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| **Course Code** | **09MA313** | **Duration** | **3hrs** |
| **Course Name** | **ABSTRACT CONTROL THEORY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | State and prove *the Hille-Yosida Theorem.* | CO1 | R | 15 |
|  | b. | Let *T(t)* be a *Co* semigroup. If *T(t)* is compact for *t >to*, then prove that *T(t)* is continuous in the uniform operator topology for *t >to.* | CO1 | Un | 5 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Let *T(t)* be aCosemigroup and let *A* be its infinitesimal generator.  *If ||T(t)||≤M ewt ,*then the following two assertions are equivalent:  (i) There exists a *to*> 0 such that *T(t)* is differentiable for *t* >*to.*  *(ii)* There exist real constants *a, b* and *C* such that *b > 0, C > 0,* and || R( :A)|| ≤ *C|Im|* for , *Re  ≤.* | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Let *A* be a densely defined linear operator with a nonempty resolvent set . Then prove that the initial value problems has a unique solution *u(t)*, which is continuously differential on *[0, ],* for every initial value *x* in *D(A)* if and only if *A* is the infinitesimal generator of a *C*0 semigroup *T(t).* | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Let be the infinitesimal generator of an analytic semigroup  and let  with. If is the mild solution of, prove that is Holder continuous with exponent on  for every.If moreover, prove that is Holder continuous with the same exponent on. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Let be a stable family of infinitesimal generators of *C0* semigroups on *X* such that *D(A(t)) = D* is independent of *t* and for every *v* in *D, A(t)v* is continuously differentle in *X*. If *f* , then prove that for every *v* the initial value problem has a unique solution *u* given by | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Let *X* be a Banach space and for every *t, 0 ≤ t ≤ T* and let *A(t)* be a bounded linear operator on *X.* If the function *t →A(t)* is continuous in the uniform operator topology, then prove that, for every *x X*the initial value problem | CO1 | Un | 12 |
|  | b. | Let *U(t, s), 0 ≤ s ≤ t ≤ T* be a evolution system in a Banach space *X* satisfying *|| U(s, t)|| ≤ F* for *0 ≤ s ≤ t ≤ T.* If *H(t)* is a strongly continuous family of bounded linear operators in *X,* then prove that there exists a unique family of bounded linear operators on X such that for *x* in *X* and *V(s, t)x* is continuous in *s, t* for *s ≤ t ≤ T.* | CO1 | Un | 8 |
|  |  |  |  |  |  |
| 7. |  | Let be continuous in on  and uniformly Lipschitz continuous (with constant *L*) on . If  is the infinitesimal generator of a semigroup , on , then prove that for every , has a unique mild solution u. | CO1 | Ap | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Let  be the infinitesimal generator of an analytic semigroup  satisfying  and assume further that  . If, and  satisfies the assumption **(F)**, prove that for every initial data ,has a unique local solution  where | CO1 | Ap | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Prove that the observed linear systemis observable on *[0, T]* iff the observability Grammian matrix is positive definite. | CO1 | Un | 12 |
|  | b. | Consider the system governed by  *– x = u*. Find the control u which steers this system to . | CO1 | Ev | 8 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to understand the basic concepts in Semigroups of Linear Operators, Applications to Partial Differential Equations and Infinite Dimensional Linear System Theory for higher mathematics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 15 | 37 | 40 | 80 | 8 | - | 180 |
|  | | | | | | | **180** |



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| **Course Code** | **10MA302** | **Duration** | **3hrs** |
| **Course Name** | **COMMUTATIVE ALGEBRA** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | | |
| 1. | | a. | For any A-module M, the following statements are equivalent:   1. M=0; 2. MP = 0 for all prime ideals of p of A; 3. Mm = 0 for all maximal ideals of m of A. | CO1 | An | 15 |
|  | | b. | State and Prove First Uniqueness Theorem. | CO1 | U | 5 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | State and Prove Second Uniqueness Theorem. | CO1 | U | 10 |
|  | | b. | Let *M* be a finitely generated *A* - module, *S* a multiplicatively  closed subset of *A* . Prove that *S* 1(Ann (*M* ))  Ann(*S* 1 M). | CO1 | Ap | 10 |
|  | |  |  |  |  |  |
| 3. | | a. | State and Prove Going-up Theorem. | CO1 | U | 10 |
|  | | b. | Suppose that *M* has a composition series of length *n*. Show that every composition series of *M* has length *n*, and every chain in *M* can be extended to a composition series. | CO1 | E | 10 |
|  | |  | **(OR)** |  |  |  |
| 4. | | a. | State and Prove Going-down Theorem. | CO1 | U | 10 |
|  | | b. | Prove that *M* is a Noetherian *A* -module  every submodule of  *M* is finitely generated. | CO1 | R | 10 |
|  | |  |  |  |  |  |
| 5. | | a. | If A is Noetherian ring, then prove that the polynomial ring A[x] is Noetherian. | CO1 | An | 10 |
|  | | b. | Let *a*  (1) be an ideal in a Noetherian ring. Prove that the prime ideals which belong to *a* are precisely the prime ideals which occur in the set of ideals (*a* : *x*) (*x*  *A*) . | CO1 | Ap | 10 |
|  | |  | **(OR)** |  |  |  |
| 6. | | a. | State and Prove structure theorem for Artin rings. | CO1 | U | 10 |
|  | | b. | Show that in a Artin ring, the nilradical R is nilpotent. | CO1 | An | 10 |
|  | |  |  |  |  |  |
| 7. | | a. | Show that the ring of integers in an algebraic number filed *K* is a  Dedekind domain. | CO1 | An | 6 |
|  | | b. | Let *A* be a local domain. Show that *A* is a discrete valuation ring   every non-zero fractional ideal of *A* is invertible. | CO1 | An | 14 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | Let A be a Noetherian domain of dimension one. Then the following are equivalent:   1. A is integrally closed; 2. Every primary ideal in A is a prime power; 3. Every local ring AP (p≠0) is a discrete valuation ring | CO1 | An | 20 |
| **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Prove that the nilradical of *A* is the intersection of all the prime  ideals of *A*. | CO1 | An | 15 |
|  | | b. | Show that every ring *A*  0 has at least one maximal ideal. | CO1 | E | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | At the end of the course, scholars will able to get knowledge in technology, methodology and  applications of commutative algebra. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 45 | 20 | 90 | 15 | - | 180 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | If α, β, γ, δ are the roots of the equation x4 – 2x3+4x2+6x-21=0, then find α+β+γ+δ. | | | CO1 | R | | 1 |
| 2. | Define Reciprocal equation. | | | CO1 | U | | 1 |
| 3. | Find the sum of the eigen values of the matrix A= . | | | CO1 | R | | 1 |
| 4. | If A is orthogonal, then AT is also \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | U | | 1 |
| 5. | Write the condition for the 2 straight lines  to be coplanar. | | | CO1 | R | | 1 |
| 6. | Find the direction ratios of the line passing through the points (4, 2, 5) and (–1, 0, –8). | | | CO1 | U | | 1 |
| 7. | The reciprocal of the length of radius of curvature is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | | 1 |
| 8. | Define evolute of a curve. | | | CO1 | U | | 1 |
| 9. | Find  if x3+y3 +3xy–1 =0. | | | CO1 | R | | 1 |
| 10. | Define Jacobian for u and v which are functions of the independent variables x and y. | | | CO1 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Decrease by 1 the roots of the equation: . | | | CO1 | | U | 3 |
| 12. | Find the characteristic equation of the matrix: . | | | CO1 | | U | 3 |
| 13. | Find the angle between the planes  x+y+z=8 and 2x+y–z=3. | | | CO1 | | U | 3 |
| 14. | Find the envelope of x cos α + y sin α = a sec α, where α is the parameter. | | | CO1 | | U | 3 |
| 15. | Write Taylor’s series expansion of a function of two variables. | | | CO1 | | U | 3 |
| 16. | If x = r cos θ, y = r sin θ, then find . | | | CO1 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | |  | Solve , given that two of its roots are equal in magnitude but opposite in sign. | CO1 | | A | 12 |
| 18. | | a. | Increase by 2 the roots of  and hence solve the equation. | CO1 | | A | 6 |
|  | | b. | Solve . | CO1 | | A | 6 |
| 19. | |  | Verify Cayley-Hamilton Theorem for A =. Hence compute A-1 . | CO1 | | A | 12 |
| 20. | |  | Show that the lines and are coplanar. Find their point of intersection. | CO1 | | A | 12 |
| 21. | |  | Find the evolute of the parabola y2 = 4ax. | CO1 | | A | 12 |
| 22. | | a. | Find the centre of curvature at any point (c,c) on xy = c2. | CO1 | | A | 6 |
|  | | b. | Find radius of curvature of xy2 = a3 – x3 at (a, 0). |  | | A | 6 |
| 23. | |  | Find the maximum volume of the largest rectangular solid which can be inscribed in the ellipsoid . | CO1 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Expand ex cosy in powers of x and y as far as the terms of the second degree using Taylor’s series. | CO1 | | A | 12 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 23 | 96 |  |  |  | 124 |
| 5 23 96 | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Integrate  is \_\_\_\_\_\_\_\_\_. | | 1 |
| 2. | Evaluate | | 1 |
| 3. | Find the value of . | | 1 |
| 4. | Define Gamma function. | | 1 |
| 5. | Find the particular integral of | | 1 |
| 6. | Solve . | | 1 |
| 7. | If , then .R =\_\_\_\_\_\_\_\_. | | 1 |
| 8. | State Stoke’s theorem . | | 1 |
| 9. | Find the Laplace Transform of *cos 5t.* | | 1 |
| 10. | =\_\_\_\_\_\_\_\_\_\_\_. | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Evaluate . | | 3 |
| 12. | Show that | | 3 |
| 13. | Find the Wronskian W of the two solutions  and | | 3 |
| 14. | Find the directional derivatives of  at the point (2,-1,1) in the direction of vector. | | 3 |
| 15. | Solve | | 3 |
| 16. | Prove that | | 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 | 6 |
|  | b. | Change the order of integration and hence evaluate | 6 |
|  |  |  |  |
| 18. |  | State and prove the relation between Beta and Gamma Function. | 12 |
|  |  |  |  |
| 19. | a. | Solve the simultaneous equation | 6 |
|  | b. | Solve | 6 |
|  |  |  |  |
| 20. | a. | Find the value of ‘a’ so that (x+3y) + (y – 2z) + (x + az) is solenoidal. | 6 |
|  | b. | Prove that  is irrotational and find . | 6 |
|  |  |  |  |
| 21. | a. | Evaluate | 6 |
|  | b. | Find the inverse Laplace transform of . | 6 |
|  |  |  |  |
| 22. |  | Solve by the method of variation of parameters. | 12 |
|  |  |  |  |
| 23. |  | Apply Convolution theorem to evaluate. | 12 |
| **COMPULSORY QUESTION** | | | |
| 24. | a. | Calculate  over the area included between the circles  and. | 6 |
|  | b. | Find the volume of the sphere  triple integration. | 6 |



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| **Course Code** | **12MA301** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Calculate mean median, mode, standard deviation and 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 | | CO1 | A | 10 |
|  | b. | The following table gives the aptitude test scores and productivity indices of 10 workers selected at random:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Aptitude  Scores (X): | 70 | 74 | 73 | 80 | 82 | 56 | 65 | 80 | 78 | 92 | | Productivity Index (Y): | 76 | 72 | 72 | 92 | 93 | 54 | 58 | 72 | 70 | 91 |   Calculate the two regression equations and estimate  (i).The productivity index of a worker whose test score is 90.  (ii).The test score of a worker whose productivity index is 75. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | From the following data, calculate the first four moments about  (i) the assumed mean 25 (ii) the actual mean. Also, find the coefficient of skewness and kurtosis   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Class Interval | 0-10 | 10-20 | 20-30 | 30-40 | | Frequency | 1 | 3 | 4 | 2 | | CO1 | A | 10 |
|  | b. | Find the rank correlation coefficient for the following data   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 80 | 72 | 83 | 62 | 74 | 90 | 87 | 48 | 65 | 74 | | Y | 74 | 66 | 76 | 57 | 90 | 71 | 78 | 58 | 60 | 80 |   . | CO1 | E | 10 |
| 3. | a. | 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) at least one of them hits the target (c) exactly two of them hits the target. | CO1 | An | 10 |
|  | b. | A bolt is manufactured by 3 machines A, B, and C. A turns out that twice as many items as B, B and C produce an equal number of items. 2% of bolts produced by A and B are defective and 4% of bolts produced by C are defective. All bolts are put into 1 stockpile and1 is chosen from this pile. What is the probability that it is  defective? | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The following data are the number of seeds germinating out of 10 on damp filter for 80 sets of seeds. Fit a binomial distribution to this data.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | f | 6 | 22 | 26 | 14 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | | CO1 | A | 10 |
|  | b. | In a test of 2000 electric lamps it was found that the life of a particular brand was normally distributed with average life of 2040 hours and standard deviation of 60 hours. Estimate the number of lamps likely to burn for (i) more than 2150 hours (ii) less than 1950 hours (iii) between 1950 hours and 2150 hours | CO1 | A | 10 |
| 5. | a. | In a random sample of 1200 person from the city of Delhi, 500 are found to be consumers of rice. In a sample of 1000 from the city of Mumbai, 400 are found to be consumers of rice. Do these data reveal a significant difference between the two cities as far as the proportion of rice consumers is concerned at (i)1%(ii) 5% level of significance.. | CO1 | A | 10 |
|  | b. | A simple sample of heights of 6400 English men has a mean of 170 cm and 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 English men? | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, recorded the following increase in weight (gms)  Diet A :5, 6, 8, 1, 12, 4, 3, 9, 6, 10  Diet B : 2, 3, 6, 8, 10, 1, 2, 8.  Does this show the superiority of diet A over diet B? | CO1 | A | 10 |
|  | b. | An ice cream producer unit wishes to test whether the preference pattern of consumers for its products in dependent on income level or not. From the following data can you conclude that the preference pattern is independent of income level?   |  |  |  |  | | --- | --- | --- | --- | | Income | Product A | Product B | Product C | | Low | 170 | 30 | 80 | | Medium | 50 | 25 | 60 | | High | 20 | 10 | 55 | | CO1 | A | 10 |
| 7. | a. | Explain the basic principles of Experimental Design. | CO1 | U | 5 |
|  | b. | Four Doctors each test four treatments for a certain disease and observe the number of days each patient take to recover. The results are as follows. Analyze the variance and discuss the difference between (i) Doctors (ii) Treatments   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Treatment | | | | | Doctor | I | II | III | IV | | A | 10 | 14 | 19 | 20 | | B | 11 | 15 | 17 | 21 | | C | 9 | 12 | 16 | 19 | | D | 8 | 13 | 17 | 20 | | CO1 | An | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The following data resulted from an experiment to compare three burners B1, B2 and B3. The latin square design was designed used as the tests were made on three engine and spread over 3 days.   |  |  |  |  | | --- | --- | --- | --- | | Days | Engines | | | | 1 | 2 | 3 | | 1 | B1-16 | B2-17 | B3-20 | | 2 | B2-16 | B3-21 | B1-15 | | 3 | B3-15 | B1-12 | B2-13 |   Test the hypothesis that there is no significant difference between the burners | CO1 | An | 15 |
|  | b. | Compare RBD and LSD. | CO1 | U | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Two Random processes X(t) and Y(t) are defined by  X(t) = Acosβt+Bsinβt and Y(t) = Bcosβt-Asinβt, show that X(t) and Y(t) are jointly wide sense stationary if A and B are uncorrelated random variables with zero means and the same variances, λ is a constant | CO1 | A | 10 |
|  | b. | A fair die is tossed repeatedly. If Xn denotes the maximum of the numbers occurring in the first n tosses, find the transition probability matrix P of the Markov chain { Xn }. | CO1 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to make logical conclusions using statistical concepts. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 10 | 110 | 50 | 10 | - |  |
|  | | | | | | | **180** |



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| **Course Code** | **12MA336** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | *i.* Let *(L, ≤)*be a lattice ordered set. If we define *xy := inf(x, y),x ˅ y := sup(x, y),* then prove that *(L, , ˅)*is an algebraic lattice.  ii. Let *(L, , ˅)*be an algebraic lattice. If we define then prove that*(L, ≤)*is a lattice ordered set. | CO1 | R | 15 |
|  | b. | Define sublattice and give an example for sublattice. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prove that a polynomial *p* in *Pn* is equivalent to the sum of all prime implicants of *p.* | CO1 | U | 10 |
|  | b. | State and prove the *De Morgan's Laws for lattice.* | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | In a large room there are electrical switches next to the three doors to operate the central lighting. The three switches operate alternatively, i.e., each switch can switch on or switch off the lights. Construct the switching circuit and contact diagram. | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Draw the switching circuit *p = x1(x2(x3+x4)+x3(x5+x6)).* | CO1 | Ap | 5 |
|  | b. | Determine the symbolic representation of the circuit given by | CO1 | Ap | 10 |
|  | c. | Determine the truth function of *((x1 ˅ x2) ˅ x3) ˅ (x1 x3).* | CO1 | Ap | 5 |
|  |  |  |  |  |  |
| 5. |  | Let *L* be a finite extension of *K* and let *K* be a finite extension of *F.* Then prove that *[L:K][K:F] = [L:F].* | CO1 | An | 20 |
|  |  | (OR) |  |  |  |
| 6. |  | Prove that a polynomial *f* in *Fq[x]* of degree *m* is primitive if and only if *f* is monic*, f(0) ≠0*, and the order of *f* is equal to *qm – 1.* | CO1 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | State and prove *Unique Factorization Theorem.* | CO1 | U | 10 |
|  | b. | For every integral domain ≠{0}, prove that there is a field F with the following properties:   1. *RF*, 2. If *RF’ and F’ is a field, then RF’.* | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Let m = 2, n= 5, and H . Determine the group code eH : B2 →B5. | CO1 | E | 16 |
|  | b. | Find the distance between x and y;   1. *x = 110110; y = 000101.* 2. *x = 001100; y = 010110.* | CO1 | E | 4 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | State and prove the Chinese Remainder Theorem for polynomials. | CO1 | An | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to get Knowledge in applications of lattices. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 20 | 30 | 20 | 90 | 20 | - | 180 |
|  | | | | | | | **180** |

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The acceleration of a particle, whose path given by  at is\_\_\_\_\_. | | CO1 | R | 1 |
| 2. | The speed of the particle where the velocity,  is \_\_\_\_\_. | | CO1 | R | 1 |
| 3. |  | | CO2 | R | 1 |
| 4. | If  is conservative then \_\_\_\_\_\_. | | CO2 | R | 1 |
| 5. | The fixed points of  are \_\_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | The mapping, c is a complex constant is called \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | For any scalar function, is \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | C-R equations in Cartesian form are \_\_\_\_\_\_\_\_. | | CO4 | R | 1 |
| 9. | If  is harmonic then \_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | has pole of order \_\_\_\_\_\_\_ at z = 2. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A particle moves along the curve x=3t+2, y= 5t2, z=2t-1, where  is the time period. Find the component of velocity and acceleration at t=1 in the direction . | | CO1 | U | 3 |
| 12. | Find the directional derivative of  at  in the direction of . | | CO2 | U | 3 |
| 13. | Find the fixed points of the mapping. | | CO3 | U | 3 |
| 14. | Prove that the function  is a harmonic function. | | CO4 | U | 3 |
| 15. | Draw the circle. | | CO5 | U | 3 |
| 16. | Evaluatewhere c 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. |  | Calculate the curvature and torsion of the curve | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Verify Gauss Divergence theorem for  taken over the cube bounded by the planes x=0, x=1, y=0, y=1, z=0 and z=1. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Find an analytic function f(z) whose real part is . Also find the conjugate harmonic of u. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Find the bilinear mapping which maps the points  onto . | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Find the image of the infinite stripe  under the transformation. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Find the angle between the two surfaces  and  at the point . | CO5 | A | 6 |
|  | b. | Prove that f(z)=sinz is analytic and hence find its derivative. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Find the Laurent’s series of  in the region. | CO4 | A | 6 |
|  | b. | Find the orthogonal trajectories of the family of curves for. | CO4 | A | 6 |
|  |  | **COMPULSORY QUESTION** |  |  |  |
| 24. |  | Evaluate  using contour integration. | CO6 | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | 12 | - | - | - | 17 |
| CO3 | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | 1 | 4 | 24 | - | - | - | 29 |
| CO5 |  | 4 | 24 | - | - | - | 28 |
| CO6 | - | 4 | 12 | - | - | - | 16 |
| 6 22 96 | | | | | | | **124** |

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

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| **Q. No.** | | **Questions** | **Course Outcome** | **Bloom’s Level** | **Marks** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | | \_\_\_\_\_\_\_\_ | CO1 | R | 1 | |
| 2. | | =\_\_\_\_\_\_\_ | CO1 | R | 1 | |
| 3. | | =\_\_\_\_\_\_\_\_ | CO1 | R | 1 | |
| 4. | | L-1(1/s) | CO1 | R | 1 | |
| 5. | | If f(x) = f(-x) then it is known as \_\_\_\_\_\_\_\_\_\_ function | CO2 | R | 1 | |
| 6. | | =\_\_\_\_\_\_ | CO2 | R | 1 | |
| 7. | | Write the formula for Infinite Fourier sine transform | CO2 | R | 1 | |
| 8. | | =\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CO2 | R | 1 | |
| 9. | | Z() = \_\_\_\_\_\_\_\_ | CO2 | R | 1 | |
| 10. | | = \_\_\_\_\_\_\_ | CO2 | U | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | | Find L (e2t – 3 + 2e-6t) | CO1 | U | | 3 |
| 12. | | Find inverse Laplace transform of | CO1 | U | | 3 |
| 13. | | Evaluate e-2tcost dt | CO1 | An | | 3 |
| 14. | | Find | CO2 | U | | 3 |
| 15. | | Derive Z (). | CO2 | An | | 3 |
| 16. | | Find the -transform of | CO2 | 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 | CO1 | E | | 6 |
|  | b. | Find | CO1 | E | | 6 |
| 18. | a. | Using convolution theorem,find. | CO1 | A | | 6 |
|  | b. | |  |  |  | | --- | --- | --- | | Find | CO1 | 5 | | CO1 | E | | 6 |
|  |  |  |  |  | |  |
| 19. |  | Solve given, using Laplace transform. | CO3 | A | | 12 |
|  |  |  |  |  | |  |
| 20. |  | Find the Fourier transform of and hence find | CO2 | E | | 12 |
|  |  |  |  |  | |  |
| 21. |  | Find the Fourier transform of  and hence find | CO2 | An | | 12 |
|  |  |  |  |  | |  |
| 22. |  | Derive  and | CO2 | R | | 12 |
|  |  |  |  |  | |  |
| 23. |  | Solve given , | CO3 | A | | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Use partial fractionto evaluate | CO2 | A | | 6 |
|  | b. | Use residue method to evaluate | CO2 | A | | 6 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Students have the knowledge in solving engineering problems using Laplace Transforms. | | | | | | | |
| CO2 | Students are able to know the transform techniques | | | | | | | |
| CO3 | Students will solve difference and differential equations problems in their engineering fields. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 4 | 6 | 6 | 3 | 18 | - | 37 |
| CO2 | | 17 | 7 | 12 | 15 | 12 | - | 63 |
| CO3 | | - | - | 24 | - | - | - | 24 |
|  | | | | | | | | **124** |

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

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Write the formula for . | | | CO1 | R | | 1 |
| 2. | The real part of | | | CO1 | U | | 1 |
| 3. | Write the characteristic equation of 3x3 matrix. | | | CO2 | R | | 1 |
| 4. | Find the product of the eigen values of the matrix . | | | CO2 | U | | 1 |
| 5. | Differentiate with respect to x. | | | CO3 | R | | 1 |
| 6. | If then find . | | | CO3 | U | | 1 |
| 7. | *\_\_\_\_\_\_\_\_\_\_\_.* | | | CO4 | R | | 1 |
| 8. | Evaluate dx. | | | CO4 | U | | 1 |
| 9. | If the roots of the auxillary equation are -2 and -3 then write the complementary function. | | | CO5 | R | | 1 |
| 10. | Solve . | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Separate into real and imaginary parts of | | | CO1 | | U | 3 |
| 12. | Find the rank of the matrix =. | | | CO2 | | U | 3 |
| 13. | Differentiate with respect to x. | | | CO3 | | U | 3 |
| 14. | Evaluate . | | | CO4 | | U | 3 |
| 15. | Evaluate . | | | CO5 | | U | 3 |
| 16. | Find the particular integral of . | | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | | a. | Prove that . | CO1 | | A | 6 |
|  | | b. | If ,then prove that | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 18. | |  | Find the eigen values and eigen vectors of the matrix =. | CO2 | | A | 12 |
|  | |  |  |  | |  |  |
| 19. | | a. | If then find . | CO3 | | A | 6 |
|  | | b. | Differentiate with respect to x. | CO3 | | A | 6 |
|  | |  |  |  | |  |  |
| 20. | |  | Evaluate using method of partial fraction. | CO5 | | A | 12 |
|  | |  |  |  | |  |  |
| 21. | | a. | Prove that . | CO3 | | A | 6 |
|  | | b. | Evaluate . | CO5 | | A | 6 |
|  | |  |  |  | |  |  |
| 22. | |  | Show that . | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | Verify Cayley Hamilton Theorem for the matrix . | CO2 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Solve . | CO6 | | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 |  | - | - | - | 5 |
| CO2 | 1 | 4 | 24 | - | - | - | 29 |
| CO3 | 1 | 4 | 42 | - | - | - | 47 |
| CO4 | 1 | 4 |  | - | - | - | 5 |
| CO5 | 1 | 3 | 18 | - | - | - | 22 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
| 6 22 96 | | | | | | | **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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define the *Taylor’s Series* of a function *f(x)* at a point *c.* | | CO1 | R | | 1 |
| 2. | *(0.276)8 = ( ----)2* | | CO1 | U | | 1 |
| 3. | What is the error in the Bisection Algorithm applied to the function in the interval after n step? | | CO2 | R | | 1 |
| 4. | Find the interval in which the initial positive root lies for the equation . | | CO2 | R | | 1 |
| 5. | Define interpolation | | CO3 | R | | 1 |
| 6. | Define the cardinal function | | CO3 | U | | 1 |
| 7. | If f is a polynomial of degree n , then all divided differences | | CO4 | R | | 1 |
| 8. | What is the order of error in the Trapezoidal Rule? | | CO4 | U | | 1 |
| 9. | To use Simpson’s 3/8th rule, the number of subinterval *n* should be \_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 10. | Is a linear spline function? Justify your answer. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find the Taylor’s series of *f(x) = ex at c = 0.*Also find its error term. | | CO1 | | A | 3 |
| 12. | What is the iterative formula to find the inverse of 19 using Newton’s Method? | | CO2 | | A | 3 |
| 13. | Find a polynomial of least degree that interpolate the following data:   |  |  |  | | --- | --- | --- | | x | 1.4 | 1.25 | | y | 3.7 | 3.9 | | | CO3 | | An | 3 |
| 14. | Form the divided difference table for the following data and hence find .   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 1 | | y | 3 | 5 | 5 | 7 | | | CO4 | | A | 3 |
| 15. | Find the value of using Gaussian quadrature by taking 2 points? | | CO5 | | A | 3 |
| 16. | Fit a linear spline to the following data:   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | 0 | | | 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. |  | Expand in powers of h. Hence compute and | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | Convert the following numbers.  (314.1728)16 = ( )10  = ( )2  (2576.35546875)10 = ( )8 = ( )2 | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Using Newton Raphson method, find an approximate root of  correct to 4 decimal places. | CO3 | | E | 8 |
|  | b. | Write the Pseudo code of Bisection method. | CO3 | | U | 4 |
|  |  |  |  | |  |  |
| 20. | a. | Using Newton’s Algorithm find the polynomial from the table given below.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | y | 2 | 14 | 4 | 2 | 2 | 15 | | CO4 | | E | 8 |
|  | b. | Write down the pseudocode for Newton’s divided difference polynomial. | CO4 | | U | 4 |
|  |  |  |  | |  |  |
| 21. |  | Computeusing (i) Trapezoidal rule (ii) Simpson’s one third rule (iii) Simpson’s three eight rule . | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Find a root ofcorrect to 4 decimal using Bisection method. | CO3 | | A | 6 |
|  | b. | the value of using Newton Raphson method. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 23. |  | Use Lagrange’s interpolating polynomial method to find y when x=9.5, from the data given below:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 7 | 8 | 9 | 10 | | y | 3 | 1 | 1 | 9 | | CO4 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Find the equations of the natural cubic interpolating spline for the following data:   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | -1 | | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the uses of Taylor’s series 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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 15 | - | - | - | 17 |
| CO2 | 2 | - | 15 | - | - | - | 17 |
| CO3 | 1 | 5 | 12 | 3 | 8 | - | 29 |
| CO4 | 1 | 5 | 15 | - | 8 | - | 29 |
| CO5 | 1 | - | 15 | - | - | - | 16 |
| CO6 | - | 1 | 15 | - | - | - | 16 |
|  | | | | | | | **124** |

