Code No: (R22MA401BS) | R22 | H.T.No. | | | 8 | R | | | | | |

**CMR ENGINEERING COLLEGE: : HYDERABAD**
**UGC AUTONOMOUS**
**II–B.TECH–II–Semester End Examinations (Supply) -December- 2025**
**MATHEMATICAL AND STATISTICAL FOUNDATIONS**
**(CSM)**

**[Time: 3 Hours]** **[Max. Marks: 60]**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART-A** **(10 Marks)**

| | | | |
|---|---|---|---|
| 1. | a) | Identify the formula for the expectation of a random variable. | [1M] |
| | b) | Recall the additive rule of probability. | [1M] |
| | c) | Define a binomial distribution. | [1M] |
| | d) | Name the parameters of a normal distribution. | [1M] |
| | e) | State the null hypothesis for testing the difference of proportions. | [1M] |
| | f) | Define point estimation in the context of statistics. | [1M] |
| | g) | Define the term "fitted model" in the context of regression analysis. | [1M] |
| | h) | Define simple linear regression. | [1M] |
| | i) | Define linear congruences with example. | [1M] |
| | j) | List the steps involved in factorizing an integer into its prime factors. | [1M] |

**PART-B** **(50 Marks)**

| | | | |
|---|---|---|---|
| 2. | a) | Explain how to determine the sample space for a simple experiment. | [5M] |
| | b) | Calculate the probability of getting at least one head in three-coin tosses. | [5M] |

**OR**

3. Calculate the cumulative distribution function (F(x)) of a continuous random variable given its PDF. [10M]

$$f(x) = \begin{cases} kxe^{-\lambda x}, for\ x \geq 0, \lambda > 0 \\ 0, otherwise \end{cases}$$

4. Write the procedure for testing of hypothesis z-test for a sample mean given the population mean and standard deviation. [10M]

**OR**

5. Determine the probability of observing 4 events in each interval if the average rate of events is 2 per interval using the Poisson distribution. [10M]

6. Discuss the briefly about Type-I and Type II errors. [10M]

**OR**

7. Compare the use of z-test and t-test in hypothesis testing for large samples. [10M]

8. Compute the coefficient of correlation using Karl Pearson's formula for a given dataset. [10M]

| wages | 100 | 102 | 102 | 102 | 100 | 99 | 97 | 98 | 96 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cost of living | 98 | 99 | 99 | 97 | 95 | 92 | 95 | 94 | 90 | 91 |

**OR**

9. Differentiate between the least squares estimator and other estimation methods. [10M]

10. Apply the concept of congruences to solve the linear congruence $15x \equiv 12(mod21)$. [10M]

**OR**

11. State and prove the fundamental theorem of arithmetic. [10M]

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