GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-III

Course Title: Statistical Quality Control
(Course Code: 4332905)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	Third

1. RATIONALE

In industry, diploma graduates are required to judge quality of raw materials, work in process and that of final products such as yarn and fabrics continuously to maintain quality as per requirement. This is a very important activity and involves intermittent or continuous manual or automated inspection of parameters to collect data and analyse it using statistical quality control techniques to interpret quality of raw materials, work in process and final products as yarn and fabrics. Based on this need, this course has been designed to provide the necessary knowledge and skills in statistical quality control techniques.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Analyse and interpret textile data related to industry processes / sub processes / product parameters for quality control in yarns, colouring (dyeing) and fabrics using statistical techniques.**

3. COURSE OUTCOMES (Cos)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

a) Paraphrase need of statistics in quality control.

b) List international systems of units for textile and important of BIS units for textile.

c) Produce frequency distribution, graphical charts of frequency distribution and control charts.

d) Calculate measures of central tendencies, dispersion, correlation, probability of given data.

e) Estimate hypothesis using F, T and CHI Sq. test.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	0	3	30*	70	0	0	100

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the microproject to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-*Lecture;* **T** *– Tutorial/Teacher Guided Theory Practice;* **P** *-Practical;* **C** *– Credit,* **CA** *- Continuous Assessment;* **ESE** *-End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES – (Not Applicable)

The following practical outcomes (PrOs) that are the sub-components of the COs. *Some of the* **PrOs** *marked* **'*'** *are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Total		

Note

i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list*.*

ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Operate the equipment setup or circuit	20
3	Follow safe practices measures	10
4	Record observations correctly	20
5	Interpret the result and conclude	30
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED – (Not Applicable)

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1		

7. AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this competency.
    a) Work as a leader/a team member.
    b) Follow ethical practices.
    c) Practice environmental friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
    i. 'Valuing Level' in 1st year
    ii. 'Organization Level' in 2nd year.
    iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
Unit-I Introduction to S.Q.C. in textile	1a. Describe the concept of quality control in textile. 1b. List variable textile parameters requiring for quality control. 1c. Enumerate Importance of SQC in textile processes & sub processes.	1.1. Importance of quality and quality control. 1.2. Importance of statistics in quality control 1.3. Quality control for various textile parameters.
Unit-II International system of units for textile parameters	2a. Write international systems of units for textile. 2b. Enlist important BIS units for textile.	2.1. Recommended B.I.S. Units for textile processes & sub processes parameters.

Unit-III Frequency distribution and control charts	3a. Prepare frequency distribution from the given data. 3b. Prepare graphical charts for given frequency distribution. 3c. Prepare control charts. 3d. Interpret various control charts.	3.1. Different types of frequency distribution. 3.2. Different methods of graphical Representation. 3.3. $\bar{X}$, R, p, np, c chart and their application. 3.4. Interpretation of above-mentioned charts.
Unit - IV Measures of Central tendencies, Dispersion, Correlation, Probability	4a. Calculate measures of central tendency- mean median, mode and quartile. 4b. Calculate mean deviation, standard deviation. c.v. %, Variance. 4c. Describe the effect of change in values of Mean deviation, standard deviation, c.v. %, variance on parameters of textile processes 4d. Establish correlation between two given variables. 4e. Describe sampling technique. 4f. Apply binomial distribution for working out probability for event. 4g. Apply poisson distribution 4h. Apply normal distribution	4.1. Different measures of central tendency 4.2. Calculation of mean, median, mode and quartile. 4.3. Different measures of dispersion 4.4. Calculation of mean deviation, Standard deviation and C.V.% 4.5. Correlation- diff types of correlation 4.6. Karl Pearson's coefficient of correlation 4.7. Sampling Technique for textile processes 4.8. Detail study of binomial distribution with simple Calculation 4.9. Detail study of poisson distribution with simple Calculation 4.10. Detail study of normal distribution. with simple calculation,
Unit – V Hypothesis Test	5a. Judge the hypothesis using T test 5b. Judge the hypothesis using F test 5c. Judge the hypothesis using X2 (chi -square) test.	4.1. Study of T test simple textile example 4.2. Study of F test with simple textile example 4.3. Study of X2 test (chi -square test) with simple textile example