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| **Course Code** | **14MA2015/17MA2015** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY, RANDOM PROCESS AND NUMBERICAL 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. | Define Independent Events. | | CO1 | R | | 1 |
| 2. | What is 53 Sundays in a non-leap year? | | CO1 | U | | 1 |
| 3. | Define probability mass function of a random variable | | CO2 | R | | 1 |
| 4. | The probability density function of a random variable f(x) =kx, 0<x<2;Find k. | | CO2 | U | | 1 |
| 5. | If (X, Y) two dimensional random variable, F(-∞,∞)= \_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | The average of independent, identically distributed random variables X1, X2,…, Xn follows \_\_\_\_\_\_\_\_\_\_ distribution as n tends to ∞. | | CO3 | U | | 1 |
| 7. | The variance of the exponential distribution is \_\_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 8. | The mean of the Poisson distribution is \_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 9. | In a random process{X(s,t)}, if t is fixed then {X(s,t)} is called \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 10. | In order to apply Simpson’s one third rule, the number of intervals must be \_\_\_\_\_\_\_\_. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | If P(A)=1/3, p(B)=3/4 and p(AUB)=11/12 find p(B/A). | | CO1 | | R | 3 |
| 12. | The CDF of a continuous random variable F(x) = 3e-2x where x>0. Find the probability density function f(x). | | CO2 | | Ap | 3 |
| 13. | For a binomial distribution with mean 12 and standard deviation 4. Find the parameter n, p, q. | | CO3 | | An | 3 |
| 14. | Six coins are thrown simultaneously, find probability of getting exactly two heads. | | CO4 | | Ap | 3 |
| 15. | Find Mean of stationary process whose Autocorrelation function is | | CO5 | | Ap | 3 |
| 16. | The table given below gives the velocity v of a moving particle at time ‘t’ seconds. Find the distance covered by the particle in 12 sec   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | t | 2 | 4 | 6 | 8 | 10 | 12 | | v | 40 | 18 | 36 | 62 | 96 | 138 | | | CO6 | | Ap | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | In a shooting test, the probability of hitting a target is 1/2for A, 2/3 for B and 3/4for C. If all of them fire at the target, find the probability of (i) None of them hit the target (ii) Atleast one of them hit the target (iii) Atleast two of them hit the target | CO1 | | E | 6 |
|  | b. | A and B alternatively 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. | CO1 | | Ap | 6 |
|  |  |  |  | |  |  |
| 18. |  | The chances of A, B and C becoming a general manager of a certain company are in the ratio 4: 2: 3. The probability that the bonus scheme will be introduced in the company if A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus has been introduced what is the probability that B has been appointed as general manager. | CO1 | | Ap | 12 |
|  |  |  |  | |  |  |
| 19. |  | A random variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | p(x) | 0.2 | 2k | 0.3 | 3k | 0.1 | k |   (i) Find k, (ii) Evaluate p(-2 <x <2) (iii) p(x<0) (iv) p(0<x<3) (v) p(x>1) (vi) Find mean. | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | The joint probability mass function of (X, Y) is p(x,y) =k(3x+2y); x=0,1,2; y=1,2,3. Find (i) k (ii) All Marginal Probability distribution (iii) Conditional probability distributions | CO2 | | E | 12 |
|  |  |  |  | |  |  |
| 21. |  | 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 | | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | In a test on 2000 electric lamps, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of lamps likely to burn for (i) More than 2150 hours (ii) Less than 1950 hours (iii) More than 1920 hours but less than 2160 hours. | CO3 | | Ap | 12 |
|  |  |  |  | |  |  |
| 23. |  | Two Random processes X(t) and Y(t) are defined by  X(t) = 5cosλt+10sinλt and Y(t) = 10cosλt-5sinλt, show that X(t) and Y(t) are jointly wide sense stationary, if A and B are uncorrelated random variables with zero means and same variances, λ is a constant | CO4 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Find dy/dx at x=0 and x=1 from the following data   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 0.2 | 0.4 | 0.6 | 0.8 | 1 | | y | 0 | 0.24 | 0.46 | 1.08 | 2.04 | 3.4 | | CO5 | | An | 6 |
|  | b. | Evaluate using (i) Trapezoidal rule (ii) Simpson’s (both) rules.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | y | 1 | 0.5 | 0.2 | 0.1 | 0.059 | 0.0384 | 0.0270 | | CO6 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to Have knowledge in Probability theory. |
| CO2 | Get knowledge on various distributions. |
| CO3 | Make simple mathematical descriptions or modeling of random signals. |
| CO4 | Solve problems based on central limit theorem. |
| CO5 | Apply numerical methods for scientific computing. |
| CO6 | Solve differential equations using numerical methods |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 1 | 18 | 6 | 12 |  | 41 |
| CO2 | 1 | 1 | 3 |  | 12 |  | 17 |
| CO3 | 1 | 1 | 12 | 15 |  |  | 29 |
| CO4 |  | 2 | 3 | 12 |  |  | 17 |
| CO5 | 1 |  | 3 | 6 |  |  | 10 |
| CO6 | 1 |  | 3 | 6 |  |  | 10 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **14MA2018** | **Duration** | **3hrs** |
| **Course Name** | **OPERATIONS RESEARCH II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | |
| 1. | Distinguish inventory ordering cost and inventory holding cost. | | | | CO1 | U | | 1 |
| 2. | Interpret the concept of Economic Ordering Quantity (EOQ). | | | | CO1 | U | | 1 |
| 3. | Define Burst Event and indicate the same in a network. | | | | CO1 | R | | 1 |
| 4. | Identify the use of a dummy activity in a network. | | | | CO2 | R | | 1 |
| 5. | FCFS stands for \_\_\_\_\_\_\_\_\_\_\_\_. | | | | CO2 | R | | 1 |
| 6. | Define Random number. | | | | CO2 | R | | 1 |
| 7. | State the limitations of graphical method in solving game theory. | | | | CO3 | R | | 1 |
| 8. | Define ‘Pure strategy’ with respect to game theory. | | | | CO3 | R | | 1 |
| 9. | List one advantage and limitation of simulation. | | | | CO3 | U | | 1 |
| 10. | State ‘Group replacement’ policy. | | | | CO3 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | |
| 11. | In a mechanical workshop, it takes 10 days to get the stock of coolant oil after placing an order. The daily requirement of coolant oil in the workshop is 50 litres. Based on the past experience it is determined that the safety is 5 days stock. Infer the re-order point | | | | CO1 | | A | 3 |
| 12. | Determine the critical path of the following project   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-4 | 1-3 | 2-4 | 3-4 | | Duration(Weeks) | 3 | 6 | 4 | 5 | 2 | | | | | CO1 | | U | 3 |
| 13. | Write Notes on : LCFS ,Arrival Rate , Queue size and Population Size | | | | CO2 | | R | 3 |
| 14. | List the advantages of Monte -Carlo simulation | | | | CO3 | | U | 3 |
| 15. | Summarize the applications of Game theory | | | | CO2 | | A | 3 |
| 16. | State ‘scrap value’ and ‘useful life’ of the product | | | | CO2 | | 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. |  | | 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 | | | CO1 | | A | 12 |
| 18. |  | | 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 VI Time between order | | CO1 | | An | 12 |
| 19. |  | | 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 | | CO2 | | A | 12 |
| 20. |  | | 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, determine 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 | | | CO2 | | A | 12 |
| 21. |  | | Solve 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 | | | CO1 | | An | 12 |
| 22. |  | | Arrival 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 he 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 |
| 23. |  | | In a big manufacturing company, raw materials are received from various vendors. The transport of these  Raw materials are done using trucks. Before the raw materials are sent to the stores, they are to be inspected. The inspector takes 6 minutes for inspecting a truck and he can inspect only one truck at a time. Once the truck is inspected, it is sent to the stores .The following data is available   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Inter arrival time of truck(minutes) | 2 | 3 | 4 | 5 | 6 | 8 | 11 | 12 | 14 | | Frequency | 3 | 6 | 9 | 18 | 20 | 19 | 10 | 8 | 7 |   Using the Montecarlo simulation, determine the following using the following 15 random numbers  23,89,27,86,10,38,59,43,17,81,36,43,76,84 and 56 for inter arrival time of the truck  a) Average waiting time of the inspector b)average waiting time of truck | | CO 3 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. |  | The owner of a stone crushing machine determines fom 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 decrease by 15 percent of the purchase price every year, what is the optimal replacement policy? | | | CO2 | | A | 12 |

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|  | **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 |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 5 | 15 | 36 |  |  | 57 |
| CO2 | 6 | 3 | 39 |  |  |  | 48 |
| CO3 | 2 | 5 |  | 12 |  |  | 19 |
|  | | | | | | | **124** |

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

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| **Q. No.** | **Questions** | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | | | | |
| 1. | a. | Find the least number which when divided by 48, 60, 72, 108 and 140 leaves 38, 50, 62, 98 and 130 as remainders respectively. | CO1 | | A | | | 8 |
|  | b. | 5% of income of A is equal to 15% of income of B and 10% of income of B is equal to 20% of income of C. If C’s income is Rs.2000, then find the total income of A, B and C. | CO1 | | A | | | 8 |
|  |  |  |  | |  | | |  |
| 2. | a. | If the numerator of a fraction be increased by 15% and its denominator be diminished by 8%, the value of the fraction is 15/16. Find the original fraction. | CO2 | | U | | | 6 |
|  | b. | The Simple Interest on certain sum for 2 years at 5% per annum is Rs.300. what is the extra money gained as interest if the rate is 8% per annum on the same sum for 2 years? | CO2 | | A | | | 6 |
|  | c. | Find the value of | CO1 | | U | | | 4 |
|  |  |  |  | |  | | |  |
| 3. | a. | What is Aman's present age, if after 20 years his age will be 10 times his age 10 years back? | CO3 | | U | | | 5 |
|  | b. | If the manufacturer gains 10%, the wholesale dealer 15% and the retailer 25 % then find the cost of production of a table, the retail price of which is Rs.1265? | CO3 | | U | | | 5 |
|  | c. | In what ratio must a merchant mix two varieties of rice costing Rs. 9.30 and Rs. 10.80 per kg respectively so as to get a mixture worth Rs. 10 per kg? | CO3 | | A | | | 6 |
|  |  |  | |  | |  |  | |
| 4. | a. | In how many ways can 5 boys and 4 girls be arranged in a bench (i) if there are no restrictions (ii) if boys and girls are seated in separate groups (iii) if boys are seated first, followed by girls are seated | | CO4 | | A | 8 | |
|  | b. | A Box contains 3 white, 4 green and 5 red balls. Three balls are drawn from the box randomly. (i) What is the probability that they are of same color? (ii) What is the probability that they are not same color? | | CO4 | | A | 8 | |
|  |  |  | |  | |  |  | |
| 5. | a. | A cistern is filled in 20 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is thrice as fast as A. How much time will pipe A alone take to fill the tank? | | CO3 | | A | 8 | |
|  | b. | A train 240 m long passes a pole in 24 seconds. How long will it take to pass a platform 650 m long? | | CO3 | | U | 4 | |
|  | c. | A and B together can do a work in 4 days. A alone can do the work in 12 days. How many days B alone will complete the work? | | CO3 | | U | 4 | |
|  |  |  | |  | |  |  | |
| 6. | a. | The students in three classes are in the ratio of 2 : 3 : 4. If 20 students are added in each class, the ratio becomes 4 : 5 : 7. Find the total number of students in all the three classes before the increase. | | CO1 | | A | 6 | |
|  | b. | The average of 11 numbers is 60. If the average of first 5 numbers is 58 and that of last 5 is 56. Find the sixth number. | | CO1 | | A | 6 | |
|  | c. | Find the greatest possible length which can be used to measure exactly the lengths 7m, 3m 85cm and 12m 95cm. | | CO1 | | U | 4 | |
|  |  |  | |  | |  |  | |
| 7. | a. | Two poles of equal heights stand on either sides of a roadway which is 120m wide. At a point on the roadway between the poles ,the elevations of the top of the poles are 60 degree and 30 degree. Find the heights of the poles and the position of the point. | | CO5 | | A | 8 | |
|  | b. | A motorboat, whose speed in 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. Find the speed of the stream (in km/hr)? | | CO4 | | U | 4 | |
|  | c. | The angle of elevation of the top of a tower at a distance 500 metres from its foot is 30.Find the height of the tower. | | CO5 | | U | 4 | |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | | | | |
| 8. | a. | Study the following bar graph carefully and answer the questions given below.  Imports and exports of a country from 2000 - 2001 to 2004 -2005  <http://p3.placement.freshersworld.com/power-preparation/sites/default/files/Bar%20Graph%20Image1.JPG>  (i) In which year the gap between the import and export was maximum?  (ii) In which year the gap between the imports and exports was minimum? (iii) The exports in 2001 - 2002 was approximately how many times that of the year 2003- 2004?  (iv) Give the ratio between the number of years in which export is greater than imports and import is greater than exports.  (v) Give the difference between the average of imports and exports. | | CO6 | | An | 15 | |
|  | b. | The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and the answer the questions based on it.  **Various Expenditures (in percentage) Incurred in Publishing a Book**    (i) What is the central angle of the sector corresponding to the expenditure incurred on Royalty?  (ii) If for a certain quantity of books, the publisher has to pay  Rs. 30,600 as printing cost, then what will be amount of royalty to be paid for these books? | | CO6 | | An | 5 | |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 8 | 28 |  |  |  | 36 |
| CO2 |  | 6 | 6 |  |  |  | 12 |
| CO3 |  | 18 | 14 |  |  |  | 32 |
| CO4 |  | 4 | 16 |  |  |  | 20 |
| CO5 |  | 4 | 8 |  |  |  | 12 |
| CO6 |  |  |  | 20 |  |  | 20 |
| 40 72 20 | | | | | | | **132** |

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| **Course Code** | **16MA1005** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED MATHEMATICS – MATRICES AND CALCULUS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define Characteristic Equation. | | CO1 | U | | 1 |
| 2. | If the matrix A is symmetric, them A = \_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | The imaginary roots of the algebraic equation occurs in \_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | Form the second degree equation one of whose root is 2+i. | | CO2 | R | | 1 |
| 5. | The envelope of the family of curves  is \_\_\_\_\_\_\_\_\_. | | CO3 | U | | 1 |
| 6. | What is the radius of curvature of the straight line? | | CO3 | R | | 1 |
| 7. | Tripple Integral is used to find \_\_\_\_\_\_\_\_\_.. | | CO3 | U | | 1 |
| 8. | Evaluate  . | | CO5 | R | | 1 |
| 9. | One of the root of the equation  is \_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | Give an Example for non oscillatory sequence. | | CO4 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | If 2, 5, 7 are the Eigen values of the matrix A, find the Eigen values of i) A2 ii) A-1 | | CO1 | | A | 3 |
| 12. | If  is a root of , then find the other root and hence find one of the factor. | | CO2 | | U | 3 |
| 13. | Find the envelope of family of straight line , where  being the parameter. | | CO3 | | An | 3 |
| 14. | Evaluate | | CO5 | | E | 3 |
| 15. | Evaluate | | CO5 | | A | 3 |
| 16. | Find the sum of all numbers divisible by 9 between 200 and 500. | | 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. |  | Evaluate the (i) characteristic equation (ii) Eigen values  (iii) Eigen vectors of the matrix | CO1 | | E | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Solve  given that  is a root of the equation. | CO2 | | E | 6 |
|  | b. | Solve the equation | CO2 | | E | 6 |
|  |  |  |  | |  |  |
| 19. | a. | Find the radius of curvature of the curve  at (0,0). | CO3 | | A | 6 |
|  | b. | Find the center of curvature at  on | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Find the area of the rectangle bounded by the lines x=0, y=0, x=a, y=b. | CO5 | | E | 6 |
|  | b. | A person borrowed a sum of Rs. 3,500 on the condition to repay in 23 monthly instalments of Rs.150 and the last instalment of Rs.50. Calculate the simple interest at the rate of 5% per annum, which he has to pay as the 25thinstalment. | CO4 | | E | 6 |
|  |  |  |  | |  |  |
| 21. |  | Find the evolute of the parabola | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | Evaluate, where V is the volume of tetrahedron bounded by the lines and | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Reduce the quadratic form  to a Canonical form and also find its rank, index, signature and nature. | CO2 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A person has two daughters A and B aged 13 and 16 years. He has Rs.40, 000 with him now but wants that both of them should get the equal amount when they are 20 years old. How he should divide the money if it were to be deposited in a bank giving 9% compound interest per annum? | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | To manipulate matrices and to do matrix algebra. |
| CO2 | To evaluate the eigen values and eigen vectors problems. |
| CO3 | To apply the concept of differentiations and integrations in real life problems. |
| CO4 | To discuss the series and sequences problems. |
| CO5 | To relate the calculus in different fields. |
| CO6 | To Justifying in results in sequences 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 | 3 | - | 12 | - | 17 |
| CO2 | 2 | 3 | - | 12 | 12 | - | 29 |
| CO3 | 1 | 2 | 12 | 15 | - | - | 30 |
| CO4 | - | 1 | - | - | 6 | - | 7 |
| CO5 | 1 | 1 | 15 | - | 9 | - | 26 |
| CO6 | - | 3 | - | 12 | - | - | 15 |
|  | | | | | | | **124** |



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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define Research and explain the types of research. | CO1 | R | 15 |
|  | b. | Discuss the significance of research in solving human problems. | CO1 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the steps involved in the process of research. | CO1 | R | 10 |
|  | b. | Discuss the significance of review of related literature. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | Explain the various methods of Sampling. | CO1 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Classify the different types of variables in Research. Explain the importance of each of them with suitable examples. | CO1 | U | 15 |
|  | b. | What are the criteria for a good research work? | CO1 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Explain the various methods of Research. | CO2 | R | 15 |
|  | b. | State the importance of rating scales and explain the different types of rating scales used in research. | CO2 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the different types of experimental group designs. | CO2 | U | 10 |
|  | b. | Discuss the different types of graphical representation of data. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Find rank correlation coefficient for the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 92 | 89 | 87 | 86 | 77 | 71 | 63 | 53 | 50 | 86 | | y | 86 | 83 | 91 | 77 | 85 | 52 | 82 | 37 | 57 | 68 | | CO2 | A | 10 |
|  | b. | From the following data, find (i) Which firm pays more amount as monthly wages, (ii) Which firm has greater variability in individual wages.   |  |  |  | | --- | --- | --- | |  | Firm I | Firm II | | Number of workers | 100 | 200 | | Mean monthly wages | 7000 | 8000 | | S.D of individual wages | 2 | 2.5 | | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Discuss the types of hypothesis and write about the techniques of testing hypothesis. | CO2 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the different types of research reports. | CO3 | R | 10 |
|  | b. | Explain the ethical practices to be followed in research. | CO3 | U | 10 |

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 45 | 35 |  |  |  |  | 80 |
| CO2 | 25 | 35 | 20 |  |  |  | 80 |
| CO3 | 10 | 10 |  |  |  |  | 20 |
|  | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | | |
| 1. | The condition for which the binomial expansion to be valid is\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 2. | Expand in terms of . | | CO1 | U | | 1 |
| 3. | Find the value of in. | | CO1 | U | | 1 |
| 4. | Write the expansion of . | | CO2 | R | | 1 |
| 5. | = \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 6. | If, find . | | CO2 | U | | 1 |
| 7. | Evaluate . | | CO2 | U | | 1 |
| 8. |  | | CO2 | U | | 1 |
| 9. | If A and B are mutually exclusive events, then = \_\_\_\_\_\_. | | CO3 | R | | 1 |
| 10. | Two dice are thrown, then n(S) =\_\_\_\_\_\_\_\_\_ . | | CO3 | R | | 1 |
| 11. | . | | CO3 | R | | 1 |
| 12. | . | | CO3 | R | | 1 |
| 13. | The mean of the binomial distribution is\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 14. | For a Poisson distribution mean is equal to \_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 15. | The standard deviation of a standard normal distribution is \_\_\_\_\_\_. | | CO4 | R | | 1 |
| 16. | If the sample size is less than 30, then the sample is known as \_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 17. | The statistical constants of the sample in a population are known as \_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 18. | Write down the standard value of Z for two-tailed test at 5% level of significance. | | CO5 | R | | 1 |
| 19. | =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 20. | The normal probability curve is symmetrical about \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | | |
| 21. | Resolve into partial fractions. | | CO1 | | A | 5 |
| 22. | Sum the series | | CO1 | | A | 5 |
| 23. | Differentiate with respect to, given. | | CO2 | | A | 5 |
| 24. | Evaluate  using Bernoulli’s integration. | | CO2 | | A | 5 |
| 25. | Find the probability that (i) a leap year selected at random has 53 Sundays (ii) a non leap year selected at random has 53 Sundays. | | CO3 | | A | 5 |
| 26. | If P(A) = 0.35, P(B) = 0.75, P(A∪B) = 0.95 Find P(). | | CO3 | | A | 5 |
| 27. | A lot consists of 10 good articles, 4 with minor defects, 2 with major defects. Two articles are taken at random. Find the probability that both are good. | | CO4 | | An | 5 |
| 28. | In a city a sample of 1000 people was taken and out of them 540 are vegetarians and the rest are non-vegetarians. Can we say that both habits of eating are equally popular in the city at 1% LOS. | | CO5 | | An | 5 |
| 29. | A random variable X is normally distributed with mean 12 and standard deviation 4. Find P(0 ≤x≤ 12). | | CO4 | | A | 5 |
| 30. | A random sample of size 600 persons selected at random from a large city shows that the percentage of males in the sample is 53. It is believed that the ratio of males to the total population in the city is. Test whether the belief is confirmed by the observation. | | CO6 | | An | 5 |
| 31. | Three guns are fired at a target with probabilities 0.7,0.8,0.9 respectively. Find the probability that the target is being hit. | | CO6 | | A | 5 |
| 32. | and alternatively throw a pair of dice.  wins if he throws 6 before throws 7 and wins if he throws 7 before throws 6. If begins the game, find the probability of his winning. | | CO5 | | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | | |
| 33. | a. | Expand  in ascending powers of x. Find the coefficient of . State the condition on which the expansion is valid. | CO1 | | A | 8 |
| b. | Sum the series: | CO1 | | A | 7 |
|  |  |  |  | |  |  |
| 34. | a. | Find maxima and minima of | CO2 | | A | 8 |
| b. | Fit a Poisson distribution and hence deduce theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f(x) | 122 | 60 | 15 | 2 | 1 | | CO4 | | A | 7 |
|  |  |  |  | |  |  |
| 35. | a. | In a test of 2000 electric bulbs, it was found that the life of a particular type was normally distributed with average life of 2040 hrs and standard deviation 60 hrs. Estimate the number of bulbs likely to burn for (i) more than 2150 hrs (ii) less than 1950 hrs (iii) more than 1920 hrs but than 2160 hrs. | CO4 | | An | 8 |
| b. | The following table gives a classification of a sample of 160 plants of their flower color and flatness of the leaf. Test whether the flower color is independent of flatness of the leaf.   |  |  |  | | --- | --- | --- | |  | Flat leaves | Curled leaves | | White flower | 99 | 36 | | Red flower | 20 | 5 | | CO5 | | An | 7 |
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|  | **COURSE OUTCOMES** |
| CO1 | Understand basic mathematics and the technique, methodology. |
| CO2 | Know the applications of Maxima and Minima concepts. |
| CO3 | Use the applications of statistics in practical life. |
| CO4 | Apply Probability Distributions logics to solve the problems. |
| CO5 | Understand in collection, presentation and drawing conclusion about biological data. |
| CO6 | Apply the subject knowledge in their engineering subjects. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 2 | 25 |  |  |  | 28 |
| CO2 | 2 | 3 | 18 |  |  |  | 23 |
| CO3 | 4 | - | 10 |  |  |  | 14 |
| CO4 | 4 | - | 12 | 13 |  |  | 29 |
| CO5 | 4 |  | 5 | 12 |  |  | 21 |
| CO6 |  |  | 5 | 5 |  |  | 10 |
|  | | | | | | | **125** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The locus of Centre of curvature for a curve is called \_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | Write the value of | | CO2 | R | | 1 |
| 3. | Examine the convergence of the sequence. | | CO3 | U | | 1 |
| 4. | The series, converge for \_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 5. | If A is a singular matrix then its determinant value is \_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 6. | If the eigenvalues of A is 1,2,3 then find the eigen values of . | | CO4 | R | | 1 |
| 7. | Write the dimension of | | CO5 | U | | 1 |
| 8. | Define kernel of the linear transformation | | CO5 | R | | 1 |
| 9. | Find if | | CO5 | U | | 1 |
| 10. | Define a Solenoidal vector. | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | State the relation between beta and gamma function. | | CO1 | | U | 3 |
| 12. | Expand ex in powers of ‘x’ | | CO2 | | U | 3 |
| 13. | Find the sum and product of the eigen values of . | | CO3 | | U | 3 |
| 14. | Check whether the vectors (1,0,1), (1,1,0) and (1,1,-1) are linearly independent | | CO4 | | U | 3 |
| 15. | Find the directional derivative of  at the point (1,-2,1) in the direction of . | | CO5 | | U | 3 |
| 16. | Define an inner product space. | | 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. | Evaluateusing beta and gamma functions | CO1 | | A | 6 |
|  | b. | Evaluate | CO2 | | A | 6 |
| 18. |  | Test the convergence of the series . | CO3 | | A | 12 |
| 19. |  | Find the Eigen values and Eigen vectors of matrix | CO4 | | A | 12 |
| 20. |  | Solve the system of equations | CO4 | | A | 12 |
| 21. | a. | Check whether the set is a basis for | CO5 | | A | 6 |
|  | b. | Prove that T:V3 → V3 defined by T(x1,x2,x3) =( x1,x2,0) is a linear transformation. | CO5 | | A | 6 |
| 22. |  | A particle moves along x=2t+3, y=3t2 , z= t3+ 5 where‘t’ is the time. Find the component of velocity, speed and acceleration at t=1, along the direction of | CO5 | | A | 12 |
| 23. |  | If then find (i) div( and curl ( at (1,2,1) (ii) find curl curl ( (iii) check whether is irrotational vector | CO5 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Find an orthonormal basis of the vectors (1,0,1,1), (-1,0,-1,1) and (0,-1,1,1) of  using standard inner product | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Demonstrate knowledge in special functions. | | | | | | | |
| CO2 | Evaluate surface area and volume using definite integral. | | | | | | | |
| CO3 | Express functions as infinite series. | | | | | | | |
| CO4 | Understands solving system of equations using matrices. | | | | | | | |
| CO5 | Relate vector spaces with magnetic field and moving fluid | | | | | | | |
| CO6 | Construct linear transformation. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 4 | 6 |  |  |  | 11 |
| CO2 | |  | 3 | 6 |  |  |  | 9 |
| CO3 | | 1 | 4 | 12 |  |  |  | 17 |
| CO4 | | 1 | 4 | 24 |  |  |  | 29 |
| CO5 | | 2 | 5 | 36 |  |  |  | 43 |
| CO6 | |  | 3 | 12 |  |  |  | 15 |
|  | | | | | | | | **124** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Euler’s theorem on homogenous function. | | CO1 | R | 1 |
| 2. | Let *u* and *v* be functions of *x* and *y* then | | CO1 | U | 1 |
| 3. | Solve the differential equation = 0. | | CO2 | A | 1 |
| 4. | Find the Particular Integral for the differential equation | | CO2 | A | 1 |
| 5. | Write the recurrence formula of the Bessel’s function . | | CO3 | A | 1 |
| 6. | Write the Legendre Polynomial . | | CO3 | A | 1 |
| 7. | Solve the partial differential equation . | | CO4 | U | 1 |
| 8. | Evaluate the Complementary Function of the partial differential equation | | CO4 | R | 1 |
| 9. | What is the value of , if is an odd function in the interval ? | | CO5 | U | 1 |
| 10. | What is the one dimensional wave equation? | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the first and second partial derivatives of the function with respect to *x* | | CO1 | A | 3 |
| 12. | Find the particular integral of . | | CO2 | A | 3 |
| 13. | Evaluate . | | CO3 | An | 3 |
| 14. | Solve the partial differential equation . | | CO4 | A | 3 |
| 15. | Find the Fourier constant for the function in the interval . | | CO5 | A | 3 |
| 16. | What are the three possible solutions of one dimensional heat equation? | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | If  prove that | CO1 | An | 6 |
|  | b. | If , and , find | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Using the method of variation of parameters, solve | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Express interms of and . | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Solve | CO4 | An | 8 |
|  | b. | Solve | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. |  | Obtain the Fourier series for in the interval | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve . | CO4 | A | 6 |
|  | b. | Solve . | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | A uniform elastic string of length 100 cm is subjected to a constant tension of 5 kg. If the ends are fixed and the initial displacement is , , while the initial velocity is zero. Find the displacement of the string. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A rod of length *l* has its ends A and B kept at and respectively until steady state condition prevails. If the temperature at B is reduced to and kept so, while that of A is maintained. Find the temperature at a distance *x* from A and at time *t*. | CO6 | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Solve using differentiation techniques. |
| CO2 | Classify different types of higher order ODE. |
| CO3 | Understands solution of first and second order ODE. |
| CO4 | Demonstrate knowledge in solution of PDE. |
| CO5 | Apply solution of PDE in heat and wave equations. |
| CO6 | Express functions as infinite series. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO2 | - | - | 5 | 12 | - | - | 17 |
| CO3 | - | - | 14 | 3 | - | - | 17 |
| CO4 | 1 | 1 | 15 | 12 | - | - | 29 |
| CO5 | - | 1 | 15 | - | - | - | 16 |
| CO6 | 4 | - | - | 24 | - | - | 28 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | | | |
| 1. | Write the formula for quartile deviation. | | | CO1 | R | | 1 |
| 2. | What is the use of class intervals? | | | CO1 | U | | 1 |
| 3. | Write the empirical relationship between mean, median and mode. | | | CO1 | R | | 1 |
| 4. | Define coefficient of variation. | | | CO1 | R | | 1 |
| 5. | Give the relationship between correlation and regression coefficients. | | | CO2 | U | | 1 |
| 6. | Define positive correlation. | | | CO2 | R | | 1 |
| 7. | Write the formula for Karl Pearson’s coefficient of correlation. | | | CO2 | R | | 1 |
| 8. | Write the general equations of the two regression lines. | | | CO2 | R | | 1 |
| 9. | Define critical region. | | | CO3 | R | | 1 |
| 10. | Mention any two applications of Chi square test. | | | CO3 | U | | 1 |
| 11. | Define two types of errors. | | | CO3 | U | | 1 |
| 12. | Define degrees of freedom. | | | CO3 | R | | 1 |
| 13. | Give the layout plan for RBD. | | | CO4 | R | | 1 |
| 14. | Mention the basic principles of designs of experiments. | | | CO4 | R | | 1 |
| 15. | Mention the statistic used in F test. | | | CO4 | R | | 1 |
| 16. | What is post hoc test? | | | CO4 | U | | 1 |
| 17. | What do you mean by factorial experiment? | | | CO5 | U | | 1 |
| 18. | What do you mean by ANOVA? | | | CO5 | U | | 1 |
| 19. | Write any method to manage data with missing values. | | | CO5 | U | | 1 |
| 20. | Define the term confounding. | | | CO5 | R | | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | | | |
| 21. | Find the mean and standard deviation for the following data:  112, 250, 212, 317, 120, 157, 222, 319, 123, 227 | | | CO1 | | A | 5 |
| 22. | The mean of marks in Statistics of 100 students in a class was 72. The mean of marks of boys was 75, while their number was 70. Find out the mean marks of girls. | | | CO1 | | A | 5 |
| 23. | The following frequency table gives the marks of 100 students in a class:   |  |  | | --- | --- | | Class Interval | Frequency | | 5-10 | 4 | | 10-15 | 15 | | 15-20 | 35 | | 20-25 | 23 | | 25-30 | 10 | | 30-35 | 8 | | 35-40 | 5 |   Find the mean marks of students. | | | CO1 | | An | 5 |
| 24. | Find the rank correlation coefficient for the data below   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 3 | 8 | 9 | 2 | 7 | 10 | 4 | 6 | 1 | 5 | | Y | 5 | 9 | 10 | 1 | 8 | 7 | 3 | 4 | 2 | 6 | | | | CO2 | | E | 5 |
| 25. | Find the correlation coefficient for the following data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Production (in crores) | 55 | 56 | 58 | 59 | 60 | 60 | 62 | | Exports (in crores) | 35 | 68 | 70 | 80 | 82 | 88 | 65 | | | | CO2 | | E | 5 |
| 26. | The two lines of regression are *x =0.7y + 5.2* and *y=0.3x+ 2.8*. Find the mean of x and y series. Also find the correlation coefficient. | | | CO2 | | An | 5 |
| 27. | A random sample of 10 company has the following production in crores170, 183, 188, 195, 100, 110, 107, 120, 101 and 198. Do these data support the assumption of a population mean production of 200 at 5% level? | | | CO3 | | An | 5 |
| 28. | 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 | | | | CO3 | | An | 5 |
| 29. | Two independent samples from a normal population had the following values:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Sample I | 16 | 26 | 27 | 23 | 24 | 22 | | Sample II | 33 | 42 | 35 | 32 | 28 | 31 |   Do the population variances differ significantly at 5% level of significance? | | | CO3 | | A | 5 |
| 30. | The following data give the sales(in thousands of rupees) by 3 salesmen. Perform ANOVA   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Salesman I | 2 | 4 | 3 | 8 | 4 | | Salesman II | 5 | 7 | 2 |  |  | | Salesman III | 6 | 8 | 4 | 3 |  | | | | CO4 | | An | 5 |
| 31. | Write a short notes on Split Plot designs. | | | CO5 | | U | 5 |
| 32. | Give the ANOVA table for a 22 factorial experiment and explain. | | | CO5 | | U | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | | | |
| 33. | |  | Find two regression lines and hence find the correlation coefficient for the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 33 | 92 | 124 | 85 | 96 | 108 | 56 | 142 | 54 | 69 | | Y | 88 | 150 | 132 | 78 | 65 | 96 | 105 | 136 | 62 | 85 |   Also estimate Y when X = 110 and estimate X when Y = 75 | CO2 | | A | 15 |
| 34. | |  | In a locality 100 persons were randomly selected and asked about their educational achievements. The results are given as below.   |  |  |  |  | | --- | --- | --- | --- | | **Education** | **Middle** | **High School** | **College** | | **Male** | 10 | 15 | 25 | | **Female** | 25 | 10 | 15 |   Use – test to check whether education is independent of sex. | CO3 | | A | 15 |
| 35. | |  | A farmer wishes to test 4 varieties of seeds A, B, C and D on the yield of rice. The seeds are used in a Latin Square Design and the result are tabulated here. Perform Analysis of Variance and draw your conclusions.   |  |  |  |  | | --- | --- | --- | --- | | A105 | B95 | C125 | D115 | | C115 | D125 | A 105 | B105 | | D115 | C95 | B105 | A115 | | B95 | A135 | D95 | C115 | | CO4 | | A | 15 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 3 | 1 | 10 | 5 | - | - | 19 |
| CO2 | 3 | 1 | 15 | 5 | 10 | - | 34 |
| CO3 | 2 | 2 | 20 | 10 | - | - | 34 |
| CO4 | 3 | 1 | 15 | 5 | - | - | 24 |
| CO5 | 11 | 3 | - | - | - | - | 14 |
|  | | | | | | | **125** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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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|  | **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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | - | 12 | - |  | 17 |
| CO3 | - | 10 | 24 | - | 3 | - | 37 |
| CO4 | 1 | - | 24 | - | 12 |  | 37 |
| CO5 | 1 | 3 | 6 | - | - | - | 10 |
| CO6 | - | - | 6 | - | - | - | 06 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18MA2005** | **Duration** | **3hrs** |
| **Course Name** | **PROBABILITY 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. | If  is the complementary event of A, then P() = \_\_\_\_\_\_. | | CO1 | | U | | 1 |
| 2. | Find the Probability of getting an odd number when a die is tossed. | | CO1 | | R | | 1 |
| 3. | If F(x,y) is the cumulative distribution function of the two dimensional random variable, then F(x, )= ---- | | CO2 | | R | | 1 |
| 4. | Two continuous random variables X and Y with joint pdf *f*(*x*,*y*) and marginal densities *g*(*x*) and *h*(*y*) is said to be independent if \_\_\_\_\_\_\_\_. | | CO2 | | R | | 1 |
| 5. | What is the standard deviation of the Standard normal distribution? | | CO3 | | U | | 1 |
| 6. | The mean of Poisson distribution is \_\_\_\_\_\_\_\_. | | CO3 | | R | | 1 |
| 7. | What is the error term in fitting the parabola using the method of least squares? | | CO4 | | U | | 1 |
| 8. | What are the limits for correlation coefficient? | | CO5 | | R | | 1 |
| 9. | Define large sample. | | CO6 | | U | | 1 |
| 10. | Write down the test statistic for Chi square test. | | CO6 | | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | A fair coin is tossed 4 times. Find the probability of getting (i) exactly four heads (ii) atleast one head. | | CO1 | | | An | 3 |
| 12. | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | P(x) | 0 | k | 2k | 2k | 3k | k2 | 2 k2 | 7 k2 +k |   Find the value of k . | | CO2 | | | E | 3 |
| 13. | If the mean and variance of Binomial distribution are 6 and 3, determine the distribution. | | CO3 | | | A | 3 |
| 14. | Find the mean and median for the following data.  1423, 1332, 1543, 1324, 1552, 1632,1325,1662,1231. | | CO4 | | | E | 3 |
| 15. | Define Type I error, Type II error. | | CO6 | | | U | 3 |
| 16. | Find the value of the population standard deviation for two small samples given , , and where s1 and s2 are sample standard deviations. | | CO6 | | | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | a. | The chances of A, B and C becoming a general manager of a certain company are in the ratio 4: 2: 3. The probability that the bonus scheme will be introduced in the company if A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus has been introduced what is the probability that B has been appointed as general manager. | | CO1 | | An | 6 |
|  | b. | 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 | | A | 6 |
|  |  |  | |  | |  |  |
| 18. |  | 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) 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 given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 43 | 38 | 22 | 9 | 1 | | | CO3 | | E | 6 |
|  | b. | The number of accidents in a year to taxi drivers in a city follows a poisson distribution with mean 3. Out of 1000 taxi drivers find approximately the number of drivers with (i) no accident in a year (ii) more than 3 accidents in a year. | | CO3 | | U | 6 |
|  |  |  | |  | |  |  |
| 20. | a. | Find the rank correlation coefficient between the variables X and Y from the following pairs of observed values.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 50 | 55 | 65 | 50 | 55 | 50 | 50 | 55 | 79 | 75 | | Y | 110 | 110 | 115 | 125 | 140 | 115 | 130 | 120 | 115 | 150 | | | CO4 | | A | 6 |
|  | b. | Find 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 | | | CO5 | | An | 6 |
|  |  |  | |  | |  |  |
| 21. | a. | In a random Sample of size 500, the mean is found to be 20. In another random sample of size 400, the mean is 15. Could the samples have been drawn from the same population with standard Deviation 4? | | CO6 | | An | 6 |
|  | b. | 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 | | An | 6 |
|  |  |  | |  | |  |  |
| 22. | a. | Fit a straight line and a parabola to the following data by the least squares method and find out which one is most appropriate. Reason out for your conclusion.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | y | 14 | 18 | 22 | 28 | 35 | 39 | | | CO4 | | U | 6 |
|  | b. | 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 (iii) more than 1920 but less than 2160 hrs. | | CO3 | | A | 6 |
|  |  |  | |  | |  |  |
| 23. | a. | A continuous random variable X has the following distribution  . Find (i) k (ii) P(3 < X < 4) (iii) mean (iv) variance | | CO2 | | E | 6 |
|  | b. | Find the two Lines of Regression   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | | CO5 | | E | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. |  | A group of 10 rats fed on dietA and another group of 8 rats fed on diet B, recorded the following increase in weight. Test whether the variances are significantly different.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | DietA | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | DietB | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | | CO6 | | | An | 12 |

