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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | A rectangular steel bar having a cross section 2cm 3cm is subjected to tensile force of 6000N(612.2kgf). If the axes are chosen, determine the normal and shear stresses on a plane whose normal has the following direction cosines:  i) , ii) ,  iii) . | CO1 | E | 10 |
|  | b. | Derive the equations of equilibrium in 2D case. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain normal and shear stress with its mathematical expressions. | CO1 | An | 10 |
|  | b. | Discuss the interpretation of the shear strain components. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. |  | Derive the mathematical expression for the torsion of general prismatic bars of solid cross sections. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Derive the expression for stresses due to gravitation. | CO2 | A | 10 |
|  | b. | Determine the diameter 2c and 2b the negative allowance for a two-layer barrel of inner diameter 2a=100mm. the maximum pressure the barrel is to withstand is pmax=2000kgf/cm2. The material is steel with E=2(10)6kgf/cm2; in tension or compression is 6000kgf/cm2. The factor of safety is 2. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Derive the mathematical expression for the rotating disks of uniform thickness. | CO3 | A | 10 |
|  | b. | The inner surface of the hollow tube is at temperature Ti and the outer surface at zero temperature. Assuming the steady state conditions, calculate the stresses. What are the values of the and  near the inner and outer surfaces. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | A flat steel turbine disk of 75 cm outside diameter with a 15 cm diameter rotates at 3000rpm, at which speed the blades and shrouding cause a tensile rim loading of 44kgf/cm2. The maximum stress at this speed is to be 1164kgf/cm2. Find the maximum shrinkage allowance on the diameter when the diameter when the disk and the shift are rotating. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Discuss the laminates and derive the mathematical expressions. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | If an isotropic solid is heated non uniformly to a temperature distribution T(x, y, z) and the material has unrestricted thermal expansion, the resulting strain will be eij = αTδij. Show that this case can only occur if the temperature is a linear function of the coordinates; that is,T = ax + by +cz +d. | CO5 | E | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the stress analysis in pressure vessel. | CO6 | A | 10 |
|  | b. | Obtain the expression for various elastic constants for the transversely isotropic materials. | CO6 | An | 10 |

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

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

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Three cubes of iron with edges measuring 6 cm, 8 cm, and 10 cm respectively are melted and formed into a single cube. Calculate the edge length of the new cube formed. | CO1 | A | 6 |
|  | b. | A, B and C start at the same time and in the same direction to run around a circular stadium. A completes one round in 252 seconds, B in 308 seconds and C in 198 seconds, all starting at the same point. Estimate the time they will meet again at the starting point. | CO1 | An | 6 |
|  | c. | The average of four consecutive even numbers is 27. Estimate the largest of these numbers. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 2. | a. | Nitin borrowed some money at a rate of 6% p.a. for the first three years, 9% p.a. for the next five years and 13% p.a. for the period beyond eight years. If the total interest paid by him at the end of eleven years is ₹8160, then calculate the amount of money he borrowed. | CO2 | A | 6 |
|  | b. | A sum of money doubles itself at compound interest in 15 years. Calculate after how many years it will become eight times. | CO2 | A | 6 |
|  | c. | Identify the least number to be multiplied with 21600 must to make it a perfect cube. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 3. | a. | A, B and C enter into partnership. A invests 3 times as much as B invests and B invests two-thirds of what C invests. At the end of the year, the profit earned is ₹6600. Calculate the share of B. | CO4 | A | 6 |
|  | b. | In how many different ways can the letters of the word ‘CORPORATION’ be arranged so that the vowels always come together? | CO4 | U | 6 |
|  | c. | In a class, there are 15 boys and 10 girls. Three students are selected at random. Find the probability of selecting 1 girl and 2 boys. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | A can do a piece of work in 80 days. He works at it for 10 days and then B alone finishes the remaining work in 42 days. Determine the time it will take for A and B to complete the work together. | CO3 | A | 6 |
|  | b. | A, B and C are three pipes connected to a tank. A and B together fill the tank in 6 hours. B and C together fill the tank in 10 hours. A and C together fill the tank in 7 ½ hours. Estimate the time it will take for pipes A, B and C to fill the tank separately. | CO3 | A | 6 |
|  | c. | Three equal glasses are filled with mixtures of milk and water. The proportion of milk to water is 2:3 in the first glass, 3:4 in the second glass and 4:5 in the third glass. The contents of three glasses are emptied into a single vessel. Calculate the proportion of milk to water in it. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 5. | a. | A man covers a certain distance between his house and office on scooter. Having an average speed of 30km/hr, he is late by 10min. However with a speed of 40km/hr, he reaches his office 5 min earlier. Find the distance between his house and office. | CO5 | A | 6 |
|  | b. | From the top of a hill 200m high, the angle of depression of the top and bottom of a tower are observed to be and . Calculate the height of the tower. | CO5 | A | 6 |
|  | c. | If the shadow of a pole 3m high is m long, then find the angle of elevation of the Sun. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 6. | a. | A boat takes 4 hours 12 minutes for travelling downstream from point A to point B and coming back to point A upstream. If the velocity of the stream is 9km/hr and the speed of the boat in still water is 12km/hr, then compute the distance between A and B. | CO3 | A | 6 |
|  | b. | A man is standing on a railway bridge which is 180m long. The train crosses the bridge in 20 seconds and the man in 8 seconds. Find the length of the train and its speed. | CO3 | A | 6 |
|  | c. | X’s age 3 years ago was 3 times the present age of Y. At present, Z’s age is twice the age of Y. Also Z is 12 years younger than X. Find the present age of Z. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 7. | a. | Find the greatest number which when divides 55, 127 and 175 leaves the same remainder. | CO1 | U | 6 |
|  | b. | The seats for Mathematics, Physics and Biology in a school are in the ratio 5:7:8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. Estimate the ratio of increased seats. | CO1 | U | 6 |
|  | c. | A shopkeeper sells one transistor for ₹840 at a gain of 20% and another for ₹960 at a loss of 4%. Calculate the total gain or loss percent. | CO3 | U | 4 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | The circle-graph shows the expenditure of a country on various sports during a particular year. Study the graph and answer the questions given below:  https://www.indiabix.com/_files/images/data-interpretation/pie-charts/15-2-9-1.png  1. Find the percentage of expenditure on Tennis over the total expenditure.  2. Find the percentage increase in expenditure on Hockey compared to that on Golf.  3. Calculate the percentage decrease in expenditure on Football compared to that on Cricket.  4. If the total amount spent on sports during the year was ₹2 crores, then find the amount spent on Cricket and Hockey together.  5. If the total amount spent on sports during the year is ₹1,80,00,000, then find the amount spent on basketball that exceeds that on tennis. | CO6 | An | 10 |
|  | b. | The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2021 and 2022. Answer the questions based on the graphs.    1. Find the total sales of branches B1, B3 and B5 together for both the years (in thousand numbers).  2. Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?  3. Find the average sales of all the branches (in thousand numbers) for the year 2021.  4. Find the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years.  5. Find the percentage of the average sales of branches B1, B2 and B3 in 2022 to the average sales of branches B1, B3 and B6 in 2021. | CO6 | An | 10 |

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

|  |  |
| --- | --- |
|  | **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 |



**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define symmetric matrix. | | CO1 | R | 1 |
| 2. | Rank of a null matrix is \_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Find the Eigen values of the matrix  . | | CO2 | U | 1 |
| 4. | If the Eigen values of a 3x3 matrix A are 1, 2,-3, then find the signature of the quadratic form corresponding to the matrix A. | | CO2 | R | 1 |
| 5. | Write down the Taylor’s series formula at | | CO3 | U | 1 |
| 6. | Mention the standard five point formula to solve | | CO3 | R | 1 |
| 7. | What is the value of . | | CO4 | U | 1 |
| 8. | Find the value of | | CO4 | R | 1 |
| 9. | What is the value of | | CO5 | U | 1 |
| 10. | Define complete graph. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the inverse of the matrix of | | CO1 | U | 3 |
| 12. | Form the characterstic equation of | | CO2 | U | 3 |
| 13. | Classify the partial differential equation | | CO3 | An | 3 |
| 14. | Find | | CO4 | U | 3 |
| 15. | Find | | CO5 | U | 3 |
| 16. | Find and for the following graph. | | 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. | Solve the system of equations by Cramer’s rule: | CO1 | A | 6 |
| b. | Find the rank of the matrix | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Find the Eigen values and Eigen vectors of the matrix | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Given , find the value of y(1.1) using Taylor’s series method. | CO3 | A | 6 |
| b. | Given, find the values of y at  using Euler’s method. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Find the Laplace transform of the following functions | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Find  using partial fraction method. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Find  using method of partial fraction. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Solve  given using Z- transform. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Using labeling algorithm, compute a maximal flow in the network given below. | CO6 | An | 12 |

