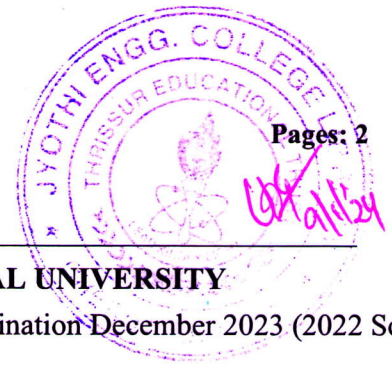


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221TCS002122301



Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester M.Tech Degree Regular and Supplementary Examination December 2023 (2022 Scheme)

Discipline: COMPUTER SCIENCE AND ENGINEERING

Course Code & Name: 221TCS002 FOUNDATIONS OF COMPUTER SCIENCE

Normal Distribution tables are permitted during the examination

Max. Marks: 60

Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks

Marks

- 1 Use mathematical induction to prove that 5 divides $n^5 - n$ whenever n is a non-negative integer. (5)
- 2 Is the set of real numbers countable? prove your answer. (5)
- 3 Solve the recurrence relation $a_n - 3a_{n-1} = 5 \cdot (7^n)$, $n \geq 1$, $a_0 = 2$ (5)
- 4 In a certain factory turning razor blades, there is a small chance of $1/500$ for any blade to be defective. The blades are in packets of 10. Use Poisson's distribution to calculate the approximate number of packets containing
 - (i) No defective blades
 - (ii) One defective blade
 - (iii) Two defective blades respectively in a consignment of 10000 packets.(5)
- 5 In a set of 'm' randomly selected people, what is the probability that at least two people share the same birthday? (5)

PART B

Answer any 5 questions. Each question carries 7 marks

- 6 20 students are participating in an after-school program offering classes in Yoga Bridge course and Painting. Each student must take at least one of these 3 classes but may take 2 or all the 3 classes. Ten students take yoga, 13 students take bridge and 9 take Painting. Nine students take at least 2 classes. How many students are taking all the 3 courses? (7)
- 7 (a) Define Pigeon hole principle (3+4)

(b) What is the minimum number of students required in a maths class to be sure that at least 6 will receive the same grade if there are 5 possible grades such as A,B,C,D,E.

- 8 The harmonic numbers H_K , $K = 1,2,3 \dots$ are defined as (7)
 $H_K = 1 + 1/2 + 1/3 + \dots + 1/K$. Use mathematical induction to show that
 $H_{2N} \geq 1 + N/2$.
- 9 Determine the number of positive integers 'n' where $1 \leq n \leq 100$ and 'n' is not divisible by 2,3, or 5. (7)
- 10 Ram and Sita are planning to apply for a job. The probability that Ram will apply for a job is $1/4$, Probability that Ram will apply for a job given Sita applies for the job is $1/2$. The probability that Sita applies for a job given that Ram applies is $1/3$. Determine the probability that Ram does not apply for the job given that Sita does not apply for the job. (7)
- 11 Prove that the inverse of the product of two elements of a group G is equal to the product of the inverse taken in reverse order. (7)
- 12 Suppose that a person deposits 20000 Rs in a savings account at a bank yielding 11% per year with interest compounded annually. How much will be in the account after 40 years? (Strictly solve the problem using the concept of recurrence relation) (7)
