# FACULTY OF SCIENCE

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# COURSE STRUCTURE

(Choice Based Credit System)

# MASTER OF SCIENCE
# (SURFACE COATING TECHNOLOGY)

**Effective from Academic Year: 2022-23**

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

Faculty Name: Science

Programme Name: Master of Science (Surface Coating Technology)

# Programme Structure Summary

| SEMESTER I | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Group | Course Name | Cr | Teaching Scheme | | | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
| | | | T | P | Tu | Cont. Hrs | | | | | |
| Core | Chemistry & Technology of Polymer Science | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Chemistry & Technology of Inorganic Pigments | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Surface Chemistry & Surface Engineering | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Practical: - Analysis of Pigments, Oils & Resins | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Practical: - Analysis of Architectural Coatings | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | 50/20 | - | - | 50/20 |
| Elective | Process Control & Instrumental Analysis | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Mechanical Engineering for Coating Technologist | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |

| SEMESTER II | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Group | Course Name | Cr | Teaching Scheme | | | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
| | | | T | P | Tu | Cont. Hrs | | | | | |
| Core | Technology of Resins for Surface Coatings – I | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Chemistry & Technology of Organic Pigments, High Performance Pigments, Additives & Solvents | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Coating Properties & Analysis of Coating | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Practical: - Instrumental Analysis and Analysis of Additives, Solvents & Raw material for resin | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Practical: - Analysis of Industrial Coatings & Inks | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | 50/20 | - | - | 50/20 |
| Elective | Chemical Engineering Operations | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Economics & Industrial Management | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |

Faculty Name: Science

Programme Name: Master of Science (Surface Coating Technology)

| SEMESTER III | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Group | Course Name | Cr | Teaching Scheme | | | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
| | | | T | P | Tu | Cont. Hrs | | | | | |
| Core | Technology of Resins for Surface Coatings – II | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Technology of Paint Manufacturing | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Technology of Architectural Coatings and Industrial Coatings | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Practical: - Processing of Surface Coatings I | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Practical: - Processing of Surface Coatings II | 4 | - | 8 | - | 8 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | 50/20 | - | - | 50/20 |
| Elective | Chemical Reaction Engineering | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Technology of Packaging and Printing Inks | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |

| SEMESTER IV | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Group | Course Name | Cr | Teaching Scheme | | | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
| | | | T | P | Tu | Cont. Hrs | | | | | |
| Core | Coating Application & Specialty Coatings | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Corrosion Technology & Heavy Duty Protective Coatings | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Technology of Construction Chemicals | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |
| Core | Practical: - Project Work | 8 | - | 16 | - | 16 | - | - | 100/40 | 100/40 | 200/80 |
| Core | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | 50/20 | - | - | 50/20 |
| Elective | Marketing Management | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | | 100/40 |
| Elective | Environmental Management | 4 | 4 | - | - | 4 | 50/20 | 50/20 | - | - | 100/40 |

| | |
|---|---|
| Faculty Name: | Science |
| Programme Name: | Master of Science (Surface Coating Technology) |

## Programme Outcomes (POs)

| | |
|---|---|
| **PO-1** | The Post-graduates will have sound knowledge of principles involved in the area of paint/surface coatings and will play a major in development of coating industries. |
| **PO-2** | The Post-graduates will adapt to the various formulations/manufacture of coatings as per the changing technologies and requirements of society. |
| **PO-3** | The Post-graduates will design and deploy paints/coatings that meets the needs of individuals and the industries. |
| **PO-4** | Acquainted with the latest development in Surface Coating fields to enable them to take up higher studies, research & developmental work. |
| **PO-5** | Provide a platform to the students to interact with leading teachers, scientists, and industry practitioners. |

## Program Specific Outcomes (PSOs)

| | |
|---|---|
| **PSO-1** | Students will be able to design, formulate, and apply surface coating systems using principles of resin chemistry, pigment dispersion, and application techniques. They will also evaluate coating performance through standard methods (e.g., corrosion resistance, adhesion, durability), ensuring compliance with functional, aesthetic, and industrial quality standards. |
| **PSO-2** | Students will demonstrate professional competence in national and international surface coating industries through specialized knowledge in eco-friendly formulations, environmental compliance, and surface engineering. They will be equipped to lead sustainable innovations and entrepreneurial ventures contributing to industry advancement and societal welfare. |

CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

Faculty Name: Science

Programme Name: M.Sc. Surface Coating Technology

Semester: I

Academic Batch: 2022-23

| Course Group | Board of Studies / Faculty Ownership | Course Code | Course Name | Cr | Teaching Scheme | | | | Assessment/Evaluation Type | | External Exam Duration (Hrs.) | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T | P | Tu | Cont. Hrs | T | P | T | P | | | | | |
| Core | Science | 201470101 | Chemistry & Technology of Polymer Science | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470102 | Chemistry & Technology of Inorganic Pigments | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470103 | Surface Chemistry & Surface Engineering | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470104 | Practical: - Analysis of Pigments, Oils & Resins | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470105 | Practical: - Analysis of Architectural Coatings | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470106 | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | - | - | - | - | 50/20 | - | - | 50/20 |
| Elective | Science | 201470107 | Process Control & Instrumental Analysis | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Science | 201470108 | Mechanical Engineering for Coating Technologist | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |

**# T = Theory, P = Practical, Tu = Tutorial**

Name & Sign [Chairman - Board of Studies]:

Name & Sign [Dean / Director]:

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Faculty of Science
The CVM University

CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

Faculty Name: Science

Programme Name: M.Sc. Surface Coating Technology

Semester: II

Academic Batch: 2022-23

| Course Group | Board of Studies / Faculty Ownership | Course Code | Course Name | Cr | Teaching Scheme | | | | Assessment/Evaluation Type | | External Exam Duration (Hrs.) | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T | P | Tu | Cont. Hrs | T | P | T | P | | | | | |
| Core | Science | 201470201 | Technology of Resins for Surface Coatings – I | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470202 | Chemistry & Technology of Organic Pigments, High Performance Pigments, Additives & Solvents | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470203 | Coating Properties & Analysis of Coating | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470204 | Practical: - Instrumental Analysis and Analysis of Additives, Solvents & Raw material for resin | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470205 | Practical: - Analysis of Industrial Coatings & Inks | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470206 | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | - | - | - | - | 50/20 | - | - | 50/20 |
| Elective | Science | 201470207 | Chemical Engineering Operations | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Science | 201470208 | Economics & Industrial Management | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |

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CVM UNIVERSITY
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Faculty Name: Science

Programme Name: M.Sc. Surface Coating Technology

Semester: III

Academic Batch: 2022-23

| Course Group | Board of Studies / Faculty Ownership | Course Code | Course Name | Cr | Teaching Scheme | | | | Assessment/ Evaluation Type | | External Exam Duration (Hrs.) | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T | P | Tu | Cont. Hrs | T | P | T | P | | | | | |
| Core | Science | 201470301 | Technology of Resins for Surface Coatings – II | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470302 | Technology of Paint Manufacturing | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470303 | Technology of Architectural Coatings and Industrial Coatings | 4 | 4 | - | - | 4 | T | | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 201470304 | Practical: - Processing of Surface Coatings I | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470305 | Practical: - Processing of Surface Coatings II | 4 | - | 8 | - | 8 | - | P | - | 4 | - | - | 50/20 | 50/20 | 100/40 |
| Core | Science | 201470306 | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | - | - | - | - | 50/20 | - | - | 50/20 |
| Elective | Science | 201470307 | Chemical Reaction Engineering | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Science | 201470308 | Technology of Packaging and Printing Inks | 4 | 4 | - | - | 4 | T | - | 2 | - | 50/20 | 50/20 | - | - | 100/40 |

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Faculty Name: Science

Programme Name: M.Sc. Surface Coating Technology

Semester: IV

Academic Batch: 2022-23

| Course Group | Board of Studies / Faculty Ownership | Course Code | Course Name | Cr | Teaching Scheme | | | | Assessment/Evaluation Type | | External Exam Duration (Hrs.) | | INT(T) Max./ Passing | EXT(T) Max./ Passing | INT(P) Max./ Passing | EXT(P) Max./ Passing | Grand Total Max./ Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | T | P | Tu | Cont. Hrs | T | P | T | P | | | | | |
| Core | Science | 401470401 | Coating Application & Specialty Coatings | 4 | 4 | - | - | 4 | T | - | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 401470402 | Corrosion Technology & Heavy Duty Protective Coatings | 4 | 4 | - | - | 4 | T | - | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 401470403 | Technology of Construction Chemicals | 4 | 4 | - | - | 4 | T | - | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Core | Science | 401470404 | Practical: - Project Work | 8 | | 16 | - | 16 | - | P | - | - | - | - | 100/40 | 100/40 | 200/80 |
| Core | Science | 401470405 | Comprehensive Viva-Voce | 1 | 1 | - | - | 1 | - | - | - | - | - | 50/20 | - | - | 50/20 |
| Elective | Science | 401470406 | Marketing Management | 4 | 4 | - | - | 4 | T | - | 2 | | 50/20 | 50/20 | - | - | 100/40 |
| Elective | Science | 401470407 | Environmental Management | 4 | 4 | - | - | 4 | T | - | 2 | | 50/20 | 50/20 | - | - | 100/40 |

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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470101**

**Course Title:** **Chemistry & Technology of Polymer Science**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** To enable the students to understand the importance of basic concept of polymer, mechanism and various techniques of polymerization, characterization of polymers by molecular weight and by advanced instrumental techniques viz. TGA, DSC, FTIR etc.

