | CO2 | A | 3 |
|  | Find the constants a,b,c if is irrotational. | | CO5 | A |  |
| 15. | Evaluate . | | CO4 | E | 3 |
| 16. | Obtain the complete solution of p2+q2 =x+y. | | 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. | Examine whether the following series is convergent or divergent using the Comparison test. | CO2 | An | 5 |
|  | b. | Obtain the Taylor series expansion of f(x) = cosx at x = . | CO2 | E | 4 |
|  | c. | Using Cauchy’s Root test , examine the convergence of the series | CO2 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Find the volume of the sphere x2+y2+z2 = a2 by using multiple integration. | CO4 | E | 6 |
|  | b. | Evaluate (i) β(3/2, 3/2) (ii) , using the concept of Beta function. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Find the fourier series expansion of f(x) = k, in (0, 2π). | CO2 | A | 6 |
|  | b. | Obtain the Half range fourier sine series for f(x) = x in (0,1). | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Find the first order and second order partial derivatives of the function  u = cos(2x+7y). | CO3 | E | 6 |
|  | b. | If u = x+3y2-z3, v=4x2yz, w= 2z-xy, find at (1,-1,0). | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Evaluate , where R is the region enclosed by the lines x=0, y=0, x+y=1. | CO1 | E | 8 |
|  | b. | Evaluate . | CO1 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Find the directional derivative of x3y2+z2 at (1,0,-1) in the direction of . | CO5 | E | 6 |
|  | b. | Find the maxima and minima values of f(x,y) = xy subject to the constraint g(x,y) = 4x2+y2-8, using lagrange’s method of multipliers. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate the following using Gamma and Beta functions.  (i) (ii) (iii) Г (iv) Г | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Solve . | CO6 | E | 6 |
|  | b. | Solve x(y-z)p + y(z-x)q = z(x-y). | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **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. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 3 | 5 | - | 8 | - | 16 |
| CO2 | 2 | 5 | 15 | 5 | 4 | - | 31 |
| CO3 | - | 1 | 6 | - | 9 | - | 16 |
| CO4 | 1 | 1 | - | - | 27 | - | 29 |
| CO5 | - | - | 4 | 6 | 6 | - | 16 |
| CO6 | - | 3 | 6 | - | 7 | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **23MA2005** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR DIGITAL SCIENCES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | In a survey of 260 college students, the following data were obtained: 64 watch football game, 94 watch hockey game, 58 watch basketball game, 28 watch both football and basketball, 26 watch both football and hockey, 22 watch both hockey and basketball and 22 do not watch any of the three kind of games. (i) How many students watch all the three games? (ii) How many students watch exactly one of the games? | CO1 | A | 10 |
|  | b. | Let , and .  Compute (i)  (ii)  (iii) A ⊙ B (iv) B⊙A | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Solve the system of equations by Cramer’s method; , , . | CO1 | An | 10 |
|  | b. | Let *A ={a, b, c, d}* and the relation *R* on *A* is defined by R={ (a, a), (a, c), (a, d), (b, d), (b, c), (c, c), (c, a), (d, a)}. (i) Draw the digraph of R (ii) Find the in-degrees and out degrees of all elements of A. (iii) Find MR , MR2 | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | A freshman class consists of 40 students, 30 of which are women. The class needs to select a committee of 7 to represent them in the student senate. How many committees are possible if (i) the committee has exactly 5 women? (ii) the committee has at least 5 women? (iii) the committee has all women? | CO2 | A | 10 |
|  | b. | How many different choices one has, to buy a new car if there are two body styles (sedan, hatchback), 5 colours, and 3 engine models (GL, SS, SL) to choose from? Also draw the tree representation of the different available choices. | CO2 | A | 5 |
|  | c. | The number plate of a car starts with two letters and four digits. How many different number plates are there if (i) repetition of digits is allowed (ii) repetition of digits is not allowed? | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Let A = {1,2,3,4,5,6,7,8} and ,  be the permutations of A. Find   1. , ) 3. Is an odd/even permutation? | CO2 | A | 10 |
|  | b. | If 4 maths books are selected from 6 Maths books and 3 English books are selected from 5 english books, then how many ways can the 7 books be arranged on a shelf if (i) the first book is a maths book and the last book is an English book? (ii) maths and English books are kept separately (iii) there is no restriction to arrange the books? | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Show that (Z, +) is a commutative group. | CO3 | An | 10 |
|  | b. | Consider the (2, 5) encoding function defined by e(00)= 00000, e(01)= 01110, e(10)= 10101, e(11)= 11011. Show that this encoding function is a group code. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Show that  is a tautology. | CO5 | An | 10 |
|  | b. | Using truth table, show that  and  are logically equivalent. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Show that the following premises are inconsistent.  (i) If Jack misses many classes through illness, then he fails high school.  (ii) If Jack fails high school, then he is uneducated.  (iii) If Jack reads a lot of books, then he is not uneducated.  (iv) Jack misses many classes through illness and reads a lot of books. | CO5 | An | 10 |
|  | b. | Find the bitwise OR, bitwise AND, and bitwise XOR of each of these pairs of bit strings. (i) x = 101 1010, y = 010 1011 (ii) u = 1001 0001, v = 0101 1010 (iii) p = 000 1110 1110, q = 001 0001 0011 | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define Euler circuit, and Hamilton circuit. Construct an Euler path, Euler circuit, Hamilton path, and Hamilton circuit for the graph given below if it exist. | CO6 | An | 10 |
|  | b. | Define planar graph, complete graph and give an example. Determine whether the graphs given below are isomorphic. Justify your answer.  **C:\Users\ADMIN\Pictures\Graph3.png** | CO6 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Construct the tree of the algebraic expression. (i) Identify the root, branches and leaf of the tree (ii) Also find prefix, infix and postfix form of the tree. | CO6 | An | 10 |
|  | b | Find the minimal spanning tree for the weighted graph given below.  v1  v2  v5  v4  v6  v3  19  21  18  14  11  6  5  10  16  33 | CO6 | An | 10 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Apply matrix techniques in solving simultaneous equations. |
| CO2 | Acquire knowledge of counting principle, and functions. |
| CO3 | Recognize algebraic structure in computation |
| CO4 | Compute error in transmission of code word. |
| CO5 | Conclude the truth value of propositions using logic. |
| CO6 | Construct networks with minimum resources. |

