**20MA301**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **January, 2024** | **Common to CE, CM, CB, CS, DS, EC, EE, EI & ME** | | |
| **Third Semester** | **Probability and Statistics** | | |
| **Time:** Three Hours | | **Maximum:** 70 Marks | |
| ***Answer question 1 compulsory.*** | | | **(14X1 = 14Marks)** |
| ***Answer one question from each unit.*** | | | **(4X14=56 Marks)** |
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|  |  |  | CO | BL | M |
| 1 | a) | Define probability density function. | CO1 | L1 | 1M |
|  | b) | Write any two properties of Normal distribution. | CO1 | L1 | 1M |
|  | c) | When do you say that two random variables are independent? | CO1 | L1 | 1M |
|  | d) | If a random variable has the gamma distribution with α = 2 and β = 3, find the mean and variance. | CO1 | L1 | 1M |
|  | e) | State Central limit theorem. | CO2 | L1 | 1M |
|  | f) | Find the value of the population correction factor for n = 10 and N = 500. | CO2 | L1 | 1M |
|  | g) | Find the value of **F0.95 (8, 8).** | CO2 | L1 | 1M |
|  | h) | Define Type-I error and Type-II error. | CO2 | L1 | 1M |
|  | i) | Write (1- α)100 % Confidence interval for population Variance **σ 2** | CO3 | L1 | 1M |
|  | j) | Write the test statistic for Matched pairs Comparisons test. | CO3 | L1 | 1M |
|  | k) | What is unbiased estimator of population variance **σ 2 ?** | CO3 | L1 | 1M |
|  | l) | Write the normal equations to fit the curve y = a + bx | CO4 | L1 | 1M |
|  | m) | What is correlation? | CO4 | L1 | 1M |
|  | n) | State the principle of least squares. | CO4 | L1 | 1M |
| **Unit-I** | | | | | |
| 2 | a) | If the probability density of a random variable is given by .  Then find (i) the value of (ii) the probability that the random variable takes on a value between 1/4 and 3/4 and (iii) mean | CO1 | L3 | 7M |
|  | b) | In a certain city, the daily consumption of electric power (in millions of kilowatt- hours) can be treated as a random variable having a gamma distribution with α = 3 and β = 2. If the city’s power plant has a daily capacity of 12MKWH, what is the probability that this power supply will be inadequate on any given day? | CO1 | L3 | 7M |
| **(OR)** | | | | | |
| 3 | a) | Given a random variable having the normal distribution with µ= 16.2 and σ2 = 1.5625, find the probabilities that it will take on a value (i) greater than 16.8 (ii) less than 14.9 and (iii) between 13.6 and 18.8. | CO1 | L3 | 7M |
|  | b) | The joint density of two continuous random variables X and Y    (i) Find the value of . (ii) Find (iii)Find | CO1 | L3 | 7M |
| **Unit-II** | | | | | |
| 4 | a) | Hard disks for computers must spin evenly, and one departure from level is called roll. The roll for any disk can be modelled as a random variable having mean 0.2250 mm and standard deviation 0.0042 mm. The sample mean roll will be obtained from a random sample of 40 disks. What is the probability that will lie between 0.2245 and 0.2260 mm | CO2 | L3 | 7M |
| **P.T.O**  **20MA301** | | | | | |
|  | b) | Suppose we want to establish that the thermal conductivity of a certain kind of cement brick differs from 0.340, the value claimed. To test the claim a random sample of 35 determinations yielded a mean of 0.343 and a standard deviation of 0.010. Use a 0.05 level of significance to test whether to accept or reject the claim. | CO2 | L3 | 7M |
| **(OR)** | | | | | |
| 5 | a) | A process for making certain bearings is under control if the diameters of the bearings have a mean of 0.5000cm. what can we say about this process if a sample of 10 of these bearings has a mean diameter of 0.5060 cm and a standard deviation of 0.0040 cm. | CO2 | L3 | 7M |
|  | b) | The specifications for a certain kind of ribbon call for a mean breaking strength of 180 pounds. If five pieces of the ribbon (randomly selected from different rolls) have a mean breaking strength 169.5 pounds, test the null hypothesis μ = 180 pounds against the alternative hypothesis μ < 180 pounds at the 0.01 level of significance. Assume that the population distribution is normal. | CO2 | L3 | 7M |
| **Unit-III** | | | | | |
| 6 | a) | The dynamic modulus of concrete is obtained for two different concrete mixes. For the first mix, n1 = 33, = 115.1 and s1 = 0.47 psi. For the second mix, n2 = 31, = 114.6 and s2 = 0.38. Test with α = 0.05, the null hypothesis of equality of mean dynamic modulus versus the two-sided alternative. | CO3 | L3 | 7M |
|  | b) | A random sample of 6 steel beams has a mean compressive strength of 58,392 psi with a standard deviation of 648 psi. Test the null hypothesis psi for the compressive strength of the given kind of steel against the alternative hypothesis psi. Use 0.05 level of significance | CO3 | L3 | 7M |
| **(OR)** | | | | | |
| 7 | a) | To compare two kinds of bumper guards, 6 of each kind, were mounted on a certain kind of compact car. Then each car was run into a concrete wall at 5 miles per hour and the following are the costs of the repairs ( in rupees)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Bumper Guard 1 | 407 | 448 | 423 | 465 | 402 | 419 | | Bumper Guard 2 | 434 | 415 | 412 | 451 | 433 | 429 |   Use the 0.01 level of significance to test whether the difference between the  two-sample means is significant. | CO3 | L3 | 7M |
|  | b) | It is desired to determine whether there is less variability in the silver plating done by company1 than in that done by company 2. If independent random samples of size 12 of the two companies work yield s1 = 0.035mil and s2 = 0.062 mil, test the null hypothesis **σ 1 2 = σ 2 2** against the alternative hypothesis **σ 1 2 < σ 2 2** at the 0.05 level of significance | CO3 | L3 | 7M |
| **Unit-IV** | | | | | |
| 8 | a) | In a random sample of 600 cars making a right turn at a certain instructions, 157 pulled into the wrong lane. Test the null hypothesis that actually 30 % of all drivers make this mistake at the given intersection, using the alternative hypothesis p ≠ 0.30 at the level of significance α = 0.05. | CO4 | L3 | 7M |
|  | b) | Fit a second degree polynomial **y = a + bx + cx2** following data by least squares method..   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 1 | 5 | 7 | 9 | 12 | | y | 10 | 15 | 12 | 15 | 21 | | CO4 | L3 | 7M |
| **(OR)** | | | | | |
| 9 |  | As a part of the investigation of the collapse of the roof the roof of a building, a testing laboratory is given all the available bolts that connected the steel structure at the three different positions on the roof. The forces required to shear each of these bolts are as follows.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Position 1 | 90 | 82 | 79 | 98 | 83 | 91 |  | | Position 2 | 105 | 89 | 93 | 104 | 89 | 95 | 86 | | Position 3 | 83 | 89 | 80 | 94 |  |  |  |   Perform an analysis of variance at the 0.05 level of significance whether the differences among the sample means at the 3 positions are significant. | CO4 | L3 | 14M |