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

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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 | 2 | - | - | - | 21 | - | 23 |
| CO3 | 1 | 7 | 3 | - | 6 |  | 17 |
| CO4 | - | 7 | 12 | - | 3 | - | 22 |
| CO5 | 1 | - | - | 6 | 6 | - | 13 |
| CO6 | - | 5 | - | 24 | 3 | - | 32 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18MA2009** | **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. | Consider the universal set U={1,2,3,4,5,6,7,8,9,10} and a set A={1,2,3,4}. The complement set of A is \_\_\_\_\_\_\_. | | CO1 | | A | | | 1 | |
| 2. | Empty set is a subset of any finite set. - True or false? | | CO1 | | R | | | 1 | |
| 3. | A function f : A → B is said to be a \_\_\_\_\_\_\_\_\_\_\_\_ function if every element of A has the same image in B. | | CO2 | | R | | | 1 | |
| 4. | If there are *m* ways to do one thing, and *n* ways to do another, then there are \_\_\_\_ ways of doing both. | | CO2 | | R | | | 1 | |
| 5. | State Pigeonhole principle. | | CO3 | | A | | | 1 | |
| 6. | How many ways can the letters in the word PENCIL be arranged? | | CO3 | | A | | | 1 | |
| 7. | If all the vertices of a tree, other than the leaves, has exactly two children then the tree is called \_\_\_\_\_\_\_\_\_\_ | | CO6 | | R | | | 1 | |
| 8. | Write the truth table for. | | CO4 | | R | | | 1 | |
| 9. | A vertex with degree 0 is called \_\_\_\_\_\_\_\_\_\_\_\_\_ vertex. | | CO6 | | R | | | 1 | |
| 10. | The chromatic number of a graph G is the \_\_\_\_\_\_\_\_\_\_\_\_required to color the graph. | | CO6 | | R | | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | |
| 11. | Find the Cartesian product A\*B and B\*A if A = {1, 2, 3} and  B = {a, b, c}. | | CO1 | | | A | | 3 | |
| 12. | Determine whether the function f from {a, b, c, d} to {1, 2, 3, 4, 5} with f (a) = 4, f (b) = 5, f (c) = 1, and f (d) = 3 is one-to-one. | | CO2 | | | An | | 3 | |
| 13. | If 7 colors are used to paint 50 bicycles, at least how many cycles will have the same color ? | | CO3 | | | A | | 3 | |
| 14. | In a group of 5 boys and 3 girls, four children are to be selected. In how many different ways they can be selected if 2 boys and 2 girls should be in the group of children? | | CO3 | | | A | | 3 | |
| 15. | Let A = {1, 2, 3}. Draw the hasse diagram of power set P(A). | | CO4 | | | An | | 3 | |
| 16. | Let G be the set of all nonzero real numbers and let .Show that is a semi group. | | 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. | If U = {1,2,3,4,5,6,7,8,9,10} and A= {1,2, 4,7,8,10} and  B = {2,5,8}. Find , , A - B, B- A, A. | | CO1 | | | A | | 6 |
|  | b. | In a survey of 260 college students, the following data were obtained: 64 watch football game, 94 watch hockey game, 58 watch basket ball game, 28 watch both football and basket ball, 26 watch both football and hockey, 22 watch both hockey and basket ball and 22 do not watch any of the three kind of games.(i) Draw venn diagram representation of the problem (ii) How many students watch all the three games? | | CO1 | | | A | | 6 |
|  |  |  | |  | | |  | |  |
| 18. |  | Show that the following premises are inconsistent.  (a) If Jack misses many classes through illness, then he fails high school.  (b) If Jack fails high school, then he is uneducated.  (c) If Jack reads a lot of books, then he is not uneducated.  (d) Jack misses many classes through illness and reads a lot of books. | | CO4 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 19. | a. | Prove by mathematical induction is divisible by 3 for every. | | CO2 | | | A | | 6 |
|  | b. | Find GCD using Eulidean algorithm and express it in the form of. | | CO2 | | | A | | 6 |
|  |  |  | |  | | |  | |  |
| 20. | a. | Show that (Z, +) is a commutative semigroup. | | CO5 | | | An | | 6 |
|  | b. | Let G be the set of all nonzero real numbers and let a\*b = ab / 2. Show that (G, \*) is an Abelian group. | | CO5 | | | An | | 6 |
|  |  |  | |  | | |  | |  |
| 21. | a. | Show that  is a tautology | | CO4 | | | A | | 6 |
|  | b. | Using truth table, show that ¬(*p*∨ (¬*p*∧*q*)) and ¬*p*∧¬*q* are logically equivalent. | | CO4 | | | A | | 6 |
|  |  |  | |  | | |  | |  |
| 22. | a. | Prove by mathematical induction , for every , | | CO4 | | | An | | 6 |
|  | b. | A committee of 12 has to be selected out of 10 men & 10 women. In how many ways a committee of (i) 6 men & 6 women can be formed? (ii) 7 men and 5 women can be formed? | | CO3 | | | A | | 6 |
|  |  |  | |  | | |  | |  |
| 23. | a. | Let R = {(t, u), (u, w),(u, x),(u, v),(v, z),(v, y)} be a relation on the set A = {t, u, v, w, x, y, z}. Determine whether R is a tree. If so, find its root and draw it. | | CO6 | | | A | | 6 |
|  | b. | If *A ={1, 2, 3, 4, 5, 6}* and the relation *R* on *A* is defined by *R={ (1,2), (1,3), (2,2), (2,6), (3,4), (3,5), (4,2), (4,3), (5,6), (6,4)}*. Find (i) MR (ii) digraph of R (iii) In-degrees and out degrees of all elements of A | | CO6 | | | A | | 6 |
| **COMPULSORY QUESTION** | | | | | | | | | |
| 24. |  | Define Hamilton path and Euler path. Construct an Euler circuit for the following graph. | | CO6 | | | An | | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge in sets, relation and function. |
| CO2 | Analyze using Mathematical induction. |
| CO3 | Understand basic counting techniques. |
| CO4 | About propositional logic. |
| CO5 | Understand algebraic structures and morphisms. |
| CO6 | Classify different types of graphs. |

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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** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18MA2012** | **Duration** | **3hrs** |
| **Course Name** | **NUMERICAL MATHEMATICS AND COMPUTING** | **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 nested multiplication form of *f(x) = x3 – 2x2 + x – 3.* | | | CO1 | U | | 1 |
| 2. | Convert the octal number (475.62)8 to the binary number. | | | CO1 | An | | 1 |
| 3. | In divided difference table, if *f[x2, x1] = 2,* then *f[x1, x2] =* ….. | | | CO2 | U | | 1 |
| 4. | For the below table, *l0(x) =* ….   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | f(x) | 2 | 4 | 4 | | | | CO2 | E | | 1 |
| 5. | The number of subinterval *n* =\_\_\_\_\_\_\_in Simpson’s 1/3rd rule. | | | CO3 | R | | 1 |
| 6. | Find *R(4, 1),* if *R(4, 0) = 7* and *R(3, 0) = 4* | | | CO3 | U | | 1 |
| 7. | Check whether a linear spline function. | | | CO4 | U | | 1 |
| 8. | In the B splines of degree 0, *Bi0(x)=\_\_\_\_\_\_* | | | CO4 | R | | 1 |
| 9. | In fourth order Runge-Kutta method, *k4* = -------- | | | CO5 | R | | 1 |
| 10. | Write the corrector formula is …. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Write the pseudo code for the expression *a1 + a2 + … +an.* | | | CO1 | | R | 3 |
| 12. | Find the polynomial that interpolates the following values.   |  |  |  | | --- | --- | --- | | x | 0 | 2 | | f(x) | 7 | 11 | | | | CO2 | | A | 3 |
| 13. | Calculate the value of using Gaussian quadrature by taking 2 points. | | | CO3 | | E | 3 |
| 14. | Fit a linear spline from the following data:   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | 0 | | | | CO4 | | A | 3 |
| 15. | Find the value of *k1* given *y’ = - y, y(0) = 1* by taking *h = 0.1 u*sing the second order Runge-kutta method, | | | CO5 | | An | 3 |
| 16. | Using Crank Nicholson method, find the value of *u* from the below table. | | | 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. | Find a root of the equation *x3 – 4x – 9 = 0* correct to 4 decimal places using *Bisection Method.* | CO1 | | An | 12 |
|  | |  |  |  | |  |  |
| 18. | | a. | Construct the Divided – Difference table for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 3 | 2 | 5 | | y | 2 | 1 | 5 | 6 | -183 | | CO2 | | A | 6 |
|  | | b. | Find the Lagrangian interpolating polynomial for the data given below.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 2 | 3 | 4 | |  | 7 | 11 | 28 | 63 | | CO2 | | An | 6 |
|  | |  |  |  | |  |  |
| 19. | | a. | Evaluate  using (i) Trapezoidal rule (ii) Simpson’s rules | CO3 | | E | 6 |
|  | | b. | Use Romberg Algorithm to approximate  by evaluating R(1,1). | CO3 | | E | 6 |
|  | |  |  |  | |  |  |
| 20. | | a. | Check whether the below function is a quadrature spline function. | CO4 | | U | 6 |
|  | | b. | Determine the natural cubic interpolating spline function for the below table.   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | -1 | | CO4 | | A | 6 |
|  | |  |  |  | |  |  |
| 21. | | a. | Find *y(1.1)* given that *y ‘ = x+y*; *y(1) =0* using Taylor’s series method | CO5 | | E | 6 |
|  | | b. | Compute *y* at *x = 0.1* by taking *h = 0.05* given *y ‘ = x + y + xy; y(0) = 1* using Euler’s method. | CO5 | | E | 6 |
|  | |  |  |  | |  |  |
| 22. | | a. | Convert the following.  (7152.46)8= (\_\_\_\_\_\_\_\_\_\_) 10 = (\_\_\_\_\_\_\_\_\_ )16 = ( \_\_\_\_\_\_\_ )2. | CO1 | | U | 6 |
|  | | b. | Find the root of *f(x) = x3 – x + 1 = 0* by using *Newton Raphson* method correct to five decimal places. | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 23. | | a. | How many sub-intervals are needed to approximate with error not to exceed using the trapezoid rule? | CO3 | | E | 6 |
|  | | b. | Convert *p4(x) = -5 + 2x – 4x(x-1) + 8x(x-1)(x+1) + 3x(x-1)(x+1)(x-2)* to nested form then find the value of *p4(3).* | CO1 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Solve *x + y +54z = 110; 27x + 6y – z = 85; 6x + 15y + 2z = 72 b*y using Gauss-Seidel iterative method. | CO6 | | An | 6 |
|  | | b. | Solve , the boundary conditions are given below(give only 3 iterations) | CO6 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Knowledge about different methods of solving algebraic equations |
| CO2 | Interpolate data |
| CO3 | Compute using numerical integration |
| CO4 | Compute using spline functions |
| CO5 | Solving ordinary differential equations using numerical techniques |
| CO6 | Solving partial differential equations using numerical techniques |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 3 | 13 | 6 | 13 | - | - | 35 |
| CO2 | - | 1 | 8 | 7 | 1 | - | 17 |
| CO3 | 1 | 1 | - | - | 21 | - | 23 |
| CO4 | 1 | 5 | 11 | - | - | - | 17 |
| CO5 | 2 | - | - | 3 | 12 | - | 17 |
| CO6 | 3 | 13 | 6 | 13 | - | - | 35 |
|  | | | | | | | **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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | State and Prove Euler’s Theorem | CO1 | A | 8 |
|  | b. | Find the chromatic number chromatic polynomial for the following graphs. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | If G is a graph with n vertices and m edges and , then prove that it has Hamiltonian circuit. | CO1 | An | 8 |
|  | b. | Define the following with an Example:  (i) Complete Graph (ii) Connected Graph (iii) Linear Graph (iv) Coloring of Graph | CO1 | U | 8 |
|  |  |  |  |  |  |
| 3. | a. | Draw an Expression tree for the following expression  (a+b\*c)+((d\*c+f)\*g). Traverse in Pre-order, in-order and post-order, hence find its prefix, infix and postfix notation | CO2 | A | 12 |
|  | B | Evaluate 7 4 1 \* - 4 \* 9 3 / + | CO2 | E | 4 |
|  |  |  |  |  |  |
| 4. |  | Explain Prim’s and Krushkal’s Algorithm. Find the minimal spanning tree using Prim’s and Krushkal’s algorithm for the following graph. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Find GCD of 124 and 323 using Euclidean Algorithm and find its Bezout’s identity and Bezout’s Coefficients. | CO6 | E | 10 |
|  | b | Prove that there are infinitely many primes. | CO6 | An | 6 |
|  |  |  |  |  |  |
| 6. |  | State and Prove Kleen’s Theorem. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 7. | a. | Two random processes {X(t)} and {Y(t)} are defined by X(t) = Acos5t +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 withzero 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. | Customers arrive at a one-man barber shop according to a Poissonprocess with a mean interarrival time of 12 min. Customers spend an average of 10 min in the barber’s chair.  (i) What is the expected number of customers in the barber shop and in the queue?  (ii) Calculate the percentage of time an arrival can walk straight into thebarber’s chair without having to wait.  (iii) How much time can a customer expect to spend in the barber’s shop?  (iv) Management will provide another chair and hire another barber, when a customer’s waiting time in the shop exceeds 1.25 h. How much must theaverage rate of arrivals increase to warrant a second barber?  (v) What is the average time customers spend in the queue? | CO3 | E | 10 |
|  | b. | A petrol pump station has 4 pumps. The service times follow the exponential distribution with a mean of 6 min and cars arrive for serve in a Poisson Process at the rate of 30 cars per hour. (i) What is the probability that an arrival would have to wait in line? (ii) Find the average waiting time, average time spent in the system and the average number of cars in the system (iii) For what percentage of time would a pump be idle on an average? | CO3 | E | 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 |  | 8 | 8 | 16 |  |  | 32 |
| CO2 |  |  | 28 |  | 4 |  | 32 |
| CO3 |  |  |  |  | 20 |  | 20 |
| CO4 |  |  |  | 16 |  |  | 16 |
| CO5 |  |  | 10 |  | 6 |  | 16 |
| CO6 |  |  |  | 6 | 10 |  | 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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Find the sum to infinity of the series | CO1 | A | 8 |
|  | b. | Using Binomial expansion, evaluate correct to five decimal places. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | Find the maxima and Minima of the following functions.  (i) f(x) = 3x3-9x. (ii) f(x) = | CO2 | A | 8 |
|  | b. | Find the derivative of the function defined by the expression | CO2 | E | 8 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate | CO3 | U | 8 |
|  | b. | Using Bernoulli’s method, estimate | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | Fit a binomial distribution to the following data and hence find the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 5 | 29 | 36 | 25 | 5 | | CO5 | E | 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. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 5. | a. | A simple sample of heights of 6400 Englishmen has a mean of 170 cm and a S.D of 6.4 cm, while a simple sample of heights of 1600 Americans has a mean of 172 cm and a S.D of 6.3 cm. Do the data indicate that Americans are on the average taller than Englishmen? | CO6 | E | 8 |
|  | b. | A sample analysis of examination results of 500 students was made. It was found that 220 students had failed , 170 students had secured a third class, 90 were placed in second class and 20 got a first class. Do these results commensurate with the general examination result which is in the ratio 4:3;2:1 for the various categories respectively? | CO6 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | Apply the Partial fraction method and find | CO3 | E | 10 |
|  | b. | If Prove that | CO1 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | The 2 samples are drawn from the 2 normal population from the following data. Test whether the 2 samples have the same variance at 5% level.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample I | 60 | 65 | 71 | 74 | 76 | 82 | 85 | 87 | --- | --- | | Sample II | 61 | 66 | 67 | 85 | 78 | 63 | 85 | 86 | 88 | 91 | | CO6 | An | 10 |
|  | b. | A machinist is making engine parts with the axile diameter of 0.700 inch. A random sample of 10 parts shown the mean diametr of 0.742 inch with the standard deviation of 0.040 inch. Compute the statistic you would use to test whether the work is meeting the specification? | CO6 | A | 6 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | The following data resulted from an experiment to compare 3 burners B1, B2, B3. 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. | CO4 | An | 20 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | --- | 14 | 8 | --- | --- | ---- | 22 |
| CO2 | --- | --- | 8 | --- | 8 | --- | 16 |
| CO3 | --- | 8 | 8 | --- | 10 | --- | 26 |
| CO4 | --- | --- | --- | 20 | 6 | --- | 26 |
| CO5 | --- | --- | --- | --- | 10 | --- | 10 |
| CO6 | --- | --- | 14 | 10 | 8 | --- | 32 |
|  | | | | | | | **132** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | State Mean value theorem. | | | CO1 | R | | 1 |
| 2. | Find the value of | | | CO1 | U | | 1 |
| 3. | The Laplace Transform of is \_\_\_\_\_\_\_\_\_. | | | CO2 | R | | 1 |
| 4. | =\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO2 | U | | 1 |
| 5. | If J= and J’=, then JJ’=\_\_\_\_\_. | | | CO3 | R | | 1 |
| 6. | Write the necessary condition for f(x,y) to be maximum. | | | CO3 | U | | 1 |
| 7. | Evaluate | | | CO4 | R | | 1 |
| 8. | Write the formula for area enclosed by plane curves whose equations are in polar form. | | | CO4 | U | | 1 |
| 9. | Find given ++. | | | CO5 | R | | 1 |
| 10. | If =+ *y+ z,* then =\_\_\_\_\_\_\_\_\_\_\_. | | | CO5 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Express d in terms of gamma function. | | | CO1 | | U | 3 |
| 12. | Find the Laplace Transform of | | | CO2 | | U | 3 |
| 13. | If ,, then find . | | | CO3 | | U | 3 |
| 14. | Evaluate . | | | CO4 | | U | 3 |
| 15. | Find the directional derivative of at the point (1, -1,1) in the direction of + *2+ 2.* | | | CO5 | | U | 3 |
| 16. | If =3xy-, evaluate d , where C is the curve in the xy-planefrom (0,0) to (1,2). | | | CO1 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | | a. | Express in terms of gamma functions.  Hence evaluate: (i)  (ii) . | CO1 | | A | 12 |
|  | |  |  |  | |  |  |
| 18. | | a. | Find the Laplace Transform of . | CO2 | | A | 6 |
|  | | b. | Find the inverse Laplace Transform of . | CO2 | | A | 6 |
|  | |  |  |  | |  |  |
| 19. | | a. | Expand log(1+y) in powers of x and y upto terms of third degree. | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | | a. | Change the order of integration and evaluate . | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 21. | | a. | Find the angle between the surfaces and +-3 at the point (2, -1,2). | CO4 | | A | 6 |
|  | | b. | If , v = , , prove that grad u, grad v and grad w are coplanar. | CO4 | | A | 6 |
|  | |  |  |  | |  |  |
| 22. | | a. | If , , , show that the Jacobian of , *,* with respect to x1, x2, x3 is 4. | CO5 | | A | 6 |
|  | | b. | Discuss the maxima and minima of f(x, y)=. | CO5 | | A | 6 |
|  | |  |  |  | |  |  |
| 23. | | a. | Evaluate | CO4 | | A | 6 |
|  | | b. | Find by triple integration, the volume of the sphere . | CO4 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Verify Gauss divergence theorem  taken over the cube bounded by the plane x=0, x=1, y=0, y=1, z=0, z=1. | CO1 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply differentiation techniques to find extreme values of functions. |
| CO2 | Relate the properties of Laplace transform. |
| CO3 | Solve using multivariable differentiation techniques. |
| CO4 | Solve problems using integration techniques. |
| CO5 | Apply basic tools in vector differentiation. |
| CO6 | Apply MATLAB tools to solve mathematical problems |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 7 | 24 | - | - | - | 32 |
| CO2 | 1 | 4 | 12 | - | - | - | 17 |
| CO3 | 1 | 4 | 24 | - | - | - | 29 |
| CO4 | 1 | 4 | 24 | - | - | - | 29 |
| CO5 | 1 | 4 | 12 | - | - | - | 17 |
| CO6 |  |  | - | - | - | - |  |
| 5 23 96 | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **19MA2002** | **Duration** | **3hrs** |
| **Course Name** | **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. | Reduce the law  into a linear law. | | CO1 | U | | 1 |
| 2. | Define curve fitting. | | CO1 | R | | 1 |
| 3. | When Gauss elimination method is used to solve AX=B, A is transferred into a \_\_\_\_\_\_\_\_\_ matrix. | | CO2 | R | | 1 |
| 4. | If f(x) is continuous in the interval (a,b) and if f(a) and f(b) are of opposite signs, then the equation f(x)=0 will have \_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | What is the value of | | CO3 | U | | 1 |
| 6. | Find the relation between (i) E and (ii) E and | | CO3 | U | | 1 |
| 7. | Simpson’s three-eighths rule is applicable only when n is a \_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 8. | The error in the Trapezoidal rule is of the order \_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | Mention any two methods that you can solve first order differential equation | | CO5 | U | | 1 |
| 10. | Check whether the equation  is parabolic or not. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | What are the normal equations in fitting a parabola by the method of least squares? | | CO1 | | An | 3 |
| 12. | Write down the criterion for the convergence of Gauss-Jacobi Iteration method | | CO2 | | U | 3 |
| 13. | Form the difference table for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 2 | 4 | 6 | 8 | 10 | | y | 0 | 0 | 1 | 0 | 0 | | | CO3 | | An | 3 |
| 14. | Give Newton – Cote’s quadrature formula. | | CO4 | | U | 3 |
| 15. | Write down Taylor’s series Algorithm. | | CO5 | | An | 3 |
| 16. | (i) The standard five point formula and (ii) diagonal five point formula are \_\_\_\_\_\_\_\_. | | 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. | Fit a straight line to the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | y | 1 | 1.8 | 1.3 | 2.5 | 6.3 | | CO1 | | A | 6 |
|  | b. | From the table given below,find the best values of a and b in the law  by the method of least squares   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 5 | 8 | 12 | 20 | | y | 3 | 1.5 | 1 | 0.55 | 0.18 | | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | Find the real positive root of by Newton’s method correct to four decimal places. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | Using Lagrange’s interpolation formula, find the value of y when x = 9.5 given   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 7 | 8 | 9 | 10 | | y | 3 | 1 | 1 | 9 | | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | Apply the fourth order Runge-Kutta method to find y(0.2) and y(0.4) given that | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | Compute y at x = 0.25 and x = 0.5 by Modified Euler method given | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | Solve the system of equations by Gauss Elimination method | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 23. |  | A river is 80 meters wide. The depth‘d’ in meters at a distance x meters from one bank is given by the following table. Calculate the area of cross-section of the river using Simpson’s rule.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | | d | 0 | 4 | 7 | 9 | 12 | 15 | 14 | 8 | 3 | | CO3 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
|  |  | SolvegivenTaking h = 1, find the values upto t = 5 | CO6 | | An | 12 |

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

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | What is the nested multiplication form of *f(x) = x3+ 2x2– x+7*? | | | CO1 | U | | 1 |
| 2. | (ACB.104)16 = ( \_\_\_\_\_\_\_\_ ) 2. | | | CO1 | An | | 1 |
| 3. | In divided difference table, if *f[x3, x2, x1] = 2,* then *f[x1,x2,x3] =*\_\_\_\_\_\_\_\_ . | | | CO2 | U | | 1 |
| 4. | For the below table, *l0(x) =* ….   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | f(x) | 1 | 4 | 8 | | | | CO2 | E | | 1 |
| 5. | To use Simpson’s 31/3rd rule, the number of subinterval *n* should be\_\_\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 6. | If *R(4, 0) = 12* and *R(3, 0) = 6*, then *R(4, 1)* = \_\_\_\_\_\_\_\_ . | | | CO3 | U | | 1 |
| 7. | Is a linear spline function? Justify your answer. | | | CO4 | U | | 1 |
| 8. | The B splines of degree 0, *Bi0(x)* is \_\_\_\_\_\_\_\_ . | | | CO4 | R | | 1 |
| 9. | In fourth order Runge-Kutta method, *k3* = \_\_\_\_\_\_\_\_ . | | | CO5 | R | | 1 |
| 10. | The corrector formula is \_\_\_\_\_\_\_\_ . | | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Write the pseudo code for the expression *a1 + a2 + … +an.* | | | CO6 | | R | 3 |
| 12. | Find the polynomial that interpolates the following values.   |  |  |  | | --- | --- | --- | | x | 0 | 3 | | f(x) | 7 | 9 | | | | CO2 | | A | 3 |
| 13. | Find the value of using Gaussian quadrature by taking 2 points. | | | CO2 | | E | 3 |
| 14. | |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 2 | 0 |   Fit a linear spline to the following data: | | | CO3 | | A | 3 |
| 15. | Using the second order Runge-kutta method, find the value of *k2* given *y’ = 1+ y, y(0) = 1* by taking *h = 0.2.* | | | CO4 | | An | 3 |
| 16. | Using Crank Nicholson method, find the value of *u* from the below table. | | | 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. | |  | Using *Bisection Method*, find the root of *f(x) = x3 – 6x +4 = 0*correct to 4 decimal places. | CO1 | | An | 12 |
|  | |  |  |  | |  |  |
| 18. | | a. | Form the divided difference table and hence find the interpolating  polynomial of least degree for   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X | 0 | 1 | -1 | 2 | -2 | | Y | -5 | -3 | -15 | 39 | -9 | | CO2 | | A | 5 |
|  | | b. | Using cardinal functions, find the Lagrangian interpolating polynomial for the following table.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 3 | 2 | 5 | | y | 2 | 1 | 5 | 6 | -183 | | CO2 | | An | 7 |
|  | |  |  |  | |  |  |
| 19. | |  | Evaluate by taking six equal sub-intervals, using  (a) Trapezoidal rule (b) Simpson’s 1/3 rule  (c) Simpson’s 3/8 rule. Also find the actual value. | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 20. | | a. | Determine whether the below function is a quadrature spline function, | CO3 | | U | 4 |
|  | | b. | Find the natural cubic interpolating spline function for the below table.   |  |  |  |  | | --- | --- | --- | --- | | x | -1 | 0 | 1 | | y | 1 | 3 | 5 | | CO3 | | A | 8 |
|  | |  |  |  | |  |  |
| 21. | | a. | Find *y(0.1)*and *y(0.2)* by using Euler’s method given that | CO4 | | E | 6 |
|  | | b. | Using Taylor’s series method, find *y(1.1)*and *y(1.2)*  given that  ; *y(1) =0.* | CO4 | | E | 6 |
|  | |  |  |  | |  |  |
| 22. | | a. | Convert the following.  (6275.37)8= (\_\_\_\_\_\_\_\_\_\_) 10 = (\_\_\_\_\_\_\_\_ )16 = ( \_\_\_\_\_\_\_ )2. | CO1 | | U | 6 |
|  | | b. | Find the root of *f(x) = x3 – x + 1 = 0* by using *Newton Raphson* method correct to five decimal places. | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 23. | | a. | How many sub-intervals are needed to approximate with error not to exceed using the trapezoid rule? | CO2 | | E | 6 |
|  | | b. | Convert to the below function nested form then find the value of *p4(3).p4(x) =5+2x + x(x+1) + 8x(x+1)(x-1) + 3x(x+1)(x-1)(x+2)* | CO1 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Solve by using Liebmann’s iterative method, the boundary conditions are given below: | CO5 | | An | 12 |

