# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3173623**
**Semester –VII**
**Subject Name: New Development in Dyes**

**Type of Course:** Chemical Technology
**Prerequisite:** Studied subjects of previous semesters. Basic knowledge of development in pigments.
**Rationale:** The main objective of this subject is to study the new functional pigment & Recent Trends in pigment technology in chemical industries.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Topic | Teaching Hours |
|---|---|---|
| 1 | **New functional dyes:** Introduction, Interactions of Functional Dyes. **Metal-Complex Dyes:** Introduction, Chemical Constitution and Properties. **Solvent Dyes:** Introduction, Chemical Constitution and application properties. **Fat and Oil Soluble Dyes:** Dyes Soluble in Polymers; Solvent Dyes for Other. | 10 |
| 2 | **Applications of Functional Dyes:** Functional Dyes by Application: Laser Printing and Photocopying; Thermal Printing; Ink-Jet Printing, **Other Technologies:** Dyes in Solar cells, Dyes in Fluorescent Sensors and Probes, Dyes in electrophotography. | 10 |
| 3 | **Hair Dyes:** Bleaching, Dyeing with Oxidation Dyes, Dye Classes, Product Forms, Dye-Removal Preparations, Testing of Hair Dyes. **Food Dyes:** Introduction**,** Uses and Individual Substances, Examples of Chemical Structures, Purity Requirements. | 10 |
| 4 | **Recent development in dyeing Technology:** Technology involved is based on solvents used in typical dyes synthesis reactions with emphasis on selection criteria. Ionic liquids as solvents. Solid- solid reaction. Statistical quality control techniques. Specifications of raw materials, process parameters, other quality parameters & their statistical treatment. Methods of dyeing. | 08 |
| 5 | **Recent Applications of dyeing Technology**: Dye-sensitised solar cell (DSSC) Technology, Electrochemical dyeing, Plasma technology, Supercritical Dye system. | 07 |

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**Suggested Specification table with Marks (Theory):**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R level | U level | A level | N level | E level | C level |
| 40 | 25 | 15 | 10 | 05 | 05 |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**References:**


1. G. Buxbaum (Ed.) Industrial Inorganic Pigments, Second, Completely Revised Edition, 1998 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.
2. H. M. Smith (Ed.) High Performance Pigments 2002 WILEY-VCH Verlag GmbH & Co.KGaA, Weinheim.
3. Willy Herbst, Klaus Hunger, Industrial Organic Pigments- Production, Properties,Applications Third, Completely Revised Edition (With Contributions byGerhard Wilker, Heinfred Ohleier and Rainer Winter) 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim


**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | To get an knowledge of new functional, metal complex, solvent and fat soluble dyes. | 15 |
| CO-2 | To apply the knowledge of functional dyes & recent dyes technology. | 15 |
| CO-3 | To illustrate the manufacturing of hair & food dyes. | 20 |
| CO-4 | To explain the recent development in dyeing technology. | 20 |
| CO-5 | To describe the recent applications of dyeing technology. | 20 |
| CO-6 | To build a bridge between theoretical and practical concept used in dyes industry | 10 |

**List of Experiments:**

1. Identification of functional dyes.
2. Synthesis of some coumarin functional dyes.
3 Synthesis of Acid Dye Metal Complexes
4. Synthesis of Solvent Dyes Based on 2-Hydroxy-4-n-octyloxybenzophenone.
5. Synthesis of Hair dyes.
6. Synthesis of Food dyes.
7. To study the Methods of dyeing.
8. To study Dye-sensitised solar cell (DSSC) Technology.

9. To study Electrochemical dyeing.
10. To study Plasma technology.
11 To study Supercritical Dye system.

**Open Ended Project fields:-**
**Students are free to select any area of Engineering &Technology** based on chemical technology applications to define Projects.
Some suggested projects are listed below:

1. Literature survey on new functional dyes.
2. Carry out synthesis of new functional dyes.
3. Carry out synthesis of new functional dyes. Product profile and its manufacturing process of new functional dyes.
4. PPT on New functional dyes.

**List of Open Source Software/learning website:**

1. Literature available on internet
2. Dyes & Pigments dictionaries
3. Delnet
4. Literature available under R&D in dyes industries