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

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| **Course Code** | **23MA3002** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY AND FUZZY SETS** | **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. | Given that P (A) = 0.26 and P(B) = 0.45, If A and B are mutually exclusive events, then find (i) ) (ii) P (A B) (iii) (iv)  (v) P(A∩). | CO1 | An | 10 |
|  | b. | Mr. A and Mr. B throw alternatively a pair of dice. A wins the game, if he throws 6 before B throws 7. B wins the game, if he throws 7 before A throws 6. If A begins the game, what is the probability of his winning? | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Machine A contributes for 25% of the items produced by a factory, 35% for Machine B, and 40% for Machine C. The percentages of satisfactory articles produced are 80% for A, 90% for B and 95% for C. An article is chosen at random. a) What is the probability that it is satisfactory? b) Assuming that the article is satisfactory, what is the probability that it was produced by Machine A? | CO1 | A | 10 |
|  | b. | In a shooting test, the probability of hitting the target is 1/2 for A, 2/3 for B and 3/4 for C. If all of them fire at the target, then find the probability that (a) None of them hits the target (b) atleast one of them hits the target (c) Exactly two of them hits the target. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | 4 coins were tossed simultaneously. Find the probability of getting (i) exactly 3 heads (ii) at least 2 heads (iii) at most 2 heads. | CO2 | A | 10 |
|  | b. | In a test of 2000 electric bulbs, it was found that the life of specific brand was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs that are likely to burn for (i) more than 2170 hours (ii) less than 1850. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A manufacturer knows that the condensers contain 1% defects on average. He packs them in 100 pack-boxes. Using Poisson distribution, find the probability that a box picked at random will contain (i) no defective (ii) atleast 3 defective. | CO2 | E | 10 |
|  | b. | Explain the different types of tests for random numbers. | CO2 | An | 10 |
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| 5. | a. | Given two fuzzy sets A and B. Find the following fuzzy union and intersection.  A = { (x1, 0.2), (x2, 0.5), (x3, 0.6), (x4, 0.8), (x5, 1.0) }  B = { (x1, 0.8), (x2, 0.6), (x3, 0.4), (x4, 0.2), (x5, 0.1) }  (i),, , (ii),, ,  (iii). | CO3 | A | 10 |
|  | b. | Let. Given  and are the fuzzy sets of.  Find Algebraic sum, Algebraic Product, Bounded Sum, Bounded Product. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let. Given be a fuzzy set defined by   1. Find all -cuts and strong -cuts (ii) Find Supp(A), Core(A) and h(A) | CO3 | A | 10 |
|  | b. | Given A = [2, -6] and B = [1, 5] are two fuzzy numbers. Find  A + B, A - B, A • B and A / B. | CO3 | E | 5 |
|  | c. | Find addition, subtraction and symmetric image of given two triangular numbers A = (-2, 2, 4) and B = (-2, 0, 5). | CO3 | E | 5 |
|  |  |  |  |  |  |
| 7. | a. | Prove that  is a tautology. | CO4 | An | 10 |
|  | b. | Determine the truth values in T3 for biconditional, negation, conjunction, disjunction and implication for the three valued logic. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Construct a truth table for (p → q) ˅(q → p). | CO4 | An | 10 |
|  | b. | If and, then find the relation “If A, then B” using (i) Lukasiewicz implication (ii) Mamdani implication (iii) Kleene-Dienes implication. | CO4 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Draw the general scheme of a fuzzy controller and explain its components. | CO5 | A | 10 |
|  | b. | Explain the concepts of fuzzy neural networks and fuzzy automata. | CO5 | A | 10 |

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

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|  | | **COURSE OUTCOMES** | | | | | | | |
| CO1 | | Recognize the meaning of conditional probability and Baye’s theorem | | | | | | | |
| CO2 | | Solve problems using probability distributions | | | | | | | |
| CO3 | | Identify different operations on fuzzy sets | | | | | | | |
| CO4 | | Differentiate classical logic and fuzzy logic | | | | | | | |
| CO5 | | Develop fuzzy expert systems | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | | |
| **CO / P** | | **R** | **U** | **A** | **An** | **E** | **C** | **Total** | |
| CO1 | |  |  | 10 | 20 | 10 |  | 40 | |
|  | |  |  |  |  |  |  |  | |
| CO2 | |  |  | 10 | 20 | 10 |  | 40 | |
| CO3 | |  |  | 30 |  | 10 |  | 40 | |
| CO4 | |  |  | 10 | 20 | 10 |  | 40 | |
| CO5 | |  |  | 20 |  |  |  | 20 | |
|  | | | | | | | | **180** | |