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

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

Graphical user interface, application

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Compute the factorial of 5 using for loop in MATLAB. | CO1 | A | 4 |
|  | b. | 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 |
|  | c. | Explain the following built in function with an example.   1. Trigonometric 2. Exponential 3. Factor | CO1 | R | 6 |
|  |  |  |  |  |  |
| 2. | a. | Solve the following ordinary differential equation using MATLAB code. | CO2 | A | 6 |
| b. | Create two vectors to represent the polynomial: and and also find the derivative of the product of the polynomial using MATLAB. | CO2 | A | 5 |
| c. | Solve using MATLAB. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 3. | a. | Manipulate the string "Hello, Python!” using the following methods in python and also write the output:   1. Case fold 2. Swap case 3. Upper | CO3 | U | 6 |
| b. | Explain comparison operator 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 2nd to 4th element. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 4. | a. | Write a python program using while loop to display the following output:   1. Print i as long as i is less than 6 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 10. | CO4 | A | 5 |
| c. | In Python, use the elif condition to find the greater of any two numbers. | CO4 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | If A = and B=then multiply the two matrices using nested list. | CO4 | A | 8 |
|  | b. | Explain the following built in functions in list with an example:   1. Insert 2. Pop 3. Clear 4. Reverse | 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 |
|  |  |  |  |  |  |
| 7. | a. | Write the detailed LaTeX code for the following table: | CO5 | A | 8 |
|  | b. | Write 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 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 6 | 4 |  |  |  | 16 |
| CO2 |  | 5 | 11 |  |  |  | 16 |
| CO3 | 5 | 6 | 5 |  |  |  | 16 |
| CO4 |  | 13 | 19 |  |  |  | 32 |
| CO5 |  | 8 | 24 |  |  |  | 32 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **132** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | | **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 product of the eigen values of matrix | | | CO2 | R | | 1 |
| 5. | Examine the convergence of the sequence | | | CO3 | R | | 1 |
| 6. | If  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. | Define solenoidal vector. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Check whether the lines  and  are coplanar. | | | CO1 | | U | 3 |
| 12. | Express A as the sum of a symmetric and skew symmetric matrix where | | | CO2 | | U | 3 |
| 13. | Show that the series  diverges if . | | | CO3 | | U | 3 |
| 14. | Write down half range Fourier sine series expansion of f(x) = x in the interval | | | CO4 | | U | 3 |
| 15. | Evaluate | | | CO5 | | U | 3 |
| 16. | If  then find . | | | 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 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 | | A | 6 |
|  | | b. | Evaluate | CO5 | | A | 6 |
|  | |  |  |  | |  |  |
| 22. | |  | Discuss the convergence of the series | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | Verify Cayley Hamilton theorem for the matrix . | CO2 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 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 | | A | 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 Level** | | | | | | | |
| 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 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | | | | | | **Course Outcome** | | **Bloom’s Level** | | | **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 | | R | | | 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 | | U | | | 1 |
| 8. | L (e2t – 3 ) | | | | | | | | CO5 | | R | | | 1 |
| 9. | Solve 2p-3q=1. | | | | | | | | CO3 | | U | | | 1 |
| 10. | Obtain the complete solution for *z = px+qy+p2+q2* | | | | | | | | CO3 | | U | | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | | | | | | |
| 11. | Find asymptotes of the curve | | | | | | | | CO1 | | | An | | 3 |
| 12. | Solve the Cauchy Euler equations | | | | | | | | CO2 | | | U | | 3 |
| 13. | Find the Centre and radius of the circle | | | | | | | | CO4 | | | An | | 3 |
| 14. | Find *L (.* | | | | | | | | CO5 | | | U | | 3 |
| 15. | Solve | | | | | | | | CO3 | | | An | | 3 |
| 16. | Write the three possible solutions of the one-dimensional wave equation. | | | | | | | | CO3 | | | 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. |  | | | Expand e2xsin y about (0, π/2) up to the third term using Taylor Series | | | | | CO1 | | | E | | 12 |
| 18. |  | | | 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 | | 6 |
|  | b. | | | Find the value of a, b,c if f(z) = x-2ay + i (bx-cy) is analytic. | | | | | CO4 | | | U | | 6 |
| 20. | a. | | | Find the Laplace transforms of the periodic function, where is a constant. | | | | | CO5 | | | An | | 6 |
|  | b. | | | Find | | | | | 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. |  | | | Solve: | | | | | CO2 | | | E | | 12 |
| **COMPULSORY QUESTION** | | | | | | | | | | | | | | |
| 24. |  | | | An insulated rod 20cms long has its ends A and B kept at 30∙C and 60∙C respectively, until steady state conditions prevail. The temperature at each end is then suddenly reduced to 0∙C and kept so. Find the resulting temperature function u(x,t). | | | | | CO3 | | | A | | 12 |
|  | | | | | | | | | | | | | | |
|  | | **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. | | | | | | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | | | | | | | |
| 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** | |

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define Standard Deviation. | | CO1 | U | | 1 |
| 2. | The number of rooms in the seven star hotels in Chennai city is 71, 30, 61,59,31,40 and 29.Find the median number of rooms? | | CO1 | A | | 1 |
| 3. | If X and Y are random variables, then covariance between X and Y is defined as \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | Difference between positive and negative correlation. | | CO2 | R | | 1 |
| 5. | A coin is tossed 2 times. Find the probability to get a more heads than tails. | | CO3 | U | | 1 |
| 6. | If is the complementary event of A , P( | | CO3 | R | | 1 |
| 7. | Define random Random variable with example. | | CO4 | U | | 1 |
| 8. | State the properties of the cdf of a two- dimensional RV(X, Y). | | CO4 | R | | 1 |
| 9. | Comment the follwing :For poission distribution with mean = 8 and variance = 7 | | CO5 | A | | 1 |
| 10. | What is meant by level of significance? | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Compute Q1 for the data relating to the marks of 8 students in an examination given below 25, 48, 32, 52, 21, 64, 29, and 57. | | CO1 | | E | 3 |
| 12. | If regression coefficients are -0.3 and -0.8, then the correlation coefficient is \_\_\_\_\_\_\_\_\_\_. | | CO2 | | A | 3 |
| 13. | State Baye’s theorem. | | CO3 | | R | 3 |
| 14. | Define joint pmf and pdf of discrete and continuous RV. | | CO4 | | R | 3 |
| 15. | For binomial distribution with *n =24* and *p =1/2*, calculate mean and variance. | | CO5 | | A | 3 |
| 16. | Define type I and type II errors in testing of 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. | The following table shows age distribution of persons in a particular region:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Age | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | No .of persons | 2 | 3 | 4 | 3 | 2 | 1 | 0.5 | 0.1 |   Find the median age. | CO1 | | E | 6 |
|  | b. | The following data is obtained from the survey. Compute H.M   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Speed of the car | 130 | 135 | 140 | 145 | 150 | | No. of cars | 3 | 4 | 8 | 9 | 2 | | CO1 | | E | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Calculate the rank correlation coefficient for the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 78 | 89 | 97 | 69 | 59 | 79 | 68 | | Y | 125 | 137 | 156 | 112 | 107 | 136 | 124 | | CO2 | | E | 6 |
|  | b. | Calculate the correlation coefficient for the following heights of fathers X and their sons Y.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 75 | 76 | 77 | 77 | 78 | 79 | 80 | 82 | | Y | 77 | 78 | 75 | 78 | 82 | 82 | 79 | 81 | | CO2 | | E | 6 |
|  |  |  |  | |  |  |
| 19. | a. | A random variable X has the following probability distribution.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | p(x) | 0.1 | K | 0.2 | 2K | 0.3 | 3K |   (a)Find K, (b) Evaluate P(X< 2) (c) Evaluate the mean of X | CO3 | | A | 6 |
|  | b. | If p(x) =  (a) Show that p(x) is a pdf  (b) Find its distribution function p(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)* = 8xy, 0<x<1 , 0 < y <2  = 0 , elsewhere  Compute (i) (X>1/2), (ii)P() | CO4 | | E | 6 |
|  |  |  |  | |  |  |
| 21. | a. | The life of a lamp produced by a factory is distributed normally with a mean of 50 days and standard deviation of 15 days. If 5000 lamps are fitted on the same day, find the number of lamps to be replaced after 74 days. | CO5 | | An | 6 |
|  | b. | If X is Poisson variable with parameter λ and if P(X = 0) = 0.2 evaluate P(X>2). | CO5 | | A | 6 |
|  |  |  |  | |  |  |
| 22. | a. | A box contains 100 watches, 20 of which are defective. 10 are selected at random for inspection, find the probability that   1. All 10 are defective (ii) All 100 are good 2. At least 1 is defective. | CO5 | | An | 6 |
|  | b. | Between the hours of 2 and 4 p.m. the average number of phone calls per minute coming into the switch board of a company is 2.5. Find the probability that during one particular minute there will be (i) no phone calls at all (ii) exactly 2 calls. | CO5 | | E | 6 |
|  |  |  |  | |  |  |
| 23. | a. | A sample of 900 members is found to have a mean 3.5 cm. can it reasonably regarded as a simple sample from large population whose mean is 3.38 and standard deviation 2.4 cm? | CO6 | | An | 6 |
|  | b. | A group of 10 rats feed on a diet A and another group of 8 rats feed on diet B recorded the following increase in weight.  Find if the variances are significantly different.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 10 | 1 | 2 | 8 | - | - | | CO6 | | E | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | A bag contains 10 white and 3 black balls. Another bag contains 3 white and 5 black balls. Two are drawn at random from the first bag and placed in second bag and then one ball is taken at random from the latter. What is the probability that it is a white ball? | CO3 | | An | 6 |
|  | b. | A lot consists of 10 good articles with 4 minor defects and 2 are major defective. Two are chosen the lot at random (without replacement).Find the probability that (i) both are good, (ii) both have major defects; (iii) exactly 1 is good. | CO3 | | An | 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 | 4 | - | 12 |  | 17 |
| CO2 | 2 | - | 3 | - | 12 |  | 17 |
| CO3 | 4 | 1 | 6 | 12 | 6 |  | 29 |
| CO4 | 4 | 1 | - | 6 | 6 |  | 17 |
| CO5 | - | - | 10 | 12 | 6 |  | 28 |
| CO6 | - | 4 | - | 6 | 6 | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | What is the inverse of the matrix . | | CO1 | U | | 1 |
| 2. | Is the matrix in the Row Echelon Form? | | CO1 | R | | 1 |
| 3. | State Cayley – Hamilton Theorem. | | CO2 | R | | 1 |
| 4. | What are the Eigen values of matrix if 1, 2, 3 are the Eigen values of matrix A? | | CO2 | R | | 1 |
| 5. | Is a linear function? | | CO3 | U | | 1 |
| 6. | Evaluate . | | CO3 | R | | 1 |
| 7. | Evaluate . | | CO4 | U | | 1 |
| 8. | Evaluate. | | CO4 | R | | 1 |
| 9. | Write the formula to calculate the area of the surface using double integration. | | CO5 | U | | 1 |
| 10. | Is an odd function or even function? | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Evaluate 3 given and . | | CO1 | | E | 3 |
| 12. | Two Eigen values of the matrix are equal to 1. Find the third Eigen value. | | CO2 | | A | 3 |
| 13. | Differentiate with respect to x, . | | CO3 | | A | 3 |
| 14. | What is the value of ? | | CO4 | | E | 3 |
| 15. | What is the value of ? | | CO5 | | A | 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 using Gauss Jordan Method. | CO1 | | A | 6 |
|  | b. | Test the consistency of the system of equations and solve using Gauss Elimination Method.  ; ; | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | Reduce the quadratic form  to the canonical form using orthogonal reduction and hence find its nature, signature and index. | CO2 | | E | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Find the first order and second partial derivatives of the function . | CO3 | | A | 6 |
|  | b. | Find the Jacobian where ; . | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. |  | Integrate (i) (ii) (iii) . | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Find the area bounded by the parabola and . | CO5 | | A | 8 |
|  | b. | Evaluate . | CO5 | | A | 4 |
|  |  |  |  | |  |  |
| 22. | a. | Solve the system of equations by Cramer’ Method  ; ; | CO1 | | A | 6 |
|  | b. | Solve the system of equations using Gauss Jordan Method  ; 3; | CO1 | | E | 6 |
|  |  |  |  | |  |  |
| 23. |  | Evaluate the (i) characteristic equation (ii) Eigen values (iii) Eigen vectors of the matrix | CO2 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Obtain the Fourier series for in the interval | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Solve linear systems of equations using matrices. |
| CO2 | Find the Eigen values, Eigen vectors of matrices and diagonalize 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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 18 | - | 9 | - | 29 |
| CO2 | 2 | - | 3 | - | 24 | - | 29 |
| CO3 | 1 | 1 | 15 | - | - | - | 17 |
| CO4 | 1 | 1 | 12 | - | 3 | - | 17 |
| CO5 | 1 | - | 15 | - | - | - | 16 |
| CO6 | 1 | - | 15 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | The curvature of a straight line at any point is \_\_\_\_\_\_\_\_. | CO1 | R | 1 |
| 2. | State the parametric form of the ellipse. | CO1 | R | 1 |
| 3. | Evaluate | CO2 | E | 1 |
| 4. | Is the series 1 + 1/2 + 1/22 + 1/24 + … divergent, convergent or oscillatory? | CO2 | U | 1 |
| 5. | Define Vector Space. | CO3 | R | 1 |
| 6. | State the dimension of the vector space . | CO3 | U | 1 |
| 7. | What is the torsion of a plane curve? | CO4 | U | 1 |
| 8. | When is a vector said to be irrotational? | CO4 | R | 1 |
| 9. | Calculate the distance between the vectors  and . | CO5 | E | 1 |
| 10. | What is the Laplace transform of f(t) = t2? | CO6 | E | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Evaluate | CO1 | E | 3 |
| 12. | Expand (i) Sinx (ii) (iii) | CO2 | U | 3 |
| 13. | Verify if the vectors (0, – 4, 2), (0, 3, – 2) and (– 6, 4, 3) are linearly independent or not. | CO3 | A | 3 |
| 14. | Evaluate (i) (ii)  if | CO4 | E | 3 |
| 15. | Verify if the vectors , and are orthogonal to each other. | CO5 | A | 3 |
| 16. | Find the Laplace Transformation of | 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 evolute of the curve ; | | CO1 | | A | | 12 |
|  |  |  | |  | |  | |  |
| 18 | a. | Evaluate | | CO1 | | E | | 6 |
| b. | Find the area of the cardioid | | CO1 | | A | | 6 |
|  |  |  | |  | |  | |  |
| 19. | a. | Test the convergence of the series | | CO2 | | An | | 6 |
| b. | Expand about the point . | | CO2 | | A | | 6 |
|  |  |  | |  | |  | |  |
| 20. | a. | Find the linear transformation. Prove that such that and | | CO3 | | A | | 6 |
| b. | For given by  find Rank and Nullity of T | | CO3 | | A | | 6 |
|  |  |  | |  | |  | |  |
| 21. |  | Find the curvature and torsion of the curve  at | | CO4 | | A | | 12 |
|  |  |  | |  | |  | |  |
| 22. |  | Construct an orthonormal basis for W using Gram Schmidt Process, given that | | CO5 | | A | | 12 |
|  |  |  | |  | |  | |  |
| 23. | a. | Evaluate the Laplace transform of | | CO6 | | E | | 6 |
| b. | Evaluate the Inverse Laplace transform of | | CO6 | | E | | 6 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. | a. | Evaluate the Inverse Laplace transform of using partial fraction | CO6 | | E | | 6 | |
| b. | Evaluate the Inverse Laplace transform of using convolution theorem | CO6 | | E | | 6 | |

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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 Transforms. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | - | 18 | - | 9 | - | 29 |
| CO2 | - | 4 | 6 | 6 | 1 | - | 17 |
| CO3 | 1 | 1 | 15 | - | - | - | 17 |
| CO4 | 1 | 1 | 12 | - | 3 | - | 17 |
| CO5 | - | - | 15 | - | 1 | - | 16 |
| CO6 | - | 3 | - | - | 25 | - | 28 |
|  | | | | | | | **124** |

**Graphical user interface, application

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | | | | |
| 1. | The equation of a straight line parallel to x-axis at a distance of 10 units above the x-axis is \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | A | | 1 |
| 2. | What is the y- intercept of the graph of y = -5x + 6? | | CO1 | R | | 1 |
| 3. | The equation of the straight line with slope of -9  and y-intercept  of 2 is \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 4. | If  is a circle then the equation of normal to the circle at (x1,y1) is given by\_\_\_\_\_\_\_\_\_\_\_ | | CO3 | R | | 1 |
| 5. | The equation of the tangent at () to the circle is \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | **=\_\_\_\_\_\_\_\_\_\_.** | | CO4 | R | | 1 |
| 7. | Find the value of | | CO4 | U | | 1 |
| 8. | If y = x2 + cos x, then =\_\_\_\_\_\_\_\_\_\_. | | CO4 | A | | 1 |
| 9. | Find ,where | | CO4 | R | | 1 |
| 10. | While finding the maxima and minima, then is \_\_\_\_\_\_\_\_\_\_ value. | | CO4 | R | | 1 |
| 11. | The formula for | | CO5 | A | | 1 |
| 12. | Integrate. | | CO5 | U | | 1 |
| 13. | =\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 14. | The formula | | CO5 | R | | 1 |
| 15. | Integrate =\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 16. | Find the transpose of the matrix . | | CO6 | U | | 1 |
| 17. | Define upper diagonal matrix | | CO6 | R | | 1 |
| 18. | Matrix A is a skew- symmetric matrix if and only if A=\_\_\_\_\_\_\_\_\_\_. | | CO6 | R | | 1 |
| 19. | Find the determinant of the matrix | | CO6 | U | | 1 |
| 20. | If the matrix A is a non-singular matrix then determinant of A is \_\_\_\_\_\_\_\_\_\_\_. | | CO6 | U | | 1 |
| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | | | | |
| 21. | **The fours vertices of a parallelogram are A(-2, 3), B(3, -1), C(p, q) and D(-1, 9). Find the value of p and q.** | | CO2 | | A | 5 |
| 22. | Find the equation of the circle on the line joining (-1, 2) and (-3, 5) as diameter. Also find the centre and radius of the circle. | | CO3 | | A | 5 |
| 23. | Find the equation of tangent and normal to the circle at the point (2,-3). | | CO3 | | A | 5 |
| 24. | If , then find . | | CO4 | | A | 5 |
| 25. | Find . | | CO4 | | A | 5 |
| 26. | If then find . | | CO4 | | A | 5 |
| 27. | Solve | | CO5 | | A | 5 |
| 28. | Integrate . | | CO5 | | A | 5 |
| 29. | Evaluate. | | CO5 | | E | 5 |
| 30. | If and B then find A+B, A-B and 2A-3B. | | CO6 | | A | 5 |
| 31. | If and B then find AB and BA. | | CO6 | | A | 5 |
| 32. | Find if | | CO6 | | A | 5 |
| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | | | |
| 33. | a. | Find the point of intersection of the two lines and . | CO2 | | A | 5 |
|  | b. | Find the equation of the circle passing through the points (1, 0), (-1, 0) and (0, 1). Find its centre and radius. | CO3 | | A | 10 |
|  |  |  |  | |  |  |
| 34. | a. | Differentiate with respect to x. | CO4 | | A | 5 |
|  | b. | Find the maxima and minima of in the interval (0,2) | CO4 | | A | 10 |
|  |  |  |  | |  |  |
| 35. | a. | Evaluate | CO5 | | E | 5 |
|  | b. | Find the area of the tangent cut off from the parabola by the line . | CO5 | | A | 10 |
|  |  |  |  | |  |  |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | - | 6 | - | - | - | 7 |
| CO2 | - | 1 | 5 | - | - | - | 6 |
| CO3 | 2 |  | 20 | - | - | - | 22 |
| CO4 | 3 | 1 | 31 | - | - | - | 35 |
| CO5 | 1 | 3 | 26 | - | 5 | - | 35 |
| CO6 | 2 | 3 | 15 | - | - | - | 20 |
|  | | | | | | | **125** |

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

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | What is the radius of curvature of a circle? | | | CO1 | U | | 1 |
| 2. | The value of  is \_\_\_\_\_\_\_\_\_. | | | CO1 | A | | 1 |
| 3. | The sequence  is oscillatory through \_\_\_\_\_\_\_\_\_\_. | | | CO2 | A | | 1 |
| 4. | The p-series  is divergent if \_\_\_\_\_\_\_\_ | | | CO2 | U | | 1 |
| 5. | The necessary condition for the existence of Fourier series is \_\_\_\_\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 6. | The Euler’s constant, in a Fourier series of over is | | | CO3 | A | | 1 |
| 7. |  | | | CO4 | A | | 1 |
| 8. | What is the value of f’(x) , if ? | | | CO4 | An | | 1 |
| 9. | If then grad  is \_\_\_\_\_\_\_\_\_\_. | | | CO5 | A | | 1 |
| 10. | Find curl  if | | | CO6 | A | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | . | | | CO1 | | A | 3 |
| 12. | Test the convergence of . | | | CO2 | | An | 3 |
| 13. | Find the R.M.S value of in . | | | CO3 | | A | 3 |
| 14. | If , then find the value of . | | | CO4 | | E | 3 |
| 15. | Find the directional derivative of at the point (2,-1,1) in the direction of . | | | CO5 | | A | 3 |
| 16. | Find the solution of the 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. | |  | Find the center of curvature of the Ellipse  at , hence show that its evolute is . | CO1 | | A | 12 |
| 18. | |  | Prove that . | CO2 | | An | 12 |
| 19. | |  | Find the Fourier series for **.** | CO3 | | An | 12 |
| 20. | |  | If .Compute the Jacobian  and prove that | CO4 | | A | 12 |
| 21. | |  | Test the convergence of the series . | CO4 | | An | 12 |
| 22. | |  | Change the order of integration and evaluate . | CO5 | | E | 12 |
| 23. | |  | Prove that  does not exist. | CO5 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Solve by the method of variation of parameter | CO6 | | E | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 1 | 16 | - | - | - | 17 |
| CO2 |  | 1 | 1 | 15 |  |  | 17 |
| CO3 | 1 |  | 4 | 12 | - | - | 17 |
| CO4 |  |  | 13 | 13 | 3 |  | 29 |
| CO5 |  |  | 5 | 12 | 12 | - | 29 |
| CO6 |  |  | - | - | 15 | - | 15 |
|  | | | | | | | **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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Find the Eigen values of | | CO1 | R | | 1 |
| 2. | If the Eigen values of a 3x3 matrix A are 2,-3, 4, then find the index of the quadratic form corresponding to the matrix A. | | CO1 | R | | 1 |
| 3. | In Simpson’s 1/3rd rule, the value of n should be\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | In Bisection method, if f(0) = -2, f(1) = 4, f(2)= 3 and f(3)=1, then the root lies between\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | Write down the Taylor’s series formula to solve a first order ordinary differential equation. | | CO3 | R | | 1 |
| 6. | Mention the condition for a second order partial differential equation to be parabolic. | | CO3 | R | | 1 |
| 7. | What is the value of | | CO4 | R | | 1 |
| 8. | Find the value of | | CO4 | R | | 1 |
| 9. | What is the value of | | CO5 | R | | 1 |
| 10. | Define an Euler graph. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find the sum and product of all Eigen values of | | CO1 | | U | 3 |
| 12. | If, then evaluate using Trapezoidal rule by taking h=1. | | CO2 | | U | 3 |
| 13. | Classify the partial differential equation | | CO3 | | U | 3 |
| 14. | Find | | CO4 | | U | 3 |
| 15. | Calculate | | CO5 | | U | 3 |
| 16. | Find and for the following graph. | | 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 Eigen values and Eigen vectors of | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | Find a root of the equation  correct to 3 decimal places using bisection method. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | Solve given  for one step in  direction by taking | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | Solve  using Laplace transform. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | Find | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Solve the system of equations | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Solve  given using  Z- transform. | CO4 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Using labeling algorithm, compute a maximal flow in the network given below | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will be able to 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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 | - | - | - | 17 |
| CO2 | 2 | 3 | 24 | - | - | - | 29 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 2 | 3 | 24 | - | - | - | 29 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Define skew-symmetric matrix. | | | CO1 | R | | 1 |
| 2. | Write down the condition for a system of equations to be inconsistent. | | | CO1 | R | | 1 |
| 3. | If an eigen values of a matrix A are 2, 3 and 5, then find an eigen values of a matrix 2A. | | | CO2 | R | | 1 |
| 4. | Find the sum of an eigen values of the matrix | | | CO2 | R | | 1 |
| 5. | In Bender Schmidt method, find the value of k, given  by assuming h=1. | | | CO3 | R | | 1 |
| 6. | Write the formula for RungeKutta method of fourth order. | | | CO3 | R | | 1 |
| 7. | Find | | | CO4 | R | | 1 |
| 8. | Find | | | CO4 | R | | 1 |
| 9. | Find the value of | | | CO5 | R | | 1 |
| 10. | Define an Euler graph. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Evaluate the determinant of the matrix | | | CO1 | | U | 3 |
| 12. | Find the eigen values of the matrix A= | | | CO2 | | U | 3 |
| 13. | Classify the PDE | | | CO3 | | U | 3 |
| 14. | Evaluate | | | CO4 | | U | 3 |
| 15. | Evaluate | | | CO5 | | U | 3 |
| 16. | Write down the degree of all the vertices of a graph | | | 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 inverse of the matrix | CO1 | | A | 6 |
|  | | b. | Solve the system of equations and | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 18. | |  | Find the eigen values and eigen vectors of the matrix A= | CO2 | | A | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | Using Eulers method, find an approximate value of y corresponding to x=1, given that and when | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Solve  given and | CO4 | | A | 12 |
|  | |  |  |  | |  |  |
| 21. | | a. | Evaluate | CO5 | | A | 6 |
|  | | b. | Find the inverse Z-transform of | CO5 | | A | 6 |
|  | |  |  |  | |  |  |
| 22. | | a. | Evaluate  using convolution theorem. | CO4 | | A | 8 |
|  | | b. | Find the rank of the matrix | CO1 | | A | 4 |
|  | |  |  |  | |  |  |
| 23. | |  | Verify Cayley Hamilton theorem for the matrix | CO2 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Find the maximum flow for the below graph and also find minimum cut. | CO6 | | A | 10 |
|  | | b. | Draw the complete graph of and | CO6 | | U | 2 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to 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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 16 | - | - | - | 21 |
| CO2 | 2 | 3 | 24 | - | - | - | 29 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 2 | 3 | 20 | - | - | - | 25 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 5 | 10 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | In a polynomial equation with real coefficients, imaginary roots occurs in \_\_\_\_\_\_\_\_ pairs. | | CO1 | U | | 1 |
| 2. | Define absolute error. | | CO1 | R | | 1 |
| 3. | Write the order of the convergence of Newton-Raphson method. | | CO1 | U | | 1 |
| 4. | What is the convergence condition of iteration method? | | CO1 | R | | 1 |
| 5. | Gauss Jordon method is a \_\_\_\_\_\_\_\_\_method. | | CO3 | R | | 1 |
| 6. | In Gauss elimination method the coefficient matrix is transformed to \_\_form. | | CO3 | U | | 1 |
| 7. | For the below table, *l0(x) =* ….   |  |  |  |  | | --- | --- | --- | --- | | x | 1 | 2 | 3 | | f(x) | 2 | 4 | 4 | | | CO4 | U | | 1 |
| 8. | To use Simpson’s 3/8th rule, the number of subinterval *n* should be … | | CO5 | R | | 1 |
| 9. | Write Euler’s formula. | | CO6 | R | | 1 |
| 10. | Taylor’s series is used to solve \_\_\_\_\_\_\_\_\_ equations. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Determine the nature of the roots of . | | CO1 | | A | 3 |
| 12. | Find the first iteration value of between 0 and 1 using Newton Raphson method. | | CO1 | | A | 3 |
| 13. | What are the normal equations to fit a parabola? | | CO2 | | A | 3 |
| 14. | Find the polynomial that interpolates the following values.   |  |  |  | | --- | --- | --- | | x | 0 | 2 | | f(x) | 7 | 11 | | | 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=f(x) | 1.93 | 1.95 | 1.98 | 2.01 | 2.03 | 2.06 | | | CO5 | | A | 3 |
| 16. | Using the second order Runge-kutta method, find the value of *k1* given *y’ =y, y(0) = 1* by taking *h = 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. | Solve given that whose roots are in G.P. | CO1 | | A | 6 |
|  | b. | Form the third degree equation, two of whose roots are 1-i and 2. | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | Using *Bisection Method*, find a root of the equation *x3 – 4x – 9 = 0* correct to 4 decimal places. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Solve the system of equations by Gauss elimination method | CO3 | | A | 6 |
|  | b. | Fit a straight line for the following by the method of least square.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X: | 5 | 10 | 15 | 20 | 25 | | Y: | 15 | 19 | 23 | 26 | 30 | | CO2 | | A | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Construct the Divided – Difference table for the below data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 3 | 2 | 5 | | y | 2 | 1 | 5 | 6 | -183 | | CO4 | | A | 6 |
|  | b. | Using cardinal functions, find the Lagrangian interpolating polynomial for the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 2 | 3 | 4 | |  | 7 | 11 | 28 | 63 | | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 21. |  | Evaluate with h=0.2 by using  (i)Trapezoidal rule  (ii) Simpson’s 1/3rd rule  (iii) Simpson’3 3/8th rule  Using Taylor’s series method, find *y(1.1)* given that *y ‘ = x+y*; *y(1) =0.* | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Find the root of *f(x) = x3 – x -5 = 0* by using Secant method correct to five decimal places. | CO1 | | A | 6 |
|  | b. | Find the root of *f(x) = x3 – x + 1 = 0* by using *Newton Raphson* method correct to five decimal places. | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 23. |  | Solve the system of equations by Gauss Jordan method | CO3 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Solve given y(1)=0 and find y(1.1) and y(1.2) by using Taylor’s series method. | CO6 | | A | 12 |

