GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Colour Matching in Textiles
(Course Code: 4355902)

Diploma programme in which this course is offered	Semester in which offered
Textile Design	5th Semester

1. RATIONALE

Colour matching is a vital process in ensuring continuity of colour from the master standard to all subsequent production batches.In textile industries, the desired color is obtained by mixing three or four dyes. The most important problem in the industry is how to arrive at the perfect match to the customer's samples using the minimum amount of dyes.

This job is normally attended by an expert dyeing master who decides the three or four dyes color recipe to reproduce a given shade. The dyeing master maintains the record of his experience in "shade Bank" and selects one of the color recipes, which may be close to the standard. By trial and error method necessary changes are done to obtain the exact match. Most appropriate recipe depends on the cost of dyes and quality of the products required. This process is done with the help of software is known as Computer Color Matching.

2. COMPETENCY

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

To predicts close recipe for any given shade with the help of spectrophotometer & colour software

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) Analyze the colour matching requirement for the textile industry.
b) Appreciate the technique of colour measurement by spectrophotometer & colour matching cabinet.
c) Classify the different types of colour mixing theory & colour atlas system.
d) Identify different types of confusion occurs in colour perception.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	4	5	30*	70	50	50	200

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for 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

The following practical outcomes (PrOs) are the sub-components of the COs.*These PrOs need to be attained to achieve the Cos.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1.	Draw and make colour grey wheel	IV	04
2.	Draw and make designer colour wheel	IV	04
3.	Draw and make Munshell colour chart	IV	04
4.	Draw and make Tint , Tone & Shade Chart	I	04
5.	Draw flow chart of Visual colour Matching	V	04
6.	Draw flow chart of computer colour Matching	V	04
7.	Demonstrate the working procedure of colour matching cabinet	V	02
8.	Analyze colour matching cabinet & match the sample with standard sample under different light source.	II	04
9.	Demonstrate Metamerism, After Image & Simultaneous contrast	III	02
10.	Demonstrate the working procedure of spectrophotometer	V	02
11.	Match 5 sample of any colour with same colour of standard sample & find out the difference by spectrophotometer	V	02
12.	Colour 1 with standard sample	V	04
13.	Colour 2 with standard sample	V	04
14.	Colour 3 with standard sample	V	04
15.	Colour 4 with standard sample	V	04
16.	Colour 5 with standard sample	V	04
	Total		**56**

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	Knowledge about colour & colour mixing theories.	20
2	Matching samples with standard sample by using colour matching cabinet & spectrophotometer	20
3	Willingness and attitude to complete different assignment	10
4	Initiative regarding innovative way to complete the assignment	20
5	Overall preparedness and progress during the assignment.	30
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

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

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	A3 Drawing Sheet , Pencil , Water Colour , Eraser	1 to 16
2	Colour Matching Cabinet , Spectrophotometer , Standard Fabric Samples	1 to 16

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 course competency.

a) Follow safety practices.
b) Practice good housekeeping.
c) Demonstrate working as a leader/a team member.
d) Maintain tools and equipment
e) Follow ethical practices.

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

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy*that are formulated for development of the COs and competency. If required, more such 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 different levels)	Topics and Sub-topics
Unit – I **Light ,Colour and Eye**	1a. Perception of colour 1b. Light Waves 1c. Colour Vision 1d. Eye Structure 1e. Defects of colour vision	1.1 Eye Structure 1.2 Retina , Pupil , Iris , Optic Nerve 1.3 Primary Colour Sensation 1.4 Complementary Colour 1.5 Different Light Spectral power Curve
Unit – II **Source of Light**	2a. Different types of Light source 2b. Wave Length of Different Colour 2c. Lambert & Beer Law 2d. Colour Mixing Law 2e. Application of colour mixing law	2.1. Light Source like D -65 , TL- 84 , UV Light, Tungsten Lamp Light 2.2. Experiment & use of different type of pen(Sketch Pen, Crayons ,Etc) 2f. Additive Colour Mixing 2.3. Subtractive Colour Mixing 2.4. Maxwell Disk , Binocular Mixing ,Inkjet Printers
Unit – III **Confusions In Colour Perception**	3a. Understand colour confusion 3b. After Image 3c. Simultaneous Contrast 3d. Metamerism	3.1 Negative After Image 3.2 Positive After Image 3.3 Successive contrast 3.4 Different Examples where Simultaneous Contrast is seen 3.5 Different Examples where Metamerism is seen
Unit – IV **Colour Order Systems**	4a. Understand Visual/ Manual colour Matching Process 4b. Understand Computer colour Matching Process 4c. Mechanism Of Colour Vision Process 4d. Under Stand Different type of Colour Order System	4.1 Natural Colour Order System 4.2 Ostwald Colour Order System 4.3 ICI colour Atlas 4.4 Chroma Cosmos 5000 4.5 CIE System 4.6 CIE Standard Illuminants 4.7 CIE Standard Observer
Unit– V **Colour Measuring Instruments**	6e. Colour matching Cabinet 6f. Understand the need of Spectrophotometer 6g. Objective Specification of Colour : Tristimulus Value 6h. The CIELAB System	5.1 Flow Chart of Visual Colour Matching 5.2 Flow Chart of Computer Colour Matching 5.3 Software and Hardware for colour matching 5.4 Colour difference