**b)** Functionality concept and importance of Tg.

**c)** The course provides basic information about the Chain Topology; Physical, chemical, thermal, mechanical, and electrical properties of polymers; Structure property relationship in polymers; Crystallinity; Concept of Cross Linking & Cross Link Density, its effect on polymer properties, Solubility criteria for the polymers, Solubility parameter, Solution properties, thermodynamics of polymer solutions, Phase separation in polymer solutions, Rheology of polymers; Degradation of Polymers

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Historical developments in Polymeric materials; Concept of Monomer, Oligomer & Polymer (Homopolymers & Copolymers); Classification of Polymer; Types of Polymerizations - Addition & Condensation polymerization, Techniques of polymerization – Bulk, Solution, Suspension & Emulsion; Kinetics of Polymerization |
| 2 | Functionality concept; Concept of Molecular weight of polymer, |



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| | |
|---|---|
| **3** | Determination of molecular weight. Characterization of polymers by Advanced Instrumental Techniques viz. TGA, DSC, FTIR etc. |
| **4** | Chain Topology; Glass Transition Temperature; Physical, chemical, thermal, mechanical, and electrical properties of polymers; Structure property relationship in polymers; Crystallinity; Concept of Cross Linking & Cross Link Density, its effect on polymer properties |

**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Bailey's Industrial Oils and Fat products Vol I to Vol V, Hui Y.H., 5th ed; John Wiley and Sons, NY., 1996. |
| **2** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996. |
| **3** | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993. |
| **4** | Introduction to Drying oil Technology by AR Mills. |
| **5** | Oldring PKT "Resins for surface coatings - VOI I", 2nd ed., 1995 |
| **6** | Principles of Polymer science, by Bahadur and Sastry, Narosa Publishing House 2002. |
| **7** | Polymer Science by Gowarikar, John Wiley and Sons, 1st ed., 1991 |
| **8** | Encyclopedia of polymer Science and Engineering, 2nd ed., John Wiley and Sons , Inc |
| **9** | Polymer Chemistry by Malcolm P. Stevens, Oxford University Press Inc, 1990. |
| **10** | Text book of Polymer Science, Billmeyer, John Wiley and Sons, .3rd ed. |
| **11** | Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corpn, 1982. |
| **12** | Introduction to Polymer Science and Technology, H.S. Kaufman and J.J. Falcetta, Willey – Interscience Publication, 1977. |
| **13** | Polymer Science and Technology of Plastics and Rubbers, 1st ed., P.Ghosh, Tata McGraw – Hill Publishing Company 1990. |
| **14** | Text book of polymer Science, P. Nayak and S.Lenka, Kalyani Publishers, 1986. |
| **15** | Fundamentals of polymer science an introductory text, P.Painter and M. Colman, Technomic publishing Co Inc, 1994. |
| **16** | Paint technology Manual, Part 2, 2nd ed., OCCA, "Chapman and Hall", NY 1969. |
| **17** | Polymer chemistry, Seymour and Carraher, Marcel Dekker, 2003. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| **Distribution of Theory Marks in %** | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |



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**Course Outcomes (CO):**

| Sr. No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student should be able to understand the basic concept of monomer, Polymer and repeating units and their properties. | **25** |
| **CO-2** | Students will be able to develop the knowledge in the concepts of Polymer, their classifications, and nomenclature.<br>Students will able to evaluate the mechanism and kinetics of free radical cationic and anionic polymerization. | **25** |
| **CO-3** | Students will able to appraise the mechanism and kinetics of copolymer free radical the synthesis techniques for polymer. | **25** |
| **CO-4** | Students will able to determine the concept of functionality, concept of molecular weight of the polymer and understand the techniques used for determination. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470102**

**Course Title:** **Chemistry & Technology of Inorganic Pigments**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Provide an introduction to the theory of Color, classification of Inorganic pigments and its reaction chemistry, synthesis, and its application.

**b)** Chemistry and technology of Extenders. Manufacture, properties, and application of anticorrosive pigments in Protective and Maintenance Coating.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Theory of Color; Important Physico-Chemical Characteristics of Pigments, Analysis & testing of pigments. |
| 2 | Classification of Inorganic Pigments; Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.; Chemistry & technology of Fillers. |
| 3 | Technology of Carbon Black Pigment; Manufacture, Properties and Applications of Metallic Pigments, Metal Oxide Pigments, Iron Blue Pigments, Ultra-marine Blue & Chromium Pigments |
| 4 | Manufacture, Properties & Application of anticorrosive pigments. |



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**Reference Books/Audio-visual Course:**


| | |
|---|---|
| **1** | HF Payne VOI II, Organic Coating Technology, 3rd ed John Wiley & Sons Ltd, 1967 |
| **2** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996 |
| **3** | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993. |
| **4** | T.C. Patton, Pigment Handbook, 3 VoIs, Wiley-Interscience, New York, 1973. |
| **5** | P.A. Lewis, Pigment Handbook, 3 Vols, Wiley-Interscience, New York, 1985. |
| **6** | Industrial Inorganic Pigments, BuxBaun, 3rd ed., 2005, Wiley – VCH Verlag |
| **7** | Metallic Pigments in Polymer, 1st ed., Ian Wheeler, Rapra Tech. Ltd., 1999 |
| **8** | Solomon 'Chemistry of Pigments & Fillers.', 1st ed., John Wiley & Sons., 1983 |
| **9** | Swaraj Paul, 'Surface coating', 2nd ed., John Wiley & Sons Ltd, 1996. |
| **10** | Z. W. Wicks, Jones, Pappas; "Organic Coatings" Sci. & Tech, VOl I John Wiley and Sons, Inc., NY 1992. |
| **11** | Pigments: An introduction to physical Properties, David Patterson |
| **12** | Basics of Paint Technology, Vol I, V.C. Malshe, 1st ed. 2000 |


**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Students will have a broad and fundamental understanding of Theory of Colour. The mechanism of color formation and effect of various factors on shade and hue of pigment. Understand the topics like Physico-Chemical Characteristics of Pigments, Analysis & testing of pigments. | **25** |
| **CO-2** | Students will understand Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.; | **25** |
| **CO-3** | Students will learn application, uses, Chemistry & technology of Extenders and Fillers. | **25** |
| **CO-4** | Students will understand the Manufacturing process, Properties & Application of anticorrosive pigments used to make anticorrosive paints and coatings. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470103**

**Course Title:** **Surface Chemistry & Surface Engineering**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Provides basic information about Application of surface chemistry, Interfacial tension, Free energy changes, wetting & emulsification; Chemistry & Technology of Surfactants.