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|  | **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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 2 | 42 | - | - | - | 46 |
| CO2 | - | - | 9 | - | - | - | 9 |
| CO3 | 1 | 1 | 18 | - | - | - | 20 |
| CO4 | - | 1 | 15 | - | - | - | 16 |
| CO5 | 1 | - | 15 | - | - | - | 16 |
| CO6 | 2 | - | 15 | - | - | - | 17 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The Eigen values of are \_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | State the Cayley-Hamilton theorem. | | CO1 | R | | 1 |
| 3. | Find *f’(x)* for *f(x) = 4x – x2 +Sin2x*. | | CO2 | U | | 1 |
| 4. | Evaluate | | CO2 | E | | 1 |
| 5. | The vector v(x, y, z) is solenoid if \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | In vector calculus*, i*x j *=* \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | The general solution of *(D2+2D +1)y = 0* is \_\_\_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 8. | Let *x(t)* be the displacement of the particle with respect to the time *t.* Then the velocity of the particle is \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | In fitting of parabola, the normal equations are \_\_\_\_\_\_\_\_\_\_.. | | CO5 | R | | 1 |
| 10. | In the method of least square method, what is the general form of the equation of straight line? | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find the characteristic equation of the matrix. | | CO1 | | An | 3 |
| 12. | Find the area of the region bounded by *x = 0, x = 2, y = 0* and *y = 3.* | | CO2 | | A | 3 |
| 13. | Let r = 2xi +3yj + zk be the position vector. Then find Div r and curl r. | | CO3 | | A | 3 |
| 14. | Find the particular integral of *(D4 + 1)y = sin2x+e2x.* | | CO4 | | An | 3 |
| 15. | How many solution exists for the system of equations 2*x +3 y =1* and 10*x +15y =5.* | | CO5 | | U | 3 |
| 16. | Write the Simpson’s formulae for finding the evaluation of integral. | | 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. |  | Diagonalise the symmetric matrix by an orthogonal transformation. | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 18. | a. | If *u = x+2y+z, v =x-2y+3z, w =2xy-xz+4yz-2z2*, then show that they are not independent and also find the relation between *u, v* and *w.* | CO2 | | E | 6 |
| b. | Evaluate | CO2 | | E | 6 |
|  |  |  |  | |  |  |
| 19. | a. | Find the maximum value of the directional derivatives of*ɵ(x, y, z) = x2yz + 4xz2* at *(1, -1, -2)* in the direction 3*i – j – 4k.* | CO3 | | An | 6 |
| b. | Using Green’s Theorem, evaluate the line integral over the region *R*, described by connecting the points *(0, 0), (2, 0), (2, 4),* oriented clockwise. | CO3 | | E | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Solve *(D2 -5D + 6) y = e4x+sin2x*. | CO4 | | An | 6 |
| b. | A 50g mass vibrates in SHM at the end of the spring. The amplitude of the motion is *12 cm* and the period is *0.1* minutes. Find the maximum speed of the mass. What will be the speed at *x = A/2*? | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 21. | a. | Using *Newton Raphson*, find a root of the equation *f(x)=x3–x+1=0* correct to 4 decimal places. | CO5 | | A | 6 |
| b. | Using Gauss elimination method, solve *5x+4y=15, 3x+7y=12.* | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Find A-1 if using Cayley Hamilton theorem. | CO1 | | A | 6 |
| b. | Find the rank of the matrix. | CO1 | | An | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Evaluate | CO2 | | E | 6 |
| b. | If u = (x-y) + (y-z) + (z-x), then find the value of | CO2 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Find the value of  using (i) Trapezoidal rule  (ii) Simpson’s 3/8th rule (iii) Actual value | CO6 | | E | 6 |
| b. | Compute f’(2.2) and f’’(2.2) from the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 | | f(x) | 4.0552 | 5.9 | 6.76 | 8.81 | 9.75 | | CO6 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to apply matrix concepts to model and solve problems in the fields of engineering appropriately. |
| CO2 | The student will be able to design and solve the engineering problems using variational techniques. |
| CO3 | The student will be able to construct the differentiation model to develop solutions in the fields of physical phenomena. |
| CO4 | The student will be able recognize and find solution for real time technical problems using ordinary differential equations. |
| CO5 | The student will be able to apply numerical techniques in solving engineering problems. |
| CO6 | The student will be able to solve dynamical problems 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 | 6 | 21 | - | - | 29 |
| CO2 | - | 7 | 3 | - | 19 | - | 29 |
| CO3 | 2 | - | 3 | 6 | 6 | - | 17 |
| CO4 | 1 | 1 | 12 | 9 | - | - | 23 |
| CO5 | 2 | 3 | 6 | - | - | - | 11 |
| CO6 | 3 | - | - | 6 | 6 | - | 15 |
|  | | | | | | | **124** |

**Graphical user interface, application

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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. | If 2,3,5 are the Eigenvalues of A, then Eigenvalues of  are | | | CO1 | | A | | | 1 | |
| 2. | State Cayley-Hamilton Theorem. | | | CO1 | | R | | | 1 | |
| 3. | For applying Simpson’s 3/8 rule, the number of sub intervals should be multiples of \_\_\_\_\_\_\_\_\_\_\_\_ | | | CO2 | | R | | | 1 | |
| 4. | The order of error in Trapezoidal rule is \_\_\_\_\_\_\_ | | | CO2 | | R | | | 1 | |
| 5. | **= \_\_\_\_\_\_\_\_\_\_\_** | | | CO3 | | R | | | 1 | |
| 6. | **= \_\_\_\_\_\_\_\_\_\_** | | | CO3 | | R | | | 1 | |
| 7. | Let, . The Fourier constant \_\_\_\_\_\_\_\_ | | | CO6 | | A | | | 1 | |
| 8. | **\_\_\_\_\_\_\_\_\_\_\_** | | | CO6 | | R | | | 1 | |
| 9. | Z [n] = \_\_\_\_\_\_\_\_\_\_ | | | CO4 | | R | | | 1 | |
| 10. | Z [1] = \_\_\_\_\_\_\_\_\_\_ | | | CO4 | | R | | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | | |
| 11. | Write any two properties of eigen values. | | | CO1 | | | R | | 3 | |
| 12. | Find the interval of positive roots of the equation x3 – x = 8 | | | CO2 | | | An | | 3 | |
| 13. | Using bisection method find the negative root of x3 – 4x + 9 = 0 | | | CO2 | | | A | | 3 | |
| 14. | Write the formula for Fourier sine and cosine transforms pair. | | | CO6 | | | R | | 3 | |
| 15. | Find | | | CO3 | | | A | | 3 | |
| 16. | Find Z [an] | | | CO4 | | | 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. | |  | Verify Cayley-Hamilton theorem for the matrix | | CO1 | | | A | | 12 |
|  | |  |  | |  | | |  | |  |
| 18. | |  | Using Newton-Raphson method, find the root of the equation of, correct to six decimal places. | | CO2 | | | An | | 12 |
|  | |  |  | |  | | |  | |  |
| 19. | |  | Solve , given and obtain the value of by using Taylor series method. | | CO2 | | | An | | 12 |
|  | |  |  | |  | | |  | |  |
| 20. | |  | Evaluate by using (i) Trapezoidal rule (ii) Simpson’s 1/3 rule (iii)Simpson’s 3/8 rule | | CO2 | | | An | | 12 |
|  | |  |  | |  | | |  | |  |
| 21. | |  | Estimate the value of  and  from the following data by using Newton’s forward and backward difference formula:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | 20 | 25 | 30 | 35 | 40 | 45 | |  | 354 | 332 | 291 | 260 | 231 | 204 | | | CO2 | | | An | | 12 |
|  | |  |  | |  | | |  | |  |
| 22. | |  | Find the Fourier sine and cosine transform of and find | | CO6 | | | E | | 12 |
|  | |  |  | |  | | |  | |  |
| 23. | |  | Solve given using laplace transform. | | CO3 | | | An | | 12 |
|  | |  |  | |  | | |  | |  |
| **COMPULSORY QUESTION** | | | | | | | | | | |
| 24. | | a. | Find *Z{n}* and *Z{n2}* and hence find *Z{(n – 1)2}.* | | CO4 | | | An | | 6 |
|  | | b. | Find *Z{**}* | | CO4 | | | An | | 6 |

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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 | Categorize Z-Transform of sequence and series. |
| CO5 | Solve difference equations problems in their engineering fields. |
| CO6 | Describe the different transform techniques. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 |  | 13 |  |  | - | 17 |
| CO2 | 2 |  | 3 | 27 |  | - | 32 |
| CO3 | 2 |  | 3 | 12 |  | - | 17 |
| CO4 | 2 |  | 3 | 12 |  | - | 17 |
| CO5 |  |  |  |  |  |  |  |
| CO6 | 1 |  | 4 |  | 12 | - | 17 |
|  | | | | | | | **100** |

**Graphical user interface, application

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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** | | **Course Outcome** | | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | What is the nested multiplication form of *f(x) = x3 – 2x2 + x +13*? | | CO1 | | U | | 1 |
| 2. | (AB.14)16 = (…..) 2 | | CO1 | | AP | | 1 |
| 3. | Find the value of *R(0, 0)* for the integral . | | CO3 | | AP | | 1 |
| 4. | To use Simpson’s 1/3rd rule, the number of subinterval n should be…. | | CO3 | | R | | 1 |
| 5. | Write the Taylor’s series expansion of y(x3). | | CO5 | | R | | 1 |
| 6. | In *Runge-kutta method* of order II, while finding y(x2), what is the formula for *k1*? | | CO5 | | R | | 1 |
| 7. | What is the classification | | CO6 | | U | | 1 |
| 8. | Write the general form of standard five point formula. | | CO6 | | R | | 1 |
| 9. | If A and B are independent events, then | | CO2 | | U | | 1 |
| 10. | In test of hypothesis, if |Cal t| > tab t, then we have to reject …… | | CO2 | | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Represent the functionin the nested form and find the value of. | | | CO1 | | AN | 3 |
| 12. | Find the value of using Gaussian quadrature by taking 2 points? | | | CO3 | | AP | 3 |
| 13. | Find *y(0.2)* by using Euler’s method given that | | | CO5 | | AN | 3 |
| 14. | Using Crank Nicholson method, find the value of *u* from the below table. | | | CO6 | | AN | 3 |
| 15. | State Total theorem on probability. | | | CO2 | | R | 3 |
| 16. | Write the probability density function of Binomial and Poisson distributions | | | CO2 | | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. |  | Using *Bisection Method*, find the root of *f(x) = x3 – x + 1 = 0* correct to 4 decimal places. | CO1 | | | AN | 12 |
|  |  |  |  | | |  |  |
| 18. |  | Evaluate by taking six equal sub-intervals, using  (i) Trapezoidal rule (ii) Simpson’s 1/3 rule  (iii) Simpson’s 3/8 rule. Also find the actual value. | CO3 | | | E | 12 |
|  |  |  |  | | |  |  |
| 19. | a. | Given that , find *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | CO5 | | | A | 6 |
|  | b. | Given that  , find y(0.4) by using Adams predictor and corrector methods. | CO5 | | | A | 6 |
|  |  |  |  | | |  |  |
| 20. |  | Solve with and *u(x,0) = 20 = u(x,1)* by taking *h = 0.25* using Liebmann’s iterative method, correct to three decimal places | CO6 | | | AN | 12 |
|  |  |  |  | | |  |  |
| 21. | a. | 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 ). | CO2 | | | 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 | | CO2 | | | A | 6 |
|  |  |  |  | | |  |  |
| 22. | a. | Determine whether the below function is a first degree spline function. | CO4 | | | AN | 4 |
|  | b | Construct a quadratic spline function for the below data   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | y | 2 | 3 | 1 | 4 | | CO4 | | | A | 8 |
| 23. | a. | Find the two regression line equations, and also find the value of y when x = 57.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 40 | 50 | 30 | 60 | 65 | 55 | 30 | | Y | 38 | 65 | 50 | 72 | 62 | 49 | 35 | | CO2 | | | AN | 6 |
|  | b. | Find the rank correlation for the below data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 51 | 68 | 73 | 46 | 50 | 65 | 47 | | Y | 49 | 72 | 74 | 44 | 58 | 66 | 50 | | CO2 | | | AN | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | a. | Fit a straight line to the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | y | 1 | 3 | 4 | 5 | 6 | | CO2 | | | 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 | 14 | 18 | 12 | 11 | 15 | 14 | | CO2 | | | AN | 6 |

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

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **20MA2002** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED COMPUTATIONAL 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. |  | | CO1 | U | | 1 |
| 2. | Find | | CO1 | R | | 1 |
| 3. | What are the Euler’s constants? | | CO2 | R | | 1 |
| 4. | Define a periodic function and give an example | | CO2 | U | | 1 |
| 5. | If F(s) is the Fourier transform of f(x), then | | CO3 | U | | 1 |
| 6. | Prove that | | CO3 | R | | 1 |
| 7. | Form a partial differential equation by eliminating the arbitrary constants a and b from z = ax + by | | CO4 | U | | 1 |
| 8. | Write down the auxiliary simultaneous equations of Lagrange’s linear equation | | CO4 | R | | 1 |
| 9. | Give the most suitable solution of one dimensional wave equation | | CO5 | U | | 1 |
| 10. | Mention two simulation models and their uses. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find | | CO1 | | An | 3 |
| 12. | State Dirichlet’s conditions | | CO2 | | U | 3 |
| 13. | If F(s) is the Fourier transform of f(x), then prove that | | CO3 | | U | 3 |
| 14. | Solve | | CO4 | | A | 3 |
| 15. | What are the various possible solutions of one dimensional heat equation? | | CO5 | | U | 3 |
| 16. | Express the equations of water dynamics in terms of specific water expenditures. | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Solve by the method of transforms, the equation | CO1 | | An | 9 |
|  | b. | Find | CO1 | | A | 3 |
|  |  |  |  | |  |  |
| 18 |  | Compute the first three harmonics of the Fourier series of f(x) given by the following table:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 60 | 120 | 180 | 240 | 300 | | y | 1 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Find the Fourier transform of    Hence evaluate (i)  and (ii) | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Solve | CO4 | | A | 6 |
|  | b. | Solve | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 21. |  | Solve  subject to the conditions  (i)  (ii)  (iii) | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Find the complete integral of (i)  and  (ii) | CO4 | | A | 6 |
|  | b. | Solve | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 23. |  | Expand  in a Fourier series. Hence deduce that | CO1 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A rectangular plate with insulated surfaces is 8 cm wide and so long compared to its width that it may be considered as an infinite plate. If the temperature along the short edge y = 0 is  while the two long edges x = 0 and x = 8 as well as the other short edge are kept at 0. Find the steady state temperature at any point of the plate. | CO5 | | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 3 | 24 |  |  | 28 |
| CO2 | 1 | 4 |  | 12 |  |  | 17 |
| CO3 | 1 | 4 | 12 |  |  |  | 17 |
| CO4 | 1 | 1 | 27 |  |  |  | 29 |
| CO5 |  | 4 | 24 |  |  |  | 29 |
| CO6 |  | 1 | 3 |  |  |  | 4 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | If and  then the next approximation to the root by bisection method is \_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | U | | 1 |
| 2. | Convert  to decimal. | | | CO1 | R | | 1 |
| 3. | Newton form of the interpolating polynomial is given by \_\_\_\_\_\_\_\_\_\_\_ | | | CO2 | R | | 1 |
| 4. | Find  from the following table:   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 7 | 8 | 9 | 10 | |  | 3 | 0 | 5 | 9 | | | | CO2 | R | | 1 |
| 5. | The formula to find  using Romberg’s algorithm in evaluating  is given by\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | U | | 1 |
| 6. | The Taylor series solution about the point , is given by ­­­­\_\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 7. | Reduce to the standard form to apply Gaussian two point formula. | | | CO4 | U | | 1 |
| 8. | Given and , determine the value of at  by Euler’s method. | | | CO4 | R | | 1 |
| 9. | Give an example for a parabolic equation. | | | CO5 | U | | 1 |
| 10. | To use Bender-Schmidt recurrence equation, the value of must be equal to \_\_\_\_\_\_\_\_\_ | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Convert  to octal. | | | CO1 | | An | 3 |
| 12. | Find by nested multiplication if | | | CO2 | | U | 3 |
| 13. | Evaluate  using trapezoidal rule from the following data   |  |  |  | | --- | --- | --- | | x | -3 | 3 | | y | 81 | 81 | | | | CO3 | | An | 3 |
| 14. | Find the value of, by Taylor series method for the differential equation, given , correct to four decimal places. | | | CO4 | | U | 3 |
| 15. | Find the nature of the partial differential equation | | | CO5 | | An | 3 |
| 16. | Give the most general type of linear integral equation.  To reduce the general type of linear integral equation to the first kind and second kind what are the appropriate substitutions? | | | 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. | By bisection method obtain the root of equation, correct to five decimal places. | CO1 | | E | 8 |
|  | | b. | Give the pseudo code for bisection method. | CO1 | | R | 4 |
|  | |  |  |  | |  |  |
| 18. | |  | Given that, ,  find the value of . | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | A curve passes through the points (1, 2), (1.5, 2.4), (2, 2.7), (2.5, 2.8),(3, 3), (3.5, 2.6) and (4, 2.1). Obtain the area bounded by the curve, the x - axis, and . Also find the volume for the solid of revolution got by revolving the area about the x – axis. | CO3 | | E | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Solve the equation , given  using modified Euler’s method and tabulate the solutions at . | CO4 | | E | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | Solve by Crank-Nicholson scheme the equationsubject to , , , for two time steps. | CO5 | | E | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | Let . Approximate by the trapezoid rule using partition points 0, 2, and 4. Repeat by using partition points 0, 1, 2, 3, and 4. Now apply Romberg extrapolation to obtain a better approximation. | CO5 | | A | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | Solve given , , , assuming . Find the values of upto | CO4 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Show that  is a solution of Volterra integral equation . | CO6 | | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 1 | - | 3 | 8 | - | 17 |
| CO2 | 2 | 3 | - | - | 12 | - | 17 |
| CO3 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO4 | 1 | 4 | - | - | 24 | - | 29 |
| CO5 | - | 1 | 12 | 3 | 12 | - | 28 |
| CO6 | 3 | 1 | - | - | 12 | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Find the order of partial differential equation:  . | | CO1 | U | | 1 |
| 2. | Solve = 2. | | CO1 | R | | 1 |
| 3. | The one dimensional heat equation is \_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 4. | The value of a2in one dimensional wave equation is \_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | If A and B are independent events then P(AՈB)= \_\_\_\_\_\_\_\_\_. | | CO3 | U | | 1 |
| 6. | If P(A) = 1/3, P(B)=1/4 and  P(AՈB)= 1/12 then find P(A/B) | | CO3 | R | | 1 |
| 7. | If F(x,y) is the CDF of a two dimensional random variable(X,Y) then | | CO3 | U | | 1 |
| 8. | The mean of Binomial distribution is \_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 9. | The first moment about the mean is \_\_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 10. | Define a small sample. | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find complete solution of partial differential equation: *pq = k.* | | CO1 | | U | 3 |
| 12. | Classify the partial differential equation  . | | CO2 | | U | 3 |
| 13. | Seven coins are thrown simultaneously find probability of getting exactly three heads. | | CO3 | | U | 3 |
| 14. | The joint probability density function of x and y is  f (x, y) = (3x2+xy) , 0 < x < 1, 0 < y < 2  Find the marginal density of Y. | | CO3 | | U | 3 |
| 15. | If the second , third and fourth moments about the mean are  ,  , and then find (i) the measure of skewness (ii) measure of kurtosis . | | CO4 | | U | 3 |
| 16. | Define Producer’s Risk, Consumer’s Risk. | | CO5 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Solve  . | CO1 | | A | 6 |
|  | b. | Solve : . | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | A tightly stretched string with fixed end points x=0 and x=*l*is initially at rest in its equilibrium position. If it is set vibrating by giving each point a velocity *k(lx-x2)*. Find the displacement of the string. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. | a. | A bag consists of 10 blue balls, 4 black balls and 2 green balls.  Two balls are chosen at random. Find the probability that  (i) both are blue (ii)both are black(iii) neither is blue. | CO3 | | A | 6 |
|  | b. | The chances of A, B, C becoming general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A,B,C become general manager are 0.3,0.7,0.8 respectively. If the bonus scheme has been introduced, find the probability that Mr. A has been appointed as general manager. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. | a. | The random variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | -2 | -1 | 0 | 1 | 2 | 3 | | *p(x)* | 0.1 | K | 0.2 | 2K | 0.3 | 3K |  1. Find K 2. Evaluate *P(X<2)* 3. Find Cumulative Distribution function, *CDF* 4. Find mean of X. | CO3 | | A | 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 | | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 21. | a. | The time required to repair a machine is exponentially distributed with parameter λ=1/2. (i) Find the probability that the repair time exceeds 2hrs. (ii) Find the conditional probability that a repair takes atleast 10hrs given that its duration exceeds 9hrs. | CO3 | | A | 6 |
|  | b. | For the bivariate probability distribution of (X,Y) given below, find(i) P(X≤1) (ii) P(Y≤1) (iii)P(X≤1,Y≤ 1) (iv)P(X≤1/Y≤1)   |  |  |  |  | | --- | --- | --- | --- | | x | y | | | | 0 | 1 | 2 | | 0 | 0.1 | 0.04 | 0.06 | | 1 | 0.2 | 0.08 | 0.12 | | 2 | 0.2 | 0.08 | 0.12 | | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 22. |  | 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) Find K (ii) Find marginal distributions of X and Y (iii) Find conditional distributions of X given Y  (iv) Find conditional distributions of Y given X. | CO3 | | A | 12 |
| 23. |  | Find the two Lines of Regression   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 6 | 2 | 10 | 6 | | y | 9 | 11 | 4 | 8 | | CO4 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | In an experiment on immunization of cattle from a disease the following results are obtained   |  |  |  | | --- | --- | --- | |  | affected | unaffected | | Inoculated | 40 | 70 | | Not inoculated | 60 | 30 |   Examine whether the effect of vaccine is independent of controlling the incidence of the disease. | CO6 | | A | 12 |

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

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

**Graphical user interface, application

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| **Course Code** | **20MA2005** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE STRUCTURES** | **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 is a set with 2 elements, then the number of elements in power set of A is \_\_\_\_\_\_\_\_. | | | | CO1 | U | | | 1 |
| 2. | | If A and B are sets, then AU (AՈB) = \_\_\_\_\_\_\_\_. | | | | CO1 | U | | | 1 |
| 3. | | The projection function, = \_\_\_\_\_\_\_\_. | | | | CO2 | U | | | 1 |
| 4. | | The Successor function S(8) = \_\_\_\_\_\_\_\_. | | | | CO2 | R | | | 1 |
| 5. | | The letters of the word "MATH" taken all at a time can be written in \_\_\_\_\_\_\_\_ ways. | | | | CO3 | U | | | 1 |
| 6. | | Compute C(5,2) | | | | CO3 | U | | | 1 |
| 7. | | True/False: Given that P: 2+5=7. Q: 7-2=3.  2+5=7 OR 7-2=3 is \_\_\_\_\_\_\_\_. | | | | CO4 | U | | | 1 |
| 8. | | The converse of (P→Q) is \_\_\_\_\_\_\_\_. | | | | CO4 | R | | | 1 |
| 9. | | A nonempty set G together with Binary operation \* is called  \_\_\_\_\_\_\_\_  if \* satisfies closure, associative and identity and inverse properties. | | | | CO5 | R | | | 1 |
| 10. | | The Dual of (ꭋPV Q) V(ꭋP ᴧꭋQ) is \_\_\_\_\_\_\_\_. | | | | CO4 | U | | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | | |
| 11. | | If A and B are two sets defined as A= { 2,3,4,5,6} and  B= {3,5,6,7,9}then find (A∆B) | | | | CO1 | | U | | 3 |
| 12. | | Find LCM of (16,48) | | | | CO2 | | U | | 3 |
| 13. | | How many permutations of a,b,c,d,e,f,g (i) end with 'a’  (ii) begin with 'c' and end with 'a'(iii) 'c' and 'a' occupy end places | | | | CO3 | | U | | 3 |
| 14. | | If P is ‘true’, Q is ‘false’ then compute  Ⴄ(P↑Q) ⇔ (ႤQ↓ႤP) | | | | CO4 | | A | | 3 |
| 15. | | In a Boolean Algebra (i) a\*1= \_\_\_\_\_\_\_\_.  (ii) a (ab)= \_\_\_\_\_\_\_\_. (iii) a\*a= \_\_\_\_\_\_\_\_. | | | | CO5 | | U | | 3 |
| 16. | | Compute the adjacency matrix of the graph given below: | | | | 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. |  | | | 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) MRoSiv) V) and vi) find R. | | CO1 | | | A | 12 |
|  |  | | |  | |  | | |  |  |
| 18. | a. | | | If f(x) = 3x+5 and g(x)=2x+3 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 (252,198) using Euclidean Algorithm and hence find Bezout constants. | | CO2 | | | A | 6 |
|  |  | | |  | |  | | |  |  |
| 19. | a. | | | Prove by mathematical induction :  (1+2+3+…..+n) = n(n+1)/2 | | CO3 | | | A | 6 |
|  | b. | | | A survey among 100 students, shows that of three ice cream flavours vanilla, chocolate and strawberry, 50 like vanilla, 43 like chocolate28 like strawberry, 13 like vanilla and chocolate, 11 like chocolate and strawberry,12 like strawberry and vanilla, 5 like all the three. Find the number of students who like the flavours,  i. chocolate but not strawberry (ii) Chocolate and strawberry but not vanilla (iii) vanilla or chocolate but not strawberry. | | CO3 | | | A | 6 |
|  |  | | |  | |  | | |  |  |
| 20. | a. | | | Show that (P→Q) ⬄( ႤQ→ ႤQ) is a Tautology. | | CO4 | | | A | 6 |
|  | b. | | | Find i)Principal Disjunctive Normal Form PDNF and  ii.) Principal Conjunctive Normal Form PCNF of Pᴧ(P→Q). | | CO4 | | | A | 6 |
|  |  | | |  | |  | | |  |  |
| 21. | a. | | | Prove that G= {1, 5, 7, 11} is a Group under multiplication modulo 12. | | CO5 | | | A | 6 |
|  | b. | | | Find i. Euler Circuit ii. Hamiltonian circuit | | CO6 | | | A | 6 |
| 22. |  | | | Let A = {1,2,3,4,5,6,7,8} 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. |  | | | Find minimum weight of the spanning tree of the graph given below using i) Prim’s Algorithm ii)Kruskal’s Algorithm | | CO6 | | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | | | | |
| 24. | a. | | Find Prefix, Infix, Postfix Expressions of the following Tree: | | | CO6 | | | An | 6 |
|  | b. | | Evaluate the expression: + \* 2 + / 8 2 5 1 | | | CO6 | | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Solve the problems using the concepts of sets, functions and relations. |
| CO2 | Apply number theory in data encryption. |
| CO3 | Demonstrate knowledge in counting techniques. |
| CO4 | Establish truth values using mathematical logic. |
| CO5 | Understand algebraic structures and morphisms. |
| CO6 | Model network problems using graph and trees. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 5 | 18 | - | - | - | 23 |
| CO2 | 1 | 4 | 6 | - |  |  | 11 |
| CO3 | - | 5 | 12 | - | - | - | 17 |
| CO4 | 1 | 4 | 12 | - |  |  | 17 |
| CO5 | 1 | 4 | 18 | - | - | - | 23 |
| CO6 | - | - | 21 | 12 | - | - | 33 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 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. | What is the standard deviation of the standard normal distribution? | | | CO3 | R | | 1 |
| 6. | The mean of the Poisson distribution is\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 7. | If X and Y are two independent RVs thenX+Y() = \_\_\_\_\_\_. | | | CO4 | R | | 1 |
| 8. | What is the nature of , if ‘T’ is continuous and ‘S’ is discrete? | | | CO4 | R | | 1 |
| 9. | The random process which is not stationary is called\_\_\_\_\_\_ process. | | | CO5 | R | | 1 |
| 10. | The Poisson Process is a \_\_\_\_\_\_Process. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 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, determine the distribution. | | | CO3 | | A | 3 |
| 14. | If a random variable X has the moment generating function obtain the variance of X. | | | CO4 | | An | 3 |
| 15. | Find the mean and variance of the stationary process , 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 (ii) atmost one is good (iii) 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. | |  | 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) K (ii) Marginal probability distribution (iii) Conditional probability distribution (iv) 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. | Find the density function f(x) corresponding to the characteristic function defined as φ(𝑡) = { 2 − |𝑡|, 𝑓𝑜𝑟 |𝑡| ≤ 2  0, 𝑓𝑜𝑟 |𝑡| >2 | CO4 | | E | 6 |
|  | | b. | Find the Moment Generating function of the Binomial distribution and evaluate its mean. | CO4 | | An | 6 |
|  | |  |  |  | |  |  |
| 21. | |  | Two random processes and are defined by  and Show that and are jointly wide sense process, where ‘’ and ‘’ are random variables. If (i) (ii) (iii) | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | If the joint pdf of a two dimensional 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 | Recognize probability models. |
| CO2 | Solve using discrete and continuous random variables. |
| CO3 | Classify the problems using probability distributions. |
| CO4 | Analyses 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 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** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If F(x,y) is the cumulative distribution function of a two dimensional random variable(X,Y) , then | | CO1 | U | | 1 |
| 2. | If X is a discrete random variable, then  ΣP(x)  = \_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | The mean of Binomial distribution is \_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 4. | If X follows exponential distribution, then P(X>25/X>20) = | | CO2 | R | | 1 |
| 5. | Define a small sample. | | CO3 | U | | 1 |
| 6. | The tabulated value of Z for single tailed test at 5% Level of Significance is \_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | The degree of freedom ‘t’ test of single small sample mean is \_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 8. | In order of test, goodness of fit \_\_\_\_\_\_\_\_ test is used. | | CO4 | R | | 1 |
| 9. | If > then the test statistic of F is \_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | A collection of Random variables that are functions of time is said be \_\_\_\_\_\_. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | If the joint probability density function of (X,Y) is f(x,y)=4xy 0<x<1,0<y<1 then find marginal density function of Y. | | CO1 | | U | 3 |
| 12. | The number of monthly breakdown of a computer follows Poisson distribution with mean 1.8. Find probability that this computer will function for a month without breakdown. | | CO2 | | U | 3 |
| 13. | Define Type II error. | | CO3 | | U | 3 |
| 14. | The average score of 100 students is 65 with standard deviation 0.5. In order to test that average score of the students in the city is 70, Define null hypothesis and alternative hypothesis. | | CO4 | | U | 3 |
| 15. | Give an example of Completely Randomized design of experiment. | | CO5 | | U | 3 |
| 16. | The transition probability matrix of a Markov chain with states {1,2,3} is given below. Sketch the state transition diagram | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | A continuous random variable X has the probability density function f(x) = kx2 , 0<x< 2 (i)Find the value of k  (ii) Find P(X<1) (iii) Find mean of X. | CO1 | | A | 6 |
|  | b. | The random variable X has the following probability distribution   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | 0 | 1 | 2 | 3 | 4 | 5 | | *p(x)* | k | k | 2k | 4k | 2k | k |   (i) Find K (ii) Evaluate *P(X<3)* (iii) Find CDF, cumulative distribution function (iv) Find mean of X | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | The joint probability mass function of (X,Y) is P(x,y)=K(2x+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 (iv) Find conditional distributions of X given Y (v) Find conditional distributions of Y given X. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 19 |  | Find (i) correlation coefficient (ii)the two Lines of Regression   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 10 | 12 | 13 | 12 | 16 | 15 | | y | 40 | 38 | 43 | 45 | 37 | 43 | | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | If X follows normal distribution with mean 8 and standard deviation 4 then find (i)P(X>12) (ii) P(X<16) | CO2 | | A | 6 |
|  | b. | Fit a Binomial Distribution to the following data and find theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 4 | 29 | 36 | 25 | 6 | | CO2 | | A | 6 |
|  |  |  |  | |  |  |
| 21. | a. | In a city a sample of 1000 persons were taken and out of them 540 are vegetarians and the rest are non-vegetarians.  Test the hypothesis that both habits of eating are equally popular in the city at 5% level of significance. | CO3 | | A | 6 |
|  | b. | A random sample of 400 men and 600 women were asked whether they would like to have a school near their residence, 200 men and 325 women were in favour of the proposal. Test the hypothesis that the proportion of men and women in favour of the proposal are the same at 5% LOS. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 22. |  | The following data are collected on two attributes.   |  |  |  | | --- | --- | --- | |  | Indians | Non- Indians | | Families consuming tea | 40 | 70 | | Families not consuming tea | 60 | 30 |   Based on this, can you conclude that the habit of consumption of tea and Nationality are independent? | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Three varieties of a crop are tested with four replications and yields are given in kilograms. Analyze the variance and discuss the difference between (a)blocks (b) Crops   |  |  |  |  | | --- | --- | --- | --- | | Blocks | Crops | | | | A | B | C | | I | 47 | 49 | 48 | | II | 51 | 49 | 53 | | III | 49 | 52 | 52 | | IV | 49 | 50 | 51 | | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | The transition probability matrix of a Markov chain {Xn} , n=1,2,3,… having three states 1,2,3 is and the initital distribution is p(0) = (0.3,0.3,0.4)  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 | | A | 6 |
|  | b. | Find mean and variance of the Random process whose autocorrelation function is given by | CO6 | | A | 6 |