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

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

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Determine the Eigen values of the matrix | | CO1 | U | 1 |
| 2. | Compute the rank of the matrix | | CO1 | U | 1 |
| 3. | If then find the value of | | CO2 | U | 1 |
| 4. | Write the formula to calculate the surface area of the solid generated by revolution about x-axis and the ordinates x = a and x = b. | | CO2 | R | 1 |
| 5. | State the Green’s theorem. | | CO3 | R | 1 |
| 6. | If then find | | CO3 | R | 1 |
| 7. | Compute the complementary function for the differential equation | | CO4 | U | 1 |
| 8. | Determine the order of the differential equation | | CO4 | R | 1 |
| 9. | Write the linear form of the equation y=a . | | CO5 | R | 1 |
| 10. | Write the formula to calculate Newton’s forward interpolation formula. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A two-story building can be modelled as a 3×3 mass-stiffness matrix system  Find the characteristic equation of the stiffness matrix. | | CO1 | A | 3 |
| 12. | A beam element in a finite element model undergoes deformation, where the displacement functions are and Find the Jacobian matrix  for the displacement field. | | CO2 | A | 3 |
| 13. | The velocity field of an incompressible fluid is given as . Prove that this field is solenoidal. | | CO3 | A | 3 |
| 14. | Solve the differential equation . | | CO4 | A | 3 |
| 15. | Write the normal equations for the curve . | | CO5 | A | 3 |
| 16. | Find  from the following data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | | y | 10 | 20 | 30 | 40 | | | 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 structural engineer is analyzing the stiffness matrix of a 3D frame structure, which is given by .Verify Cayley Hamilton theorem for the matrix A. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | , then find at the point (1,2,3). | CO2 | A | 6 |
|  | b. | Find the first and second order partial derivatives of  U x2+y2+x3y2 +3xy. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Verify Green’s theorem for the line integral where the region is given by and | CO3 | A | 8 |
|  | b. | Prove that the vector f is irrotational, if +(++1). | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | Solve the differential equation (D2 - 4D + 3) y = e 2x  + sin4x + x2+100. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | A civil engineer is studying the settlement of soil under a given load. The measured settlement y (in mm) under different applied pressures x (in kPa) is given as:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Applied Pressure x (kPa) | 5 | 10 | 15 | 20 | 25 | | Soil Settlement y (mm) | 16 | 19 | 23 | 26 | 30 |   Determine the best-fitting straight-line equation using the method of least squares. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Solve the system of equations 3x + 4y +5z = 18; 2x – y +8z = 13;  5x – 2y + 7z = 20 using Gauss elimination method. | CO5 | A | 6 |
|  | b. | Find the positive root of correct to three decimal places, using Newton-Raphson method. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Find the Eigen values and Eigen vectors of the matrix A= . | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A civil engineer is analyzing the cross-sectional area of a river channel using numerical integration techniques. The width of the river is divided into equal segments of 1 meter apart, and the measured depths (in meters) at these points are given below:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Distance from one bank x (m) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | Depth f(x) (m) | 2 | 3 | 4 | 5 | 4 | 3 | 2 |   Evaluate the area using (i) Trapezoidal rule  (ii) Simpson’s 1/3 rule  (iii) Simpson’s 3/8 rule and correct to three decimal places. | CO6 | E | 12 |

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

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

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If  is the complementary event of A , then P() = --------.. | | CO1 | U | 1 |
| 2. | If A and B are independent events, then P(AB) = ---------- | | CO1 | R | 1 |
| 3. | A discrete random variable X has the following probability distribution. Find the value of k.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | | p(x) | 0.3 | k | 0.1 | k | | | CO2 | R | 1 |
| 4. | If F(x) is the cumulative probability distribution function of a random variable X, then --------. | | CO2 | R | 1 |
| 5. | The mean of the Poisson distribution is ------. | | CO3 | U | 1 |
| 6. | If K=1, then the gamma distribution is an-------- distribution. | | CO3 | R | 1 |
| 7. | State the uniqueness property of the characteristic function. | | CO4 | U | 1 |
| 8. | Describe the nature of the random process, where ‘t’ is continuous and ‘s’ is discrete. | | CO5 | R | 1 |
| 9. | In a random process if s and t are fixed then is a ----------. | | CO5 | U | 1 |
| 10. | The sum of two independent Poisson processes is-------. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A statistical problem is given to two students. The chances of solving it are 0.8 and 0.9 respectively. Find the probability that none of them solves the problem. | | CO1 | An | 3 |
| 12. | Acontinuous random variable X that can assume any value between x=2 and x=5 has a density function given by f(x) =k(1+x) . Find (i) k and (ii) P(x<4) | | CO2 | U | 3 |
| 13. | If the mean and variance of Binomial distribution are 5 and 2, then determine the probability distribution function. | | CO3 | A | 3 |
| 14. | If a random variable X has the moment generating function , then estimate the mean of X. | | CO4 | A | 3 |
| 15. | Compute the mean and variance of the Random process whose autocorrelation function is given by | | CO5 | U | 3 |
| 16. | If is a Gaussian process with μ(t)=10 and C(,) = 16 , then find P | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A lot consists of 10 good sensors, 4 with minor defects and 2 with major defects. Two sensors 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. | CO1 | A | 6 |
|  | b. | Mr. A and Mr. B throws alternatively a pair of dice. Mr. A wins the game, if he throws 6 before Mr. B throws 7. Mr. B wins the game, if he throws 7 before Mr. A throws 6. If Mr. A begins the game, what is the probability of his winning? | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | The joint probability mass function of (X, Y) is P (x, y) = K(2x+3y), x = 0,1,2 and y = 1,2,3 Find (i) K (ii) Marginal distribution of X and Y (iii) conditional distributions of X given Y (iv) Conditional distributions of Y given X. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | The time (in hours) required to repair a machine is an exponentially distributed random variable with parameter λ=1/2. Find the probability that a repair time exceeds 2 hours. | CO3 | An | 6 |
|  | b. | Fit a Poisson distribution and calculate the expected frequencies for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 122 | 60 | 15 | 2 | 1 | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Determine the moment generating function of the Binomial distribution and evaluate its mean. | CO4 | A | 6 |
|  | b. | Compute the characteristic function of poisson distribution.. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Two random processes and are defined by  and Show that and are jointly wide sense stationary process, A and B are random variables, if (i) (ii) (iii) | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | For the bivariate probability distribution of (X,Y) given below, Find (i) P(X≤1)  (ii) P(Y ≤ 3) (iii) P(X≤1, Y ≤ 3) (iv) P(X≤1/ Y ≤ 3) (v) P(Y ≤ 3 / X≤1).   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | In a bolt factory machines A, B, C produce 25%, 35% and 40% of the total output respectively. Of their output 5%, 4% and 2% respectively are defective bolts. If a bolt chosen at random from the combined output. What is the probability that it is defective? If a bolt chosen at random is found to be defective, what is the probability that it was produced by machine B? | CO1 | An | 6 |
|  | b. | The resistance of a certain type of resistor is normally distributed with a mean of 100 ohms and a standard deviation of 5 ohms. What percentages of resistors are expected to have a resistance between 95 and 105 ohms and less than 90 ohms? | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | An office receive 5 calls per minute on an average, What is the probability of receiving (i) No calls in one minute interval (ii) At most 2 calls in a 5 minutes interval. | CO6 | A | 6 |
|  | b. | A fair die is tossed repeatedly. If Xn denotes the maximum number occurring in the first n tosses, then find the transition probability matrix p of the Markov chain and also find and 6). | CO6 | A | 6 |

