FACULTY OF SCIENCE

Courses of Study

Master of Science (Surface Coating Technology)

(Choice based Credit System)

Effective from June 2010
### Semester I (Total 650 marks)

<table>
<thead>
<tr>
<th>Course No</th>
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<tbody>
<tr>
<td><strong>Core Subjects</strong></td>
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</tr>
<tr>
<td>SCT 401</td>
<td>Chemistry &amp; Technology of Oils and Polymer Science</td>
</tr>
<tr>
<td>SCT 402</td>
<td>Chemistry &amp; Technology of Inorganic Pigments</td>
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<tr>
<td>SCT 403</td>
<td>Surface Chemistry &amp; Surface Engineering</td>
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<tr>
<td><strong>Elective</strong></td>
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<tr>
<td>SCT 404 A</td>
<td>Process Control &amp; Instrumental Analysis</td>
</tr>
<tr>
<td>SCT 404 B</td>
<td>Fundamental Mechanical Engineering for Coating Technologist</td>
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<tr>
<td>SCT 405</td>
<td>Practical: Analysis of Pigments, Oils &amp; Resins</td>
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<tr>
<td>SCT 406</td>
<td>Practical: Analysis of Architectural coatings</td>
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<tr>
<td>SCT 407</td>
<td>Viva-Voce</td>
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<tr>
<td>SCT 501</td>
<td>Polymer Physics &amp; Properties of Polymer</td>
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<tr>
<td>SCT 502</td>
<td>Chemistry &amp; Technology of Organic Pigments, High Performance pigments, Additives &amp; Solvents</td>
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<tr>
<td>SCT 503</td>
<td>Coating Properties &amp; Analysis of Coating</td>
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<tr>
<td><strong>Elective</strong></td>
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<tr>
<td>SCT 504 A</td>
<td>Chemical Engineering Operations</td>
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<tr>
<td>SCT 504 B</td>
<td>E- Business &amp; Entrepreneurship</td>
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<tr>
<td>SCT 505</td>
<td>Practical: Instrumental Analysis and Analysis of Additives, Solvents &amp; Raw material for resin</td>
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<tr>
<td>SCT 506</td>
<td>Practical: Analysis of Industrial Coatings &amp; Inks</td>
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<tr>
<td>SCT 601</td>
<td>Technology of Resins for Surface Coatings – I</td>
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<tr>
<td>SCT 602</td>
<td>Technology of Paint manufacturing</td>
</tr>
<tr>
<td>SCT 603</td>
<td>Technology of Architectural Coatings, Industrial Coatings and Construction chemicals</td>
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<td><strong>Elective</strong></td>
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<tr>
<td>SCT 604 A</td>
<td>Chemical Reaction Engineering</td>
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<td>SCT 604 B</td>
<td>Economics &amp; Industrial Management</td>
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<tr>
<td>SCT 605</td>
<td>Practical – Processing of Surface Coatings I</td>
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<tr>
<td>SCT 606</td>
<td>Practical – Processing of Surface Coatings II</td>
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<td>SCT 607</td>
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<td>SCT 701</td>
<td>Technology of Resins for Surface Coatings – II</td>
</tr>
<tr>
<td>SCT 702</td>
<td>Technology of Printing Inks &amp; Heavy Duty Protective Coatings</td>
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<tr>
<td>SCT 703</td>
<td>Coating Application &amp; Specialty coatings</td>
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<td><strong>Elective</strong></td>
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<tr>
<td>SCT 704 A</td>
<td>Marketing Management</td>
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<tr>
<td>SCT 704 B</td>
<td>Environmental Management</td>
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<tr>
<td>SCT 705</td>
<td>Practical: Project &amp; Seminar</td>
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<td>SCT 706</td>
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<tr>
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<td>Viva-Voce</td>
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</table>
Course No.: SCT 401
Title: Chemistry & Technology of oils and Polymer Science

Chemistry and classification of Oils (Triglycerides); Characteristics, properties and uses of Drying, semidrying and Non-drying oils; Modified and treated oils their types, manufacturing processes, properties and uses.