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

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The probability of sure 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 normal distribution. | | CO2 | R | | 1 |
| 4. | The variance of a Poisson distribution is 0.5. Find P(X = 5). | | CO2 | An | | 1 |
| 5. | In large two tailed test, at 5 % level of significance, tab z = \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | In F-test, if S2X>S2Y, then Cal F = \_\_\_\_\_\_\_\_\_\_\_. | | CO3 | U | | 1 |
| 7. | In small sample tests, the sample size should be \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 8. | Let n be the size of the sample. Then the degrees of freedom of Students’ t-test is \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | In one-way Anova classification table, what is the degrees of freedom within the samples? | | CO5 | R | | 1 |
| 10. | Write any two classifications of random process. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | A coin is tossed three times. Find the probability distribution function for the number of tails. | | CO1 | | An | 3 |
| 12. | Find the binomial distribution for which the mean is 4 and variance is 3. | | CO2 | | Ap | 3 |
| 13. | Define standard error and critical region. | | CO3 | | R | 3 |
| 14. | In Chi-square test, write the expected frequencies for the below observed frequencies   |  |  |  | | --- | --- | --- | | 10 | 25 | 30 | | 15 | 30 | 10 | | 35 | 20 | 25 | | | CO4 | | An | 3 |
| 15. | In one-way ANOVA, if SSC = 10; SST = 50 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 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) *P(X< 3)* (iii) *P(1 < X < 4)*  (iv) Mean (v) Variance (vi) Cumulative distribution function of *X*. | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Find the rank correlation for the below data.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 40 | 50 | 38 | 60 | 65 | 50 | 35 | | Y | 38 | 60 | 55 | 70 | 60 | 48 | 30 | | CO2 | | Ap | 6 |
| b. | Fit a binomial distribution for the below data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | f | 6 | 13 | 25 | 22 | 21 | 13 | | CO2 | | Ap | 6 |
|  |  |  |  | |  |  |
| 19. | a. | A machine puts out 16 imperfect articles in a sample of 500. After machine is overhauled, it pulls out 3 imperfect articles in a batch of 100. Has the machine improved? | CO3 | | An | 6 |
| b. | Random samples of 400 men and 600 women were asked whether they would liketo have a flyover near their residence. 200 men and 325 women were in favor ofthe proposal. Test the hypothesis that proportions of men and women in favor ofthe proposal are same at 5% level of significance. | CO3 | | An | 6 |
|  |  |  |  | |  |  |
| 20. |  | A die is thrown 264 times with the following results. Prove that the die is unbiased by using Chi-square test.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. appeared on the die | 1 | 2 | 3 | 4 | 5 | 6 | | Frequency | 40 | 32 | 28 | 58 | 54 | 60 | | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | To study the performance of three detergents and three different water temperatures, the following whiteness readings were obtained with specially designed equipment.   |  |  |  |  | | --- | --- | --- | --- | | Water Temp. | Detergents | | | |  | A | B | C | | Cold water | 57 | 55 | 67 | | Warm water | 49 | 52 | 60 | | Hot water | 54 | 46 | 58 |   Perform a two-way analysis of variance, using 5 % level of significance. | CO5 | | Ev | 12 |
|  |  |  |  | |  |  |
| 22. | a. | The mean weekly sales of a soap bars in departmental stores was 146.3 bars per store. After advertising campaign the mean weekly sales in 22 stores for a typical week increased to153.7 and S.D. of 17.2. Was the advertising campaign successful? | CO4 | | An | 6 |
| b. | Find the two regression line equations, and also find the value of y when x = 8.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO2 | | Ap | 6 |
|  |  |  |  | |  |  |
| 23. |  | To test the significance of the variations of the retail prices of the commodity in three principal cities; Bombay, Calcutta and Delhi, the four shops were chosen at random in each city and prices are observed in rupees were as follows:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Bombay | 16 | 8 | 12 | 14 | | Calcutta | 14 | 10 | 10 | 6 | | Delhi | 4 | 10 | 8 | 8 |   Do the data indicate that the prices in the three cities are significantly different? | CO5 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Show that the process is wide-sense stationary, *A* and *B* are Random variables if   1. *E(A) = E(B)=0* 2. *E(A2) = E(B2)* 3. *E(AB)= 0* | 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** |

Graphical user interface, application

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| **Course Code** | **20MA2010** | **Duration** | **3hrs** |
| **Course Name** | **BUSINESS MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **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 | A | 10 |
|  | b. | Find the sum of all natural numbers from 1 to500 which are divisible by 3. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Find the 10th term of the G.P. ¼ , -½ , 1, -2 ,…… | CO1 | A | 10 |
|  | b. | The 4th and 9th terms of a G.P are 54 and 13122 respectively. Find the sequence. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Find the time required for to earn Rs.400 as simple interest in the principal of 2000 at the rate of 10 %. | CO2 | E | 10 |
|  | b. | Find the compound amount and compound interest of Rs. 5000 for 3 years at 8% converted (i) annually and (ii) semiannually. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | An Industrialist wants to set up a sinking fund to accumulated Rs.60000 by the end of 5 years . What monthly deposit is required if the fund earns interest at 10.5% compounded monthly? | CO2 | E | 10 |
|  | b. | A bill of Rs. 800 due 3 months, at 8% per annum. Calculate the Bankers discount, True discount and Bankers gain. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Using the digits {1,2,3,4,5} how many three digits integers can be made if (i) no restrictions  (ii) if it odd and repetition is allowed  (iii) if it odd and repetition is not allowed.  (iv) if it even and repetition is allowed. | CO3 | An | 8 |
|  | b. | Find the number of distinguishable permutations of the letters in(a) OHIO and (b) MISSISSIPPI. | CO3 | An | 6 |
|  | c. | In how many ways a committee consisting of 5 men and 3 women, can be chosen from 9 men and 12 women? | CO3 | An | 6 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | If U = {1,2,3,4,5,6,7,8,9,10} and A= {1,2, 4,7,8,10} and  B = {2,5,8}. Find , , A - B ,B- A, A’. | CO4 | A | 10 |
|  | b. | Find the Cartesian product A x B between the sets  A ={1,2,3,4} and B ={a,b,c}. | CO4 | A | 5 |
|  | c. | Define function. Explain one-one and onto functions. | CO4 | U | 5 |
|  |  |  |  |  |  |
| 7. | a. | Let and , find A+B, A-B and (A+B)T. | CO5 | A | 15 |
|  | b. | Evaluate the determinant value of the matrices   1. (ii) | CO5 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Solve the following system of equations using Cramer’s rule.  2x+3y+4z= 29  x+y+2z = 13  3x+2y+z=16. | CO5 | E | 10 |
|  | b. | Find the inverse of the matrix . | CO5 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | A manufacturer produces two types of models M1 and M2. Each M1 model requires 4 hours of grinding and 2 hours of polishing, where each M2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on M1 model is Rs.3 and M2 model is Rs.4. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models so that he may make the maximum profit in a week? | CO6 | C | 10 |
|  | b. | Solve by graphical method, Maximize Z = -3x1 + 4x2  Subject to constraints x1 + x2 ≤ 4  2x1 + 3x2 ≥ 18 and x1, x2 ≥ 0. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the progression techniques in solving finance problems. |
| CO2 | Determine the solutions to financial transactions. |
| CO3 | Apply the concept of permutations and combinations in business organizations. |
| CO4 | Represent the business problems using set theory. |
| CO5 | Construct and solve business problems using matrix methods. |
| CO6 | Formulate the business problems in terms of LPP. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | - | 40 | - | - | - | 40 |
| CO2 | - | - | - | - | 40 | - | 40 |
| CO3 | - | - | - | 20 | - | - | 20 |
| CO4 | - | 5 | 15 | - | - | - | 20 |
| CO5 | - | - | 30 | - | 10 | - | 40 |
| CO6 | - | - | 10 | - | - | 10 | 20 |
|  | | | | | | | **180** |

Graphical user interface, application

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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** | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** | |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | | | | | |
| 1. | a. | Define primary and secondary data. Discuss the various methods of collecting primary data. | CO1 | | | R | | 10 | |
|  | b. | The marks scored by 50 students in an examination paper are given below.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 30 | 45 | 48 | 55 | 39 | 25 | 31 | 12 | 18 | 21 | | 54 | 59 | 51 | 33 | 43 | 44 | 10 | 38 | 19 | 26 | | 47 | 35 | 37 | 41 | 46 | 33 | 51 | 37 | 58 | 58 | | 17 | 19 | 23 | 26 | 29 | 38 | 57 | 36 | 35 | 44 | | 43 | 27 | 31 | 43 | 22 | 31 | 47 | 34 | 18 | 15 |   Construct a frequency distribution taking a class interval of 10 marks. Represent the data by a histogram. | CO1 | | | U | | 10 | |
|  |  | **(OR)** |  | | |  | |  | |
| 2. | a. | Draw a pie chart of the following data relating to area (in hectares) under food crops.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Food Crops | Rice | wheat | Barley | Jawar | Bajra | Maize | Others | | Area  (in ‘000 hectares) | 8 | 8 | 4 | 2 | 2 | 5 | 11 | | CO1 | | | A | | 10 | |
|  | b. | Draw less than and more than ogive curves for the following data and hence find the median.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | Frequency | 3 | 9 | 15 | 30 | 18 | 5 | | CO1 | | | A | | 10 | |
|  |  |  |  | | |  | |  | |
| 3. | a. | Find the mean and median from the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Weight(in gms) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | No. of articles | 14 | 17 | 22 | 26 | 23 | 18 | | CO2 | | | A | | 14 | |
|  | b. | Calculate the mode for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Class | 0 - 100 | 100 - 200 | 200 - 300 | 300 - 400 | 400 - 500 | | Frequency | 3 | 17 | 25 | 40 | 30 | | CO2 | | | A | | 6 | |
|  |  | **(OR)** |  | | |  | |  | |
| 4. | a. | The daily wages of a labourer are given below. Determine the quartile deviation and coefficient of quartile deviation.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Wages (Rs.) | 0 - 100 | 100 - 200 | 200 - 300 | 300 - 400 | 400 - 500 | | No. of days | 5 | 8 | 21 | 12 | 6 | | CO3 | | | A | | 12 | |
|  | b. | Compute the mean deviation and its coefficient from the following series.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Values | 10 | 11 | 12 | 13 | 14 | | Frequency | 3 | 12 | 18 | 12 | 3 | | CO3 | | | A | | 8 | |
|  |  |  |  | | |  | |  | |
| 5. | a. | The following data were obtained while observing the life span of a few neon lights of a company. Calculate the standard deviation and variance.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | 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 | |
|  | b. | Particulars regarding income of two village are given below:   |  |  |  | | --- | --- | --- | |  | Village A | Village B | | Number of people | 600 | 500 | | Average income | Rs. 175 | Rs.186 | | Variance of income | 100 | 81 |  1. In which village there is greater variability in income? 2. What is the total income of both the villages taken together? 3. What is the combined standard deviation? | 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. | Calculate Spearman’s rank correlation coefficient after making adjustments for repeated ranks of the data given below.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 48 | 33 | 40 | 9 | 16 | 16 | 65 | 24 | 16 | 57 | | Y | 13 | 13 | 24 | 6 | 15 | 4 | 20 | 9 | 6 | 19 | | CO4 | | | An | | 10 | |
|  |  |  |  | | |  | |  | |
| 7. | a. | From the following data.   |  |  |  | | --- | --- | --- | |  | X | Y | | Mean | 36 | 85 | | Standard Deviation | 11 | 8 | | Coefficient of correlation | 0.66 | |  1. Find the regression equations of X on Y. 2. Estimate the value of X when Y = 75? | CO5 | | | An | | 10 | |
|  | b. | Calculate the mean of variables X and Y and correlation coefficient for the regression equations 2Y - X = 50 and 3Y - 2X = 10. | CO5 | | | U | | 10 | |
|  |  | **(OR)** |  | | |  | |  | |
| 8. | a. | Fit a trend line to the following data by (i) graphic method and  (ii) method of semi-averages.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | | Sales  (‘000 Units) | 65 | 95 | 85 | 115 | 110 | 120 | 130 | | CO6 | | | An | | 8 | |
|  | b. | Calculate the trend values by the method of least squares from the given data and estimate the sales for the year 2010.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 2003 | 2004 | 2005 | 2006 | 2007 | | Sales of a Company  (Rs. Lakhs) | 70 | 74 | 80 | 86 | 90 | | CO6 | | | An | | 12 | |
| **PART – A (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | | | |
| 9. | a. | Calculate the seasonal index for the following series.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 2016 | 78 | 66 | 84 | 80 | | 2017 | 76 | 74 | 82 | 78 | | 2018 | 72 | 68 | 80 | 70 | | 2019 | 74 | 70 | 84 | 74 | | 2020 | 76 | 74 | 86 | 82 | | | CO6 | | | An | | 10 |
|  | b. | Compute a price index for the following by  (i) simple aggregate method  (ii) the average of price relative method using both arithmetic mean and geometric mean.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Commodity | A | B | C | D | E | F | G | H | | Price in 2017 | 40 | 120 | 140 | 130 | 60 | 70 | 65 | 75 | | Price in 2018 | 60 | 140 | 170 | 135 | 100 | 80 | 75 | 80 | | | CO6 | | | An | | 10 |

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

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 20 | - | - | - | 40 |
| CO2 | - | - | 20 | - | - | - | 20 |
| CO3 | - | - | 20 | - | 20 | - | 40 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 10 | - | 10 | - | - | 20 |
| CO6 | - | - | - | 40 | - | - | 40 |
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| **Course Code** | **20MA2014** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICS FOR DIGITAL SCIENCES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Find the rank of the matrix . | CO1 | E | 10 |
|  | b. | Solve the following system of linear equations by matrix inversion method.  3x+2y=14  3x+3y=18. | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Solve the system of equations by Cramer’s rule.  3x+y+2z=3  2x-3y-z =-3  x+2y+z=4. | CO1 | E | 10 |
|  | b. | Find the eigenvalues and eigenvectors of the matrix  A = | CO1 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Find  if . | CO2 | An | 6 |
|  | b. | If  then find. | CO2 | An | 7 |
|  | c. | Evaluate. | CO2 | An | 7 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Use a membership table to show that  A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C). | CO3 | U | 6 |
|  | b. | 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 | 7 |
|  | c. | 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 and P ∩ Q. | CO3 | A | 7 |
|  |  |  |  |  |  |
| 5. | a. | If U = {1,2,3,4,5,6,7,8,9,10} and A= {1,2, 4,7,8,10} and  B = {2,5,8}. Find , , A - B, B- A, A. | CO3 | An | 10 |
|  | b. | Using the digits {1,2,3,4,5} how many three digits integers can be made if (i) no restrictions (ii) it is odd and repetition is allowed  (iii) it is odd and repetition not allowed.  (iv) it is even and repetition is allowed | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | 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 | 6 |
|  | b. | Find the number of distinguishable permutations of the letters in(a) OHIO and (b) MISSISSIPPI. | CO4 | An | 7 |
|  | c. | A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting line up of one center, two forwards, and two guards? | CO4 | An | 7 |
|  |  |  |  |  |  |
| 7. | a. | Show that  is a tautology | CO5 | An | 10 |
|  | b. | Using truth table, show that ¬(*p*∨ (¬*p*∧*q*)) and ¬*p*∧¬*q* are logically equivalent. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define Hamilton path. Find a Hamiltonian circuit of minimal weight for the graph shownbelow. | CO6 | A | 10 |
|  | b. | Write the in degree and out degree for the vertices of the graph shown below. Also list all possible paths from the vertex a to e. Is the graph a tree? Justify. | CO6 | A | 10 |
| **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. | Find the minimal spanning tree for the graph given below. | CO6 | A | 12 |

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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 | - | - | - | 20 | - | - | 20 |
| CO3 | - | 6 | 14 | 20 | - | - | 40 |
| CO4 | - | - | 20 | - | - | - | 20 |
| CO5 | - | - | - | 20 | - | - | 20 |
| CO6 | - | - | 40 | - | - | - | 40 |
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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** | | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** | | |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | | | | | | | |
| 1. |  | | The following numbers give 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 and hence draw the histogram. | | | CO1 | | | E | | 20 | |
|  |  | | **(OR)** | | |  | | |  | |  | |
| 2. |  | | Protein intake of 400 families are given in the form frequency table is given below.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Protein Intake/day(g) | 10 - 15 | 15 - 20 | 20 - 25 | 25 – 30 | 30 - 35 | 35 – 40 | 40 -45 | | No. of families | 2 | 28 | 125 | 270 | 303 | 197 | 65 |   Compute arithmetic mean, median and mode for the above data. | | | CO2 | | | E | | 20 | |
|  |  | |  | | |  | | |  | |  | |
| 3. |  | | Compute the quartile deviation and coefficient of quartile deviation for the data given below:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 0 - 5 | 5 – 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 – 30 | | No. of Students | 4 | 6 | 8 | 12 | 7 | 2 | | | | CO2 | | | An | | 20 | |
|  |  | | **(OR)** | | |  | | |  | |  | |
| 4. |  | | Compute Pearson’s coefficient of correlation from the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 44 | 46 | 48 | 52 | 54 | 56 | 62 | 60 | 42 | 53 | | y | 36 | 40 | 42 | 44 | 46 | 48 | 41 | 52 | 55 | 50 | | | | CO3 | | | An | | 20 | |
| 5. |  | | Obtain the two regression equation for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | | y | 3 | 4 | 2 | 5 | 1 |   and also find x when y = 3.5 | | | CO3 | | | E | | 20 | |
|  |  | | **(OR)** | | |  | | |  | |  | |
| 6. |  | | Calculate the seasonal index for the following:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year |  |  |  |  | | 2018 | 75 | 83 | 94 | 82 | | 2019 | 71 | 88 | 83 | 72 | | 2020 | 72 | 85 | 84 | 90 | | 2021 | 84 | 72 | 86 | 79 | | 2022 | 90 | 79 | 81 | 90 | | | | CO4 | | | An | | 20 | |
|  |  | |  | | |  | | |  | |  | |
| 7. |  | | A lot consists of 8 good articles, 3 with minor defects and 2 with major defects. Two articles are chosen at random. Find the probability that (i) both are good (ii) both have major defects (iii) atleast one is good (iv) atmost one is good (v) exactly one is good. | | | CO5 | | | E | | 20 | |
|  |  | | **(OR)** | | |  | | |  | |  | |
| 8. | a | | The chances of A, B and C becoming the general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company. If A, B and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as general manager? | | | CO5 | | | An | | 10 | |
|  | b. | | A and B throws 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 B begins the game, what is the probability of his winning? | | | CO5 | | | An | | 10 | |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | | | | | | |
| 9. | a. | | | 10 coins are tossed 1024 times and the following frequencies are observed. Compare these frequencies with expected frequencies.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | f | 2 | 10 | 38 | 106 | 188 | 257 | 226 | 128 | 59 | 7 | 3 | | CO6 | | | E | | | | 10 |
|  | b. | | | The number of monthly breakdown 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 with (i) only one breakdown(ii) at least one breakdown (iii) at most two breakdown. | CO6 | | | An | | | | 10 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  |  |  | 20 |  | 20 |
| CO2 |  |  |  | 20 | 20 |  | 40 |
| CO3 |  |  |  | 20 | 20 |  | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  | 20 | 20 |  | 40 |
| CO6 |  |  |  | 10 | 10 |  | 20 |
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| **Course Code** | **20MA2017** | **Duration** | **3hrs** |
| **Course Name** | **DISCRETE MATHEMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | A survey of 500 television watchers produce the following information: 285 watch football games, 195 watch hockey games, 115 watch basketball games, 45 watch football and basketball games, 70 watch football and hockey games, 50 watch hockey and basketball games and 50 do not watch any of the three kinds of games. How many people in the survey watch all three kinds of games? | CO1 | A | 10 |
| b. | Compute , and for the given matrices A and B:  , . | CO1 | A | 10 |
| **(OR)** | | | | | |
| 2. | a. | Show that *1 + 2 + 3 + … + n =* for all *n ≥ 1* by using Mathematical induction. | CO1 | An | 10 |
| b. | Using Euclidean algorithm, find the G.C.D of (58, 34) and express it in the form of . | CO1 | A | 10 |
|  | | | | | |
| 3. | a. | Prove that. | CO2 | A | 8 |
| b. | Construct truth table for. | CO2 | U | 7 |
| c. | Verify that the proposition is a contradiction. | CO2 | U | 5 |
| **(OR)** | | | | | |
| 4. | a. | How many different license plates are available if each plate contains a sequence of three letters followed by three digits? | CO3 | U | 5 |
| b. | Show among 100 people there are at least 9 were born on the same month. | CO3 | A | 5 |
| c. | How many different seven person committees can be formed each containing 3 women from an available set of 20 women and 4 men from an available set of 30 men? | CO3 | A | 5 |
| d. | How many distinguishable permutations of the letters in the word “ASSOCIATITVE”. | CO3 | U | 5 |
|  | | | | | |
| 5. | a. | Let A = {1, 2, 3, 4, 5} = B; aRb if and only if a is a multiple b. Find the domain, range, relation matrix and draw the digraph of the relation R. Also list all in-degree and out-degree of all vertices. | CO4 | A | 10 |
| b. | Let A = {1,2,3,4,5,6} and the digraph of R is    Find and draw the digraph of . | CO4 | An | 10 |
| **(OR)** | | | | | |
| 6. | a. | Find the transitive closure using Warshall’s algorithm.  on A = {1,2,3,4}. | CO4 | A | 10 |
| b. | Let R and S be two relations whose digraphs are given:    Compute . | CO4 | An | 10 |
|  | | | | | |
| 7. | a. | Let A = {1, 2, 3, 5, 6, 10, 15, 30} and the relation be such that if x divides y. Draw the Hasse diagram of (A, ). | CO5 | U | 8 |
| b. | Determine the matrix of the partial order whose Hasse diagram is given:. | CO5 | A | 6 |
| c. | Show that D18 is a bounded lattice. | CO5 | A | 6 |
| **(OR)** | | | | | |
| 8. | a. | Consider the rooted tree given below:    i) List all level - 3 vertices ii) List all leaves.  iii) What are the siblings of *v*8? iv) What are the descendants of *v*8?  v) Compute the tree T(*v*2). vi) Compute the tree T(*v*3). | CO6 | U | 6 |
| b. | Construct the tree of the algebraic expression  . | CO6 | A | 7 |
| c. | Draw a binary tree whose postorder search produces the string TREEHOUSE. | CO6 | A | 7 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Use Fluery’s algorithm to construct an Euler circuit for the following graph. | CO6 | A | 8 |
| b. | Construct a spanning tree with ‘e’ as a root using Prim’s Algorithm for the given graph: | CO6 | A | 12 |

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

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

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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Let. Given and  are the fuzzy sets of .Find  (i),, ,  (ii),, ,  (iii) | CO1 | A | 10 |
|  | b. | Let. Given and are the fuzzy sets of.  Find,, ,,. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Let. Let be a fuzzy set defined by.   1. Find all -cuts and strong -cuts 2. Find Supp(A), Core(A) and h(A) | CO2 | A | 10 |
|  | b. | State first decomposition theorem. Demonstrate the first decomposition theorem using the given fuzzy set . | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | Let. Given and are the fuzzy sets of.  Find Standard Product, Algebraic Product, Bounded Product, Drastic Product. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | 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. | Given A = {(3, 1), (4, 0.5)} and B = {(2, 1), (4, 0.5)} are two fuzzy numbers. Find A + B and A - B | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. |  | Find the solution of the equation A + X = B, where A and B are two fuzzy numbers defined by | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Find the membership function of the given triangular number A = (-5, -1, 1). | CO3 | A | 5 |
|  | b. | Find addition, subtraction and symmetric image of given two triangular numbers A = (-3, 2, 4) and B = (-1, 0, 6). | CO3 | A | 5 |
|  | c. | Construct a truth table for (P → Q) **˅** (Q → R). | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. |  | Prove that is a tautology. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Draw the architecture of a fuzzy expert system and explain it. | CO5 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain the general scheme of a fuzzy controller. | CO6 | U | 20 |

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

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

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | A transport company uses three types of trucks T1, T2 and T3 to transport three types of vehicles V1, V2 and V3. The carrying capacity of each truck in terms of three types of vehicles is given below.   |  |  |  |  | | --- | --- | --- | --- | |  | V1 | V2 | V3 | | T1 | 1 | 3 | 2 | | T2 | 2 | 2 | 3 | | T3 | 3 | 2 | 2 |   Using Cramer’s rule, find the number of trucks of each type that are required to transport 85, 105 and 110 vehicles of type V1, V2 and V3 respectively. | CO1 | A | 10 |
|  | b. | Solve the following system of equations by Gauss- Jordan method  2x - y + 3z = 9  x + y + z = 6  x - y + z = 2. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Using matrix inversion method, solve the following system of equations.  x + y + z = 3  x + 2y + 3z = 4  x + 4y + 9z = 6. | CO1 | A | 10 |
|  | b. | Solve the following equations by Gauss-Seidal method  2x + y + 6z = 9  8x + 3y + 2z = 13  x + 5y + z = 7. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Find the eigenvalues and eigenvectors of the matrix . | CO2 | A | 10 |
|  | b. | Verify Cayley-Hamilton theorem for the matrix and hence find A-1 and A3. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The product of two eigenvalues of the matrix is 14. Find the third eigenvalue. | CO2 | A | 5 |
|  | b. | Reduce the quadratic form to canonical form by orthogonal reduction . Also find the rank, index, signature and nature of the quadratic form. | CO2 | A | 15 |
|  |  |  |  |  |  |
| 5. | a. | Let Vn be the set of all ordered n tuples of real numbers. . Prove that Vn is a vector space. | CO3 | U | 10 |
|  | b. | Determine the dimension of Nul A and Col A for the matrix . | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Computeand  using the vectors and . | CO4 | A | 5 |
|  | b. | Show that the set S ={**u**1,**u**2,**u**3}, where,  and  is an orthogonal set for R3. Express the vector  as a linear combination of the vectors in S. | CO4 | A | 15 |
|  |  |  |  |  |  |
| 7. | a. | Letwhere; and . Using Gram-Schmidt process find the orthogonal basis and orthonormal bases for *w*. | CO4 | A | 15 |
|  | b. | Let V be P2 with the inner product defined by , where , and . Let  and . Compute  and . | CO4 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The transformation is defined as . Prove that T is a linear transformation. | CO5 | U | 10 |
|  | b. | For , find the range, kernel, rank and nullity of the linear transformation . | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe sparse matrix and its uses. Explain the array representation of sparse matrix with an example. | CO6 | R | 10 |
|  | b. | Find the addition and transpose of sparse matrices A and B in triplet form, where  and. | CO6 | A | 10 |

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

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

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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If A is any event then ) = \_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | What is the probability of an odd number when a die is thrown? | | CO1 | R | | 1 |
| 3. | If F(x) is cumulative distribution of a random variable X, then F(∞) = \_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | Find k if the probability density function of the continuous random variable X is f(x) = kx; 0< x <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(X/Y) = \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | Mean of the Binomial Distribution is \_\_\_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 8. | If X is a exponential random variate with parameter λ=0.5 then what is the mean of the variate? | | CO4 | R | | 1 |
| 9. | If X takes the values 2, 3, 3, 2, 5, 5, 5, 2, 6, 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 die 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 Binomial distribution, the mean is 16 and the standard deviation is 8. Find the value of q. | | CO4 | | U | 3 |
| 15. | Find the median of the following frequency table:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **x** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | f | 9 | 5 | 17 | 12 | 10 | 6 | 17 | | | CO5 | | An | 3 |
| 16. | Find β2 when μ1=0, μ2=2.5, μ3=0, μ4=4. 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. | A and B alternatively 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. | CO1 | | An | 6 |
|  | b. | An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two balls are drawn at random from the first urn and placed in the second urn and then 1 ball is taken at random from the latter. What is the probability that it is a white ball? | CO1 | | Ev | 6 |
|  |  |  |  | |  |  |
| 18. |  | The probability function of an infinite discrete distribution is given by P(x=j)= 1/2 j . Verify that the total probability is 1,find also P(X is even),P(X ≥3), P(X multiple of 3) and mean of X. | CO2 | | Ap | 12 |
|  |  |  |  | |  |  |
| 19. |  | The joint probability mass function of a two dimensional discrete random variable(X,Y) is given by 𝑝(𝑥, 𝑦) = 𝑘(𝑥 + 𝑦) , *x* = 0, 1, 2 and *y* = 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. | In a test on 2000 electric lamps, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of lamps likely to burn for (i) More than 2150 hours (ii) Less than 1950hours (iii) More than 1920 hours but less than 2160 hours. | CO4 | | Ap | 6 |
|  |  |  |  | |  |  |
| 21. |  | Find the mean, median, mode and Quartile deviation for the following distribution   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | | f | 12 | 16 | 6 | 7 | 9 | | CO5 | | Ap | 12 |
|  |  |  |  | |  |  |
| 22. |  | For the bivariate probability distribution of (X, Y) given below. Find P(X≤1), P(Y ≤3), P(X ≤1, Y ≤3), P(X≤1/Y≤3), P(Y≤3/X≤1) and 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 | | An | 12 |
|  |  |  |  | |  |  |
| 23. |  | A random variable X has the following probability distribution. (i) Find k (ii) Estimate P(X < 2) (iii) P(-2 < X < 2) (iv) Find the cdf of X (v) Find mean and variance.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **x** | **-2** | **-1** | **0** | **1** | **2** | **3** | | P(x) | 0.1 | k | 0.2 | 2k | 0.3 | 3k | | CO2 | | Ev | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Find the rank correlation of the following:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **X** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | Y | 4 | 3 | 1 | 2 | 6 | 5 | 7 | | CO6 | | A | 6 |
|  | b. | Find the lines of regression   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **X** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | | Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | | CO6 | | An | 6 |