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

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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** | Knowledge in functions of random variables. |
| **CO5** | Determine the characteristics of random processes |
| **CO6** | Understand propagation of random signals in linear systems. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA1002** | **Duration** | **3hrs** |
| **Course Title** | **PARTIAL DIFFERENTIAL EQUATIONS, VECTOR SPACES AND LAPLACE TRANSFORM** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Solve the partial differential equation. | | CO1 | U | 1 |
| 2. | Find the complete solution of the partial differential equation *z=px+qy+p2-q2.* | | CO1 | U | 1 |
| 3. | If T: U→V is a linear transformation such that the rank of the transformation is 3 and the nullity of the transformation is 1, then find the dimension of U. | | CO2 | U | 1 |
| 4. | Find the matrix of the linear transformation T: V2  →V2  defined by  . | | CO2 | U | 1 |
| 5. | Find the norm of the vector x1 = | | CO3 | U | 1 |
| 6. | Find the inner product of the vectors u = and v= . | | CO3 | U | 1 |
| 7. | Find the Laplace transform of f(t) = *e-5t*. | | CO4 | R | 1 |
| 8. | Find the Laplace transform of f(t) = *cos3t.* | | CO4 | R | 1 |
| 9. | Find the inverse Laplace transform of . | | CO5 | R | 1 |
| 10. | Find the inverse Laplace transform of . | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the complete solution of the partial differential equation : *p-q* = *4* . | | CO1 | U | 3 |
| 12. | Check whether the set of vectors {(1,2,3), (4,1,2), (3,0,1)} is linearly independent or not. | | CO2 | U | 3 |
| 13. | Find the distance between the vectors u = and v = . | | CO3 | U | 3 |
| 14. | Evaluate the integral using the Laplace transformation. | | CO4 | U | 3 |
| 15. | Find the inverse Laplace transform of F(s) = . | | CO5 | U | 3 |
| 16. | Construct the normal equations to fit a parabola using the method of least squares. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Solve the partial differential equation:  . | CO1 | A | 6 |
|  | b. | Solve the partial differential equation : . | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Prove that T: V3 V2 defined by  T(x1, x2, x3)= (x1 x2 , x1+x3) is a linear transformation. | CO2 | A | 6 |
|  | b. | Find the Kernel, Nullity, Range and Rank of the linear transformation:  T: V4 V3 defined by  T(x1, x2, x3, x4) = (x1+ x2+ x3+ x4, x1-x2, x1+ x2+ x4). | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Construct an orthogonal bases of W={x1,x2,x3} given that x1= , x2= and  x3= using Gram Schmidt’s process and hence find the orthonormal bases  of W. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find the Laplace transform of f(t) = (*te-2tsin4t*). | CO4 | A | 6 |
|  | b. | Compute the Laplace transform of f(t) = . | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Solve the differential equation +2y = given that y(0)=(0)=0 using Laplace transform. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Compute the inverse Laplace transform of F(s) = using convolution. | CO5 | A | 6 |
|  | b. | Find the inverse Laplace transform of F(s) = . | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Check whether {u1,u2,u3}is an orthogonal set of vectors given that  u1= , u2= and u3= . | CO3 | A | 6 |
|  | b. | Find the Laplace transform of f(t)= | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | An AI researcher records the training time (y) of a machine learning model  as the data set size(x) increases.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Data set size(x in millions of samples) | 1 | 3 | 5 | 7 | | Training time (y in seconds) | 250 | 1000 | 4000 | 16000 |   The researcher assumes that the training time follows an **exponential model** y=abx. Determine the values of ‘a’ and ‘b’ using method of least squares and predict the training time for x=6 millions of samples. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the solutions of PDE using various techniques |
| **CO2** | Analyze images using linear transformation |
| **CO3** | Evaluate orthogonal and orthonormal vectors |
| **CO4** | Design circuits using Laplace transforms. |
| **CO5** | Solve ODE using Laplace Transforms. |
| **CO6** | Apply methods of least squares principle for predictive analysis. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA1007** | **Duration** | **3hrs** |
| **Course Title** | **PARTIAL DIFFERENTIAL EQUATIONS, TRANSFORMS AND NUMERICAL METHODS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The subsidiary equations of the Lagrange’s linear partial differential equation are given by \_\_\_\_\_\_\_\_\_. | | CO1 | U | 1 |
| 2. | Define the particular integral. | | CO1 | R | 1 |
| 3. | If  then, the next approximate root of the equation using bisection method is given by \_\_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 4. | If  is an approximate root of the equation , then a better approximation of the root using Newton-Raphson method is given by \_\_\_\_\_\_\_\_\_. | | CO2 | U | 1 |
| 5. | The nature of a partial differential equation is parabolic if \_\_\_\_\_\_\_\_\_. | | CO3 | U | 1 |
| 6. | The numerical solution of the equationby Taylor series is given by \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | The Laplace transform of  is given by \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 8. | The Laplace transform of  is given by \_\_\_\_\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | The inverse Laplace transform of  is given by \_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | Evaluate . | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Solve . | | CO1 | E | 3 |
| 12. | Derive an iterative formula to find  (where  is a + ve integer) by Newton-Raphson method. | | CO2 | E | 3 |
| 13. | Given , , , , , , find the value of  using fourth order Runge-Kutta method. | | CO3 | A | 3 |
| 14. | The Laplace transform of  is given by \_\_\_\_\_\_\_\_\_. | | CO4 | A | 3 |
| 15. | Evaluate . | | CO5 | E | 3 |
| 16. | Evaluate . | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Solve . | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate  by using (i) Trapezoidal rule, (ii) Simpson’s one-third rule and (iii) three-eighth rule. Verify your result by actual integration. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Solve the equation  for the following mesh, with the boundary values as shown using Liebmann’s iteration procedure. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate . | CO4 | E | 6 |
|  | b. | Evaluate . | CO4 | E | 6 |
|  |  |  |  |  |  |
| 21. |  | Evaluate . | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Evaluate the Laplace transform of the periodic function  where, , T is the period. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate the differential equation, given , by using Laplace transform. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate . | CO6 | E | 6 |
|  | b. | Evaluate the inverse - transform of . | CO6 | E | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | 1. Find solutions to the PDE using various techniques. |
| **CO2** | 1. Apply different techniques to solve algebraic and transcendental equations. |
| **CO3** | 1. Solve first-order differential equations using numerical techniques. |
| **CO4** | 1. Develop knowledge in Laplace transform techniques. |
| **CO5** | 1. Describe differential equations using Laplace Transforms. |
| **CO6** | Create knowledge of Z-transforms. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA1009** | **Duration** | **3hrs** |
| **Course Title** | **DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The area bounded by the curve *x = f(y),* the *y-axis* and *y = a, y = b* is …. | | CO1 | U | 1 |
| 2. | If u = log(, then find ux and uy . | | CO1 | R | 1 |
| 3. | Find the complementary function (D2 – 6D+ 9) y= 0. | | CO2 | R | 1 |
| 4. | Find the particular integral of (*D2 – 4)y = e2x.* | | CO2 | R | 1 |
| 5. | Write the Cauchy-Riemann equations in polar coordinates. | | CO4 | U | 1 |
| 6. | Write the Taylor’s expansion of *f(z) = sinz* about z = 0. | | CO4 | R | 1 |
| 7. | State the linearity property of Laplace Transform. | | CO5 | R | 1 |
| 8. | Find | | CO5 | U | 1 |
| 9. | Find the solution of | | CO3 | U | 1 |
| 10. | Write the one-dimensional heat equation. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the critical points *f(x) = x3 – 3x +3.* | | CO1 | An | 3 |
| 12. | Solve *(x2D2 – xD + 1)y = 0.* | | CO2 | A | 3 |
| 13. | Prove that *f(z) = z2*is an analytic function. | | CO4 | An | 3 |
| 14. | Find *e2t* \* *e5t* , where \* - denotes the convolution. | | CO5 | A | 3 |
| 15. | Find the complete integral of | | CO3 | A | 3 |
| 16. | Write the possible solutions of one-dimensional wave equation. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compute the maxima and minima using second derivative test  (𝑥) = 2𝑥3 − 3𝑥2 − 36𝑥 + 10. | CO1 | An | 8 |
|  | b. | Expand *f(x, y) = xy + 1* in powers of *(x – 1)* and *(y + 2)* using Taylor’s theorem. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. |  | Solve *(D2 – 2D + 2)y = ex + cos(2x) + x2.* | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the bilinear transformation which maps the points *z=0, 1,*  on to the points *w= i, 1, - i*. | CO4 | An | 6 |
|  | b. | Using Cauchy’s Residues theorem, evaluate , where *C* is *| z | =3.* | CO4 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Find the Laplace Transform of . | CO5 | A | 6 |
|  | b. | Find using partial fraction method. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find the complete integral of | CO3 | A | 4 |
|  | b. | Solve the Lagrange’s linear equation  . | CO3 | A | 8 |
|  |  |  |  |  |  |
| 22. |  | Solve . | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Prove that *u(x, y) = 2x – x3 – 3xy2*is a harmonic function, and find the corresponding analytic function *f(z).* | CO4 | An | 8 |
|  | b. | Find . | CO5 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A tightly stretched string has its ends fixed at x=0 and x=l. At time t=0 the string is given a shape defined by *y(x,0) =*) and then released. Find the displacement at any point x of the string at any time t > 0. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
|  | The student will be able to |
| **CO1** | Evaluate surface area and volume using a definite integral. |
| **CO2** | Compute solutions of first- and second-order ODEs. |
| **CO3** | Classify different types of higher-order ODEs and their solutions. |
| **CO4** | Construct harmonic and bilinear transformations. |
| **CO5** | Evaluate a definite integral using complex integration. |
| **CO6** | Apply PDE concepts to solve the boundary value problems. |



