23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
**Examination Control Division**
**2073 Shrawan**

| 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 Statistics *(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. In two companies A and B engaged in similar type of industry, the average weekly wage and standard deviation are given below: [6]

| | Company A | Company B |
|---|---|---|
| Average weekly wage (Rs) | 460 | 490 |
| Standard deviation | 50 | 40 |
| No. of wage earners | 100 | 80 |

   i) Which company pays larger amount as weekly wags?
   ii) Which company show greater variability in the distribution weekly wages?
   iii) What is the mean and standard deviation of all the workers in two companies taken together?

2. State the law multiplication of probability. An Electronics company has an engineering position open. The Probability that an applicant is capable is 0.7. Each applicant is given written test and oral examination. A capable applicant passes with Probability 0.9 while an incapable applicant passes with Probability of 0.4. Find (a) the probability that an applicant passes the test (b) the probability that the applicant is capable given he/she passes the test. [6]

3. Define negative Binominal Distribution. If a boy is throwing stone at a target what is the probability that his $10^{th}$ throw is his $5^{th}$ hit, if the probability of hitting the target at any trial is 0.6. Also find the mean and variance of random variable. [5]

4. Define hypergeometric probability distribution with an example. Describe the conditions for the binomial approximation to hypergeometric distribution? [5]

5. Let X denote the amount of time for which a book on two hour reserve at a college library is checked out by a randomly selected student and suppose that X has density function, [5]

$$f(x) = 1/2x, \quad 0 \le x \le 2$$
$$= 0 \quad \text{otherwise}$$

   Calculate $P(X \le 1)$ and $P(0.5 \le X \le 1.5)$

6. Define continuous random variable with suitable example. Describe the properties of probability density function and distribution function. [5]

7. State Central limit theorem with an example. Explain why it is important in engineering field? [5]

8. A population consists of the four number 2,8,14,20 [5]
   i) Write down all possible sample size of two without replacement
   ii) Verify that the population mean is equal to the mean of the sample mean
   iii) Calculate the standard error of the sampling distribution of the sample mean

9. Define Karl Person coefficient of Correlation and coefficient of determination. What it is input in analysis. [5]

10. A house survey on monthly expenditure on food yield following data: [5]

| Monthly expenditure (100 Rs.) | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|
| Monthly income (1000 Rs.) | 2 | 4 | 5 | 7 | 6 | 6 | 5 |
| Size of the family | 4 | 5 | 7 | 10 | 8 | 11 | 4 |

Obtain the multiple correlation coefficient.

11. There was a research on voltage supply by Ba Hries supplied by two companies. Both company claims that same. But researcher suspects that there is significance difference between mean voltages between two companies. To test this, she selected independent samples from both company and in lab test the result were as follows: [5]

| | | Mean | Sample Standard deviation |
|---|---|---|---|
| Company A | 13 | 3.59V | 0.3V |
| Company B | 10 | 3.15V | 0.4V |

Test the researcher suspect was correct at 5% level of significance.

12. Shyam and Co. produces three varieties of certain product: deluxe, find and ordinary. A recent market survey is conducted for preference of products. The preference was found as follow: [5]

| Product | Production | | | |
|---|---|---|---|---|
| Deluxe | 15 | 14 | 19 | 18 |
| Fine | 17 | 12 | 20 | 16 |
| Ordinary | 16 | 18 | 16 | 17 |

Is there a significant difference in the preference of products test it using ANOVA test. Use $\alpha = 5\%$

***OR***

The following are the average weekly losses of worker hours due to accidents in 10 industrial plan before and after a certain safety program was put into operation:

| Before | 45 | 73 | 46 | 124 | 33 | 57 | 83 | 34 | 26 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|
| After | 36 | 60 | 44 | 119 | 35 | 51 | 77 | 29 | 24 | 11 |

Use the 0.05 level of significance to test whether the safety program is effective.

13. Define critical value. A manufacturer claimed that at least 95% of the water pumps supplied to the ABC Company confirmed to specification. However, the product manager at ABC Company wasn't satisfied with the claim of the manufacturer. Hence, to test the claim, the manager examined a sample of 250 water pumps supplied last month and found that 228 water pumps as per the specification. Can you conclude that the production manager is right to doubt on the claim of the manufactures? ($\alpha$=0.01) [5]

14. Describe the Hypothesis testing procedure of Chi-square test of independence for 2×2 table. [5]

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 |

a) Find sample mean, sample variance and sample standard deviation
b) Compare a value that measures the amount of variability relative to the value of mean

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