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

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| **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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If  and  find | | CO1 | U | | 1 |
| 2. | If A and B are mutually exclusive events, then | | CO1 | R | | 1 |
| 3. | Write the formula to find variance of a random variable X. | | CO2 | R | | 1 |
| 4. | A random variable X has the following probability distribution:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | | p(x) | 0.4 | 0.3 | k | 0.2 |   Find the value of k. | | CO2 | R | | 1 |
| 5. | Write down the value of | | CO3 | R | | 1 |
| 6. | If f(x,y) is the joint pdf of a 2-dimensional continuous random variable (X,Y), then write the formula for the marginal density function of Y. | | CO3 | R | | 1 |
| 7. | Write the formula to find mean of a binomial distribution. | | CO4 | R | | 1 |
| 8. | In a normal distribution, write the relationship between mean, median and mode. | | CO4 | R | | 1 |
| 9. | Find the range for the following data: 23, 71, 21, 65, 43, 39. | | CO5 | R | | 1 |
| 10. | Write any one property of correlation coefficient. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | 15% of a firm’s employees are BE degree holders, 25% are MBA degree holders and 5% have both the degrees. Find the probability of selecting a BE degree holder, if the selection is confined to MBA’s. | | CO1 | | U | 3 |
| 12. | The distribution function of a random variable X is given by Find the density function of F(x). | | CO2 | | U | 3 |
| 13. | If X and Y have joint pdf, then evaluate | | CO3 | | U | 3 |
| 14. | For a binomial distribution, mean is 6 and standard deviation is Find the first two terms of the distribution. | | CO4 | | U | 3 |
| 15. | If then find the value of the correlation coefficient r. | | CO5 | | U | 3 |
| 16. | If  and  then find the correlation coefficient r. | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | A 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) atmost 1 is good, (ii) atleast 1 is good, (iii) exactly 1 is good and (iv) neither has major defects. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | A random variable X has the following probability distribution:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | | p(x) | 0.4 | k | 0.2 | 0.3 |   Evaluate (i) the value of k, (ii) p(X<0), (iii) p(-2<X<0) , (iv) cdf of X, (v) mean of X. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | The following table represents the joint probability distribution of the discrete random variable (X,Y).   |  |  |  |  | | --- | --- | --- | --- | | Y  X | -1 | 0 | 1 | | 0 | 1/15 | 2/15 | 1/15 | | 1 | 3/15 | 2/15 | 1/15 | | 2 | 2/15 | 1/15 | 2/15 |   Find   1. All the marginal distributions 2. The conditional distribution of X given Y= -1 3. Are X and Y independent. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | Fit a Poisson distribution for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | 5 | | f | 142 | 156 | 69 | 27 | 5 | 1 | | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | The scores of two players A and B in seven rounds are given below:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | A | 74 | 75 | 78 | 72 | 78 | 77 | 79 | | B | 87 | 84 | 80 | 88 | 89 | 85 | 86 |   Who is the better player and who is the more consistent player? | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Evaluate the mean, median and mode for the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Class interval | 10-25 | 25-40 | 40-55 | 55-70 | 70-85 | 85-100 | | Frequency | 6 | 20 | 44 | 26 | 3 | 1 | | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 23. | a. | In a normal distribution, 7% of items are under 35 and 89% are under 63. Find the mean and standard deviation of the normal distribution. | CO4 | | A | 8 |
|  | b. | What is the probability that there will be 53 Sundays in (i) a leap year and (ii) a non-leap year? | CO1 | | U | 4 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Calculate the Spearman’s rank correlation coefficient for the following data:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Price in tea | 75 | 88 | 95 | 70 | 60 | 80 | 81 | 50 | | Price in coffee | 120 | 134 | 150 | 115 | 110 | 140 | 142 | 100 | | CO6 | | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 16 | - | - | - | 21 |
| CO2 | 2 | 3 | 12 | - | - | - | 17 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 2 | 3 | 20 | - | - | - | 25 |
| CO5 | 1 | 3 | 24 | - | - | - | 28 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | The second degree equation of the parabola is \_\_\_\_\_\_. | | | CO1 | R | | 1 |
| 2. | In fitting a straight line y=a+bx, the unknown values of 'a' and 'b' are determined by solving \_\_\_\_\_ equations. | | | CO1 | R | | 1 |
| 3. | The finite subset of the population is known as \_\_\_\_\_\_. | | | CO2 | R | | 1 |
| 4. | In sampling techniques, the sample size for sample test should be the value of n\_\_\_\_\_\_. | | | CO2 | R | | 1 |
| 5. | Identify the degrees of freedom to perform t-test, from the two samples A and B with 5 and 6 sample observations for 5% level of significance. | | | CO3 | U | | 1 |
| 6. | Identify the table value to perform the F-test at 5% level (Two tailed) from the two samples A and B with 12 and 9 sample observations. | | | CO3 | R | | 1 |
| 7. | The ANOVA is a tool by which total variation may be split up into several physically assignable components was defined by\_\_\_\_\_. | | | CO4 | R | | 1 |
| 8. | The group of experimental units in which no fertilizer is used is referred as \_\_\_\_\_\_. | | | CO4 | R | | 1 |
| 9. | If for 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 | U | | 1 |
| 10. | If the failure of a system is 0.3 then the reliability of the system is \_\_\_\_\_\_\_. | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Convert into linear form. | | | CO1 | | An | 3 |
| 12. | In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, the mean is 15. Could the samples have been drawn from the same population with S. D 4? | | | CO2 | | An | 3 |
| 13. | The number of air craft accidents that occurred during the various days of a week. Test whether the accidents are uniformly distributed over the week.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Day | Mon | Tue | Wed | Thur | Fri | Sat | | No of accidents | 15 | 19 | 13 | 12 | 16 | 15 | | | | CO3 | | An | 3 |
| 14. | Explain the layout of Randomized Block Design. | | | CO4 | | R | 3 |
| 15. | Construct a control chart of range for the following data on the basis of voltage, samples of5 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. | The data shows that 100 items failed during a test with a total operating time of 10000 hours. Find the reliability of the product after 500 hours using exponential distribution. | | | 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. | |  | Fit a second degree parabola for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | y | 1 | 3 | 4 | 5 | 6 | | CO1 | | E | 12 |
|  | |  |  |  | |  |  |
| 18. | | a. | In large city A, 20% of random sample of 900 school boys had a slight physical defect. In another large city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? | CO2 | | An | 7 |
|  | | b. | Write the procedure for testing of hypothesis. | CO2 | | R | 5 |
|  | |  |  |  | |  |  |
| 19. | |  | A group of 10 rats were on diet A and another group of 8 rats were fed on diet B. Find if the variances are significantly different using F test at 5% level of significance.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 1 | 10 | 2 | 8 | - | - | | CO3 | | An | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | The following data resulted from an experiment to compare three burners A, B and C. The Latin square design was designed and the tests were made on 3 engines and spread over 3 days.   |  |  |  |  | | --- | --- | --- | --- | | Days | Engines | | | | 1 | 2 | 3 | | 1 | A-16 | B-17 | C-20 | | 2 | B-16 | C-21 | A-15 | | 3 | C-15 | A-12 | B-13 |   Test the hypothesis that there is no significant difference between the burners. | CO4 | | An | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | The values of sample mean and sample standard deviation ‘s’ for 15 samples each of size 4, drawn from a population process are given below. Draw the appropriate control charts for the process average and process variability. Comment on the state of control.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Mean | 15 | 10 | 12 | 13 | 12 | 13 | 14 | 11 | 13 | 12 | | S.D | 3.1 | 2.4 | 3.6 | 2.3 | 5.2 | 5.4 | 4.3 | 3.4 | 4.1 | 3.9 | | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | 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 state of control of the process. | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 23. | | a. | 30 components are tested for two weeks. 20 of them fail in this time, with an average failure time of 1.2 weeks. What is the mean time till failure assuming a constant 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 manufacture by a company is given by is , t>0  (i) Find Reliability Function. (ii) Find Failure Rate.  (iii) Find MTTF. | CO6 | | A | 7 |
|  | | b. | Calculate the reliability of the system for the below block diagram. | CO6 | | An | 5 |

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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 Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 |  |  | 3 | 12 |  | 17 |
| CO2 | 7 |  |  | 10 |  |  | 17 |
| CO3 | 1 | 1 |  | 15 |  |  | 17 |
| CO4 | 5 |  |  | 12 |  |  | 17 |
| CO5 | 1 |  |  | 27 |  |  | 28 |
| CO6 |  | 1 | 19 | 8 |  |  | 28 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Convert the decimal number 3781 to binary form using division algorithm. | | CO1 | U | | 1 |
| 2. | If , find | | CO1 | U | | 1 |
| 3. | The cardinal polynomial of the Lagrange’s form of polynomial interpolations is \_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 4. | The process of finding the value of corresponding to any value of outside the interval is called \_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | In Simpson’s three eighth rule is a polynomial of degree \_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | Write the Gaussian two point formula. | | CO3 | R | | 1 |
| 7. | Write the formula to construct the spline function of degree one. | | CO4 | R | | 1 |
| 8. | For a function S to be a natural cubic spline function, it must be a \_\_\_\_\_\_\_\_\_ spline. | | CO4 | R | | 1 |
| 9. | In solving using fourth order Runge-Kutta method the value of | | CO5 | R | | 1 |
| 10. | The solution of a hyperbolic partial differential equation is \_\_\_\_\_\_\_\_\_, if | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Convert the number (21467)8 to decimal system. | | CO1 | | U | 3 |
| 12. | Convert to nested form and evaluate | | CO2 | | U | 3 |
| 13. | Write the Pseudocode for Simpson’s three-eighth rule. | | CO3 | | R | 3 |
| 14. | Define a cubic spline function. | | CO4 | | R | 3 |
| 15. | Compute y at x=0.1 by modified Euler’s method given and | | CO5 | | A | 3 |
| 16. | Classify the following PDE:. | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Find the real root of the equation between 1 and 2 by bisection method. Compute 5 iterations. | CO1 | | A | 6 |
|  | b. | Find the root of the equation in the interval (0, 1) using Regula-Falsi method correct to 4 decimal places. | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. | a. | By means of Newton’s divided difference formula, find the values of and from the following table.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | *x* | 4 | 5 | 7 | 10 | 11 | 13 | | *f(x)* | 48 | 100 | 294 | 900 | 1210 | 2028 | | CO2 | | E | 6 |
|  | b. | Find the cubic Lagrange’s interpolating polynomial from the following table:   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 0 | 1 | 2 | 5 | |  | 2 | 3 | 12 | 147 | | CO2 | | E | 6 |
|  |  |  |  | |  |  |
| 19. |  | Evaluate using (i) Trapezoidal rule  (ii) Simpson’s one-third rule and  (ii) Simpson’s three-eighths rule. Verify your answer with actual integration. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | Find the cubic spline approximation for the function given below:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | | y=f(x) | 1 | 2 | 33 | 244 | | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Using Taylor series method find *y* at and at given , given | CO5 | | A | 8 |
|  | b. | Apply fourth order Runge-Kutta method to find given that | CO5 | | A | 4 |
|  |  |  |  | |  |  |
| 22. | A | Construct Newton’s interpolation polynomial for the data shown in the following table:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 2 | 3 | 4 | 5 | | y | 7 | 11 | 28 | 63 | 75 | | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Using Romberg’s method, evaluate and hence obtain an approximate value for | CO3 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Solve over the square mesh of side 4 units satisfying the following boundary conditions:  . | CO6 | | E | 12 |

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

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



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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | 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 | An | 8 |
|  | b. | Three different machines Ml, M2, and M3 are used to produce similar electronic components. Machines Ml, M2, and M3 produce 20%, 30% and 40% of the components respectively. It is known that the probabilities that the machines produce defective components are 1% for M1, 2% for M2, and 3% for M3. If a component is selected randomly from a large batch, and that component is defective, find the probability that it was produced: (a) by M2, and (b) by M3. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | A car hire firm has 2 cars which it hires daily. The number demand for car on each day is distributed as a Poisson variate with mean 1.5. Obtain the proportion of the days on which (i) there was no demand (ii) the demand is refused (iii) there was one demand. | CO2 | An | 8 |
|  | b. | The weekly wages of 1000 workmen are normally distributed around a mean of Rs.70 with a standard deviation of Rs.5. Estimate the number of workers whose weekly wages will be (i) More than Rs.72 (ii) Less than Rs.69. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Find the two regression equation and also find y when x=50 for the following data:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 68 | 64 | 75 | 50 | 63 | 80 | 40 | 55 | | y | 62 | 58 | 45 | 81 | 60 | 68 | 50 | 70 | | CO3 | E | 8 |
|  | b. | The simple correlation coefficients between temperature (X1), Corn yield (X2) and rainfall (X3) are =0.77. Calculate partial coefficient of correlation and multiple correlation coefficients. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Experience has shown that 20% of a manufactured product is of top quality. In one day’s production of 400 articles, only 50 are of top quality. Show that either the production of the day chosen was not a representative sample or the hypothesis of 20% was wrong. | CO4 | A | 8 |
|  | b. | A group of 10 rats fed on diet A and another group of 8 rats fed on diet B recorded the following increase in weight (gms).   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 10 | 1 | 2 | 8 | - | - |   Does it show superiority of diet A over diet B? | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | The following data relate to the daily production of cement a large plant for 30 days.  11.5 10.0 11.2 10.0 12.3 11.1 10.2 9.6 8.7 9.3  9.3 10.7 11.3 10.4 11.4 12.3 11.4 10.2 11.6 9.5  10.8 11.9 12.4 9.6 10.5 11.6 8.3 9.3 10.4 11.5  Use sign test to test the null hypothesis that the plants average daily production of cement is 11.2 against alternative hypothesis u<11.2 at the 5% level of significance. | CO5 | An | 8 |
|  | b. | A total of 12 patients are randomly split into two groups of 6 and assigned to receive the new drug or the placebo. The patients then record how many panic attacks they have over the course of one month:  New Drug : 3 5 1 4 3 5  Placebo : 4 8 6 2 1 9  Conduct a Mann-Whitney U test to see if there is a difference in the number of panic attacks for the patients in the placebo group compared to the new drug group. Use a .05 level of significance. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | A random variable X has the following probability distribution:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | -2 | -1 | 0 | 1 | 2 | 3 | | P(x) | 0.1 | K | 0.2 | 2k | 0.3 | 3k |   Find (i) k (ii) P(-2<x<2) (iii) Mean and variance of x. | CO1 | E | 8 |
|  | b. | A random variable x has the mean µ=12 and variance =9 and an unknown probability distribution. Find 18). | CO2 | E | 8 |
|  |  |  |  |  |  |
| 7. | a. | 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? | CO4 | An | 8 |
|  | b. | On a commuter train, the conductor wants to determine whether passengers board the train in a random manner. He observes the first 25 people, with the following sequence of males and females. F F F M M F F F F M F M M M F F F F M M F F F M M. Test for randomness at the 5 % level of significance using run test. | CO5 | E | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. |  | The following data resulted from an experiment to compare three burners B1, B2 and B3. A Latin Square design was used as the tests were made on 3 engines and were spread over 3 days.   |  |  |  |  | | --- | --- | --- | --- | | Day/Engine | 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 burners. | CO6 | A | 20 |

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

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



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

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Demonstrate the importance of a research and define ‘Research’. | CO1 | A | 10 |
|  | b. | With a neat flow diagram, describe the process of formulating a research problem. | CO1 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the statement with an example: Research is concerned with proper fact finding, analysis and evaluation. | CO1 | U | 10 |
|  | b. | List the types of research and differentiate between them. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. |  | Classify the different types of variables in Research. Explain the importance of each of them with suitable examples. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Enumerate the basic principles of experimental design. Elaborate the principles in detail. | CO2 | A | 10 |
|  | b. | Summarize the importance of rating scales and relate the different types of rating scales to carryout quality research. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | In an entrance exam held for 53 students 26, 18 and 9 of the students scored 87, 63 and 28 marks respectively. Find the arithmetic mean of the test marks. | CO3 | E | 10 |
|  | b. | Differentiate between Simple Regression Analysis and Multiple Regression Analysis. Explain the application of both the techniques with a suitable example. | CO4 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Enumerate the characteristics of hypothesis. List them with an example. | CO5 | E | 10 |
|  | b. | An airplane covered a distance of 800 miles with four different speeds of 100, 200, 300 and 400 miles/hour for the first, second, third and fourth quarter of the distance. Using harmonic mean, find the average speed in miles/hour. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Find the range and quartile deviation for the following distribution:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Class Interval | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | | No. of Frequency | 6 | 8 | 17 | 21 | 15 | 11 | 2 | | CO4 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | With a neat sketch explain the structure of a Project Proposal. Draft a model project proposal based on your research work. | CO5 | C | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the process of patenting and development. | CO6 | U | 10 |
|  | b. | Draw a flowchart and explain the patenting procedure followed in India. | CO6 | U | 10 |

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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 | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 0 | 10 | 10 | 0 | 0 | 10 | 30 |
| CO2 | 0 | 10 | 20 | 20 | 0 | 0 | 50 |
| CO3 | 0 | 0 | 0 | 0 | 10 | 0 | 10 |
| CO4 | 0 | 0 | 0 | 0 | 20 | 10 | 30 |
| CO5 | 0 | 0 | 10 | 0 | 10 | 20 | 40 |
| CO6 | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Illustrate Research Ethics, its code, collegiality in scientific interactions. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Narrate – Intellectual honesty, research integrity and Scientific misconducts. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | Apply the use of various tools that are helpful in checking similarity index. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Analyze the Open access publications initiatives and online era sources to check self-archiving policies. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Elaborate the Software tool to identify predatory publications with its process flow. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Differentiate the Conflicts of interest and Publication misconduct with particular reference to unethical behavior &violation of publication ethics. | CO5 | R | 20 |
|  |  |  |  |  |  |
| 7. |  | What are plagiarism software? Explain its usage in scientific writings with prominent tools. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the significance of Indexing databases and Citation databases. | CO6 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Evaluate the initiatives to categorize the journals based on their quality metrics. | CO6 | E | 20 |

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

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

**Graphical user interface, application

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | What is the eccentricity of the ellipse? | | | CO1 | U | | 1 |
| 2. | Mention the latus rectum of Hyperbola. | | | CO1 | R | | 1 |
| 3. | Define symmetric matrix. | | | CO2 | U | | 1 |
| 4. | State Cayley-Hamilton theorem. | | | CO2 | R | | 1 |
| 5. | The sequence  is oscillatory through-----. | | | CO3 | U | | 1 |
| 6. | The p-series  is divergent if\_\_\_. | | | CO3 | R | | 1 |
| 7. | Write the half range Fourier sine series in | | | CO4 | R | | 1 |
| 8. | In a Fourier sine transform, | | | CO4 | R | | 1 |
| 9. | In integral calculus, represents\_\_\_\_\_\_\_\_. | | | CO5 | R | | 1 |
| 10. | When is a vector said to be solenoidal? | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Find the center and radius of the circle | | | CO1 | | E | 3 |
| 12. | Find the characterstic equation of | | | CO2 | | E | 3 |
| 13. | Test the convergence of sequence | | | CO3 | | A | 3 |
| 14. | State Dirichlet’s condition for Fourier series. | | | CO4 | | An | 3 |
| 15. | Find the value of . | | | CO5 | | E | 3 |
| 16. | Prove that  is irrotational. | | | CO6 | | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | | a. | Find the axis, vertex, focus, directrix and latus rectum of the following parabola  and draw it. | CO1 | | An | 6 |
|  | | b. | Show that the lines are coplanar and find its equation | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 18. | |  | Find the Eigen values and Eigen vectors of | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 19. | | a. | Test for convergence the series | CO3 | | A | 6 |
|  | | b. | Test for convergence of the alternating series | CO3 | | A | 6 |
|  | |  |  |  | |  |  |
| 20. | | a. | Find the Fourier transform of | CO4 | | E | 6 |
|  | | b. | Compute the first two harmonics for the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 0 | π/3 | 2π/3 | π | 4π/3 | 5π/3 | | f(x) | 1.98 | 1.3 | 1.05 | 1.3 | -0.88 | -0.25 | | CO4 | | An | 6 |
|  | |  |  |  | |  |  |
| 21. | | a. | Change the order of integration and evaluate | CO5 | | E | 6 |
|  | | b. | Find the area between the curves. | CO5 | | E | 6 |
| 22. | |  | Verify Cayley-Hamilton theorem and find its inverse of | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 23. | | a. | A particle is moving along the curves , and  , where t is the time. Find the velocity, speed and acceleration at t=2 in the direction. |  | |  |  |
|  | | b. | Verify Green’s theorem for  where c is bounded byand. | CO3 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Verify Gauss divergence theorem for  bounded by the lines | CO6 | | An | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 6 | 6 | 3 | - | 17 |
| CO2 | 1 | 1 | -- | - | 27 | - | 29 |
| CO3 | 2 | - | 9 | 6 | - | - | 23 |
| CO4 | 1 | - | 6 | 9 | 12 | - | 23 |
| CO5 | 1 | - |  | - | 15 | - | 16 |
| CO6 | 1 | - | 6 | 9 | - | - | 16 |
|  | | | | | | | **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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Find the mode of the values 7, 7, 12, 10, 17, 19, 21, 23, 1, 7, 21, 23, 10 | | CO1 | U | | 1 |
| 2. | Calculate the range of the following data: 258, 264, 268, 270, 242, 260, 254, 274, 259, and 246. | | CO1 | E | | 1 |
| 3. | Differentiate Positive and Negative Correlation. | | CO2 | R | | 1 |
| 4. | What is the probability of getting an even number when a fair die is thrown? | | CO3 | R | | 1 |
| 5. | Define probability. | | CO3 | A | | 1 |
| 6. | State the properties of the cdf of a two- dimensional RV( X,Y) | | CO4 | R | | 1 |
| 7. | Comment the follwing :For poission distribution with mean = 8 and variance = 7. | | CO5 | R | | 1 |
| 8. | Variance of Binomial distribution is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 9. | Define Alternate Hypothesis. | | CO6 | U | | 1 |
| 10. | Define large sample. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Compute Q3 for the data relating to the marks of 8 students in an examination given below 25, 48, 32, 52, 21, 64, 29 and 57. | | CO1 | | A | 3 |
| 12. | If regression coefficients are -0.2 and -0.6, then the correlation coefficient is ……….. | | CO2 | | U | 3 |
| 13. | A dice is thrown: find the probability of getting an   1. Doublet (b) Even numbers. | | CO3 | | An | 3 |
| 14. | X is continuous random variable with probability density function given by *f(x) = kx(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. | State the procedure for testing 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. | 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 | | E | 8 |
|  | 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 | 4 |
|  |  |  |  | |  |  |
| 18. |  | 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 | 12 |
|  |  |  |  | |  |  |
| 19. | a. | A bolt is manufactured by three machines A, B and C.A turns out twice as many items as B and machines B and C produce equal no of items. 2% of bolts produced by A and B are defective and 4% of bolts produced by C are defective. All bolts are put in to one stock pile and 1 chosen from this pile. What is the probability that it is defective? | CO3 | | E | 8 |
|  | b. | If p(x) =  (a)show that p(x) is a pdf | CO3 | | E | 4 |
|  |  |  |  | |  |  |
| 20. | a. | Three balls are drawn at random without replacement from a box containing 2 white, 3red and 4 Black balls. if X denotes the number of white balls drawn and Y denotes the number of red balls drawn, find the joint probability distribution of (X,Y) | CO4 | | An | 9 |
|  | b. | A continuous 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 the value of K. | CO4 | | E | 3 |
|  |  |  |  | |  |  |
| 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) = P(X = 4) |  | | E | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Determine Binomial distribution which mean is 4 and variance is 3. | CO5 | | E | 4 |
|  | b. | A sample of 900 members is found to have a mean 3.5 cm. can it reasonably regarded as a simple sample from large population whose mean is 3.38 and standard deviation 2.4 cm? | CO6 | | An | 8 |
|  |  |  |  | |  |  |
| 23. |  | A group of 10 rats feed on a diet A and another group of 8 rats feed on diet B recorded the following increase in weight.  Find if the variances are significantly different.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Diet A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Diet B | 2 | 3 | 6 | 8 | 10 | 1 | 2 | 8 | - | - | | CO6 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | 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 | | A | 4 |
|  | 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 | | A | 8 |

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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 | 3 | - | 13 | - | 17 |
| CO2 | - | 5 |  | - | 12 | - | 17 |
| CO3 | 1 | - | 1 | 3 | 12 | - | 17 |
| CO4 | 1 | 3 | - | 9 | 3 | - | 16 |
| CO5 | 1 | 1 | - | 3 | 16 | - | 21 |
| CO6 | 1 | 3 | 12 | 20 | - | - | 36 |
|  | | | | | | | **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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | | Find the inverse of A = . | | CO1 | U | | 1 |
| 2. | | Is the matrix A in the Row Echelon Form?  A= | | CO1 | R | | 1 |
| 3. | | Every square matrix satisfies its own \_\_\_\_\_\_\_ | | CO2 | R | | 1 |
| 4. | | Write the matrix of the quadratic form Q=𝑥2+ y2+ z2+2xy-8yz+ 6xz. | | CO2 | U | | 1 |
| 5. | | If  and  then =\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | | Differentiate y=sin 3x+x3+ e2x+5 with respect to x. | | CO3 | R | | 1 |
| 7. | | Evaluate. | | CO4 | E | | 1 |
| 8. | | = \_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | | =\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 10. | | If *f(x)* is an odd function in (- then the Euler’s constant  =\_\_\_\_\_\_\_. \_\_\_ | | CO6 | E | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | | If A =  and B = find 2A-3B. | | CO1 | | R | 3 |
| 12. | | If the canonical form of the quadratic form is, then find the Rank, Index and Signature of nature of quadratic form. | | CO2 | | An | 3 |
| 13. | | If x=rcosθ and y=rsinθ find the Jacobian of x and y with respect to r and θ. | | CO3 | | E | 3 |
| 14. | | Evaluate. | | CO4 | | E | 3 |
| 15. | | Find the area of the region bounded by the lines x=0; x=a; y=0;y=b. | | CO5 | | A | 3 |
| 16. | | If , then find the Fourier Coefficient in | | CO6 | | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | | a. | Test the consistency of the system of equations and solve using Gauss Elimination Method  𝑥+ 2𝑦+ 𝑧=3; 2𝑥+ 3𝑦+ 3𝑧=10; 3𝑥− 𝑦+ 2𝑧=13 | CO1 | | A | 6 |
|  | | b. | Find the inverse of the matrix A using Gauss Jordan Method  A=. | CO1 | | A | 6 |
|  | |  |  |  | |  |  |
| 18. | |  | Evaluate the  (i) characteristic equation(ii)Eigen values(iii)Eigen vectors of the matrix  A=. | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 19. | | a. | Using first derivative test, find the maxima and minima of a function: y = 2x3 - 3x2 + 6. | CO3 | | A | 8 |
|  | | b. | If u=cos (5x+7y)find the partial derivative of Ux,Uy,Uxy,Uyy. | CO3 | | U | 4 |
|  | |  |  |  | |  |  |
| 20. | | a. | Using integration by parts, evaluate ∫𝑥2𝑒3x𝑑𝑥. | CO4 | | E | 6 |
|  | | b. | Evaluate. | CO4 | | E | 6 |
|  | |  |  |  | |  |  |
| 21. | |  | Change the order of integration in I= and hence evaluate. | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 22. | | a. | Find the volume tetrahedron bounded by the planes and. | CO5 | | A | 8 |
|  | | b. | Evaluate. | CO5 | | A | 4 |
|  | |  |  |  | |  |  |
| 23. | |  | Obtain the Fourier Series for f(x) =x2 in the interval. | CO6 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Compute the first two Harmonic Fourier series of *f(x)* given by following table:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 |  | 2 | π | 4 | 5 | 2π | | y | 1.0 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1 | | CO6 | | A | 12 |

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

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO2 | 1 | 1 | - | 3 | 12 | - | 17 |
| CO3 | 2 | 4 | 8 | - | 3 | - | 17 |
| CO4 | 1 | - | - | - | 16 | - | 17 |
| CO5 | 1 | - | 19 | 8 | - | - | 28 |
| CO6 | - | - | 12 | - | 16 | - | 28 |
|  | | | | | | | **124** |

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Examine the convergence of the sequence = | | CO2 | R | | 1 |
| 2. | For p≤1, the P-series is ……….. | | CO2 | R | | 1 |
| 3. | Write the relationship between β and Γ functions. | | CO1 | R | | 1 |
| 4. | Write down the value of | | CO1 | R | | 1 |
| 5. | Find the value of the Euler constant in the Fourier series expansion for  in | | CO2 | R | | 1 |
| 6. | Write the down the formula for half range Fourier sine series of f(x) in | | CO2 | R | | 1 |
| 7. | If  is a vector point function, then write the value of | | CO5 | R | | 1 |
| 8. | Find the value of | | CO3 | U | | 1 |
| 9. | Write down the formula to find volume of a region. | | CO4 | R | | 1 |
| 10. | Calculate the general solution of | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Test the convergence of the series | | CO2 | | U | 3 |
| 12. | Write dx in terms of gamma function. | | CO1 | | U | 3 |
| 13. | Calculate the Euler constant  in the Fourier series expansion of  in | | CO2 | | U | 3 |
| 14. | If  then find the Jacobian | | CO3 | | U | 3 |
| 15. | Compute | | CO4 | | U | 3 |
| 16. | Solve | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Test the convergence of the series | CO2 | | An | 6 |
|  | b. | Discuss the nature of the series | CO2 | | An | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Evaluate d | CO1 | | A | 6 |
|  | b. | Find the value of | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 19. |  | Obtain the first three coefficients in the Fourier cosine series for y, where y is given in the following table:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x0 | 0 | 30 | 60 | 90 | 120 | 150 | | y | 4 | 8 | 15 | 7 | 6 | 2 | | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Evaluate the equations of the tangent plane and normal to the surface 2+ = 3−3z at (1, 2, 1). | CO3 | | A | 8 |
|  | b. | Find the value of ‘a’ if is solenoidal. | CO5 | | U | 4 |
|  |  |  |  | |  |  |
| 21. |  | Evaluate  where  S is the surface of the cube bounded by  using Gauss Divergence theorem. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | A rectangular box open at the top is to have volume of 108 cubic units. Find the dimensions of the box requiring least material for its construction. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Compute | CO4 | | A | 6 |
|  | b. | Solve | CO6 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Solve the Lagrange’s linear equation | CO6 | | A | 6 |
|  | b. | Solve | CO6 | | A | 6 |

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

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Find if . | | | CO1 | E | | 1 |
| 2. | If be an implicit relation between  and , then \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | | 1 |
| 3. | If the roots of the auxiliary equation are , then the complementary function is given by CF = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO2 | A | | 1 |
| 4. | If the complementary function of an ODE is , then the Wronskian is given by \_\_\_\_\_\_\_\_\_\_\_\_. | | | CO2 | E | | 1 |
| 5. | Define a power series in . | | | CO3 | R | | 1 |
| 6. | The Legendre’s equation is given by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | R | | 1 |
| 7. | The notation ‘’ in partial differential equation represents \_\_\_\_\_\_\_\_\_. | | | CO4 | U | | 1 |
| 8. | If the roots of the auxiliary of a PDE are 1,2,3,4, then the CF is given by \_\_\_\_\_\_\_\_\_. | | | CO4 | A | | 1 |
| 9. | The Fourier series expansion for  in the interval  is given by \_\_\_\_\_\_\_\_\_. | | | CO5 | R | | 1 |
| 10. | In the Fourier series expansion of a function  in the intervalthe value of \_\_\_\_\_\_\_\_\_\_\_\_. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | In polar coordinates  and , find the value of . | | | CO1 | | E | 3 |
| 12. | Solve . | | | CO2 | | E | 3 |
| 13. | State the value of  for which the following series is convergent. | | | CO3 | | An | 3 |
| 14. | Solve . | | | CO4 | | E | 3 |
| 15. | State the Dirichlet’s Conditions on a function  to be expanded as a Fourier series. | | | CO5 | | R | 3 |
| 16. | Find the nature of the PDE . | | | CO6 | | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | |  | Find the maximum and minimum distances of the point (3, 4, 12) from the sphere. | CO1 | | E | 12 |
|  | |  |  |  | |  |  |
| 18. | |  | Solve . | CO2 | | E | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | Express  in terms of . | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Solve . | CO4 | | E | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | Obtain the Fourier series for , in the interval . | CO5 | | E | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | Find the Fourier series expansion for if.  Hence deduce that . | CO5 | | A | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | A tightly stretched flexible string has its ends fixed at and. At time  the string is given a shape defined by , where  is a constant and then released. Find the displacement of any point at a distance  from one end at time. | CO6 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | Solve the Laplace equation subject to  and . | CO6 | | E | 12 |