**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA1012** | **Duration** | **3hrs** |
| **Course Title** | **VECTOR SPACES AND LAPLACE TRANSFORM** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The geometric series  converges for \_\_\_\_\_. | | CO1 | R | 1 |
| 2. | A series  is absolutely convergent if \_\_\_\_\_ is convergent. | | CO1 | U | 1 |
| 3. | State the dimension of the vector space | | CO2 | R | 1 |
| 4. | Write the matrix corresponding to the linear transformation T(x)=5x. | | CO2 | U | 1 |
| 5. | When is a vector said to be irrotational?. | | CO3 | R | 1 |
| 6. | What is the curvature of a plane curve?. | | CO3 | U | 1 |
| 7. | Find the inner product  for the vectors  and | | CO4 | R | 1 |
| 8. | Two vectors u and v are said to be orthogonal if\_\_\_\_\_. | | CO4 | U | 1 |
| 9. | What is the value of  . | | CO5 | R | 1 |
| 10. | Find the value of value of  . | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Test the convergence of the sequence | | CO1 | An | 3 |
| 12. | Verify whether the vectors (1, 1, 0), (2, 1, 1), and (3, 0, 3) are linearly independent or not. | | CO2 | A | 3 |
| 13. | Prove that  is solenoidal. | | CO3 | An | 3 |
| 14. | Calculate the distance between the vectors (7, 1) and (3, 7). | | CO4 | A | 3 |
| 15. | Find the value of | | CO5 | E | 3 |
| 16. | Find the value of  . | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Test the convergence of the series | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Prove that  defined by  is a linear transformation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | A particle is moving along the curves, and  , where t is the time. Find the velocity, speed and acceleration at t=1. | CO3 | E | 6 |
|  | b. | Find the directional derivative of  at (1, 0, 1) in the direction of . | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. |  | Let W = Span{x1,x2,X3}, construct an orthonormal basis for W using Gram Schmidt method, where | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Find the Laplace transform of the following functions | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Find the Laplace transform of the following functions.  (i)  (ii) | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Find  using method of partial fraction. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve  given using Laplace transform | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Formulate the convergence and divergence of sequence and series |
| **CO2** | Analyze images using linear transformation. |
| **CO3** | Relate vector spaces with Electromagnetic field. |
| **CO4** | Construct Orthonormal basis. |
| **CO5** | Evaluate Laplace Transform of standard functions |
| **CO6** | Apply Inverse Laplace Transform to solve Ordinary Differential equations. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA1014** | **Duration** | **3hrs** |
| **Course Title** | **MATRICES, NUMERICAL METHODS AND TRANSFORMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Cayley - Hamilton Theorem. | | CO1 | R | 1 |
| 2. | Write the matrix form of the quadratic form 3x2 + 5y2 + 3z2 -2yz +2zx – 2xy. | | CO1 | U | 1 |
| 3. | To use Simpson’s 1/3 rule, the number of subintervals should be -----. | | CO2 | R | 1 |
| 4. | In Newton - Raphson Method, xn+1 = -------. | | CO2 | R | 1 |
| 5. | Write the Taylor’s series expansion of y(x3). | | CO3 | U | 1 |
| 6. | In fourth order Runge-Kutta method, *k4* = ------. | | CO3 | R | 1 |
| 7. | The Laplace Transform of is ------. | | CO6 | U | 1 |
| 8. | Write the formula for L(yiv(t)). | | CO6 | R | 1 |
| 9. | State the Linearity property of Fourier Transforms. | | CO6 | R | 1 |
| 10. | For any constants a and b, Z=------. | | CO4 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Two eigen values of the matrix are 1 and 2. Find the third eigen value. | | CO1 | An | 3 |
| 12. | Construct the Difference table for the below data.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 5 | 6 | 9 | 11 | |  | 12 | 13 | 14 | 16 | | | CO2 | A | 3 |
| 13. | Compute *y(*0.1) using Euler’s method given . | | CO2 | An | 3 |
| 14. | Find the Laplace Transform of | | CO3 | A | 3 |
| 15. | Find the Fourier Cosine Transform of *e – ax*. | | CO6 | An | 3 |
| 16. | Find Z[n]. | | CO5 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Compute the eigen values and the eigenvectors of the matrix . | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Using Bisection Method, calculate the best approximate root of the equation *f(x) = x3 – 4x – 9 = 0* correct to 3 decimal places. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Given that , compute *y(0.1)* and *y(0.2)* by using Runge – Kutta method of order 4. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Find using inverse Laplace transform. | CO3 | A | 8 |
|  | b. | Find the Laplace transform of *te4t sin3t.* | CO3 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Find the Fourier Transform of . | CO6 | A | 6 |
|  | b. | Using half range Fourier Transform, evaluate . | CO6 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Solve , up to three iterations, by using Liebmann’s iterative method, the boundary conditions are given below: | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate by taking six uniform subintervals, using  (i) Trapezoidal rule (ii) Simpson’s one - third rule (iii) Simpson’s three - eighth rule. | CO2 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Solve , given using Z-transform. | CO5 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
|  | The student will be able to |
| **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** | Apply difference equations solutions in their engineering fields. |
| **CO6** | Describe the different transforms techniques. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2002** | **Duration** | **3hrs** |
| **Course Title** | **DISCRETE STRUCTURES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If *A ={x, y, z, a}* and *B={x, z, e},* then find *(A ∆ B).* | | CO1 | U | 1 |
| 2. | Define a reflexive relation on a set A. | | CO1 | R | 1 |
| 3. | If f(x,y) = xy is a number theoretic function, then using primitive recursion f(x,0) = -------- | | CO2 | U | 1 |
| 4. | The value of projection function is ----- | | CO2 | R | 1 |
| 5. | If 55 players are divided into 6 teams, at least how many players are in one team? | | CO3 | U | 1 |
| 6. | Identify the value of n, if 10Cn+3 = 10 C2n+1. | | CO3 | U | 1 |
| 7. | Construct the contrapositive of the statement: If a number is divisible by 6, then it is divisible by 3. | | CO4 | U | 1 |
| 8. | If *A= {1,2,3,4,5,6},* then Identify the truth value of 30 | | CO4 | U | 1 |
| 9. | A nonempty set G together with Binary operation \* is called --------,  if \* satisfies closure, associative and identity properties. | | CO5 | R | 1 |
| 10. | The Dual of : P V(ꭋQ ᴧꭋP) is --------- | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the relation defined on A={1,2,3,4} such that aRb if a<b. Construct the matrix of R. Check whether R is a reflexive relation. | | CO1 | A | 3 |
| 12. | Find the LCM of (220,530) using prime factorization. | | CO2 | U | 3 |
| 13. | How many ways can we form a committee of 5 members with 3 men and 2 women from 10 men and 7 women? | | CO3 | U | 3 |
| 14. | If P is ‘true’, Q is ‘false’ then compute  (P↑Q) V (Q↓P). | | CO4 | A | 3 |
| 15. | Give an example of a semigroup that is not a monoid.. | | CO5 | U | 3 |
| 16. | Compute the Adjacency matrix of the following graph: | | 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={x, y, z} represented by  MR= and MS = , then compute  i) MRUS  ii) MRՈS iii) MRoS  iv) v) and vi) MSoR. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | If f and g are two functions defined on the set of real numbers, such that  f(x) = 5x-3 , g(x)=x2+1 and h(x) = 2x+3, then compute  (i)fo(fog)x (ii) ((fog)oh)x (iii) fo(goh)x | CO2 | A | 6 |
|  | b. | Find GCD of (250,195) using Euclidean Algorithm and hence find Bezout’s constants. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Prove by mathematical induction : | CO3 | A | 6 |
|  | b. | How many permutations of the letters A,B,C,D,E,F (i) contain the string ABC (ii) contain the string BCDE (iii) contain the string ABC and CDE(iv)contain the strings ABC and DE (v) begin with A and end with F (vi) A and F occupy the end places . | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Check whether (P→Q) ᴧ (ꭋP→R) is a Tautology. | CO4 | A | 6 |
|  | b. | Prove that (P→Q) is equivalent to (ꭋP ∨ Q). | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Find i)Principal Disjunctive Normal Form PDNF and  ii.) Principal Conjunctive Normal Form PCNF of (P V Q) ᴧ(ꭋP V QVR). | CO4 | An | 6 |
|  | b. | Prove that G= {} is a Group under matrix multiplication. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Let A =  and =  =  be permutations of A   1. Compute 2. Compute 3. Is  even or odd 4. Find 5. Express as product of disjoint cycles | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | **Evaluate the following expressions**  (i) ∗ − 8 5 / + 4 2 3  (ii) 8 5 – 4 2 + 3 / ∗ | CO6 | A | 6 |
|  | b. | (i) Construct Euler circuit:    (ii) Construct Hamiltonian Circuit | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Find minimum spanning tree of the graph: | CO6 | A | 6 |
|  | b. | Find Prefix, Infix, Postfix Expressions of the following Tree. | CO6 | A | 6 |