**b)** Also, Introduction to Electroplating; Thermal Spray Coating; Cold Gas Dynamic Coating; Diffusion Coating; CVD & PVD; Plasma Immersion Ion implantation; DLC thin film; Sol Gel Coating; Laser Assisted Surface Engineering; Micro Arc Oxidation; Electro Spark Coating etc.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Surface Chemistry: Application of surface chemistry, Interfacial tension, Free energy changes, wetting & emulsification |
| 2 | Chemistry & Technology of Surfactants. |
| 3 | Surface Engineering: Introduction; Electroplating; Thermal Spray Coating; Cold Gas Dynamic Coating; Diffusion Coating; CVD & PVD; Plasma Immersion Ion implantation; DLC thin film |
| 4 | Sol Gel Coating; Laser Assisted Surface Engineering; Micro Arc Oxidation; Electro Spark Coating etc. |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Surfactants and Interfacial Phenomena, Milten, J. Rosen, Wiley Inter science Publication, New York. |
| **2** | "Paint flow and pigment dispersion", 2nd ed., T.C.Patton, 1979. |
| **3** | Fats, oleochemicals and surfactants: Challenges in the 21st century, Mani,V.V.S and Shitole. |
| **4** | Chemistry and Technology of Surfactants, Richard J. Farn, Blackwell Publishing Ltd. |
| **5** | Surface Engineering: ASM Handbook Volume 5, ASM International. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | |
|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** |
| **25** | **20** | **20** | **15** | **10** | **10** |

**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Understand the basic theory behind the application of surface chemistry, Concept of surface/interfacial energy and surface/ interfacial tension and behavior of surfactants. | **25** |
| **CO-2** | Understand Chemistry & Technology of Surfactants and how to select a particular surfactant for a surface coating application. | **25** |
| **CO-3** | Students have comprehensive background for understanding various manufacturing processes of engineering coatings and surface treatments, structure and properties of coatings, and their industrial use in technical applications. | **25** |
| **CO-4** | Student will be able to understand: - Principles of coating deposition and surface modification methods - Fundamental coating properties and their relationship - Introduction to corrosion and wear protection, and various functionalities obtainable by coatings and surface treatments | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470104**

**Course Title:** **Practical: - Analysis of Pigments, Oils & Resins**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The objective of this course is to educate the students about the composition of paints and their classifications.

**b)** Characterization (testing and evaluation) of properties of pigments and extenders and composition, properties and testing of Triglyceride / oil and resins.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Qualitative & quantitative analysis of different Organic & Inorganic Pigments, Vegetable oils, Natural & Synthetic resins. |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| CO-1 | Understand the Ingredients of Paints and its role. | 25 |
| CO-2 | Understand the various properties of pigments and extenders and determine them by analytical methods | 25 |
| CO-3 | Understand the composition and properties of various vegetable oils and learn the testing according to test methods. | 25 |
| CO-4 | Understand the Physical and chemical testing of resins according to test methods. | 25 |



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| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470105**

**Course Title:** **Practical: - Analysis of Architectural Coatings**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The objective of this course is to enable the students to understand various architectural coating properties and their evaluation.

**b)** To understand to analyse the paints.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Qualitative & quantitative analysis of various architectural coatings like different varnishes, Solvent based architectural paints, Primers, Putty, Water based paints etc. Demonstration Practical: Mechanical Engineering Operations |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| CO-1 | Analyse the surface coatings and evaluate the raw materials used | 25 |
| CO-2 | Apply the quality assurance procedures. Test the liquid architectural paints for various characteristics | 50 |
| CO-3 | Test various physical, chemical, and mechanical properties of architectural paints | 25 |



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| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470107**

**Course Title:** **Process Control & Instrumental Analysis**

**Course Group:** **Elective Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Provides an introduction to Process Control and to enable the students to understand the importance of First order and second order system, Pneumatic and electronic controllers baffle nozzle, characterization by advanced instrumental techniques viz. UV/VIS, HPLC, GC, TLC, Column etc.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents | Hours |
|---|---|---|
| 1 | Laplace transform, Response of first order system, First order in series, second order system. Time constants of measuring elements, modes of control action, selection of control modes, feedback systems component | 15 |
| 2 | Negative and Positive feedback systems, response time, Rise time, over shoot, decay ratio, transducers, Pneumatic and electronic controllers baffle nozzle mechanism for P, PI and PID systems. | 15 |
| 3 | Instrumental Analysis, Sample conditioning for process analyzers, Application of on-line analyzers in paint industries, IR process analyzers | 15 |
| 4 | UV/VIS absorption analyzers. Process gas and process liquid chromatography, HPLC, GC, TLC, Column, Paper. Use of ion- exchange resin in chemical analysis. | 15 |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Process systems Analysis and control, by D.R. Coughanour; 2nd ed Mc Graw Hill international Edition. |
| **2** | Chemical Process Control, An Introduction to Theory and Practice by G Stephanopoulas, Prentice Hall of India Private Ltd, New Delhi. |
| **3** | Instrumental Methods of Chemical Analysis, by B.K. Sharma, 2nd Edition, GOEL Publishing House, Meerut. |
| **4** | Spectroscopy of organic compounds, by P.S. Kalsi, 5th Ed. New Age International Publishers. |
| **5** | Analytical Chemistry by D. Kealy and P.J. Haines, Viva Books Pvt. Ltd., New Delhi. |
| **6** | Organic Spectroscopy by W. Kemp.3rd Ed. ELBS with Mac Millan |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Learn the Response of first order system, First order in series, second order system. Time constants of measuring elements | **25** |
| **CO-2** | Understand the construction & working of Pneumatic and electronic controllers baffle nozzle | **25** |
| **CO-3** | Knowledge of important Instrumental Analysis and Sample conditioning | **25** |
| **CO-4** | Understand the construction & working of various equipment used like liquid chromatography, HPLC, GC, TLC, Column, Paper | **25** |

| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **I**

**Course Code:** **201470108**

**Course Title:** **Mechanical Engineering for Coating Technologist**

**Course Group:** **Elective Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Provides an Introduction to; Engineering Materials & Their Properties; Elements of power transmission, Couplings & Seals; Metal Cutting Machines; Sheet Metal Operations; Welding & Casting; Abrasive Machining Process; Hydraulic & Pneumatic systems; Nozzles & Spray Guns; Spraying Systems; Robotics; Forging & Rolling

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents | Hours |
|---|---|---|
| 1 | Introduction; Engineering Materials & Their Properties | 15 |
| 2 | Elements of power transmission, Couplings & Seals | 15 |
| 3 | Metal Cutting Machines; Sheet Metal Operations; Welding & Casting; | 15 |
| 4 | Abrasive Machining Process; Hydraulic & Pneumatic systems; Nozzles & Spray Guns; Spraying Systems; Robotics; Forging & Rolling | 15 |

**Reference Books/Audio-visual Course:**

| | |
|---|---|
| 1 | Basic Mechanical Engineering, by R B Arora & B K Raghunath, Atul Prakashan |
| 2 | Robotics: Principal & Practice, Dr K.C. Jain, Dr. L.N. Aggarwal, Khanna Publications |
| 3 | Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, PHI Pvt. Ltd. |
| 4 | Introduction to Hydraulics (3rd ed), John Pippenger, Tyler Hicks, Mc-Graw Hill Book Co., |



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| | |
|---|---|
| **5** | Oil Hydraulic Systems: Principles & maintenance, Majumdar S.R. |
| **6** | Hydraulics & Pneumatics: A Technician's & Engineers' guide, Andrew Parr, Jaico |
| **7** | Basic Mechanical Engineering, by R B Arora & B K Raghunath, Atul Prakashan |
| **8** | Robotics: Principal & Practice, Dr K.C. Jain, Dr. L.N. Aggarwal, Khanna Publications Publishing House. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Students will understand various modern engineering materials and their properties. | **25** |
| **CO-2** | Ability to learn Elements of power transmission, couplings and seals, metal cutting machines, different welding methods and their defects | **25** |
| **CO-3** | List equipment used in spray painting, Gravity feed, Single pressure pot, Pumped feeds. Manifold supplies, Spray gun atomizing and air control, Needle settings and caps. | **25** |
| **CO-4** | Students will have understanding and Classification of forging processes. Forging defects and inspection. Rolling: Classification of rolling processes. Rolling of bars and shapes. | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470201**

**Course Title:** **Technology of Resins for Surface Coating - I**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Study about Chemistry and Technology of Synthetic resins viz. Alkyds, Polyester, Phenolics, Amino, Acrylic & Vinyl resins. Chemistry and Technology of Natural resins like rosin, shellac, Bitumen, Asphalts and Coal tar – Their modifications & uses.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Chemistry and Technology of Synthetic resins viz. Alkyds, Saturated and Unsaturated Polyester Resin, Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings. |
| 2 | Chemistry and Technology of Synthetic resins viz. Phenolic and Amino Resins, Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings. |
| 3 | Chemistry and Technology of Synthetic resins viz. Acrylic & Vinyl Resins: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings. |
| 4 | Chemistry and Technology of Oils and Natural resins like rosin, shellac, Bitumen, Asphalts and Coal tar – Their modifications & uses |