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to S.Q.C. in textile	02	2	3	0	5
II	International system of units for textile parameters	01	0	0	2	2
III	Frequency distribution and control charts	12	2	8	10	20

IV	Measures of Central Tendencies, Dispersion, Correlation, Probability	23	6	12	17	35
V	Hypothesis Test	04	2	2	4	8
	Total	**42**	**12**	**25**	**33**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

   a) Visit to industry and observe the quality control procedures being employed.
   b) Sampling technique for raw material, process materials and final product
   c) Parameters for quality for raw materials, process material and final product.
   d) Study the SQC techniques being employed.
   e) Undertake micro-projects.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

   a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
   b) Guide student(s) in undertaking micro-projects.
   c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
   d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
   e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
   f) Guide students on how to address issues on environment and sustainability
   g) Guide students for using data manuals.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be

individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Collection of various data from the industry and observe quality control procedures being employed.
b) Collection of data for various testing parameters of textile.
c) Sampling technique for raw material, process materials and final product.
d) Calculate mean, median and mode for test results of collected samples.
e) Calculate variance for test results of collected samples.
f) Prepare control chart for various samples.

13.   SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Textile Testing	J. E .Booth	CBS Publishers And Distributors Pvt Ltd, Delhi-2018 ISBN-10 : 8123905157 ISBN-13 : 978-8123905150
2	Statistical Methods for Textile Technology .	Tippet, Vikas Gupta.	The Textile Institute (January 1, 1993) ISBN-10 : 1870812573 ISBN-13 : 978-1870812573

3	An Introduction To Statistical Methods	C.B. Gupta, Vijay Gupta	Vikas Publishing House Pvt Ltd, 2004 ISBN-10 : 8125916547 ISBN-13 : 978-8125916543
4	Statistical Methods	Dr. S. P. Gupta	Sultan Chnad and Sons., Delhi, 2019 ISBN-10 : 9351611124 ISBN-13 : 978-9351611127
5	Selected Statistical Tests	V. Rajgopal	New Age International Private Limited, Delhi, 2006 ISBN-10 : 8122418406 ISBN-13 : 978-8122418408
6	Handbook Of Textile Testing And Quality Control	Elliot. B. Grover D. S. Hamby	Wiley India Pvt.,Newdelhi, 2011 ISBN-10 : 9788126531752 ISBN-13 : 978-8126531752
7	Testing Testing part I & 2	Raygopalan ,Angopalan	Year 1993 S.S.M.I.T.T , Tamilnadu

14.   SOFTWARE/LEARNING WEBSITES

   a) Statistical Package for the Social Sciences
   b) https://nptel.ac.in/
   c) http://nptel.iitm.ac.in
   d) http://textilelearner.blogspot.in/
   e) http://www.opentextbookstore.com/mathinsociety/current/Statistics.doc
   f) http://www.uster.com
   g) https://textilelearner.net/
   h) https://textilevaluechain.in/
   i) https://link.springer.com/

15.   PO-COMPETENCY-CO MAPPING

Semester II	STATISTICAL QUALITY CONTROL (Course Code: 4332905)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency	Analyse and interpret textile data related to industry processes / sub processes/ product parameters for quality control in yarns, colouring (Dyeing) and fabrics using statistical techniques						
Course Outcomes CO a) Paraphrase need of statistics in quality control.	-	-	-	-	-	1	-
CO b). List international systems of units for textile and important of BIS units for textile.	-	-	-	-	-	1	-
CO c). Produce frequency distribution, graphical charts of frequency distribution and control charts.	-	2	1	3	-	-	1
CO d) Calculate measures of central tendencies, dispersion, correlation, probability of given data.	3	2	1	-	2	-	1
CO e) Estimate hypothesis using F, T and CHI Sq. test	-	-	-	3	1	-	1

Legend: '**3**' for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

16.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	Zala Samrat Madansinh Lecturer	R. C. Technical Institute, Ahmedabad	079-27664785	samrat.zala@gmajl.com
2	Upadhyaya Hirenkumar Narendrabhai, Lecturer	R. C. Technical Institute, Ahmedabad	079-27664785	hnu.1810@gmail.com