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

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

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2006** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF STATISTICS AND PROBABILITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define a primary data. | | CO1 | R | 1 |
| 2. | Describe the nominal scale of data with an example. | | CO1 | U | 1 |
| 3. | If the coefficient of variation of price index of two articles X and Y are 2.03 and 2.30, then the article that has more variable price than the other is ------. | | CO2 | R | 1 |
| 4. | If and then compute the mean deviation from mean. | | CO2 | U | 1 |
| 5. | Define the positive correlation with an example. | | CO3 | R | 1 |
| 6. | Find the correlation coefficient between the maximum rate of data transfer across a network path (bandwidth in mbps) and the time it takes for data to travel from source to destination (latency in milliseconds), given that the regression coefficients are 0.4 and 0.9. | | CO3 | U | 1 |
| 7. | List the components of a Time Series. | | CO4 | R | 1 |
| 8. | State an application of Time Series Analysis. | | CO4 | U | 1 |
| 9. | If A and B are independent events such that P(A) =2/5 and P(B)=3/4 then find P(AՈB). | | CO5 | R | 1 |
| 10. | If A and B are any two random events such that P(A) = 1/2, P(B)=1/3 and  P(AՈB)= 1/12 then find P(B/A). | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the components of a Box plot. | | CO1 | U | 3 |
| 12. | Find the quartile deviation of the following data: 15, 3, 22, 19, 72, 10, and 42. | | CO2 | U | 3 |
| 13. | A group of athletes participated in two competitions, and their rankings are given below. Find the rank correlation coefficient between their performances in both the events.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Ranks in Competition A | 1 | 4 | 3 | 2 | 5 | | Ranks in Competition B. | 3 | 4 | 2 | 1 | 5 | | | CO3 | U | 3 |
| 14. | Fit a trend line to the following data by freehand method:     |  |  |  |  |  | | --- | --- | --- | --- | --- | | Year | 2016 | 2017 | 2018 | 2019 | | Production of coal in tonnes | 25 | 23 | 26 | 24 | | | CO4 | U | 3 |
| 15. | If eight coins are thrown simultaneously then find probability of getting exactly five heads. | | CO5 | U | 3 |
| 16. | If P(A)=0.3,P(B)=0.6 and  P(AՈB)=0.2   then find ). | | 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. | From the following table of income(X) and percentage expenditure on food(Y) for 25 families, construct a bivariate frequency table.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | Y | X | Y | X | Y | X | Y | X | Y | | 5508 | 12 | 9250 | 25 | 6805 | 13 | 6023 | 29 | 6890 | 11 | | 6230 | 14 | 7108 | 26 | 9006 | 25 | 7556 | 27 | 5237 | 12 | | 9208 | 18 | 6400 | 20 | 8256 | 16 | 8923 | 18 | 8170 | 18 | | 6007 | 16 | 6126 | 18 | 7556 | 15 | 5874 | 21 | 8846 | 17 | | 8106 | 15 | 6907 | 12 | 6257 | 23 | 6433 | 19 | 9005 | 19 | | CO1 | A | 6 |
|  | b. | Draw a Pie Diagram for the following data of Sixth five year Plan.   |  |  | | --- | --- | | Agriculture and Rural development | 12.9% | | Irrigation, etc | 12.5% | | Energy | 27.2% | | Industry and Minerals | 15.4% | | Transport, Communication, etc | 15.9% | | Social services and others | 16.1% | | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | The sales data of a product (in terms of the number of units sold over 85 days) is grouped into the following frequency distribution:   |  |  | | --- | --- | | Units sold | frequency | | 20-40 | 6 | | 40-60 | 9 | | 60-80 | 11 | | 80-100 | 14 | | 100-120 | 20 | | 120-140 | 15 | | 140-160 | 10 |   Calculate the mean number of units sold per day. Determine the median number of units sold and the mode of the distribution. | CO2 | A | 6 |
|  | b. | The following are the scores of two batsmen A and B in a series of innings.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A | 12 | 115 | 6 | 73 | 7 | 19 | 119 | 36 | 84 | 29 | | B | 47 | 12 | 16 | 42 | 4 | 51 | 37 | 48 | 13 | 0 |   Determine the more efficient and the more consistent player. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | From the following data, find the two lines of Regression. Predict the production index when the aptitude score is 92. Estimate the test score when the production index is 75.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Aptitude score | 60 | 68 | 65 | 70 | 72 | | Productivity index | 68 | 60 | 72 | 80 | 85 | | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A factory records the number of units produced over a period of 8 months. The management wants to see the overall trend in production by applying 5-point moving average. Plot the actual and trend values on a graph. Comment on the trend in sales.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Month | Jan | Feb | Mar | Apr | May | June | July | Aug | | Units produced | 300 | 320 | 310 | 340 | 360 | 380 | 370 | 390 | | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | The chances of A,B and C becoming general manager of a 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 then find the probability that Mr. A has been appointed as general manager. | CO5 | A | 6 |
|  | b. | In a shooting test, the probability of hitting the target is ½ for A, 2/3 for B and ¾ for C. If all of them fire at the target, find the probability that (i) atleast one hits the target (ii) exactly one hits the target (iii) none hits the target. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Apply method of least squares and find a straight line trend of the following data:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | Production of steel  (tonnes) | 80 | 90 | 92 | 83 | 94 | 99 | 92 | | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A random variable X has the following probability distribution:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | x | -2 | -1 | 0 | 1 | 2 | 3 | | P(x) | 0.1 | k | 0.2 | 2k | 0.3 | 3k |   (i)Find the value of k (ii)Find P(X<1) (iii) Find P(-2<X<2)  (iv) Find P(X<1 / -2<X<2) (v) Find the cumulative distribution function, CDF of X. (vi)Find the mean of X (vii)Find the variance of X. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Fit a Poisson distribution to the following data, and find the theoretical frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | | f | 211 | 90 | 19 | 5 | 0 | | CO6 | A | 6 |
|  | b. | The execution times of a certain algorithm on a large dataset are normally distributed with a mean of 50 milliseconds and a standard deviation of 5 milliseconds. Find the probability that a randomly selected execution time will be (i) less than 45 milliseconds (ii) more than 55 milliseconds (iii) between 45 and 55 milliseconds. | CO6 | A | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the different types of presentation of data. |
| **CO2** | Measure the central tendency and dispersion of the 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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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23MA2006** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF STATISTICS AND PROBABILITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write briefly about the characteristics of big data. Explain the different scales of measurement used in data with examples. | CO1 | U | 10 |
|  | b. | Explain the different types of data and the various ways of representing data with examples. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | The data usage (in GB) by 10 companies are 25, 29, 30, 33, 35, 37, 38, 40, 44, 48. Find the average data usage, standard deviation and co-efficient of variation. | CO2 | A | 10 |
|  | b. | The following data shows time spent by 40 customers in an e-commerce website. Calculate the average time spent by customers and the mean deviation.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Time (minutes) | 0 -10 | 10 -20 | 20 -40 | 40-60 | 60 -90 | | Frequency | 5 | 8 | 16 | 7 | 4 | | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | The scores obtained by 10 students in sports performance (X) and intelligent quotient (Y) are given below. Obtain the Spearman rank correlation coefficient.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 75 | 30 | 60 | 80 | 53 | 35 | 15 | 40 | 38 | 48 | | Y | 85 | 45 | 54 | 91 | 58 | 63 | 35 | 43 | 45 | 44 | | CO3 | A | 10 |
|  | b. | Calculate the Karl Pearson correlation coefficient for the following data and identify the type of relation between X and Y.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X | 1 | 3 | 4 | 5 | 7 | 8 | 10 | | Y | 2 | 6 | 8 | 10 | 14 | 16 | 20 | | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Obtain the regression equations of X on Y, and Y on X for the following data. Also find the value of Y when X = 73 and X = 68.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 72 | | Y | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 | | CO3 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Find the trend of profits by the method of three yearly moving averages and draw the trend line for the following data. Comment on the trend line. What is the expected profit for the year 2008?   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | | Profits  (lakhs) | 150 | 140 | 155 | 210 | 260 | 310 | 353 | 340 | | CO4 | A | 10 |
|  | b. | By the method of least square fit a straight line to the following data.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 5 | 10 | 15 | 20 | 25 | | Y | 12 | 15 | 17 | 22 | 24 | 30 | | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define time series data and explain the components of time series data with example. | CO4 | U | 10 |