Historical developments in Polymeric materials; Concept of Monomer, Oligomer & Polymer (Homopolymers & Copolymers); Classification of Polymer; Types of Polymerization - Addition & Condensation polymerization, Techniques of polymerization – Bulk, Solution, Suspension & Emulsion; Kinetics of Polymerization

Functionality concept; Concept of Molecular weight of polymer, Determination of molecular weight

Characterization of polymers by Advanced Instrumental Techniques viz. TGA, DSC, FTIR etc.

Reference Books:
4. Introduction to Drying oil Technology by AR Mills.
17. Polymer chemistry, Seymour and Carraher, Marcel Dekker,2003.
Course No.:  SCT 402
Title:  Chemistry & Technology of Inorganic Pigments

Theory of Color; Important Physico-Chemical Characteristics of Pigments, Analysis & testing of pigments

Classification of Inorganic Pigments; Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.; Chemistry & technology of Fillers

Technology of Carbon Black Pigment; Manufacture, Properties and Applications of Metallic Pigments, Metal Oxide Pigments, Iron Blue Pigments, Ultra marine Blue & Chromium Pigments

Manufacture, Properties & Application of anticorrosive pigments

Reference Books:

11. Pigments: An introduction to physical Properties, David Patterson
Course No.: SCT 403
Title: Surface Chemistry & Surface Engineering

Surface Chemistry: Application of surface chemistry, Interfacial tension, Free energy changes, wetting & emulsification; Chemistry & Technology of Surfactants

Surface Engineering: Introduction; 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.

Reference Books:

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
Course No.: SCT 404 A
Title: Process Control & Instrumental Analysis

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, feed back systems component, Negative and Positive feed back systems, response time, Rise time, overshoot, decay ratio, transducers, Pneumatic and electronic controllers baffle nozzle mechanism for P, PI and PID systems.

Instrumental Analysis, Sample conditioning for process analyzers, Application of on line analyzers in paint industries, IR process analyzers, UV/VIS absorption analyzers. Process gas and process liquid chromatography, HPLC, GC, TLC, Column, Paper. Use of ion- exchange resin in chemical analysis

Reference Books:

6. Organic Spectroscopy by W. Kemp, 3rd Ed. ELBS with Mac Millan
Course No.:  SCT 404 B  
Title:  Fundamental Mechanical Engineering for Coating Technologist

Introduction; 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

Reference Books:

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
4. Introduction to Hydraulics (3rd ed), John Pippenger, Tyler Hicks, Mc-Graw Hill Book Co.,
5. Oil Hydraulic Systems: Principles & maintenance, Majumdar S.R.
Course No.: SCT 405
Title: Practical I: Analysis of pigments, Oils & Resins
Qualitative & quantitative analysis of different organic & inorganic Pigments, Vegetable oils, Natural & Synthetic resins

Course No.: SCT 406
Title: Practical II: Analysis of Architectural coatings
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
SECOND SEMESTER

Course No.:  SCT 501
Title:  Polymer Physics & Properties of Polymer

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

Solubility criteria for the polymers, Solubility parameter, Solution properties, thermodynamics of polymer solutions, Phase separation in polymer solutions

Rheology of polymers; Degradation of Polymers

Reference Books:
Course No.:  SCT 502
Title:  Chemistry & Technology of Organic Pigments, High Performance Pigments, Additives & Solvents

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.

Technology & Applications of High Performance Pigments & Special Effect Pigments

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

Solvents: Classification of Solvents, their characteristics, uses and application.

Plasticizers: Classification, Characterization, Theory and application

Reference Books:

11. Paint Additives: Recent development, G.B.Rothenberg
12. Additives for waterborne coatings, D.R. Karsa
14. Solvents; Durrans, Thos H.
Course No.: SCT 503
Title: Coating Properties & Analysis of Coating

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 analysis according to ASTM, BIS and BS Standards, Characterization of Varnishes according to ASTM, BIS and BSS Standards.

Durability of coatings - Natural and Accelerated methods.

