R13

II B. Tech I Semester Supplementary Examinations, Feb/March - 2022
PROBABILITY AND STATISTICS
(Civil Engineering)

Time: 3 hours   Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**
4. Statistical tables are required
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PART –A

1. a) There are three boxes. in box I, 11 cards are numbered 1 to 11 and in box II, 5 cards are there numbered 1 to 5. A box is chosen and a card is drawn. If the card shows an even number then another card is drawn from the same box. If card shows an odd number another card is drawn from the other box. Find the probability that (i) both are even (ii). Both are odd (iii). If both are even what is the probability that they are from box1.   **4M**

   b) If Y~ Uniform (0,1), find $E[Y^k]$ using $M_Y(s)$.   **3M**

   c) In a random sample of 60 workers. The average time taken by them to get to work is 33.8 minutes with a standard deviation of 6.1 minutes. Can we reject the null hypothesis $\mu = 32.6$ minutes in favour of alternative null hypothesis $\mu > 32.6$ at $\alpha = 0.025$ level of significance?   **4M**

   d) Explain the procedure generally followed in testing of hypothesis.   **3M**

   e) Derive the normal equations to fit the parabola $y = a + bx + cx^2$.   **4M**

   f) Explain the terms 'Chance cause and assignable cause'.   **4M**

PART -B

2. a) For the continuous probability function $f(x) = k\ x^2 e^{-x}$ where $x \geq 0$. Find (i) k (ii) Mean (iii) Variance.   **8M**

   b) Out of 800 families with 5 children each, how many would expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) atleast one boy? Assume equal probabilities for boys and girls.   **8M**

3. a) Show that the normal distribution has $M(t) = M(t) = e^{t\mu} + 1/2 t^2 \sigma^2$ which exists for all t. Also verify the first two moments.   **8M**

   b) Let X be distributed as normal with mean μ and variance σ^2. Use moment generating functions to show that $Z = \frac{X-\mu}{\sigma}$ has a standard normal distribution.   **8M**

4. a) In an examination it is laid down that a student passes if he secures 40% are more. He is placed in the first, second and third division according as he secures 60% are more marks, between 50% and 60% marks and marks between 40% and 50% respectively. He gets a distinction in case he secures 75% or more. It is noticed from the results that 10% of the students failed in the examination, whereas 5% of them obtained distinction. Calculate the percentage of students placed in the second division. (Assume normal distribution of marks).   **8M**

   b) Samples of three kinds of materials, subjected to extreme temperature changes, produced the results shown in the following table: **8M**

	Material A	Material B	Material C	Total
Crumbled	41	27	22	90
Remained intact	79	53	78	210
Total	120	80	100	300

   Use the 0.05 level of significance to test whether, under the stated conditions, the probability of crumbling is the same for the three kinds of materials.

5. An airline claims that the typical flying time between two cities is 56 minutes.   16M
(i) Formulate a test of hypotheses with the intent of establishing that the population mean flying time is different from the published time of 56 minutes.
(ii) If the true mean is 50 minutes, what error can be made? Explain your answer in the context of the
problem.
(iii) What error could be made if the true mean is 56 minutes?

6. a) By the method of least squares fit a parabola of the form $y = a + bx + cx^2$ for   the   8M
following data:

X:	2	4	6	8	10
y:	3.07	12.85	31.47	57.38	91.29

   b) Fit a second-degree parabola to the data   8M

x :	0	1	2	3	4
y :	1.0	1.8	1.3	2.5	6.3

7. a) Discuss the basic principles underlying control charts. Explain in brief how control   8M
limits are determined for (i) P- chart (ii) C-chart.
   b) A drilling machine bores holes with a mean diameter of 0.5230cm and a standard   8M
deviation of 0.0032cm. Calculate the 2-sigma and 3-sigma upper and lower control limits for mean of samples 4, and prepare a control chart.