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**Reference Books/Audio-visual Course:**


| | |
|---|---|
| **1** | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993. |
| **2** | Resins for surface coatings, Vol I, II & III, P.K.T. Oldring, SITA Technology |
| **3** | Resins for coating: Chemistry, Properties and Applications, 1st ed, Stoye D, Hanser Publishers, 1996. |
| **4** | "Organic coatings, Science & Technology" Vol I, Wicks, Wiley Interscience Pub. Ltd, 1992. |
| **5** | The Chemistry of Organic Film Formers, Soloman, D.F. Wiley, New York. |
| **6** | Swaraj Paul, 'Surface coating', 2nd ed., John Wiley & Sons Ltd, 1996. |
| **7** | Surface coatings Vol 1 to 3 WILSON, 1st ed, Elsevier Applied Science, 1986 |
| **8** | The Technology of Paints, Varnishes & Lacquers, 1st ed., C.R. Martens, Roberts E Kniger Pub. Co-Oprat, 1974. |
| **9** | High solids Alkyd Resins, Holmberg Krister, Marcel Dekker, 1987 |
| **10** | CNSL Patents, Cashew promotion council, Ernakulam |
| **11** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996 |
| **12** | Alkyd Resin Technology, T.C. Patton |
| **13** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **14** | Water borne and Solvent based Coatings, Resins & Their Applications – Vol 1, OLDRING, 1996. |


**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the types Raw materials for Polyester resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |
| **CO-2** | Student will understand the types Raw materials for Phenolic and Amino resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |
| **CO-3** | Student will understand the types Raw materials for Acrylic and Vinyl resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |



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| | | |
|---|---|---|
| **CO-4** | Student will understand the availability of Vegetable oils and Natural resins, their extraction Process, modification, and application in surface coatings. | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470202**

**Course Title:** **Chemistry & Technology of Organic Pigments, High Performance Pigments, Additives & Solvents**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Introduce basic concepts of Dyes & Organic Pigments. It covers Technology & Applications of High-Performance Pigments & Special Effect Pigments.

**b)** Introduces the concept of Types, preparation, and applications of Metallic Driers; Additives used in aqueous and non-aqueous paint systems for wetting and dispersion, Storage stability and application properties. Classification of Solvents and Plasticizers.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Concept of Dyes & Pigments; Lakes, Tonner, Resinated pigments, Flushed Colors, Dispersed Colors; Chemistry and Technology of Organic Pigments: Azo Pigments, Benzimidazolone dioxazines, Naphthol AS Pigments, perylenes, Phthalocyanines, Quinacridones etc. |
| 2 | Technology & Applications of High-Performance Pigments & Special Effect Pigments |
| 3 | Types, preparation, and applications of Metallic Driers; Additives used in aqueous and non-aqueous paint systems for wetting and dispersion, Storage stability and application properties |
| 4 | Solvents: Classification of Solvents, their characteristics, uses and application. Plasticizers: Classification, Characterization, Theory, and application |



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**Reference Books/Audio-visual Course:**


| | |
|---|---|
| **1** | HF Payne VOI II, Organic Coating Technology, 3rd ed John Wiley & Sons Ltd, 1967. |
| **2** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996 |
| **3** | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993 |
| **4** | T.C. Patton, Pigment Handbook, 3 VoIs, Wiley-Interscience, New York, 1973. |
| **5** | P.A. Lewis, Pigment Handbook, 3 Vols, Wiley-Interscience, New York, 1985. |
| **6** | Herbst; 'Industrial Organic Pigments, Production, Properties and Application', 3rd ed., Wiley – VCH Verlag, 2004. |
| **7** | Swaraj Paul, 'Surface coating', 2nd ed., John Wiley & Sons Ltd, 1996. |
| **8** | "High Performance Pigments", Smith, Wiley – VCH Verlag, 2002 |
| **9** | Stoye : Paints, Coatings and Solvents, 1st ed., Wiley – VCH, 1993 |
| **10** | Handbook of Coating Additives, J. Calbo, 1st ed., Vol I & II, Marcel Dekker, 1992 |
| **11** | Paint Additives: Recent development, G.B.Rothenberg |
| **12** | Additives for waterborne coatings, D.R. Karsa |
| **13** | Z.W.Wicks, Jones, Pappas; "Organic Coatings" Sci. & Tech, VOl I John Wiley and Sons, Inc., NY 1992. |
| **14** | Solvents; Durrans, Thos H. |


**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Students will understand the Chemistry, Properties and Applications of Organic Pigments. | **25** |
| **CO-2** | Students will understand the Chemistry, Properties and Applications of High-Performance Pigments & Special Effect Pigments used in surface coating applications. Will specify the special effects of pigments in paints and coatings. | **25** |
| **CO-3** | Students will understand Will the role and behaviour of Additives in Paint and coating formulation | **25** |
| **CO-4** | Students will understand the classification of Solvents, their characteristics, uses and application. | **25** |



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| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
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| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470203**

**Course Title:** **Coating Properties & Analysis of Coating**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Study of important characteristics of surface coating viz. Rheological properties, Optical Properties, Adhesion and Mechanical properties, Corrosion and Chemical resisting properties, Film thickness, Liquid Paint. Surface Coating defects and Durability of coatings.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Study of important characteristics of surface coating viz. Rheological properties, Optical Properties |
| 2 | Study of important characteristics of surface coating viz. Adhesion and Mechanical properties, Corrosion and Chemical resisting properties, Film thickness, Liquid Paint analysis according to ASTM, BIS and BS Standards. |
| 3 | Characterization of Varnishes according to ASTM, BIS and BSS Standards. Durability of coatings- Natural and Accelerated methods. |
| 4 | Surface Coating defects: Defects in liquid paints, during application and cure and in dry film exposure. |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Organic Coatings: Properties and Evaluation, Kronstandt. |
| **2** | Organic Coatings - Applications, Properties & Performance, Vol II, Wicks Z. W., Wiley Interscience Pub.ltd., 1992. |
| **3** | Hess's Paint film defects, 3rd ed, Hamburg,H & Morgans,W.M. |
| **4** | Protective Paint coatings for metals, Fraunhofer and Boxall, Particullis Press Ltd, 2 Queensway, Surey, England. |
| **5** | Surface coatings: Vol II: Paints & Their Applications, 2nd ed., OCCA, Chapman and Hall, 1984. |
| **6** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **7** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996 |
| **8** | Adhesion of coatings: Theory and Practice, PROSSER |
| **9** | Paint Testing Manual, 14th ed., Gardner Sward |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will have the understanding of Rheology of Polymers, its flow and understanding how to measure optical properties. | **25** |
| **CO-2** | Student will be having through understanding of analysis of paint and coatings according to ASTM, BIS and BS Standards, Characterization of Varnishes according to ASTM, BIS and BSS Standards | **25** |
| **CO-3** | Understand the durability of the paint and coating via Natural and Accelerated methods. | **25** |
| **CO-4** | Identify various coating defects and describe remedial measures | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470204**

**Course Title:** **Practical: - Instrumental Analysis & Analysis Of Additives, Solvents & Raw Material For Resin**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** The objective of this course is to educate the students about how to make use of the Instrumental Analysis and will test and analyze different additives, solvent and raw material to prepare Synthetic resins.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Instrumental analysis of various paint raw materials; Quantitative & Qualitative analysis of additives for surface coatings, various solvents and selected raw materials for different synthetic resins. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Understand the Physical and chemical testing of resins according to test methods. | **25** |
| **CO-2** | Understand how to determine the Viscosity average Molecular weight, R I Value, Surface Tension, pH, conductivity of the raw materials | **25** |
| **CO-3** | To understand composition and properties of various additives and learn how they are tested as per standard test methods | **25** |
| **CO-4** | To understand the methods of testing of Various Volatile solvents and their properties | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470205**

**Course Title:** **Practical: - Analysis of Industrial Coatings & Inks**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** To understand various Industrial coating and Printing Ink properties and their evaluation.