Surface Coating defects: Defects in liquid paints, during application and cure and in dry film exposure.

Reference Book:
8. Adhesion of coatings: Theory and Practice, PROSSER
Course No.: SCT 504 A

Title: Chemical Engineering Operations

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.

Reference Books:

3. Unit Operation (Vol I to VI), 1st ed., by JH Coulson and JF Richardson, Pergamon Press
Entrepreneurship: Meaning, Characteristics, Qualities, Role of Entrepreneur, Entrepreneur and society.

Small Scale Industry: Meaning, Advantages, Limitations & Problems, Procedure, Incentives, prevailing industrial policy of SSI, incentives and benefits of SSI units

Motivation theories - Motivation model - need, want, motive and behavior - attitude towards work - self assessment and goal setting - Achievement, motivation and behavior measurement, SWOT analysis, TA analysis - Stress and conflict management; coping with uncertainty; creativity and innovation.

Concept of Project Management - Project identification and formulation: Sources of information - opportunity guidance - choice of technology and its evaluation consumer behavior; market survey and research; demand and resource based industry- servicing industry - import substitution - Technoeconomic feasibility assessment - shortlisting, preliminary project report, detailed project report, assessing viability and feasibility of a report

Taxation - State and Central - Concessions

Introduction to e-business;

e-commerce applications: I - Markets, Customer care, Vendor Management and Extended supply chain management; security aspects - digital signature, digital watermarking, secured socket layers, understanding threats to security, electronic payment systems - ATM model, Payment Models, credit card based payment system, 1st virtual banking, ecash, smart cards; Electronic Data interchange (EDI) - Value added networks.

**Reference Books:**

2. Entrepreneurship development programme in India by EDI, Ahmedabad.
4. E-business and IS Solutions by William J. Buffam, (LPE) Pearson Education
5. E-commerce – A Managerial Perspective by P.T. Josheph, PHI
6. E-commerce – An Indian Perspective by P.T. Josheph, Prentice Hall of India
Course No.: SCT 505
Title: Practical I: Instrumental Analysis and Analysis of Additives, Solvents & Raw material for resin
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

Demonstration Practical: Instrumental analysis such as FTIR, GPC, Thermal Analysis, SEM etc

Course No.: SCT 506
Title: Practical II: Analysis of Industrial Coatings & Inks
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.
THIRD SEMESTER

Course No.: SCT 601
Title: Technology of Resins for Surface Coatings – I

Chemistry and Technology of Natural resins like rosin, shellac, Bitumen, Asphalts and Coal tar – Their modifications & uses

Chemistry and Technology of Synthetic resins viz. Alkyds, Polyester, Phenolics, Amino, Acrylic & Vinyl resins: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings.

Reference books:
9. High solids AlkydResins, Holmberg Krister, Marcel Dekker, 1987
10. CNSL Patents, Cashew promotion council, Ernakulam
12. Alkyd Resin Technology, T.C. Patton
Course No.: SCT 602
Title: Technology of Paint manufacturing

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

Theory of pigment Wetting and dispersion; Dispersion technology, Coating manufacturing equipments - Machinery used for grinding of minerals and Pigments for paints including Balls Mill, Sand Mill, Dyano Mill, Attritor, Basket Mill, HSDD, TSD, TRM etc.

Plant Location & Paint Factory Layout; Important concepts of production management

Pollution & its control in paint industry; Safety & Hygiene in Paint Industry

Reference Books:

7. Paint Formulations: Principles & Practice; J. Boxal & Fraunhoffer
Course No.: SCT 603
Title: Technology of Architectural Coatings, Industrial Coatings & Construction Chemicals

Classification of coatings; Mechanisms of film formation in surface coatings

Technology of solvent based architectural & industrial coatings

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

Technology of Varnishes & lacquers

Technology of Powder coatings

Specific application Paints and Coatings: Wood Finishes, Road Marking Paint, Automotive coatings and refinishes, Novelty Finishes

Technology of Construction Chemicals: Adhesives & Sealants, Water proofing compounds, Polymeric Additives for Concrete admixtures, Curing Compounds etc