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
	6i. The Pass & Fail System	5.5 Shade Sorting 5.6 Assessment of Whiteness & Degree of Yellowness

***Note**: The Unit Outcomes (UOs) need to be formulated at different level 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	**Light ,Colour and Eye**	08	4	6	4	14
II	**Source of Light**	08	4	4	6	14
III	**Confusions In Colour Perception**	10	2	6	6	14
IV	**Colour Order Systems**	08	2	6	6	14
V	**Colour Measuring Instruments**	08	2	4	8	14
Total		**42**	**14**	**26**	**30**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

***Note**: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to 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 slightly vary from above table.*

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 perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Make a box to understand Metamerism
b) Present seminar on importance colour
c) Visit any dyeing industry understand the core concept colour matching.
d) Prepare portfolio of standard samples with closely match samples
e) Undertake micro-projects in teams

10. 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) to take micro-projects.

c) Blend the basic concepts with more specialized instruction

d) Visualization, Cooperative Learning, inquiry based instruction, differentiation, effective use of technology, think-pair and share etc pedagogies can be implemented as per the enlisted course outcomes.

e) Give at least 10 competitive problems for each course outcomes of this course

f) Practice, practice and practice - expose students to wide range of problems

g) 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.

h) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

i) Guide students on how to address issues on environment and sustainability using the knowledge of this course

11. 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 (group of 3 to 5). However, **in the fifth and sixth semesters**, 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 duration of the microproject should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students 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:

Suggested List of Micro-Project.

1. Make Maxwell Disk & Create Additive Colour Mixing
2. Make a Model for Binocular mixing
3. Create a Model for Simultaneous Contrast

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Colour Matching on Textiles	David Paterson	Abhishek Publications,2017 ISBN: 9789356521049
2	Instrumental Colour Measurements and Computer Aided Colour	H. S. Shah and R. S. Gandhi	Mahajan Book Distributors ,1990 (ISBN: 8185401004

	Matching for Textiles,		
3	Fundamentals of Computer Colour Matching	Shalini Patwardhan, N. S. Gangakhedkar, V. C. Gupte	The Group ,1984
4	Understanding Computer Color Matching	N. S. Gangakhedkar	Rutu Prakashan

13. UGGESTED LEARNING WEBSITES

a) https://textilelearner.net/computer-colour-matching-system-
b) https://textilefashionstudy.com/functions-of-computer-color-matching-system-ccms/
c) https://www.researchgate.net/publication/279534155_Advancements_in_Computer_Colour_Matching_Colour_Matching_through_Internet
d) https://www.intechopen.com/chapters/80062
e) https://www.scribd.com/document/37911550/Colour-Matching

14. PO-COMPETENCY-CO MAPPING

Semester I	**Computer Programming (Course Code: 4310702)**						
	POs						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem Analysis**	**PO 3 Design/ develop-ment of solutions**	**PO 4 Engineering Tools, Experimen-tation&Testing**	**PO 5 Engineering practices for society, sustainability & environment**	**PO 6 Project Manage-ment**	**PO 7 Life-long learning**
To predicts close recipe for any given shade with the help of spectrophotometer & colour software							
Course Outcomes CO a)	3	2	3	-	1	-	3
CO b)	3	2	3	2	1	-	3
CO c)	3	2	2	-	1	-	3
CO d)	3	2	3	-	1	2	1

Legend: '**3'** for high, '**2**' for medium, **'1'** for low and**'-'** for no correlation of each CO with PO.

15.COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Contact No.	Email
1.	Mr. S B Goswami, Lecturer	GPG Surat	9377568889	goswami.shailesh@gmail.com
2.	Mr.P P Rana, Lecturer	GPG Surat	8460371987	pprana.81@gmail.com