**b)** To understand to analyze the Industrial paints as per standard test methods.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Qualitative & quantitative analysis of various Industrial coatings like Epoxy coatings, Polyurethane coatings, Zinc rich coatings, Chlorinated rubber coatings etc. Qualitative & quantitative analysis of various inks like screen printing ink, lithographic ink, Flexographic inks etc. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will learn how Qualitative & quantitative analysis of various Industrial coatings like Epoxy coatings, Polyurethane coatings, Zinc rich coatings, Chlorinated rubber coatings etc can be done | **100** |

| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470207**

**Course Title:** **Chemical Engineering Operations**

**Course Group:** **Elective Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Introduce various Concept of Unit Operations; Types of Pumps, Principles of Operation of Pumps; Vacuum producing devices; Compressors; Blowers; Size reduction– crushing and grinding; Filtration; Drying; Distillation; Mixing; Heat exchangers, Principles of heat transfer, types of heat transfer, different types of heating media.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Concept of Unit Operations, Transportation of Fluids, Types of Pumps, Principles of Operation of Pumps. |
| 2 | Size reduction – crushing and grinding, Sedimentation, Filtration |
| 3 | Drying; Distillation; Mixing |
| 4 | Mode of heat transfer, types of heat transfer, different types of heating media. |

**Reference Books/Audio-visual Course:**

| | |
|---|---|
| 1 | Concept of Unit Operations, Transportation of Fluids, Types of Pumps, Principles of Operation of Pumps. |
| 2 | Size reduction – crushing and grinding, Sedimentation, Filtration |
| 3 | Drying; Distillation; Mixing |



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| | |
|---|---|
| **4** | Mode of heat transfer, types of heat transfer, different types of heating media. |
| **5** | Concept of Unit Operations, Transportation of Fluids, Types of Pumps, Principles of Operation of Pumps. |
| **6** | Size reduction – crushing and grinding, Sedimentation, Filtration |
| **7** | Drying; Distillation; Mixing |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the types and principles operation of Pumps. Student will understand the underlying concepts and methods behind Blowers & Compressors. | **25** |
| **CO-2** | Student should ability to understand the filtration techniques. | **25** |
| **CO-3** | Student will understand the types and principles operation of Pumps. Student will understand the underlying concepts and methods behind Blowers & Compressors. | **25** |
| **CO-4** | Understand the relevance and importance of the Heat Exchangers, principle of heat transfer and types. | **25** |

| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **II**

**Course Code:** **201470208**

**Course Title:** **Economics & Industrial Management**

**Course Group:** **Elective Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Introduce various Concept of Economics and HR, Inventory Management and Industrial Management.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Economics: Basic Economics Concept, Demand and Supply, Elasticity of Demand and Supply, Concept of Profit and Revenue, Concept of Equilibrium and Margin, Introduction to Micro and Macro Economics and Price theory. Commercial and Central banking; Analysis and interpretation of standard financial statements; |
| 2 | Industrial Management: Management: Concept, Nature, Functions: Planning, Organizing, Directing, Control, Decision Making, Business: Concept & Objectives, Forms of Business Organization |
| 3 | Human Resource Management: Concept – Functions- Recruitment and Selection, Training and Development, remuneration and incentive schemes |
| 4 | Inventory Management: Meaning, Importance, Techniques, Quality Control: Meaning, Importance, TQM |

**Reference Books/Audio-visual Course:**



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| | |
|---|---|
| **1** | Fundamentals of Business Organization & Management by: Y.K. Bhushan. |
| **2** | Projects: Planning, Analysis Selection, Implementation & Review by :Prasannanchendun. |
| **3** | Industrial Engineering & Management by: O.P.Khanna. |
| **4** | Personnel Management: C.B. Mamorian. |
| **5** | Best Practice in Inventory Management, by Tony Wild, Elsevier Science |
| **6** | Essentials of Inventory Management, by Max Muller, AMACOM |
| **7** | Total Quality Management – An Introductory Text by Paul James, Prentice Hall |
| **8** | Quality Control and Applications by Housen & Ghose |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Understand the basic concept of Economics. Introduction to Micro and Macro Economics | **25** |
| **CO-2** | Students should be able to explain the fundamental concepts of Industrial Management | **25** |
| **CO-3** | Students should be able to understand Human Resource Management: Concept – Functions- Recruitment and Selection, Training and Development, remuneration and incentive schemes | **25** |
| **CO-4** | Students should be able to analyse practical situations and be able to provide applicable solutions. | **25** |

| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470301**

**Course Title:** **Technology of Resins for Surface Coating - II**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Study Chemistry and Technology of Synthetic resins viz. Polyamides, Epoxy, Polyurethanes, Silicone resin, Chlorinated Rubber, Cellulosic film formers e.g. Nitrocellulose and CAB modifications & uses.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Chemistry and Technology of Synthetic resins viz. Epoxy Resins: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings. |
| 2 | Chemistry and Technology of Synthetic resins viz. Polyamides and Polyurethanes resin: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications. |
| 3 | Chemistry and Technology of Synthetic resins viz. Silicone resin, and Chlorinated Rubber: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications. |
| 4 | Chemistry and Technology of Cellulosic film formers e.g. Nitrocellulose and CAB. |



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**Reference Books/Audio-visual Course:**


| | |
|---|---|
| **1** | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993. |
| **2** | Resins for surface coatings, Vol I, II & III, P.K.T. Oldring, SITA Technology |
| **3** | Resins for coating: Chemistry, Properties and Applications, 1st ed, Stoye D, Hanser Publishers, 1996. |
| **4** | "Organic coatings, Science & Technology" Vol I, Wicks, Wiley Interscience Pub. Ltd, 1992. |
| **5** | The Chemistry of Organic Film Formers, Soloman, D.F. Wiley, New York. |
| **6** | Swaraj Paul, 'Surface coating', 2nd ed., John Wiley & Sons Ltd, 1996. |
| **7** | Surface coatings Vol 1 to 3 WILSON, 1st ed, Elsevier Applied Science, 1986 |
| **8** | The Technology of Paints, Varnishes & Lacquers, 1st ed., C.R. Martens, Roberts E Kniger Pub. Co-Oprat, 1974. |
| **9** | High solids Alkyd Resins, Holmberg Krister, Marcel Dekker, 1987 |
| **10** | CNSL Patents, Cashew promotion council, Ernakulam |
| **11** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996 |
| **12** | Alkyd Resin Technology, T.C. Patton |
| **13** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **14** | Water borne and Solvent based Coatings, Resins & Their Applications – Vol 1, OLDRING, 1996. |


**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the types Raw materials for Epoxy resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |
| **CO-2** | Student will understand the types Raw materials for Polyamide and Polyurethane resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |
| **CO-3** | Student will understand the types Raw materials for Silicone. Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |



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| | | |
|---|---|---|
| **CO-4** | Student will understand the types Raw materials for Cellulosic film formers. Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings. | **25** |

| **Curriculum Revision:** | |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470302**

**Course Title:** **Technology of Paint Manufacturing**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Emphasises on Principles of Paint Formulation, Theory of pigment Wetting and Dispersion technology, Coating manufacturing equipment, Plant Location & Paint Factory Layout;

**b)** Important concepts of production Management. Pollution & its control in paint industry; Safety & Hygiene in Paint Industry.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Principles of Paint Formulation, Rheology of mill base consistency by Daniel flow point and f (PVC); Concept of Pigment Volume concentration (PVC) and CPVC, RTM & MBC |
| 2 | Theory of pigment Wetting and dispersion; Dispersion technology |
| 3 | Coating manufacturing equipment's - Machinery used for grinding of minerals and Pigments for paints including Balls Mill, Sand Mill, Dyano Mill, Attritor, Basket Mill, HSDD, TSD, TRM etc. |
| 4 | Plant Location & Paint Factory Layout; Important concepts of production management, Pollution & its control in paint industry; Safety & Hygiene in Paint Industry |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Surface coatings: Vol II: Paints & Their Applications, 2nd ed., OCCA, Chapman and Hall, 1984. |
| **2** | "Paint flow and pigment dispersion", 2nd ed., T.C.Patton, 1979 |
| **3** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **4** | Basics of Paint Technology, Vol I, V.C. Malshe, 1st ed. 2000 |
| **5** | Basics of Paint Technology, Vol II, V.C. Malshe, 1st ed. 2008 |
| **6** | Organic Coatings - Applications, Properties & Performance, Vol II, Wicks Z. W., wiley interscience pub.ltd., 1992 |
| **7** | Paint Formulations: Principles & Practice; J. Boxal & Fraunhoffer |
| **8** | Concise Paint Technology, J. Boxal & Fraunhoffer, 1st ed., Chem Pub., 1979 |
| **9** | "Introduction to Paint Chemistry & Principle of Paint Technology", 3rd ed., Turner G.P, Chapman & Hall, 1988 |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the fundamental principles of Paint and Coating Formulation. | **25** |
| **CO-2** | Ability to understand various factors affecting the stability of paint. Ability to handle various machineries and equipment used in laboratory as well as commercial scale. | **25** |
| **CO-3** | Ability to understand the Machinery used in Paint and Coating Industry. | **25** |
| **CO-4** | Understand the Air, Water and Soil Pollution and its control in paint and coating industry. Ability to understand Safety & Hygiene in Paint, Coating and Allied Industry. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470303**

**Course Title:** **Technology of Architectural Coatings and Industrial Coatings**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The course introduces various Classifications of coatings, Mechanisms of film formation in surface coatings, Technology of solvent based architectural & industrial coatings, Technology of Water based Paints & coatings, Technology of Powder coatings and Technology of Construction Chemicals.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Classification of coatings; Mechanisms of film formation in surface coatings, Technology of solvent based architectural & industrial coatings |
| 2 | Technology of Water based Paints & coatings: Cement Paints, Chemistry and technology of emulsion and latex paints, Preparation of latex, Emulsion Polymerization Plant and Design; Developments in waterborne coatings |
| 3 | Specific application Paints and Coatings: Wood Finishes, Road Marking Paint, Automotive coatings and refinishes, Novelty Finishes |
| 4 | Technology of Varnishes & lacquers and Recent trends in Coating Industry |

