

**SARDAR PATEL UNIVERSITY**  
**VALLABH VIDYANAGAR**

**FACULTY OF SCIENCE**

***Courses of Study***

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

***(Choice based Credit System)***

***Effective from June 2010***

**DEPARTMENT OF INDUSTRIAL CHEMISTRY**  
**STRUCTURE FOR M.Sc SURFACE COATING TECHNOLOGY**

***Semester I (Total 650 marks)***

<b>Course No</b>	<b>Course Title</b>
	<b>Core Subjects</b>
SCT 401	Chemistry & Technology of Oils and Polymer Science
SCT 402	Chemistry & Technology of Inorganic Pigments
SCT 403	Surface Chemistry & Surface Engineering
	<b>Elective</b>
SCT 404 A	Process Control & Instrumental Analysis
SCT 404 B	Fundamental Mechanical Engineering for Coating Technologist
SCT 405	Practical: Analysis of Pigments, Oils & Resins
SCT 406	Practical: Analysis of Architectural coatings
SCT 407	Viva-Voce

***Semester II (Total 650 marks)***

<b>Course No</b>	<b>Course Title</b>
	<b>Core Subjects</b>
SCT 501	Polymer Physics & Properties of Polymer
SCT 502	Chemistry & Technology of Organic Pigments, High Performance pigments, Additives & Solvents
SCT 503	Coating Properties & Analysis of Coating
	<b>Elective</b>
SCT 504 A	Chemical Engineering Operations
SCT 504 B	E- Business & Entrepreneurship
SCT 505	Practical: Instrumental Analysis and Analysis of Additives, Solvents & Raw material for resin
SCT 506	Practical: Analysis of Industrial Coatings & Inks
SCT 507	Viva-Voce

**DEPARTMENT OF INDUSTRIAL CHEMISTRY**  
**STRUCTURE FOR M.SC SURFACE COATING TECHNOLOGY**

***Semester III (Total 650 marks)***

<b>Course No</b>	<b>Course Title</b>
	<b><i>Core Subjects</i></b>
SCT 601	Technology of Resins for Surface Coatings – I
SCT 602	Technology of Paint manufacturing
SCT 603	Technology of Architectural Coatings, Industrial Coatings and Construction chemicals
	<b><i>Elective</i></b>
SCT 604 A	Chemical Reaction Engineering
SCT 604 B	Economics & Industrial Management
SCT 605	Practical – Processing of Surface Coatings I
SCT 606	Practical – Processing of Surface Coatings II
SCT 607	Viva-Voce

***Semester IV (Total 650 marks)***

<b>Course No</b>	<b>Course Title</b>
	<b><i>Core Subjects</i></b>
SCT 701	Technology of Resins for Surface Coatings – II
SCT 702	Technology of Printing Inks & Heavy Duty Protective Coatings
SCT 703	Coating Application & Specialty coatings
	<b><i>Elective</i></b>
SCT 704 A	Marketing Management
SCT 704 B	Environmental Management
SCT 705	Practical: Project & Seminar
SCT 706	
SCT 707	Viva-Voce

# SARDAR PATEL UNIVERSITY, VALLABH VIDYANAGAR

## Courses for M.Sc. Surface Coating Technology

### FIRST SEMESTER

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:

1. Bailey's Industrial Oils and Fat products Vol I to Vol V, Hui Y.H., 5<sup>th</sup> ed; John Wiley and Sons, NY., 1996
2. WM Morgan, "Outlines of Paint Technology.", 3<sup>rd</sup> 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", 2<sup>nd</sup> ed., 1995
6. Principles of Polymer science, by Bahadur and Sastry, Narosa Publishing House 2002.
7. Polymer Science by Gowarikar, John Wiley and Sons, 1<sup>st</sup> ed., 1991
8. Encyclopedia of polymer Science and Engineering, 2<sup>nd</sup> 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, .3<sup>rd</sup> ed.
11. Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corp, 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, 1<sup>st</sup> 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, 2<sup>nd</sup> ed., OCCA, "Chapman and Hall", NY 1969.
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:*

1. HF Payne VOI II, Organic Coating Technology, 3<sup>rd</sup> ed John Wiley & Sons Ltd, 1967
2. WM Morgan, "Outlines of Paint Technology.", 3<sup>rd</sup> 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 Vols, Wiley-Interscience, New York, 1973.
5. P.A. Lewis, Pigment Handbook, 3 Vols, Wiley-Interscience, New York, 1985.
6. Industrial Inorganic Pigments, BuxBaun, 3<sup>rd</sup> ed., 2005, Wiley – VCH Verlag
7. Metallic Pigments in Polymer, 1<sup>st</sup> ed., Ian Wheeler, Rapra Tech. Ltd., 1999
8. Solomon 'Chemistry of Pigments & Fillers.', 1<sup>st</sup> ed., John Wiley & Sons., 1983
9. Swaraj Paul, 'Surface coating', 2<sup>nd</sup> ed., John Wiley & Sons Ltd, 1996.
10. Z.W.Wicks, Jones, Pappas; "Organic Coatings" Sci. & Tech, VOI 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, 1<sup>st</sup> ed. 2000