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

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

**Graphical user interface, application

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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** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | If  and , then find A+B. | | CO1 | R | | 1 |
| 2. | Evaluate . | | CO1 | U | | 1 |
| 3. | If  then find the sum of the eigen values. | | CO2 | R | | 1 |
| 4. | Find the rank of the matrix . | | CO2 | U | | 1 |
| 5. | If then find . | | CO3 | R | | 1 |
| 6. | \_\_\_\_\_\_. | | CO3 | U | | 1 |
| 7. | =\_\_\_. | | CO4 | R | | 1 |
| 8. | =\_\_\_\_\_ | | CO4 | U | | 1 |
| 9. | Write the formula to find the area of a given region R. | | CO5 | R | | 1 |
| 10. | Write the Fourier Coefficient for the Half Range Sine series in the interval (0,). | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Determine the product AB for the matricesand . | | CO1 | | U | 3 |
| 12. | Find the nature of the quadratic form . | | CO2 | | U | 3 |
| 13. | Find the Jacobian , if and. | | CO3 | | U | 3 |
| 14. |  | | CO4 | | U | 3 |
| 15. | Evaluate dx. | | CO5 | | U | 3 |
| 16. | Find the Fourier coefficient  for the function in . | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | a. | Solve by Cramer’s method, the system of equations  3, and 4. | CO1 | | A | 6 |
|  | b. | Find the inverse of the matrix . | CO1 | | A | 6 |
|  |  |  |  | |  |  |
| 18. |  | Verify Cayley Hamilton Theorem for the matrix  and find its inverse. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Differentiate with respect to x. | CO3 | | A | 6 |
|  | b. | then find . | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. | a. | Evaluate . | CO4 | | A | 6 |
|  | b. | Evaluate . | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 21. | a. | Find the area bounded by the parabola =and . | CO5 | | A | 8 |
|  | b. | Evaluate . | CO5 | | A | 4 |
|  |  |  |  | |  |  |
| 22. |  | Find the eigen values and the eigenvectors of the matrix . | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. | a. | If , then find . | CO3 | | A | 6 |
|  | b. | Evaluate | CO3 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Determine the first two harmonics of the Fourier Series for the following values.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | | y | 1.8 | 1.1 | 0.3 | 0.16 | 1.5 | 1.3 | 2.16 | 1.25 | 1.3 | 1.52 | 1.76 | 2.0 | | CO6 | | A | 12 |

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

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

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| **Course Code** | **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** | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** | |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | | |
| 1. | If mean = 5, median = 6 then mode = \_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | | R | | | 1 | |
| 2. | The mode value of the data set 42, 40, 50, 60, 35, 40, 58, 32, 40 is \_\_\_\_\_\_\_\_. | | CO1 | | A | | | 1 | |
| 3. | If *rxy* = 1 then the variables X and Y are \_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | | R | | | 1 | |
| 4. | If the increase in variable X results in a corresponding decrease in the variable Y then the correlation is said to be \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | | R | | | 1 | |
| 5. | The probability of getting an odd number when a fair die is thrown is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO3 | | A | | | 1 | |
| 6. | The total area under normal curve is \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | | R | | | 1 | |
| 7. | A discrete random variable assigns an \_\_\_\_\_\_\_\_ value to each element of sample space. | | CO5 | | R | | | 1 | |
| 8. | The condition for probability density function f(x) of a continuous random variable x is\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | | R | | | 1 | |
| 9. | Null hypothesis states that there is no \_\_\_\_\_\_\_ between population parameter and sample parameter. | | CO6 | | R | | | 1 | |
| 10. | What will be the conclusion of test of signiﬁcance, if Zcal>Ztab? | | CO6 | | R | | | 1 | |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | |
| 11. | The marks scored by 10 students in a test are 25, 29, 30, 33, 35, 37, 38, 40, 44, 48. Find the standard deviation. | | CO1 | | | An | | 3 | |
| 12. | A box contains 5 white and 4 green balls. 2 balls are drawn at random. Find the probability they are green. | | CO3 | | | A | | 3 | |
| 13. | The mean and variance of a binomial distribution are 4 and 4/3 respectively. Find P(X = 0). | | CO4 | | | An | | 3 | |
| 14. | The mean of an exponentially distributed random variable X is 2. Find P (X > 2). | | CO5 | | | An | | 3 | |
| 15. | Define type I and type II error in testing of hypothesis. | | CO6 | | | R | | 3 | |
| 16. | A civil engineer invents a method to decrease corrosion on iron bars. If the average corrosion on iron bar is 3mm then what are the hypothesis to test the claim? | | 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. |  | Calculate mean, median and mode for the following data   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Heights of Plants (in inches) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | | Number of Plants | 3 | 9 | 15 | 30 | 18 | 5 | | | CO1 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 18. |  | The ranking of 10 farmers in a crop cultivation competition by two judges A and B are as follows:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 6 | 5 | 3 | 10 | 2 | 4 | 9 | 7 | 8 | 1 | | B | 3 | 8 | 4 | 9 | 1 | 6 | 10 | 7 | 5 | 2 |   Compute the Spearman’s rank correlation coefficient. | | CO2 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 19. | a. | Bag I contains 3 blue and 4 red marbles, Bag II contains 5 blue and 6 red marbles and Bag III contains 7 blue and 5 red marbles. What is the probability of selecting a red marble? A bagis selected randomly and a marble taken at random was found to be red. What is the probability bag II was selected? | | CO3 | | | A | | 8 |
|  | b. | A problem in construction is given to 3 students A, B and C. The probability of A, B and C solving it are 0.5, 0.33 and 0.25 respectively. What is the probability that the problem will be solved? | | CO3 | | | A | | 4 |
|  |  |  | |  | | |  | |  |
| 20. |  | From the following probability distribution find (i) the value of k and (ii) , P (1 < x < 4) (iii) mean of X (iv) variance of X   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 2 | 3 | 4 | 5 | | |  |  |  |  |  |  | | | CO4 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 21. |  | Fit a binomial distribution to the given data and hence find the theoretical frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 5 | 29 | 36 | 25 | 5 | | | CO5 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 22. |  | The following table gives the responses of 400 participants on the question numbers 5 and 10 of a personality test inventory. Using Chi-Square Test, find whether the question number 5 and 10 are independent.   |  |  |  | | --- | --- | --- | | Question no 5 / 10 | Yes | No | | Yes | 180 | 120 | | No | 90 | 10 | | | CO6 | | | An | | 12 |
|  |  |  | |  | | |  | |  |
| 23. |  | |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Two random samples from a normal population yielded the following results.   |  |  |  | | --- | --- | --- | | Sample | Size | Standard deviation | | 1 | 16 | 3.7 | | 2 | 21 | 3.2 |   Test whether the two variances are equal using F test at 5% level of significance | | | CO6 | | | An | | 12 |
| **COMPULSORY QUESTION** | | | | | | | | | |
| 24. |  | 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 | | | An | | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Determine the statistical measures of data. |
| CO2 | Analyze the linear relationship of variables using correlation and regression models. |
| CO3 | Apply the concept of probability in machine learning problems. |
| CO4 | Understand the randomness in date in real time application. |
| 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 |  | 1 | 15 |  |  | 17 |
| CO2 | 2 |  |  | 12 |  |  | 14 |
| CO3 |  |  | 16 |  |  |  | 16 |
| CO4 | 2 |  | 15 |  |  |  | 17 |
| CO5 | 1 |  |  | 15 |  |  | 16 |
| CO6 | 2 | 3 |  | 36 |  |  | 41 |
|  | | | | | | | **121** |

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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** | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | The series | CO2 | U | 1 |
| 2. | The series 5-4-1+5-4-1+5-4-1+------------∞ is ------------- | CO2 | R | 1 |
| 3. | ℾ(3)=---- | CO1 | E | 1 |
| 4. | Find the value of β (2, 3) | CO1 | U | 1 |
| 5. | If U(x,y)=e(x+2y),find Ux | CO3 | R | 1 |
| 6. | Evaluate . | CO4 | U | 1 |
| 7. | If U(x,y)=cos(2x+3y),find Uy | CO3 | U | 1 |
| 8. | A vector is said to be irrotational if \_\_\_\_\_\_\_\_\_\_\_. | CO5 | R | 1 |
| 9. | Find the order of the partial differential equation: | CO6 | R | 1 |
| 10. | Solve (D2-5D+4)y=0 | CO6 | E | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | If, then find | CO2 | E | 3 |
| 12. | The graph of y=x2 between x=1 and x=3is rotated completely around the X-axis. Find the volume generated. | CO1 | A | 3 |
| 13. | If , then find divand curl | CO5 | U | 3 |
| 14. | Evaluate | CO3 | E | 3 |
| 15. | Evaluate | CO4 | E | 3 |
| 16. | Solve pq=1 | CO6 | U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23. Q.No 24 is Compulsory)** | | | | | | |
| 17. | a | Test the convergence of the series by using Raabe’s test | CO2 | A | | 6 |
| b | Evaluate | CO2 | E | | 6 |
|  |  |  |  |  | |  |
| 18 | a. | Evaluate | CO1 | E | | 6 |
| b. | Compute (i) x (ii) (iii) ℾ(7/2) | CO1 | A | | 6 |
|  |  |  |  |  | |  |
| 19. |  | Compute the first three harmonic series of the Fourier series for f(x) from the following data   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 0 | π/3 | 2 π/3 | π | 4 π/3 | 5 π/3 | 2π | | f(x) | 10 | 12 | 15 | 20 | 17 | 11 | 10 | | CO2 | An | | 12 |
|  |  |  |  |  | |  |
| 20. |  | Find the (i)sine series (ii)cosine series of f(x)= x2 in (0,π) | CO2 | A | | 12 |
|  |  |  |  |  | |  |
| 21. | a | Determine the critical points and minima, maxima of function defined by f(x , y) = x2- 2xy + 3y2 - 8x | CO3 | An | | 8 |
| b | Find the directional derivative of at the point (1,2,3) in the direction of | CO5 | U | | 4 |
|  |  |  |  |  | |  |
| 22. | a | Find the area of the triangle bounded by the lines x=0,y=0 and x+y=1 | CO4 | A | | 8 |
| b | Evaluate | CO4 | A | | 4 |
|  |  |  |  |  | |  |
| 23. | a. | Solve (D2+3)y= e4x+cos2x | CO6 | E | | 6 |
| b. | Solve: | CO6 | E | | 6 |
|  |  | **Compulsory:** | | | | |
| 24. | a. | Solve by using the method of variation of parameters  (D2+1)y = secx. | CO6 | An | 6 | |
| b. | Solve (x2D2-7xD+12)y = x2. | 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 | - | 1 | 9 | - | 7 | - | 17 |
| CO2 | 1 | 1 | 18 | 12 | 9 | - | 41 |
| CO3 | 1 | 1 | - | 8 | 3 | - | 13 |
| CO4 | - | 1 | 12 | - | 3 | - | 16 |
| CO5 | 1 | 7 | - | - | - | - | 8 |
| CO6 | 1 | 3 | 6 | 6 | 13 | - | 29 |
|  | | | | | | | **124** |

Graphical user interface, application

Description automatically generated with medium confidence

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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the different types of bar diagrams with an example. | CO1 | R | 10 |
|  | b. | Represent the following data by a pie diagram.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Items | Food | Clothing | Rent | Medicare | Entertainment | | Expenditure (inR) | 2400 | 200 | 800 | 150 | 450 | | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Draw a histogram, frequency polygon and frequency curve for the data. Hence find the value of the mode.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Production in tons | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | No. of Labourers | 8 | 18 | 23 | 37 | 47 | 26 | 6 | 5 | | CO1 | U | 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. | The annual profit of 50 companies are given below. Calculate their arithmetic mean and median.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Annual profit(in lakhs) | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | | No. of companies | 5 | 8 | 12 | 15 | 6 | 4 | | CO2 | A | 14 |
|  | b. | Find the missing frequency, if mode = 360.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Class | 0- 100 | 100- 200 | 200- 300 | 300- 400 | 400- 500 | | Frequency | 3 | 17 | ? | 40 | 30 | | CO2 | A | 6 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The number of vehicles sold by a car showroom in a month was recorded for 25 working days. Determine the inter-quartile range, quartile deviation and coefficient of quartile deviation.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | No. of cars sold | 5 | 10 | 12 | 15 | 18 | 20 | | No. of days | 2 | 3 | 5 | 10 | 4 | 1 | | CO3 | A | 10 |
|  | b. | Compute the mean deviation and coefficient of mean deviation from the following series.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Marks | 10 | 15 | 20 | 30 | 40 | 50 | | Frequency | 8 | 12 | 15 | 10 | 3 | 2 | | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | The following data was obtained while observing the marks scored by a group of students in Statistics. Calculate the standard deviation and variance.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Marks | 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | | No. of students | 2 | 5 | 9 | 3 | 1 | | CO3 | E | 10 |
|  | b. | For a group of 50 male workers, the mean the standard deviation of their wages are Rs. 63 and Rs.9 respectively. For a group of 40 female workers these are Rs. 54 and Rs. 6 respectively. Find the combined variance for both the group of 90 workers.   1. In which group there greater variability in wages? 2. What is the total income of both the male and female workers   taken together? 3. Find the combined standard deviation and combined variance? | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Obtain the Karl Pearson’s coefficient of correlation between aptitude score and productivity index.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Aptitude Score of workers | 57 | 58 | 59 | 59 | 60 | 61 | 62 | 64 | | Productivity Index | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 | | CO4 | An | 10 |
|  | b. | Ten competitors in a marketing competition are ranked by three judges in the following order.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Judge I | 1 | 5 | 4 | 8 | 9 | 6 | 10 | 7 | 3 | 2 | | Judge II | 4 | 8 | 7 | 6 | 5 | 9 | 10 | 3 | 2 | 1 | | Judge III | 6 | 7 | 8 | 1 | 5 | 10 | 9 | 2 | 3 | 4 |   Use rank correlation coefficient to discuss which pair of judges have common approach. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | From the given information about advertising expenditure (X) and sales (Y).   |  |  |  | | --- | --- | --- | |  | Advertisement (X) | Sales (Y) | | Mean | 10 | 90 | | Standard Deviation | 3 | 12 | | Coefficient of correlation | 0.8 | |  1. Find the regression equations of Y on X. 2. Estimate the likely sales when the advertisement expenditure is   Rs. 15 crores? | CO5 | An | 10 |
|  | b. | Two random variables have the following regression equations:  3X + 2Y = 26  6X + Y = 31  Find the mean values of X and Y and the correlation coefficient. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The following figures relate to the profits of a commercial concern for 8 years.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | Profit  (Rs.) | 15420 | 14470 | 15520 | 21020 | 26120 | 31950 | 33370 | 34670 |   Find the trend of profits by the method of 3-yearly moving averages. | CO6 | An | 8 |
|  | b. | The following are the yearly production, in tons of a certain factory.   1. Use method of least squares to calculate trend values. 2. Also estimate the production for the year 2020.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | Production (in Tons) | 24 | 25 | 29 | 26 | 22 | 24 | | CO6 | An | 12 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Calculate the seasonal index for the following series.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter | | | | | I | II | III | IV | | 2013 | 40 | 35 | 38 | 40 | | 2014 | 42 | 37 | 39 | 38 | | 2015 | 41 | 35 | 38 | 40 | | 2017 | 45 | 36 | 36 | 41 | | 2018 | 44 | 38 | 38 | 42 | | CO6 | An | 10 |
|  | b. | Compute a price index for the following by  (i) simple aggregate method.  (ii) the average of price relative method using both arithmetic mean and geometric mean.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Commodity | A | B | C | D | E | | Price in 2015 | 10 | 12 | 14 | 16 | 18 | | Price in 2017 | 12 | 14 | 16 | 18 | 20 | | CO6 | An | 10 |

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

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

Graphical user interface, application

Description automatically generated with medium confidence

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

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| **Q. No.** | | **Questions** | | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** | |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | | | | | | |
| 1. | | a. | | Solve the following system of linear equations by using Cramer’s Method: 3x + y + 2z = 3; 2x – 3y – z = – 3 and x + 2y +z = 4 | | CO1 | | E | | 10 | |
|  | | b. | | Find the inverse of the matrix | | CO1 | | An | | 10 | |
|  | |  | | **(OR)** | |  | |  | |  | |
| 2. | | a. | | Differentiate  with respect to x | | CO2 | | E | | 8 | |
|  | | b. | | If , prove that = | | CO2 | | An | | 8 | |
|  | | c. | | Evaluate | | CO2 | | E | | 4 | |
|  | |  | |  | |  | |  | |  | |
| 3. | | a. | | If U={1,2,3,4,5,6,7,8,9,10,11,12,13}, A={1,2,4,6,8}, B={2,3,4,5,6} and C={3,6,9,12,13}. Show that (i) A-(B∪C) = (A-B) ∩ (A-C) (ii) (A∩B)’= A’∪B’. | | CO3 | | An | | 8 | |
|  | | b. | | If P and Q are the multisets {3 ⋅ a, 1 ⋅ b, 2 ⋅ d} and {3 ⋅ a, 1 ⋅ b, 2 ⋅ c} then find P ∪ Q, P∩Q, P-Q and P + Q. | | CO3 | | E | | 8 | |
|  | | c. | | Determine whether the function f from {a, b, c, d} to {1, 2, 3, 4} with f (a) = 4, f (b) = 2, f (c) = 1, and f (d) =3 is a bijection. | | CO3 | | An | | 4 | |
|  | |  | | **(OR)** | |  | |  | |  | |
| 4. | | a. | | In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways they can be selected if at least one boy should be in the group of children? | | CO4 | | E | | 8 | |
|  | | b. | | A café has a lunch special consisting of an egg or sandwich (E or S); Milk, juice, or coffee (M, J, or C); Yogurt or Pie for dessert (Y or P. List out all possible meals and also draw the tree diagram. | | CO4 | | An | | 8 | |
|  | | c. | | Find the number of distinguishable permutations of the letters in STATISTICS. | | CO4 | | An | | 4 | |
|  | |  | |  | |  | |  | |  | |
| 5. | | a. | | Show that the following statements are logically equivalent   1. p ∨ (q ∧ r) (p ∨ q) ∧ (p ∨ r) 2. p ∧ (q ∨ r) (p ∧ q) ∨ (p ∧ r) 3. ¬ (p ∨ q) ¬ p ∧ ¬ q | | CO5 | | An | | 8 | |
|  | | b. | | Prove that the following statements:   1. ¬ ( p → q ) ∨ (q → p) is a contradiction 2. (p → q) ↔ (¬q →¬ p) is a tautology | | CO5 | | An | | 8 | |
|  | | c. | | Find the bitwise OR, bitwise AND, and bitwise XOR of the bit strings 01 1011 0110 and 11 0001 1101. | | CO5 | | E | | 4 | |
|  | |  | | **(OR)** | |  | |  | |  | |
| 6. | |  | | Find the Eigen values and the Eigen vectors of the matrix A= | | CO1 | | An | | 20 | |
|  | |  | |  | |  | |  | |  | |
| 7. | | a. | | Find the values of a1, a2, a3, a4 and a5 for the following sequence {an} that satisfies the recurrence relation   1. an = an−1 + 3 for n = 1, 2, 3… and a0 = 2. 2. an= for n = 1, 2, 3… 3. an= an−1 + an−2 for n = 1, 2, 3… where a0 = 3 and a1 = 5. | | CO2 | | An | | 8 | |
|  | | b. | | If A = {1,3,5} and B = {2,4,6,8}, find the Cartesian product A x B, B x A, A x A and B x B | | CO2 | | E | | 8 | |
|  | | c. | | Write the power set of {a, b, c}. | | CO2 | | E | | 4 | |
|  | |  | | **(OR)** | |  | |  | |  | |
| 8. | | a. | | Construct an Euler and Hamilton Path and circuit for the graph shown below: | | CO6 | | A | | 10 | |
|  | | b. | | Define spanning tree and construct the spanning trees for the following graph. | | CO6 | | A | | 10 | |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | | | | | |
| 9. | a. | | Show that the following two graphs are isomorphic. | | | CO6 | | | A | | 10 |
|  | b. | | Using Kruskal’s algorithm, find the minimal spanning tree for the graph given below. | | | CO6 | | | A | | 10 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Apply the matrix techniques in solving simultaneous equations. | | | | | | | |
| CO2 | Recognize different calculus methods. | | | | | | | |
| CO3 | Use sets in computer representation. | | | | | | | |
| CO4 | Make decision using permutation and combination. | | | | | | | |
| CO5 | Construct and solve problems using Logic. | | | | | | | |
| CO6 | Model network problems. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | - | - | - | 30 | 10 | - | 40 |
| CO2 | | - | - | - | 16 | 24 | - | 40 |
| CO3 | | - | - | - | 12 | 8 | - | 20 |
| CO4 | | - | - | - | 12 | 8 | - | 20 |
| CO5 | | - | - | - | 16 | 4 | - | 20 |
| CO6 | | - | - | 40 | - | - | - | 40 |
|  | | | | | | | | **180** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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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** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Find the eigen values of the matrix | | CO1 | U | 1 |
| 2. | If the eigen values of the matrix are, find the index of . | | CO1 | U | 1 |
| 3. | If the roots of an ordinary differential equation are then write its complementary function. | | CO2 | R | 1 |
| 4. | Find the order of the ordinary differential equation  . | | CO2 | U | 1 |
| 5. | Gauss Jordon method is a \_\_\_\_\_\_method. | | CO3 | R | 1 |
| 6. | In Gauss elimination method the coefficient matrix is transformed to \_\_form. | | CO3 | R | 1 |
| 7. | What is the value of ? | | CO4 | E | 1 |
| 8. | Write. | | CO4 | R | 1 |
| 9. |  | | CO5 | R | 1 |
| 10. | To apply Simpson’s 1/3rd rule, the number of intervals n =----------. | | CO6 | R | 1 |
|  | **PART – B (6 X 3 = 18 MARKS)** | |  |  |  |
| 11. | Write the characteristic equation of the matrix | | CO1 | E | 3 |
| 12. | Find the complementary function of . | | CO2 | E | 3 |
| 13. | Write the normal equations to fit a parabola. | | CO3 | An | 3 |
| 14. | Find the value of . | | CO4 | E | 3 |
| 15. |  | | CO5 | E | 3 |
| 16. | Write Newton’s forward and backward difference formula. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | Find the eigen values and eigen vectors of the matrix | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Solve | CO2 | E | 6 |
|  | b | Solve | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | Solve the system of equations by Gauss elimination method | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Fit a straight line for the following by the method of least square.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | X: | 5 | 10 | 15 | 20 | 25 | | Y: | 15 | 19 | 23 | 26 | 30 | | CO4 | An | 6 |
|  | b. | Evaluate  by the integration by parts formula. | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Change the order of the integration and evaluate | CO5 | An | 6 |
|  | b | Find the area between the parabolas and . | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. |  | Find the first two derivatives of at x= 50 and x=56 for the following table values.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | x | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | y | 3.6840 | 3.7084 | 3.7325 | 3.7563 | 3.7798 | 3.8030 | 3.8259 | | CO6 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Solve the system of equations by Gauss seidel method | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate using   1. Trapezoidal rule 2. Simpson’s 1/3rdrule 3. Simpson’s 3/8thrule 4. Compare with exact integration. | CO6 | E | 12 |

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

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

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

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| **Q. No.** | | **Questions** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | | |
| 1. | a. | | | Draw a Histogram, frequency polygon and frequency curve for the following data:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | | Freq. | 4 | 6 | 7 | 14 | 16 | 14 | 8 | 16 | 5 | | CO1 | U | 10 |
|  | b. | | | The frequency distribution of marks in Mathematics obtained by 100 students in a class is given below:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Marks | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 | | No. of Students | 7 | 11 | 24 | 32 | 9 | 14 | 2 | 1 |   Draw the less than and more than Ogives for this distribution | CO1 | U | 10 |
|  |  | | | **(OR)** |  |  |  |
| 2. | a. | | | Calculate the standard deviation of the following series.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | 6 | 9 | 12 | 15 | 18 | | *f* | 7 | 12 | 13 | 10 | 8 | | CO2 | E | 10 |
|  | b. | | | The scores of two batsmen A and B in ten innings during a certain season are:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 32 | 28 | 47 | 62 | 71 | 39 | 10 | 60 | 96 | 14 | | B | 19 | 31 | 48 | 53 | 67 | 90 | 10 | 62 | 40 | 80 |   Find which of the two batsmen A or B (a) is more efficient and (b) is more consistent in scoring | CO2 | A | 10 |
|  |  | | |  |  |  |  |
| 3. |  | | | 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 | A | 20 |
|  |  | | | **(OR)** |  |  |  |
| 4. | 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 | E | 10 |
|  | b. | | | If the heights of 300 students are normally distributed with mean 172cm & S.D. 8cm, how many students have heights (i) more than 184cm (ii) less than or equal to 160cm. | CO3 | E | 10 |
|  |  | | |  |  |  |  |
| 5. | a. | | | Calculate the correlation coefficient for the following heights (in inches) 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 | | CO4 | A | 7 |
|  | b. | | | Find the correlation coefficient and regression line of y on x for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | 1 | 2 | 3 | 4 | 5 | | *y* | 2 | 5 | 3 | 8 | 7 | | CO5 | A | 13 |
|  |  | | | **(OR)** |  |  |  |
| 6. | a. | | | Two dice are thrown, what is probability of getting a sum as (i) 5 (ii) at most 7 (iii) at least 11. | CO3 | E | 10 |
|  | b. | | | 10 Coins are thrown simultaneously. Find the probability of getting (i) exactly 7 heads (ii) at least 7 heads (iii) at most 7 heads. | CO3 | E | 10 |
|  |  | | |  |  |  |  |
| 7. | a. | | | Calculate the rank correlation coefficient for the following data:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 | | *y* | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 | | CO4 | A | 10 |
|  | b. | | | Using three year moving averages determine the trend and short-term fluctuation   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | | Production | 21 | 22 | 23 | 25 | 24 | 22 | 25 | 26 | 27 | 26 | | CO6 | An | 10 |
|  |  | | | **(OR)** |  |  |  |
| 8. |  | | | Determine the seasonal fluctuation in time series given below, indicating clearly the procedure followed.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | Quarter I | Quarter II | Quarter III | Quarter IV | | 1985 | 68 | 62 | 61 | 63 | | 1986 | 65 | 58 | 66 | 61 | | 1987 | 68 | 63 | 63 | 67 | | CO6 | An | 20 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | |
| 9. | a. | | Fit a straight line trend equation to the following data by the method of least squares and estimate the value of sales for the year 1985.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Year | 1979 | 1980 | 1981 | 1982 | 1983 | | Sales(in Rs.) | 100 | 120 | 140 | 160 | 180 | | | CO6 | A | 10 |
|  | b. | | From the following data construct an index for 1995 taking 1994 as base:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Commodities | A | B | C | D | E | | Price in 1994(Rs.) | 50 | 40 | 80 | 110 | 20 | | Price in 1995(Rs.) | 70 | 60 | 90 | 120 | 20 | | | CO6 | An | 10 |

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

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



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| **Course Code** | **MA356** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL METHODS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | State and prove the invariance of domain for contractive fields. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | If C is any non-empty closed and bounded convex set in a Hilbert space, show that each non-expensive map F : C → C has atleast one fixed point. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | State and prove the Birkhoff – Kellogg Theorem. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Let U be open in the normed space E and let f : U → E be an injective completely continuous. Then show that  a. f is an open map b. f(u) is open in E. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Using Light hill technique, solve  , where A is a constant. | CO3 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | If , obtain a power series solution of y. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 7. |  | Obtain a quadratic Lagrange polynomial over the finite element having   1. Rectangular element in the plane. 2. Triangular element in the plane. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Write a brief note on properties of discretization schemes. | CO5 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Consider the problem of source free heat conduction in an insulated rod where ends are maintained at constant temperature of 100ºC and 500ºC respectively. The one dimensional problem is governed by . Calculate the steady state temperature in the rod. Thermal conductivity k = 1000 W/m/k cross sectional area A is 10 x 10-3 m2.  0.5m  P Q    TP=100 Area A TQ=500 | CO6 | E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to understand fixed point theorems. |
| CO2 | The student will be able to compact map in normed linear space. |
| CO3 | The student will be able to apply perturbation techniques. |
| CO4 | The student will be able to understand finite element method. |
| CO5 | The student will be able to express finite volume method. |
| CO6 | The student will be able to illustrate practical problems in steady state. |

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



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| **Code :** | **MA357** | **Duration :** | **3hrs** |
| **Sub. Name :** | **GRAPHS AND NETWORKS** | **Max. Marks :** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Pattern** | **Marks** |
|  |  | **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** |  |  |
| 1. | a. | Prove that, a graph having at least three vertices is 2-connected if and only if for each pair there exists internally disjoint - path in . | A | 10 |
| b. | Prove that, for a graph with at least three vertices, the following conditions are equivalent**.**   1. is connected and has no cut-vertex. 2. Forall, there are internally disjoint - paths. 3. Forall, there is a cycle through  and . 4. , and every pair of edges in  lies on a common cycle. | A | 10 |
| **(OR)** | | | | |
| 2. |  | In the network given below, find a maximum flow from  to  by Ford –Fulkerson labeling algorithm.  Check your answer by applying the maxflow-mincut theorem. | An | 20 |
|  |  |  |  |  |
| 3. | a. | State and prove the Perfect Graph Theorem. | R | 10 |
| b. | Prove that a graph is chordal if and only if it has an intersection representation using subtrees of a tree. | R | 10 |
| **(OR)** | | | | |
| 4. | a. | Prove that vertex multiplication preserves -perfection and -perfection. | R | 10 |
| b. | A simple graph  is chordal if and only if the numbering  produced by the Maximum Cardinality Search algorithm is a simplical construction ordering of , prove. | A | 10 |
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| 5. | a. | Prove that for matroids  and  on , the size of the largest common independent set satisfies. | R | 10 |
| b. | Enumerate the properties to be satisfied by a hereditary system on  to be a matroid. | R | 10 |
| **(OR)** | | | | |
| 6. | a. | Show that the necessary and sufficient conditions for a hereditary system  to be matroid are  P: incorporation -  for all .  S: idempotence -  for all .  T: transitivity of dependence - if  and , then .  : strong elimination – whenever  **C**, , and , there exists C**C** such that . | An | 10 |
| b. | Prove that the dual of a matroid  on  is a matroid with rank function. | A | 10 |
|  |  |  |  |  |
| 7. | a. | Prove that if , then . | R | 10 |
| b. | Given edge probability , let . Prove that for constant  and constant , almost every  satisfies . | A | 10 |
| **(OR)** | | | | |
| 8. | a. | Prove that for fixed  and foxed , almost every  has clique number between  and , where . | A | 10 |
| b. | Prove that when is constant, almost every is connected. | A | 10 |
|  | | **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** |  |  |
| 9. | a. | Prove that nine schoolgirls can take four daily walks in three rows of three girls each so that no two girls walk in the same row twice. | An | 10 |
| b. | If is a graceful Eulerian graph of size m, thenor. Prove. | A | 10 |