**Reference Books/Audio-visual Course:**


| | |
|---|---|
| 1 | The Technology of Paints, Varnishes & Lacquers, 1st ed., C.R. Martens, Roberts E Kniger Pub. Co-Oprat, 1974. |
| 2 | Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I "Chapman and Hall", NY, 1993 |




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| | |
|---|---|
| **3** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **4** | Water borne and Solvent based Coatings, Resins & Their Applications – Vol 1, OLDRING, 1996. |
| **5** | Emulsion Polymers and Emulsion Polymerization, BASSETT. |
| **6** | Waterborne Coatings: Emulsions and Water Soluble Paints. 'C.R. Martens'. Van Nostrand Reinhold Company, 1981 |
| **7** | WM Morgan, "Outlines of Paint Technology.", 3rd ed, CBS Publishers & Distributors, 1996. |
| **8** | Principles of Emulsion Technology; Bacher & Paul |
| **9** | "Organic Coating Technology - VOI II", HF Payne, 3rd ed John Wiley & Sons Ltd, 1967 |
| **10** | Protective & Decorative Coatings, Vol I, II & III, J.J. Mattiello |
| **11** | Powder coatings: A Practical Guide to equipments, Process & Productivity at a profit, Vol II, Howell David M, John Willey, 2000. |


**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student should ability to understand the coating system via classification and film formation mechanisms.<br>To be able to decide basic criteria for paint and coating recipe. | **25** |
| **CO-2** | Basic understanding of designing Solvent and Water base paint formulation considering various ingredients. | **25** |
| **CO-3** | Student should ability to understand safety issues, VOC in industries, Zero or Low VOC techniques. | **25** |
| **CO-4** | Student should able to understand the concept of Varnish and Lacquers. And understand the Recent trends in Coating Industry | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470304**

**Course Title:** **Practical: - Processing of Surface Coatings - I**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The objective of this course is to enable the students to understand to do laboratory scale experiment for synthesis of polymers like Hard resins, Alkyds, Varnishes, Polyesters, Epoxies, Polyamides, Acrylics, Amino resins, CNSL resin, emulsions & water reducible resins.

**b)** To design and conduct experiments for synthesis of Resins and polymers and understand the practical problems related to the experiment.

**c)** To analyse and characterize the polymers by finding softening point, epoxy value, acid value, % solid viscosity etc. within realistic constraints of the experiment.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Synthesis & characterization of various surface coating resins like Hard resins, Alkyds, Varnishes, Polyesters, Epoxies, Polyamides, Acrylics, Amino resins, CNSL resin, emulsions & water reducible resins etc. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Formulate and evaluate Alkyd resins and carry out calculations for making tailor made alkyds | **25** |
| **CO-2** | Study chemistry and prepare epoxy resins | **25** |
| **CO-3** | Study various coating systems based on PU resins and their applications | **25** |
| **CO-4** | Study Vinyl and acrylics and their applications in surface coatings | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470305**

**Course Title:** **Practical: - Processing of Surface Coatings - II**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The objective of this course is to enable the students to understand to do laboratory scale experiment and design different formulation for Water based and Solvent based Primer, Intermediate Coat and Top coat, Clear coat, Varnish and Lacquers.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 8 | 4 | --- | --- | 50/20 | 50/20 | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Daniel flow point, Preparation of selected organic & inorganic pigments; Preparation of different architectural & industrial coatings like Enamels, Primers, Putties, Lacquers, Water based paints, Inks, HDPCs, Conversion coatings etc. |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | The student should be able to choose and decide the dosage of various pigments, extenders and additives in paints coating formulation and to be able to decide basic criteria for paint recipe | **25** |
| **CO-2** | Basic understanding of designing paint formulation considering various ingredients | **25** |
| **CO-3** | Ability to handle various machineries and equipment used in laboratory commercial scale | **25** |
| **CO-4** | Ability to understand various factors affecting the stability of paint and test different tests as per standard methods | **25** |

| **Curriculum Revision:** | |
|---|---|
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| Last Reviewed on (Month-Year): | April 2023 |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470307**

**Course Title:** **Chemical Reaction Engineering**

**Course Group:** **Elective Subject**

**Course Objectives:**

**a)** The first part of the course aims to apply knowledge from differential equations, thermodynamics, general chemistry, and material and energy balances to solve reactor design problems, to examine reaction rate data to determine rate laws, and to use them to design chemical reactors, and to choose the most appropriate reactor for a given need.

**b)** To study the basics of global reaction rate for heterogeneous reaction systems, construction & working of 3-phase reactors, BET method for determination of surface area, Helium-Mercury method for porosity determination.

**c)** The second part of the course covers various types of steam, factors to be considered in designing a steam generator, calculations involving boiler such as heat supply required, boiler efficiency, boiler power etc.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Classification of Chemical Reactors; Design equations for isothermal and adiabatic operation |
| 2 | Multiple reactor system, Recycle reactors, constant volume and constant pressure reactors |
| 3 | Kinetics of reversible, complex (Parallel and Series) and Autocatalytic reactions |
| 4 | Kinetics of heterogeneous reactions – Global rate of reaction; Adsorption Langmuir and BET; Catalyst Promoters, Poisons and Inhibitors, Surface Reactions Unimolecular and Bimolecular; Introduction to Catalytic Reactors |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Chemical Reaction Engg. by Octave Levenspiel , 3rd Ed. John Wiley & Sons. |
| **2** | Chemical Engg. Kinetics, by JM Smith, 3rd Ed. McGraw Hill Book Co. |
| **3** | Fundamentals of Chemical Reactions Engg., 2nd Ed. by Holland and Anthony, Prentice- Hall International Edition. |
| **4** | Chemical Reactor Theory, by Denbigh and Turner, University of Cambridge. |
| **5** | Reaction Engg. through solved problem, by Srivastva and Pande, Metropolitan Book Co(P) Ltd, New Delhi |
| **6** | Chemical Kinetics, by S.K. Jain, Vishal Publication, Jallandhar |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Students will be able to classify different types of chemical reactors and derive design equations for isothermal and adiabatic operations for effective reactor design and analysis. | **25** |
| **CO-2** | Students will be able to analyze multiple reactor systems, including recycle reactors, and evaluate the performance of constant volume and constant pressure reactors to optimize reaction processes. | **25** |
| **CO-3** | Students will be able to interpret the kinetics of reversible, complex (parallel and series), and autocatalytic reactions to predict reaction behavior and conversion efficiency. | **25** |
| **CO-4** | Students will be able to explain the kinetics of heterogeneous reactions, adsorption theories (Langmuir and BET), and the role of promoters, poisons, and inhibitors, and apply this knowledge to the design and operation of catalytic reactors. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **III**

**Course Code:** **201470308**

**Course Title:** **Technology of Packaging and Printing Inks**

**Course Group:** **Elective Subject**

**Course Objectives:**

**a)** The course covers in Printing Ink: Difference between Paints and Inks, the different printing Processes, Classification of Inks based on Printing Processes, Specialty Inks.