|  | b. | Draw a trend line by the method of semi averages for the following data. Comment on the trend line. What is the expected sales for the year 2008?   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | | Sales  (lakhs) | 60 | 75 | 81 | 110 | 106 | 120 | | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Two dice are thrown. List the sample space S and find the probability of  obtaining (i) sum of 7 points (ii) sum of at least 10 points (iii) sum of at most 10 points(iv) sum of 12 points | CO5 | A | 10 |
|  | b. | In a company, factories A, B, C produce 20%, 30% and 50% of the total output, respectively. Of their outputs, 3%, 4% and 5% respectively are defective items. (i) Find the probability of selecting defective item from the company. (ii) If an item chosen at random was found to be defective, then find the probability that it was produced by factory B. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | 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(X<2) (iii) P(-2<X<2) (iv) Cumulative distribution function, CDF of X. (v) mean and variance of X. | CO5 | A | 10 |
|  | b. | A manufacturer of pins knows that 2% of its products are defective. If he sells pins in boxes of 100 and guarantees that not more than 4 pins will be defective, what is the probability that the box will fail to meet the guaranteed quality? | CO5 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | The weekly wages of 1000 workmen are normally distributed with mean Rs.70 and standard deviation Rs 5. Estimate the number of workers, whose weekly wages will be (i) less than Rs. 69. (ii) more than Rs.72. (iii) between Rs 69 and Rs72. | CO6 | A | 10 |
|  | b. | Fit a binomial distribution to the given data and calculate the expected frequencies.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 0 | 1 | 2 | 3 | 4 | |  | 19 | 50 | 52 | 30 | 9 | | CO6 | A | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the different types of presentation of data. |
| CO2 | Measure the central tendency and dispersion of the data. |
| CO3 | Analyse 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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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23MA2008** | **Duration** | **3hrs** |
| **Course Title** | **BASICS OF PROBABILITY AND STATISTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | A food processing plant measures the temperature of soup batches, and the recorded temperatures are 75°C, 78°C, 80°C, 79°C, and 77°C. Determine the **mean** temperature. | | CO1 | U | 1 |
| 2. | The production quantities of a food processing plant over a week are: 300, 280, 310, 290, 305, 295, and 320. Find the **range** of the production quantities. | | CO1 | U | 1 |
| 3. | A regular 6-sided die is to be rolled once. Determine the probability that a number less than 3 is rolled. | | CO2 | U | 1 |
| 4. | The probability mass function of a Poisson distribution is ------. | | CO2 | R | 1 |
| 5. | Given the regression coefficients on and on are   respectively, then the correlation coefficient r is ------. | | CO3 | U | 1 |
| 6. | If the correlation coefficient   then the regression lines are -------. | | CO3 | U | 1 |
| 7. | The standard value of Z for a two tailed test at 5% LoS is ------. | | CO4 | R | 1 |
| 8. | The statistical measures of a population are known as ------. | | CO4 | R | 1 |
| 9. | Write the prupose of sigma chart in quality control. | | CO5 | U | 1 |
| 10. | ANOVA stands for \_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | The packaging specifications for wheat bags produced by two machines in a company are provided below:   |  |  |  | | --- | --- | --- | | Machine | I | II | | Mean weight (kg) | 5.5 | 4.7 | | Standard deviation (kg) | 0.13 | 0.10 |   Determine which machine is more consistent in packaging weight using the coefficient of variation. | | CO1 | An | 3 |
| 12. | Determine the probability that a randomly selected leap year will have 53 Sundays. | | CO2 | A | 3 |
| 13. | Calculate the Spearman’s rank correlation coefficient for the following data:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Quality rank | 3 | 2 | 1 | 4 | 5 | | Satisfaction rank | 4 | 1 | 2 | 3 | 5 | | | CO3 | A | 3 |
| 14. | A university claims that the average GPA of its students is 3.2. Formulate the null and alternative hypotheses to test if the average GPA is significantly different from 3.2. | | CO4 | U | 3 |
| 15. | Given the sample standard deviation values for 10 samples drawn from a population process, construct the appropriate control charts to monitor process variability. Provide the recommendation on observed state of control in process variability.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | SD | 3.1 | 2.4 | 3.6 | 2.3 | 5.2 | 5.4 | 4.2 | 3.3 | 4.3 | 5.1 | | | CO5 | An | 3 |
| 16. | Explain the layout of Latin Square Design. | | 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 food packaging company inspects 200 food packaging rolls. The number of defects in the rolls are grouped into the following intervals:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | No. of defects (Range) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | | Frequency (no. of rolls) | 40 | 60 | 50 | 30 | 20 |   Calculate the **mean, median**, and **mode** of the number of defects. | CO1 | A | 8 |
|  | b. | A food manufacturing company produces batches of cookies. The numbers of cookies per batch in the past 10 batches are as follows: 30, 35, 40, 25, 45, 38, 32, 37, 42 & 33. Calculate the standard deviation of the number of cookies per batch. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | A food factory produces chocolate bars using three machines: Machine A, Machine B, and Machine C. The factory uses Machine A for 50% of its production, Machine B for 30%, and Machine C for the remaining 20%. The defect rates for each machine are different: Machine A has a defect rate of 4%, Machine B has a defect rate of 2% and Machine C has a defect rate of 3%. If a chocolate bar chosen at random is found to be defective then find the probability that it was produced by Machine A. | CO2 | A | 8 |
|  | b. | A coin is tossed 3 times. Determine the probability of getting (i) exactly 2 tails (ii) at least 2 tails. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | The following data relates to advertisement expenditure (in lakhs of rupees) and the corresponding sales (in Crores of rupees) of a packaged food brand:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Advertisement Expenditure (x) | 8 | 10 | 12 | 15 | 18 | | Sales (y) | 10 | 12 | 14 | 18 | 20 |   (i)Find the two regression lines. (ii) Predict the sales corresponding to the advertisement expenditure of 25 lakhs, and estimate the advertisement expenditure corresponding to a sales target of 22 crores. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | 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 is the same at 5% LOS. | CO4 | An | 6 |
|  | b. | The heights of college students in a city are normally distributed with S.D of 6cms. A sample of 100 students has mean height 158cms. Test the hypothesis that, the mean height of college students in the city is 160cms. | CO4 | An | 6 |
| 21. |  | The following data shows the measurements of 10 samples each of size 4. Find sample mean and range and also construct  and R chart and comment on the state of control of the process.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Sample Number | | | | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Measurements | | | | | | | | | | | 5 | 3 | 6 | 12 | 15 | 18 | 13 | 10 | 5 | 6 | | 12 | 15 | 18 | 9 | 15 | 17 | 16 | 20 | 15 | 14 | | 20 | 18 | 12 | 15 | 6 | 8 | 5 | 8 | 10 | 12 | | 15 | 18 | 10 | 18 | 16 | 15 | 4 | 10 | 12 | 14 | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | The mean and variance of a Binomial distribution are 8 and 6. Estimate | CO2 | A | 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, estimate the probability that number of drivers with (i) no accidents in a year (ii) more than 3 accidents in a year. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | A food factory produces packages of cookies, and they track the number of defective packages produced each day over a period of several weeks. The number of defective packages recorded for each day of the week is as follows:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Days of the week | Mon | Tue | Wed | Thurs | Fri | Sat | | Defective packages | 12 | 10 | 15 | 14 | 11 | 13 |   Test whether defective packages are uniformly distributed across the week, using a 5% significance level. | CO4 | An | 6 |
|  | b. | A researcher wants to test whether there is an association between the type of packaging (Plastic or Paper) and the customer's preference for eco-friendly products (Yes or No). A sample of 200 customers is surveyed, and the data is recorded in the following 2x2 contingency table:   |  |  |  | | --- | --- | --- | |  | Eco-friendly (Yes) | Eco-friendly (No) | | Plastic | 40 | 60 | | Paper | 30 | 70 |   Test if there is a significant relationship between packaging type and preference for eco-friendly products at a 5% significance level. | CO4 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Four doctors each test four treatment for a certain disease and observed the number of days each patients takes to recover the results are as follows (Recovery time in days):   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Doctor | Treatment | | | | | 1 | 2 | 3 | 4 | | A | 10 | 14 | 19 | 20 | | B | 11 | 15 | 17 | 21 | | C | 9 | 12 | 16 | 19 | | D | 8 | 13 | 17 | 20 |   Using randomized block design, analyze the difference between the doctor and treatment. | CO6 | An | 12 |