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:*

1. Surfactants and Interfacial Phenomena, Milten, J. Rosen, Wiley Inter science Publication, New York.
2. "Paint flow and pigment dispersion", 2<sup>nd</sup> 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

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:*

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 Stephanopoulos, Prentice Hall of India Private Ltd, New Delhi.
3. Instrumental Methods of Chemical Analysis, by B.K. Sharma, 2<sup>nd</sup> Edition, GOEL Publishing House , Meerut
4. Spectroscopy of organic compounds, by P.S. Kalsi, 5<sup>th</sup> 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.3<sup>rd</sup> 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
3. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, PHI Pvt. Ltd.
4. Introduction to Hydraulics (3<sup>rd</sup> ed), John Pippenger, Tyler Hicks, Mc-Graw Hill Book Co.,
5. Oil Hydraulic Systems: Principles & maintenance, Majumdar S.R.
6. Hydraulics & Pneumatics: A Technician's & Engineers' guide, Andrew Parr, Jaico Publishing House



*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:

1. Principles of Polymer science, by Bahadur and Sastry, Narosa Publishing House 2002.
2. Polymer Science by Gowariker, John Wiley and Sons, 1<sup>st</sup> ed., 1991.
3. Encyclopedia of polymer Science and Engineering, 2<sup>nd</sup> ed., John Wiley and Sons , Inc
4. Text book of Polymer Science, Billmeyer, John Wiley and Sons, .3<sup>rd</sup> ed.
5. Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corpn, 1982.
6. Introduction to Polymer Science and Technology, H.S. Kaufman and J.J. Falcetta, Willey – Interscience Publication, 1977
7. Polymer Science and Technology of Plastics and Rubbers, 1<sup>st</sup> ed., P.Ghosh, Tata McGraw – Hill Publishing Company 1990.
8. Text book of polymer Science, P. Nayak and S.Lenka, Kalyani Publishers, 1986.
9. Fundamentals of polymer science an introductory text, P.Painter and M. Colman, Technomic publishing Co Inc, 1994.
10. Text book of Polymer Science and Engg Anilkumar and Gupta, Tata Mc Graw –Hill Publishing Co, Ltd., 1978.
11. Polymer Science and Technology by J.R. Fried, Prentice- Hall, Inc 1995.
12. Polymer chemistry, Seymour and Carraher, Marcel Dekker,2003.

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:*

1. HF Payne VOI II, Organic Coating Technology, 3<sup>rd</sup> ed John Wiley & Sons Ltd, 1967
2. WM Morgan, "Outlines of Paint Technology.", 3<sup>rd</sup> 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 Vols, 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', 3<sup>rd</sup> ed., Wiley – VCH Verlag, 2004
7. Swaraj Paul, 'Surface coating', 2<sup>nd</sup> ed., John Wiley & Sons Ltd, 1996.
8. "High Performance Pigments", Smith, Wiley – VCH Verlag, 2002
9. Stoye : Paints, Coatings and Solvents, 1<sup>st</sup> ed., Wiley – VCH, 1993
10. Handbook of Coating Additives, J. Calbo, 1<sup>st</sup> 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, VOI I John Wiley and Sons, Inc., NY 1992.
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:*

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, 3<sup>rd</sup> 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, 2<sup>nd</sup> ed., OCCA, Chapman and Hall, 1984.
6. "Paints and surface coatings -Theory & Practice", 2<sup>nd</sup> ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999.
7. WM Morgan, "Outlines of Paint Technology.", 3<sup>rd</sup> ed, CBS Publishers & Distributors, 1996
8. Adhesion of coatings: Theory and Practice, PROSSER
9. Paint Testing Manual, 14<sup>th</sup> ed., Gardner Sward

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:*

1. Introduction to Chemical Engg., 1<sup>st</sup> ed., By Walter L. Badger and Julius T Bancharo, Mc.Graw Hill Book Co.
2. Unit Operation of Chemical Engg., 4<sup>th</sup> ed.; By Warren L Macabe and Julian C Smith , Mc. Graw Hill Book Co.
3. Unit Operation (Vol I to VI), 1<sup>st</sup> ed., by JH Coulson and JF Richardson, Pergamon Press
4. Mass Transfer Operations, Robert E Treybal , Mc. Graw Hill Book Co.
5. Hand Book of Chemical Engg by JH Perry, 7/e, Mc. Graw Hill Book Co.
6. Fundamentals of Engg. Heat and Mass Transfer by R.C. SACHEIVA, Wiley Eastern Ltd.
7. Process Heat Transfer by Kern , Mc. Graw Hill Book Co.