**b)** The course covers in Packaging: Elements of packaging, Packaging materials and their forms, Plastic as packaging material in different forms

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Difference between Paints and Inks- Formulation, manufacturing & Application basis. The different printing Processes like Gravure, Flexographic, Screen, Lithography and Letterpress. Classification of Inks on the basis of Printing Processes. Their manufacturing techniques. Methods of Ink Drying. |
| 2 | Inkjet, Laser, Photostat copier - their merits and demerits. Quality control of Inks. Specialty Inks (Antiforgery/Security). Behavior of Inks on machines; Trouble shooting in various printing processes; Storage stability of Inks, |
| 3 | Elements of packaging, natural packaging, packaging values, Professional approach to develop package for food products, general consumables, cosmetics, pharmaceuticals, engineering materials and other utilities. Packaging materials and their forms. Paper and paper board, folded cartons and setup boxes, corrugated board, box construction, interior packing's, moulded forms, paper composites, tetra pack, wood containers, glassware's. |



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| | |
|---|---|
| **4** | Plastic as packaging material in different forms- flexible polymeric films, metallic foils, orientation and metallization.<br>Metal containers- tin plate cans, tin free steel cans and tempers, coatings and linings, aluminum cans, collapsible tubes, fiber tubes, Aerosols-principle, valves. Coatings and lamination, paper films and foils for lamination, adhesives, labels and labeling, heat transfer labels, coding and holograms etc. Package printing importance, Package disposal, Eco-Friendly packing's, Innovations in packaging: Active packaging, anti-microbial containers, RFID technologies. |

**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Printing Ink Manual; by R. H. Leach & R. J. Pierce |
| **2** | Handbook on Printing Technology |
| **3** | Modern Printing Technology |
| **4** | Complete Book on Printing Technology |
| **5** | Handbook of Package Engineering by Joseph F. Hanlon |
| **6** | Edible Coatings & Soluble Packaging by Roger Daniels |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student should able to understand formulations of Printing Ink based on different printing processes. | **25** |
| **CO-2** | Ability to understand testing methods for printing Inks. . | **25** |
| **CO-3** | Ability to understand the surface preparation methods for printings and printing defect. | **25** |
| **CO-4** | Will apply and examine the knowledge of properties for selection of packaging materials. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470401**

**Course Title:** **Coating Application & Specialty Coatings**

**Course Group:** **Core Subject**

**Course Objectives:**

The objectives of this course are to enable students to…

**a)** Study techniques of Surface Preparation for different substrate.
**b)** Conversion Coatings and Pre-treatment Chemicals.
**c)** Highlight on paint application techniques and its efficiency.
**d)** Study of Coil Coating, UV cured coating, Waterborne PU Coatings, Non-Stick coatings, Smart Coatings, Hygienic Coatings.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Techniques of Surface Preparation: Need for Surface Preparation; Manual and Mechanical methods of Surface Preparation, e.g. Sand blasting and Flame clearing |
| 2 | Conversion Coatings and Pretreatment Chemicals for Ferrous and Non-Ferrous Substrate; Surface Preparation for Plastic Substrates; Rust Converters |
| 3 | Techniques of Paint Application: Brushing, dipping, conventional spray, Air less spray, electrostatic spray, Bell applicator, electro deposition coating, vacuum impregnation, Curtain coating and roller coatings |
| 4 | Study of Coil Coating, UV cured coating, Powder Coatings, Non Stick coatings, Smart Coatings, Hygienic Coatings |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Organic Coatings - Applications, Properties & Performance, Vol II, Wicks Z. W., wiley Interscience pub.ltd., 1992. |
| **2** | Protective Paint coatings for metals, Fraunhofer and Boxall, Particullis Press Ltd, 2 Queensway, Surey, England. |
| **3** | Surface coatings: Vol II: Paints & Their Applications, 2nd ed., OCCA, Chapman and Hall, 1984. |
| **4** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **5** | The Technology, Formulation & Application of Powder coatings Vol I, Howell David M, John Willey, 2000. |
| **6** | Phosphating of Metals, RAUSH. |
| **7** | Automotive Paints and Coatings, Hans-Joachim Streitberger & Karl-Friedrich Dossel, 2008 |
| **8** | Paint Technology Handbook, Rodger Talbert, 2007 |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Students should be able to: - Decide the surface preparation methods suitable for different substrate materials. | **25** |
| **CO-2** | Students should be able to understand the requirements and applications of Conversion Coatings and Pre-treatment Chemicals | **25** |
| **CO-3** | Apply knowledge on properties offered by different Coatings based on the application requirement. | **25** |
| **CO-4** | Understand the basic concept of speciality coatings & interpret testing & evaluation. | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470402**

**Course Title:** **Corrosion Technology & Heavy Duty Protective Coatings**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The course provides an introduction to theory of Corrosion Science, Engineering and Technology, Practical forms of corrosion, Corrosion under various conditions, Corrosion in industries, Corrosion testing, Corrosion Inhibition, Technology of Heavy Duty Protective Coatings and Technology of Marine Coatings

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Corrosion Science, Engineering and Technology:- corrosion damage and cost of corrosion; functional and economic aspects of corrosion; classifications of corrosion processes; corrosion quantification and corrosion rate expressions; electrochemical aspects to affect corrosion rate - polarization and passivity; environmental factors to affect the corrosion rate. |
| 2 | Practical forms of corrosion (in practice)<br>1.Uniform corrosion,<br>Non-uniform/localized attack (i) Galvanic/Bimetallic (ii) Crevice & Filiform (iii) Pitting (iv) Inter granular corrosion (v) Selective leaching-dezincification & graphitization (vi) Erosion corrosion - impingement attack, cavitation damage, fretting corrosion (viii) Stress corrosion cracking & corrosion fatigue |



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| | |
|---|---|
| **3** | Miscellaneous-Hydrogen damage, radiation damage, caustic embrittlement.<br>(a) Corrosion under various conditions : atmospheric corrosion; underground corrosion-natural soil, stray current, biological corrosion; immersion corrosion; marine corrosion, liquid metal corrosion, aerospace, electronic equipments, dew point corrosion, high temperature corrosion.<br>(b) Corrosion in industries: chemical industries- pulp & paper, fertilizer, paint manufacture & application industries; petroleum refineries and petrochemical industries; building industry and rebar corrosion; boiler plants; automobile industry; nuclear power plants.<br>(c) Corrosion testing: Destructive and non-destructive methods; physico-chemical methods-immersion, humidity, salt spray; special property tests for SCC, IGC etc.; electrochemical methods-E-I curves/Evans diagrams/polarization diagrams; electrode potential measurements, impedance measurement, electronic instrumentations, NACE test methods;<br>(d) Corrosion Inhibition |
| **4** | Technology of Heavy Duty Protective Coatings:- Basic requirements of HDPC, Blasting, Coverage, Dry film Thickness, Chemical bondage criteria in 2K epoxy, Epoxy-Coal Tar, Epoxy Ester coatings, 2K Polyurethane Pigmented coatings, Tape Coatings, Chlorinated Rubber Paints, Zinc rich Coatings. HDPC for structures in corrosive environments.<br>Technology of Marine Coatings:- Anticorrosive Primers, Zinc Chrome & Red Lead based Boot-Top Paints. Anti-Fouling Paints- Soluble & Insoluble matrix, Self-Polishing, Copper complex based. Paints for Super structures & Harbor Installation. Testing of Marine Paints as per IS: 1470, 1419. |

**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Surface coating Technology Vol II, OCCA, Chapman and Hall, London & New York. |
| **2** | "Paints and surface coatings -Theory & Practice", 2nd ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999. |
| **3** | Protective Coatings for Metals, E.J. Vaughan & J.W. Gailer |
| **4** | Protective Paint coatings for metals, Fraunhofer and Boxall, Particullis Press Ltd, 2 Queensway, Surey, England. |
| **5** | Organic Coatings, Science and Technology, vol 2, WICKS. |
| **6** | Basics of Paint Technology, Vol I, 1st ed., V.C. Malshe, 2000 |
| **7** | Corrosion & corrosion protection handbook, by Philip A. Schweitzer (Ed.), Marcel Dekker c. |
| **8** | Corrosion and corrosion control by H.H.Uhlig & R.V.Revie Wiley-Interscience |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the Differentiation between erosion and corrosion and wet and dry corrosion, classifications of corrosion processes and factors affecting corrosion. | **25** |
| **CO-2** | Student will understand the electrochemical reaction, redox reactions in corrosion; understand construction of the electrochemical cell and Differentiate between EMF and Galvanic series | **25** |
| **CO-3** | Student will understand the mechanisms for preventing Uniform corrosion, Galvanic, Crevice, Pitting, Inter granular, Stress, Erosion, Filiform corrosion and Selective leaching and Hydrogen damage | **25** |
| **CO-4** | Student will understand corrosion prevention techniques like Heavy Duty Protective Coatings and Technology of Marine Coating. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
| Drafted on (Month-Year): | June 2022 |
| Last Reviewed on (Month-Year): | April 2023 |
| Next Review on (Month-Year): | March 2025 |



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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470403**

**Course Title:** **Technology of Construction Chemicals**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** The course provides an introduction to Construction chemicals which are mainly used for speeding up the work in construction projects that are under development or in new projects to add strength and durability to the constructions. These chemicals are mixed in a variety of construction materials to increase productivity, increase performance, boost functionality, and to safeguard the components of a building.