Reference Books:

5. Emulsion Polymers and Emulsion Polymerization, BASSETT.
8. Principles of Emulsion Technology; Bacher & Paul
Course No.:  SCT 604 A
Title:     Chemical Reaction Engineering

Classification of Chemical Reactors; Design equations for isothermal and adiabatic operation; Multiple reactor system, Recycle reactors, constant volume and constant pressure reactors; Kinetics of reversible, complex (Parallel and Series) and Autocatalytic reactions; 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

Reference Books:

5. Reaction Engg. through solved problem, by Srivastva and Pande, Metropolitan Book Co(P) Ltd, New Delhi
Course No.:  SCT 604 B  
Title:  Economics & Industrial Management

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;

Industrial Management:
Management: Concept, Nature, Functions: Planning, Organizing, Directing, Control, Decision Making
Business: Concept & Objectives, Forms of Business Organization.
Human Resource Management: Concept – Functions- Recruitment and Selection, Training and Development, remuneration and incentive schemes
Inventory Management: Meaning, Importance, Techniques
Quality Control: Meaning, Importance, TQM.
Standardization: Concept of International standardization, Need of standardization, Understanding of Important standardizations.

Reference Books:

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
Course No.: SCT 605  
Title: Practical – Processing of Surface Coatings I  
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

Course No.: SCT 606  
Title: Practical – Processing of Surface Coatings II  
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.
FOURTH SEMESTER

Course No.: SCT 701
Title: Technology of Resins for Surface Coatings – II

Chemistry and Technology of Synthetic resins viz. Polyamides, Epoxy, Polyurethanes, Silicone resin, Chlorinated Rubber: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings

Chemistry and Technology of Cellulosic film formers e.g. Nitrocellulose and CAB.

Reference Books:

Course No.: SCT 702
Title: Technology of Printing Inks & Heavy Duty Protective Coatings

The different Printing Processes - their merits and demerits.

Different types of Inks, manufacture of Inks, Quality Control of Inks, Specialty Inks. Methods of Ink drying; Behavior of Inks on machines; Trouble shooting in various printing processes; Storage stability of Inks

Corrosion; Technology of Heavy Duty Protective Coatings for structures in corrosive environments, Technology of Marine coatings

Reference Books:


2. Technology of Printing Inks, E.A. Apps


Course No.:  SCT 703
Title:  Coating Application & Specialty coatings

Techniques of Surface Preparation: Need for Surface Preparation; Manual and Mechanical methods of Surface Preparation, e.g. Sand blasting and Flame clearing; Conversion Coatings and Pretreatment Chemicals for Ferrous and Non-Ferrous Substrate; Surface Preparation for Plastic Substrates; Rust Converters

Techniques of Paint Application: Brushing, dipping, conventional spray, Air less spray, electrostatic spray, Bell applicator, electrodeposition coating, vacuum impregnation, Curtain coating and roller coatings

Study of Coil Coating, UV cured coating, Waterborne PU Coatings, Non Stick coatings, Smart Coatings, Hygienic Coatings

Reference Books:

6. Phosphating of Metals, RAUSH.
Course No.: SCT 704 A
Title: Marketing Management

Basic concepts of marketing, Product, Price, Promotion and Distribution

Functions of Marketing Management
Building customer satisfaction, strategic planning, marketing planning, MIS and marketing research, consumer behavior, marketing mix, business and competition analysis

Brand Management, Sales Promotion and Public Relations
Product Planning and Development, Product Life Cycle
Performance Evaluation of Marketing Programmes, global marketing, Rural Marketing, Industrial Marketing

Distributor Network: Importance & Management

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

Reference Books:

1. Marketing Management by Philip Kotler.
4. Managerial Economics by Peterson & Lewis
Course No.: SCT 704 B  
Title: Environmental Management

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  

Reference Books:  
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.  
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

Course No.: SCT 705  
Title: Practical: Project & Seminar

Course No.: SCT 706  
Title: Practical: Project & Seminar