Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER • 2015

Subject Code: 171402 **Date: 08/05/2015**

Subject Name: Food Standards & Quality Assurance

Time:02.30pm-05.00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is 6- sigma accuracy? **07**

A company is manufacturing Tomato ketchup. The specification for total soluble solids is in the range of 32 – 38%. The process had mean (μ) of 36.2 and standard deviation 0.83. What will be process capability and process capability index? Give your comment on the results.

(b) Answer the following questions briefly: **07**

(i) Define sensory evaluation state its applications.

(ii) Define gustation.

(iii)What is numerical scoring test?

(iv)Define stimulus error and state how to minimize it?

(v) A data set represented as "$\chi = \{1, 4, 4, 6, 1, 6, 4, 2, 3, 4, 2\}$".

Calculate its mean & mode.

(vi) Calculate the degrees of freedom enjoyed by a χ^2-distribution.

(vii) Define control sample?

Q.2 **(a)** How can Deming wheel be effectively used for continuous improvement in a food processing facility? Illustrate the process. **07**

(b) Define probability space and state the laws of probability. Three food quality analysts A, B and C were given the task of reducing the microbial load in canned mango pickles to commercial zero levels. Previous performance evaluation data analysis shows that their chances of achieving assigned tasks are 1/3, 5/18 and 1/5 respectively. Find the probability that the given task will be achieved if all three try independently. **07**

OR

Q.2 **(b)** Define hedonic evaluation and state its applications in food sector. **07**

The following is the frequency distribution of hedonic scores of a newly developed RTE snack food tested in different consumer central locations of Gujarat for its acceptability:

Hedonic Scorers	1-2	2 - 3	3-4	4-5	5-6	6-7	7-8	8-9
No. of consumers	11	17	15	36	22	12	08	03

Calculate the following:

(i) The average hedonic score of the RTE food.
(ii) Median of the hedonic score distribution.
(iii) The value of the most frequently occurring score.
(iv) Range of the distribution.
(v) Average mean deviation.
(vi) Variance.

Q.3 **(a)** Explain the following with relevant examples: **07**

(i) Skewed and symmetrical distributions

(ii) Level of significance

(iii) α, β and γ risks in food quality control

(iv) Neyman and Pearson Lemmas for hypothesis testing

(v) Fiducial control Limits

(vi) Degrees of freedom of a frequency distribution

(vii)Critical region for hypothesis testing

(b) How would you mathematically express continuous Normal distribution in terms of its parameters μ and σ? Plot it using an x-y plot and state its properties and applications. Show that its maxima occurs at the mean value ($\bar{x}$) of the distribution. **07**

Examine the frequency distribution defined as Y(x) = $\frac{1}{2\sqrt{8\pi}} e^{\frac{-(x-11)^2}{32}}$

where - ∞ < x < ∞. Prove that it represents normal distribution. Calculate its mean, variance and standard deviation.

OR

Q.3 **(a)** Examine the following statements. State if they are TRUE/FALSE giving justification: **03**

(i) H_o **:** $\mu > 8$ & $\sigma^2 = 6$ is a simple hypothesis
(ii) H_o: $\mu = 6$ & $\sigma^2 = 8$ is a composite hypothesis.
(iii) A sufficient estimator is always consistent.

(b) Define Null Hypotheses? What are the possible errors involved in the hypothesis testing procedure? Which type of error is more risky and why? As a QC officer, which type of error would you want to minimize and how? **04**

(c) Write expression for normal distribution in terms of population parameters μ and σ? State its properties and applications and show that its maximum value is $\frac{1}{\sigma\sqrt{2\pi}}$ which occurs at the mean value of the distribution. **07**

Examine the distribution $\Psi(x) = \frac{1}{\sqrt{32\pi}} e^{\frac{-(x-10)^2}{32}}$ for all $-\infty < x < \infty$. Show that it represents normal distribution. Calculate its mean, variance and standard deviation.

Q.4 **(a)** Write short notes on the following: **07**

(i) UMVUE
(ii) Efficient estimators
(iii) Regression analysis
(iv) One and two tailed tests
(v) ANOVA technique
(vi) Binomial distribution
(vii) Point estimation

(b) The total Coli count in bottled pickle is to be limited to a maximum of 10 after 12-months which is the declared shelf-life of the pickle. After 12-months, the total Coli count was estimated in 10 randomly picked up samples from a large lot and the information is tabulated as follows: **04**

Pickle Sample	Total Coli count (CFU/mg)
1	8
2	11
3	7
4	10
5	11
6	9
7	9
8	10
9	11
10	9

Using t- test determine if the estimated total Coli count is significantly more or less than the declared limit.[Take t = 2.26 at k = 9 & α = 5% & t = 3.25 at k = 9 & α = 1%].

(c) A random sample of size 20 from a normal population comprising several units of a canned product yields sample standard deviation of 6. Using χ^2-test, check the hypothesis at 95% confidence level that the population standard deviation is 9. (Take χ^2 = 30.144 at α =5% & k =19) **03**

OR

Q.4 **(a)** Answer the following questions: **07**

(i) An estimate of population parameter μ is given as E(t) = μ - 2 b. State if the estimate is biased/unbiased. What is the magnitude of bias?

(ii) What is UMVUE?

(iii) Define unbiased estimator.

(iv) Mention different point estimation techniques.

(v) How will you rate the efficiency of any given two statistic t_1 & t_2?

(vi) A certain x-y data was subjected to regression analysis and the following was calculated: Regression coefficient (b) = 3, $\overline{x} = 0.4$ *and* $\overline{y}$ = 8.

Write the equation of the regression line.

(vi) State applications of F-Test.

(b) A newly purchased solids dosing equipment was attached to a fruit beverage preparation and bottling line which produces 200 ml bottled beverage. The solids dosing equipment was set to provide 15% total solids to the beverage. The entire system was run to produce a test lot of 5000 bottles. Out of this lot, ten samples were randomly picked up for analysis. The % total solids in each bottle was found to be 14%, 15%, 16%, 12%, 13%, 15% ,20%, 17%, 16%, & 14%. Examine if the solids dosing equipment was working as per the set point. [Take t = 2.26 at k = 9 & α = 5% & t = 3.25 at k = 9 & α = 1%]. **03**

(c) Explain "Interval Estimation" technique. State the criteria a good estimator should satisfy. Show that for large samples, the sample variance gives an unbiased estimate of the population variance. **04**

Q.5 **(a)** Differentiate between quality in yesteryears and quality in today's era. Discuss the spectrum of functions of Quality control department in food industry. **07**

(b) Define benchmarking. What do you understand by Quality Function Deployment? **04**

(c) Enlist seven principles of HACCP. **03**

OR

Q.5 **(a)** What is the need of ISO 9000? Explain Product realization and resource management. **07**

(b) Introduce briefly Fruit Product Order. **04**

(c) Enlist any three disinfectants along with their limitations. **03**

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