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

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Measure the central tendency and dispersion of the data |
| **CO2** | Apply the basic concepts of probability and to understand the distributions |
| **CO3** | Analyze the linear relationship between data |
| **CO4** | Analyze the nature of sample and apply hypothetical testing |
| **CO5** | Understand statistical quality control and construct the appropriate control charts to apply in food processing and production industry |
| **CO6** | Construct models and analyze the variance using design of experiments |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Calculate the greatest number which divides 43, 91 & 183 and leaves the same remainder in each case. | CO1 | A | 5 |
| b. | The ratio of the present ages of X and Y is 5 :6. Seven years hence, this ratio would become 6 : 7. Evaluate their present ages. | CO1 | A | 5 |
| c. | The average score of a cricket player in 11 matches is 50. If the average score in first six matches is 49 and that of the last six is 52, calculate his score in the sixth match. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 2. | a. | Using Venn diagram, identify the correct option for the statements and conclusions provided below.  **Statements:** (1) Some books are tables. (2) Some tables are mirrors.  **Conclusions:** (I) Some mirrors are books. (II) No book is mirror.  **Options:** (i) only I follows (ii) only II follows  (iii) either I or II follows (iv) neither I nor II follows  (v) both I and II follow. | CO2 | A | 6 |
|  | b. | (A) Identify the correct option for the statement and assumptions provided below.  **Statement:** Please put more people on the job to make up for the delay.  **Assumptions:** (I) Delay is inevitable in most jobs.  (II) Output will increase with more number of people on the job.  **Options:** (i) only I is implicit (ii) only II is implicit  (iii) either I or II is implicit (iv) neither I nor II is implicit  (v) both I and II are implicit.  (B) Identify the correct option for the statement and arguments provided below.  **Statement:** Should the railways immediately stop issuing free passes to all its  employees?  **Arguments:** (I) No. The employees have the right to travel free.  (II) Yes. This will help railways to provide better facility.  **Options:** (i) only I is strong (ii) only II is strong  (iii) either I or II is strong (iv) neither I nor II is strong  (v) both I and II are strong. | CO2 | A | 5 |
|  | c. | (A) Identify the correct option for the statement and conclusions provided below.  **Statement:** Population increase coupled with depleting resources is going to be the scenario of many developing countries in days to come.  **Conclusions:** (I) The population of developing countries will not continue to  increase in future.  (II) It will be very difficult for the governments of developing  countries to provide its people decent quality of life.  **Options:** (i) only I follows (ii) only II follows  (iii) either I or II follows (iv) neither I nor II follows  (v) both I and II follow.  (B) Identify the correct option for the statement and arguments provided below.  **Statement:** Severe drought is reported to have set in several parts of the country.  **Courses of Action :** (I) Government should immediately make arrangement for  providing financial assistance to those affected.  (II) Food, water and fodder should immediately be sent to  all these areas to save the people and cattle.  **Options:** (i) only I follows (ii) only II follows  (iii) either I or II follows (iv) neither I nor II follows  (v) both I and II follow. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | If ‘gorblflur’ stands for ‘fan belt’, ‘pixngorbl’ stands for ‘ceiling fan’, ‘arthtusl’ stands for ‘tile roof’, then apply the intelligence to code the word ‘ceiling tile’. | CO3 | A | 6 |
| b. | In a certain code language, ‘MONKEY’ is written as ‘OQPMGA’ and ‘ZEBRA’ is written as ‘BGDTC’. Apply the same code language to code the word ‘DEER’. | CO3 | A | 5 |
| c. | Gaurav faces towards the north. Turning to his right, he walks 25m. He then turns to his left and walks 30m. Next, he moves 25m to his right. He then turns to his right again and walks 55m. Finally he turns to the right and moves 40m. In which direction is he now from his starting point? | CO3 | A | 5 |
|  |  |  |  |  |  |
| 4. | a. | (A) Identify the alternative figure which contains figure (X) as its part.    (B) Identify the figure that completes the pattern. | CO4 | U | 8 |
|  | b. | (A) Identify the figure which is different from the rest.    (B) Select a suitable figure from the options given below    Options: | CO4 | U | 8 |
|  |  |  |  |  |  |
| 5. |  | The following table gives the sales of batteries manufactures by a company over the years. Study the table and answer the questions that follow.  NUMBER OF DIFFERENT TYPES OF BATTERIES SOLD BY A COMPANY OVER THE YEARS   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | YEAR | TYPES OF BATTERIES | | | | | | | 4AH | 7AH | 32AH | 35AH | 55AH | TOTAL | | 1992 | 75 | 144 | 114 | 102 | 108 | 543 | | 1993 | 90 | 126 | 102 | 84 | 126 | 528 | | 1994 | 96 | 114 | 75 | 105 | 135 | 525 | | 1995 | 105 | 90 | 150 | 90 | 75 | 510 | | 1996 | 90 | 75 | 135 | 75 | 90 | 465 | | 1997 | 105 | 60 | 165 | 45 | 120 | 495 | | 1998 | 115 | 85 | 160 | 100 | 145 | 605 |   (i) Which battery has the highest total sales of all seven years?  (ii) What is the difference in the number of 35AH batteries sold in 1993 and 1997?  (iii) Which year has the highest percentage of 4AH batteries sold to that of the total the number of batteries sold?  (iv) What is the approximate percentage increase in the sales of 55AH batteries in 1998 compared to that in 1992? | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. | a. | A and B can complete a piece of work in 18 days, B and C in 24 days, C and A in 36 days. If A, B and C work together, in how many days can they complete the work? | CO1 | A | 5 |
| b. | In how many different ways can the letters of the word ‘BANKING’ be arranged so that the vowels are always together? | CO1 | A | 5 |
| c. | A box contains 10 black and 10 white balls. Calculate the probability of drawing two balls of same colour. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 7. |  | The following pie-chart displays the percentage distribution of the cost in self-publishing a book. Study the pie-chart below and then answer the questions accordingly.  COST IN SELF – PUBLISHING A BOOK  (i) The publisher paid ₹21500 to the book designer for publishing a certain number of books. How much amount will be paid for promotion of the book?  (ii) Calculate the sector’s central angle which is corresponding to the amount paid on Book Designing.  (iii) The cost for editing and proofreading 4200 copies of the published books is ₹65800. Find at what price the seller would sell the books to earn 20% profit.  (iv) By how much amount the formatting of the book is lesser than editing the book? | CO5 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Outline the importance of non – verbal communication in the workplace with suitable examples. | CO6 | A | 10 |
|  | b. | Illustrate the various components of attitudes and the most important attitudes of a positive workplace. | CO6 | A | 10 |