**b)** The subject includes theory of Construction chemicals which comprise of a varied range of products and includes flooring chemicals, sealants, admixtures, water proofing chemicals, Industrial Flooring, Grouts, and Chemicals for maintenance and repair of structures.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Concrete Admixtures: Mineral and Chemical Admixtures |
| 2 | Waterproofing materials in Construction<br>Concrete Repair/ Grouts: Cementitious and Polymer modified |
| 3 | Industrial Flooring: Floor Screeds & Toppings, Surface Treatments, ESD - Anti Static/ Dissipative/Conductive Floor Coatings, Road /Floor Marking Coatings |
| 4 | Sealants: Polysulphides, Polyurethanes, Silicone Bonding agents: SBR, Acrylic<br>Anchoring materials: Epoxy Other related materials such as curing agents, Mould release agents, surface retarders, expansive agents etc. |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Technology Of Building Materials and Chemicals With Processes (hand Book) |
| **2** | Building Construction Materials and Techniques by P. Purushothama Raj |
| **3** | Building Materials (Third revised edition) S. K. Duggal |
| **4** | Construction Chemicals Manufacturing Formulations Book (Grouts, Chaulks, Sealants, Putties & Adhesive) Paperback – 2016 by Dr. Javid Ahmad Dar. Ph.D |
| **5** | Technology Of Building Materials And Chemicals With Processes (hand Book) Sealants, Putties & Adhesive) Paperback – 2016 by Dr. Javid Ahmad Dar. Ph.D |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand how Concrete admixtures are used to improve the behaviour of concrete under a variety of conditions and their types as a Chemical and Mineral admixture. | **25** |
| **CO-2** | Student will understand and learn about waterproofing, types of waterproofing, advantages & disadvantages of waterproofing, its application and formulation and testing aspects. | **25** |
| **CO-3** | Student will understand the basic requirement of Industrial floor, different types of Industrial flooring options, its advantages and disadvantages and formulation and testing aspects. | **25** |
| **CO-4** | Student will understand the requirements and importance of Adhesives, Bonding agent and Sealants, its classification and types, formulation, testing and its application. | **25** |

| **Curriculum Revision:** | |
|---|---|
| Version: | 2 |
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| Last Reviewed on (Month-Year): | April 2023 |
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470404**

**Course Title:** **Practical: - Project Work**

**Course Group:** **Core Subject**

**Course Objectives:**

**a)** This course develops R & D related insight in the students and also gives them the exposure of the professional environment and includes hands on training on Industry identified problem / recent trends in the industry and to work on their solutions with the help of fundamental knowledge of Surface Coating Technology and Polymer Chemistry.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| --- | --- | 16 | 8 | --- | --- | 100/40 | 100/40 | 200/80 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Practical: - A project report based on literature survey and laboratory work conducted on topics related to Surface Coating Technology and/or chemistry is to be submitted and presented as a seminar by each student |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.



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**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | To identify the problem statement | **25** |
| **CO-2** | To learn the literature survey based on the problem statement, project work planning, and preparation of project reports | **25** |
| **CO-3** | To learn different laboratory techniques to solve the problem related to surface coating and its allied Industries | **25** |
| **CO-4** | To improve writing skills | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470406**

**Course Title:** **Marketing Management**

**Course Group:** **Elective Subject**

**Course Objectives:**

**a)** The course introduces management practices in the industry. The course provides important information regarding Marketing management, Building customer satisfaction, Brand Management, Sales Promotion and Public Relations and Export Management.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Basic concepts of marketing, Product, Price, Promotion and Distribution Functions of Marketing Management |
| 2 | Building customer satisfaction, strategic planning, marketing planning, MIS and marketing research, consumer behavior, marketing mix, business and competition analysis |
| 3 | Brand Management, Sales Promotion and Public Relations<br>Product Planning and Development, Product Life Cycle<br>Performance Evaluation of Marketing Programmes, global marketing, Rural Marketing, Industrial Marketing<br>Distributor Network: Importance & Management |
| 4 | Export Management – Importance, Promotion, Procedure and Problems Demand forecasting: long and short term demand forecasting methods. Regression Analysis and smoothing methods; Estimation of trend, cycle, seasonality components; Analysis of forecast error and computer control of forecasting systems |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Marketing Management by Philip Kotler. |
| **2** | Industrial Engineering & Management by: O.P.Khanna. |
| **3** | Marketing Management: Rajan Nair, J.C. Gandhi. |
| **4** | Managerial Economics by Peterson & Lewis |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Understand the basic concepts marketing, Product, Price, Promotion and Distribution Functions of Marketing Management | **25** |
| **CO-2** | Learn and understand how to Build customer satisfaction, its strategic and marketing planning, marketing research, consumer behaviour, marketing mix, business and competition analysis | **25** |
| **CO-3** | Understand the concept of Brand Management, Sales Promotion and Public Relations | **25** |
| **CO-4** | Learn and understand how to do Export Management – Importance, Promotion, Procedure and Problems Demand | **25** |

| **Curriculum Revision:** | |
|---|---|
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# FACULTY OF SCIENCE

## Effective from Academic Batch: 2022-23

**Programme:** **Master of Science (Surface Coating Technology)**

**Semester:** **IV**

**Course Code:** **201470407**

**Course Title:** **Environmental Management**

**Course Group:** **Elective Subject**

**Course Objectives:**

**a)** Concept of Green Chemistry & Technology, Introduction to environmental Legislations pertaining to paint & coating industries, Basic Environmental Chemistry, Management of water pollution, air pollution & hazardous waste, advanced technologies for environmental management, Cost benefit analysis of pollution abatement, Energy Conservation & renewable resource of energies, ISO standards for Environmental Management.

**Teaching & Examination Scheme:**

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | J/V/P* | | Total |
| Lecture | Tutorial | Practical | | Internal | External | Internal | External | |
| 4 | --- | --- | 4 | 50/20 | 50/20 | --- | --- | 100/40 |

* **J**: Jury; **V**: Viva; **P**: Practical

**Detailed Syllabus:**

| Sr. No. | Contents |
|---|---|
| 1 | Concept of Green Chemistry & Technology, Introduction to environmental Legislations pertaining to paint & coating industries |
| 2 | Basic Environmental Chemistry<br>Management of water pollution, air pollution & hazardous waste |
| 3 | Advanced technologies for environmental management<br>Cost benefit analysis of pollution abatement<br>Energy Conservation & renewable resource of energies |
| 4 | ISO standards for Environmental Management, Concept of Carbon Credit and Life Cycle Assessment. Environment, Health and Safety (EHS): SDS, H-Phrase, GHS Labeling |



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**Reference Books/Audio-visual Course:**

| | |
|---|---|
| **1** | Green Chemistry: Theory and Practice, Paul T. Anastas and John C. Warner. New York: Press, 1998. |
| **2** | Wastewater Engineering: Treatment, Disposal, Reuse by Metcalf & Eddy, Tata McGraw, New Delhi. |
| **3** | Basic Environmental Engineering, by R C Gaur |
| **4** | Environmental Engineering, 6th ed, Nelson L. Nemerow (Editor), Franklin J. Agardy (Editor), Joseph A. Salvato (Editor) by John Wiley & Sons, Inc. |
| **5** | Handbook of chemical and environmental engineering calculations, by Joseph P |
| **6** | Air Pollution by M N Rao, McGraw, New Delhi |
| **7** | Environmental Chemistry by A K De, Wiley Eastern Ltd |
| **8** | Non-Conventional Energy Sources by G.D.Rai |
| **9** | Green Chemistry: Theory and Practice, Paul T. Anastas and John C. Warner. New York: |
| **10** | Wastewater Engineering: Treatment, Disposal, Reuse by Metcalf & Eddy, Tata McGraw, |

**Pedagogy:**

- Five major approaches, constructivist, collaborative, integrative, reflective and inquiry-based learning are incorporated & implemented for the better understanding of a topic. In addition to theory taught in the classroom, some models, case studies, Industrial visits, In plant training are also done.

**Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):**

| Distribution of Theory Marks in % | | | | | | **R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating |
|---|---|---|---|---|---|---|
| **R** | **U** | **A** | **N** | **E** | **C** | |
| **25** | **20** | **20** | **15** | **10** | **10** | |

**Course Outcomes (CO):**

| Sr.No. | Course Outcome Statements | %weightage |
|---|---|---|
| **CO-1** | Student will understand the Concept of Green Chemistry & Technology, learn the environmental legislations pertaining to paint & coating industries. | **25** |
| **CO-2** | Student will understand how to manage water pollution, air pollution & hazardous waste and minimizing waste; Reducing air emissions; and promoting environmental management systems. | **25** |
| **CO-3** | Student will understand to reduce generation and increase recycling of waste, as well as to address the life cycle impact of paint and coatings products. • Student will also understand the importance of ISO standards for Environmental Management. | **25** |
| **CO-4** | Student will also understand the importance of ISO standards for Environmental Management. | **25** |

| **Curriculum Revision:** | |
|---|---|
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