22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B.Agri.	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Probability and Statistic *(SH602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is absolute and relative Measure of Dispersion? Construct a Box plot from the following data of marks of students as: [1+5]

Marks	10-20	20-30	30-40	40-50	50-60
No. of students	2	6	22	13	7

2. State the law of addition of probability. In a training, the 70% of persons achieved a rating of Satisfactory. Of those as rated as Satisfactory, 80% had Acceptable Scores on the personality test. Of those rated as Unsatisfactory, 35% had Acceptable Scores. Find the probability that an applicant would be a Satisfactory trainee given the Acceptable scores on personality test. [2+4]
3. Define Negative binomial distribution with its important characteristics. [5]
4. A particularly long traffic light on your morning commute is green 20% of the time that you approach it. Assume that each morning represents as independent trial. [5]
   i) Over five mornings, what is the probability that the light is green on exactly one day?
   ii) Over 20 mornings, what is the probability that the light is green on exactly four days?
5. The distribution function for a random variable X is [5]

$$F(x) = 1 - e^{-2x} \text{ for } x \geq 0$$
$$= 0 \quad \text{for } x < 0$$

   i) Find $P(X > 2)$
   ii) Find mean and variance of the variable X.
6. Define Standard Normal Distribution with their respective probability density function and describe its properties. [5]
7. An article in Wear (Vol.152, 1992, pp.171-181) presents data on the fretting wear of mild steel and oil viscosity. Representative data follow, with x = oil viscosity and y = wear volume (10^{-4} cubic millimeters). [5]

y	240	181	193	155	172	110	113	75	94
x	1.6	9.4	15.5	20.0	22.0	35.5	43.0	40.5	33.0

   i) Fit the simple linear regression model using least
   ii) Predict fretting wear when viscosity x = 30
8. What are the two regression coefficients and what do they represent? Write the properties of regression coefficient. [5]
9. Define Central Limit Theorem. An electronics company manufactures resistors that have a mean resistance of 100 ohms and a standard deviation of 10 ohms. The distribution of resistance is normal. Find the probability that a random sample of 25 resistors will have an average resistance less than 95 ohms. [5]

10. Define standard error of sample mean. A population consist of the four numbers 12, 19, 13, 16. [5]

i) Write down all possible sample size of two without replacement.
ii) Find standard error of the sample mean.

11. Describe the procedure of the test of significance for difference of two population mean for large sample. [5]

12. In the investigation of a citizens' committee complaint about the availability of fire protection within the country, the distance in miles to the nearest fire station was measured for each of five randomly selected residences in each of four areas. [5]

Area 1	7	5	5	6	8
Area 2	1	4	3	4	5
Area 3	7	9	8	7	8
Area 4	4	6	3	7	5

Do these data provide sufficient evidence to indicate a difference in mean distance for the four areas at the = 0.05 level of significance?

OR

The diameter of steel rods manufactured on two different extrusion machines is being investigated. Two random samples of sizes $n_1 = 15$ and $n_2 = 17$ are selected, and the sample means and sample variances are $\bar{x}_1 = 8.73, s_1^2 = 0.35, \bar{x}_2 = 8.68$, and $s_2^2 = 0.40$, respectively. Assume that $\sigma_1^2 = \sigma_2^2$ and that the data are drawn from a normal distribution. Is there evidence to support the claim that the two machines produce rods with different mean diameters? Use $\alpha = 0.05$ in arriving at this conclusion.

13. A random sample of 500 adult residents of Maricopa County found that 385 were in favor of increasing the highway speed limit to 75 mph, while another sample of 400 adult residents of Pima County found that 267 were in favor of the increased speed limit. Construct 95% confidence interval on the difference in the two proportions. [5]

14. Define chi-square distribution. From the following data can you conclude that there is association between the purchase of brand and geographical region? [5]

	Region		
	Central	Eastern	Western
Purchase brand	40	55	45
Do not purchase brand	60	45	55

Use 5% level of significance.

15. The following table shows the number of hours 45 hospital patients slept following the administration of a certain anesthetic. [8]

7	10	12	4	8	7	3	8	5
12	11	3	8	1	1	13	10	4
4	5	5	8	7	7	3	2	3
8	13	1	7	17	3	4	5	5
3	1	17	10	4	7	7	11	8

i) Find sample mean, sample variance and sample standard deviation.
ii) Compute a value that measures the amount of variability relative to the value of mean.

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