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

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to solve problems in elementary arithmetic reasoning. |
| CO2 | Students will be able to evaluate the logical reasoning problems. |
| CO3 | Students will be able to analyse statements with verbal reasoning. |
| CO4 | Students will be able to apply non – verbal reasoning for exploring the problems. |
| CO5 | Students will be able to understand and interpret data from charts. |
| CO6 | Students will be able to develop interview skills and expertise |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **24MA1002** | **Duration** | **3hrs** |
| **Course Title** | **STATISTICAL ANALYSIS AND RANDOM PROCESS FOR BIO-TECHNOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If X is a discrete random variables with the probability mass function P(x), then | | CO1 | R | 1 |
| 2. | If F(x,y) is the cumulative distribution function of a two dimensional random variable (X,Y), then F(-∞,) =\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Calculate the mean of a Poisson distribution that approximates a **binomial distribution** B (100, 0.05). | | CO2 | U | 1 |
| 4. | The standard deviation of a normal distribution is \_\_\_\_\_. | | CO2 | R | 1 |
| 5. | State the null hypothesis. | | CO3 | R | 1 |
| 6. | The sample size used in the large sample test is\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Identify the test used to determine the relationship between two attributes. | | CO4 | U | 1 |
| 8. | Find the test of equality for two population variances F, if  and | | CO4 | U | 1 |
| 9. | State the formula is used to find the correction factor in the design of experiment. | | CO5 | R | 1 |
| 10. | The Poisson process is a \_\_\_\_\_\_\_ process. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | In a biological system, the probability density function of a continuous random variable X, representing a certain biomolecular process is given by , x>0. Find the value of k and the average behavior of the process. | | CO1 | A | 3 |
| 12. | A biotechnology company produces batches of 100 microtubes for storing DNA samples. On average, 1% of the microtubes in a batch are defective. Using the Poisson distribution, If a batch is selected at random, find the probability that the batch contains no defective microtubes. | | CO2 | A | 3 |
| 13. | A pharmaceutical researcher claims that a newly developed drug takes an average of 15 minutes to dissolve in the bloodstream. To test this claim, a random sample of 36 patients is observed, yielding an average dissolution time of 17 minutes with a standard deviation of 3 minutes. Test whether the actual average dissolution time differs significantly from the claimed 15 minutes. | | CO3 | A | 3 |
| 14. | The following data represent two groups of individuals classified based on their genetic predisposition to a specific disease and their response to a particular drug.   |  |  |  | | --- | --- | --- | | Predisposed/Responders | Drug Responders | Non-Responders | | Genetically Predisposed | 83 | 57 | | Not Genetically Predisposed | 45 | 68 |   Using test at 5% level of significance, evaluate the association between genetic predisposition and drug response. | | CO4 | A | 3 |
| 15. | State the layout of Latin Square Design. | | CO5 | R | 3 |
| 16. | Determine whether the Poisson process is given by , r = 0, 1, 2… is covariance stationary. | | 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. |  | The following table shows the probability distribution for a discrete random variable X that represents molecular counts in a biological process.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Molecular Counts (X) | 0 | 1 | 2 | 3 | 4 | 5 | | P(X) | k | 2k | 3k | 4k | 5k | 6k |   Compute the value of k, mean and variance of molecular counts in a biological process. | CO1 | A | 12 |
| 18. |  | In a biological data analysis context, the joint probability mass function of two discrete random variables X and Y, representing biological measurements in a biochemical process, is defined as p(x,y) = k(2x+3y) , where x=0,1,2 and y=1,2,3. Determine (i) The value of k (ii) The marginal probability distributions of X and Y (iii) The conditional probability distributions of X/Y and Y/X (iv) The probability distribution of X+Y. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Fit a binomial distribution to the given biological data and compute the expected frequencies:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | No of Mutated Genes per Sample (x) | 0 | 1 | 2 | 3 | 4 | | Observed Number of Samples (f) | 5 | 29 | 36 | 25 | 5 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | A clinical study surveyed 400 patients diagnosed with Condition A and 600 patients diagnosed with Condition B to determine their preference for a newly developed treatment. Among them, 200 patients with Condition A and 325 patients with Condition B supported adopting the new treatment. Perform the hypothesis that the proportion of patients supporting the new treatment between the two conditions at a 5% significance level. | CO3 | A | 7 |
|  | b. | Describe the working rule of hypothesis testing. | CO3 | R | 5 |
|  |  |  |  |  |  |
| 21. |  | A group of 10 cell cultures treated with compound A and another group of 8 cell cultures treated with compound B exhibited the following increase in biomarker expression (in arbitrary units).   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Compound A | 5 | 6 | 8 | 1 | 12 | 4 | 3 | 9 | 6 | 10 | | Compound B | 2 | 3 | 6 | 8 | 10 | 1 | 2 | 8 | - | - |   Does this indicate the superiority of compound A over compound B? | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Four doctors each test four treatment for a certain disease and observed the number of days each patients takes to recover the results are as follows (Recovery time in days):   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Doctor | Treatment | | | | | 1 | 2 | 3 | 4 | | A | 10 | 14 | 19 | 20 | | B | 11 | 15 | 17 | 21 | | C | 9 | 12 | 16 | 19 | | D | 8 | 13 | 17 | 20 |   Using randomized block design, analyze the difference between the doctor and treatment. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | The enzyme activity of a certain type of protein is normally distributed with a mean of 100 units and a standard deviation of 5 units. What percentage of protein samples are expected to have an enzyme activity (i) Between 95 and 105 units (ii) Less than 90 units (iii) More than 107 units. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | 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 | 12 |

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

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

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **24MA1004** | **Duration** | **3hrs** |
| **Course Title** | **LINEAR ALGEBRA, TRANSFORMS AND NUMERICAL METHODS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | If the eigen values of the matrixare 1,4 and 5, then find the eigen values of | | CO1 | R | 1 |
| 2. | Find the matrix corresponding to the quadratic form | | CO1 | U | 1 |
| 3. | The roots of an equation  lies between \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | The formula used to find a root of an equation using Newton Raphson method is \_\_\_\_. | | CO2 | R | 1 |
| 5. | Write the Laplace equation to solve the partial differential equations. | | CO3 | U | 1 |
| 6. | The Milne’s predictor formula is \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | Find | | CO4 | U | 1 |
| 8. | Calculate | | CO4 | R | 1 |
| 9. | Find | | CO5 | U | 1 |
| 10. | Draw the complete graph | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the sum and product of the eigen values of the matrix | | CO1 | U | 3 |
| 12. | Construct the difference table for the following data.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 10 | 20 | 30 | 40 | 50 | | y | 12 | 7 | 8 | 54 | 49 | | | CO2 | U | 3 |
| 13. | Classify the partial differential equation | | CO3 | U | 3 |
| 14. | Compute | | CO4 | U | 3 |
| 15. | Compute | | CO5 | U | 3 |
| 16. | Find the Hamiltonian circuit 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. |  | Evaluate the eigen values and eigen vectors of the matrix | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate by using Trapezoidal rule, Simpson’s 1/3rd rule and Simpson’s 3/8th rule by taking | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Find the value of y at x= 0.1 given using Taylor’s series method. | CO3 | A | 7 |
|  | b. | Find the value of at given that  using Euler’s method by taking | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. |  | Solve given and using Laplace transform. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Solve given using Z-transform. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Apply the fourth order Runge-Kutta method to find given that | CO3 | A | 6 |
|  | b. | Find the inverse Z-transform of | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate  using partial fraction method. | CO4 | A | 8 |
|  | b. | Find the rank, index, signature and nature of the quadratic form | CO1 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Find the maximum flow and minimum cut for the following graph. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze quadratic form using orthogonal transformation of matrix. |
| **CO2** | Evaluate integrals using numerical techniques. |
| **CO3** | Solve differential equations using numerical techniques. |
| **CO4** | Describe the different transform techniques. |
| **CO5** | Use Z-transform techniques in solving engineering problems. |
| **CO6** | Demonstrate knowledge in different types of graph. |