Course No.: SCT 504 B

Title: Entrepreneurship & E- Business

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:*

1. Projects: Planning, Analysis Selection, Implementation & Review by : Prasannanchendun.
2. Entrepreneurship development programme in India by EDI, Ahmedabad.
3. Small Scale Industries by : Vasant Desai.
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:

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, 1<sup>st</sup> 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’, 2<sup>nd</sup> ed., John Wiley & Sons Ltd, 1996.
7. Surface coatings Vol 1 to 3 WILSON, 1<sup>st</sup> 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.”, 3<sup>rd</sup> ed, CBS Publishers & Distributors, 1996
12. Alkyd Resin Technology, T.C. Patton
13. “Paints and surface coatings -Theory & Practice”, 2<sup>nd</sup> ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999
14. Water borne and Solvent based Coatings, Resins & Their Applications – Vol 1, OLDRING, 1996.



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:*

1. Surface coatings: Vol II: Paints & Their Applications, 2<sup>nd</sup> ed., OCCA, Chapman and Hall, 1984
2. "Paint flow and pigment dispersion", 2<sup>nd</sup> ed., T.C.Patton, 1979
3. "Paints and surface coatings -Theory & Practice", 2<sup>nd</sup> ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999
4. Basics of Paint Technology, Vol I, V.C. Malshe, 1<sup>st</sup> ed. 2000
5. Basics of Paint Technology, Vol II, V.C. Malshe, 1<sup>st</sup> 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, 1<sup>st</sup> ed., Chem Pub., 1979
9. "Introduction to Paint Chemistry & Principle of Paint Technology", 3<sup>rd</sup> ed., Turner G.P, Chapman & Hall, 1988

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:*

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
3. “Paints and surface coatings -Theory & Practice”, 2<sup>nd</sup> 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.”, 3<sup>rd</sup> ed, CBS Publishers & Distributors, 1996.
8. Principles of Emulsion Technology; Bacher & Paul
9. “Organic Coating Technology - VOI II”, HF Payne, 3<sup>rd</sup> 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.

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:*

1. Chemical Reaction Engg. by Octave Levenspiel , 3<sup>rd</sup> Ed. John Wiley & Sons.
2. Chemical Engg. Kinetics, by JM Smith, 3<sup>rd</sup> Ed. McGraw Hill Book Co.
3. Fundamentals of Chemical Reactions Engg., 2<sup>nd</sup> 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 , Jalandhar

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:*

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

*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:

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, 1<sup>st</sup> 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. Surface coatings: Science & Technology, Swaraj Paul. 2<sup>nd</sup> ed., John Willey & Sons, 1996
7. Surface coatings Vol 1 to 3 WILSON, 1<sup>st</sup> 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. Epoxy Resins- Chemistry and Technology, 2<sup>nd</sup> ed, MAY,1988.

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:*

1. Surface coating Technology Vol II, OCCA, Chapman and Hall, London & New York.
2. Technology of Printing Inks, E.A. Apps
3. "Paints and surface coatings -Theory & Practice", 2<sup>nd</sup> ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999.
4. "Printing Ink Manual", 5 ed., Leach, 1993
5. Chemistry and Technology of water based Inks, 1<sup>st</sup> ed., LADEN, Blackie Academic & Profe., 1997
6. Protective Coatings for Metals, E.J. Vaughan & J.W. Gailer
7. Protective Paint coatings for metals, Fraunhofer and Boxall, Particullis Press Ltd, 2 Queensway, Surey, England.
8. Organic Coatings, Science and Technology, vol 2, WICKS.
9. Basics of Paint Technology, Vol I, 1<sup>st</sup> ed., V.C. Malshe, 2000

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:*

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, 2<sup>nd</sup> ed., OCCA, Chapman and Hall, 1984.
4. "Paints and surface coatings -Theory & Practice", 2<sup>nd</sup> 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



*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.
2. Industrial Engineering & Management by : O.P.Khanna.
3. Marketing Management : Rajan Nair, J.C. Gandhi.
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:*

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, 6<sup>th</sup> 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 Reynolds, John S Jeris, Louis Theodore, 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