



**CVM  
UNIVERSITY**

(Established under Gujarat Private Universities  
(Second Amendment) Act : 2019 Gujarat Act No. 20 of 2019)

## **FACULTY OF SCIENCE**

### ***Courses of Study***

### ***Master of Science***

### ***(Surface Coating Technology)***

***Effective from June 2020***

## STRUCTURE FOR M.Sc. SURFACE COATING TECHNOLOGY

### Semester I (Total 650 marks)

Course Type	Course No	Course Title	Theory / Practical	Credit	Contact Hrs/ week	Exam Duration in Hrs	Component of Marks		
							Internal	External	Total
							Total / Passing	Total / Passing	Total / Passing
<b>Core Subjects</b>	101470101	Chemistry & Technology of Polymer Science	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470102	Chemistry & Technology of Inorganic Pigments	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470103	Surface Chemistry & Surface Engineering	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470104	Practical: Analysis of Pigments, Oils & Resins	<b>Practical</b>	4	6	3	40/16	60/24	100/40
	101470105	Practical: Analysis of Architectural coatings	<b>Practical</b>	4	6	3	40/16	60/24	100/40
	101470106	Viva-Voce		1				50/20	50/20
<b>Elective Subjects (Any One)</b>	101470107	Process Control & Instrumental Analysis	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470108	Mechanical Engineering for Coating Technologist	<b>Theory</b>	4	4	3	40/16	60/24	100/40

**STRUCTURE FOR M.S SURFACE COATING TECHNOLOGY**  
**Semester II (Total 650 marks)**

Course Type	Course No	Course Title	Theory / Practical	Credit	Contact Hrs/ week	Exam Duration in Hrs	Component of Marks		
							Internal	External	Total
							Total / Passing	Total / Passing	Total / Passing
<b>Core Subjects</b>	101470201	Technology of Resins for Surface Coatings – I	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470202	Chemistry & Technology of Organic Pigments, High Performance pigments, Additives & Solvents	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470203	Coating Properties & Analysis of Coating	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470204	Practical: Instrumental Analysis and Analysis of Additives, Solvents & Raw material for resin	<b>Practical</b>	4	6	3	40/16	60/24	100/40
	101470205	Practical: Analysis of Industrial Coatings & Inks	<b>Practical</b>	4	6	3	40/16	60/24	100/40
	101470206	Viva-Voce		1				50/20	50/20
<b>Elective Subjects (Any One)</b>	101470207	Chemical Engineering Operations	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470208	Economics & Industrial Management	<b>Theory</b>	4	4	3	40/16	60/24	100/40

## STRUCTURE FOR M.SC SURFACE COATING TECHNOLOGY

### Semester III (Total 650 marks)

Course . Type	Course No	Course Title	Theory / Practical	Credit	Contact Hrs/ week	Exam Duration in Hrs	Component of Marks		
							Internal	External	Total
							Total / Passing	Total / Passing	Total / Passing
<b>Core Subjects</b>	101470301	Technology of Resins for Surface Coatings – II	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470302	Technology of Paint manufacturing	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470303	Technology of Architectural Coatings and Industrial Coatings	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470304	Practical – Processing of Surface Coatings I	<b>Practical</b>	4	6	6	40/16	60/24	100/40
	101470305	Practical – Processing of Surface Coatings II	<b>Practical</b>	4	6	6	40/16	60/24	100/40
	101470306	Viva-Voce		1				50/20	50/20
<b>Elective Subjects (Any One)</b>	101470307	Chemical Reaction Engineering	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470308	Technology of Packaging and Printing Inks	<b>Theory</b>	4	4	3	40/16	60/24	100/40

**STRUCTURE FOR M.SC SURFACE COATING TECHNOLOGY**  
**Semester IV (Total 650 marks)**

Course Type	Course No	Course Title	Theory / Practical	Credit	Contact Hrs/ week	Exam Duration in Hrs	Component of Marks		
							Internal	External	Total
							Total / Passing	Total / Passing	Total / Passing
<b>Core Subjects</b>	101470401	Coating Application & Specialty coatings	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470402	Corrosion Technology & Heavy Duty Protective Coatings	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470403	Technology of Construction Chemicals	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470404	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	<b>Practical</b>	8	12		80/32	120/48	200/80
	101470405	Viva-Voce		1				50/20	50/20
<b>Elective Subjects (Any One)</b>	101470406	Marketing Management	<b>Theory</b>	4	4	3	40/16	60/24	100/40
	101470407	Environmental Management	<b>Theory</b>	4	4	3	40/16	60/24	100/40

## CVM UNIVERSITY

Programme & Subject: M.Sc (Surface Coating Technology)

Semester: I

Syllabus with Effect from: June - 2020

Paper Code: 101470101		Total Credit: 4
Title Of Paper: Chemistry & Technology Polymer Science		
Unit	Description in detail	Weightage (%)
I	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	25 %
II	Functionality concept; Concept of Molecular weight of polymer, Determination of molecular weight. Characterization of polymers by Advanced Instrumental Techniques viz. TGA, DSC, FTIR etc.	25 %
III	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	25 %
IV	Solubility criteria for the polymers, Solubility parameter, Solution properties, thermodynamics of polymer solutions, Phase separation in polymer solutions, Rheology of polymers; Degradation of Polymers	25 %

### Basic Text & Reference Books:-

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

**CVM UNIVERSITY**  
**Programme & Subject: M.Sc (Surface Coating Technology)**  
**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470102</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Chemistry &amp; Technology Of Inorganic Pigments</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Theory of Color; Important Physico-Chemical Characteristics of Pigments, Analysis & testing of pigments	25 %
II	Classification of Inorganic Pigments; Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.; Chemistry & technology of Fillers	25 %
III	Technology of Carbon Black Pigment; Manufacture, Properties and Applications of Metallic Pigments, Metal Oxide Pigments, Iron Blue Pigments, Ultra marine Blue & Chromium Pigments	25 %
IV	Manufacture, Properties & Application of anticorrosive pigments.	25 %

**Basic Text & Reference Books:-**

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

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**Programme & Subject: M.Sc (Surface Coating Technology)**  
**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470103</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Surface Chemistry &amp; Surface Engineering</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Surface Chemistry: Application of surface chemistry, Interfacial tension, Free energy changes, wetting & emulsification	25 %
II	Chemistry & Technology of Surfactants.	25 %
III	Surface Engineering: Introduction; Electroplating; Thermal Spray Coating; Cold Gas Dynamic Coating; Diffusion Coating; CVD & PVD; Plasma Immersion Ion implantation; DLC thin film	25 %
IV	Sol Gel Coating; Laser Assisted Surface Engineering; Micro Arc Oxidation; Electro Spark Coating etc.	25 %

**Basic Text & Reference Books:-**

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

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**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470104</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Practical : Analysis of Pigments, Oils &amp; Resins</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Qualitative & quantitative analysis of different organic & inorganic Pigments, Vegetable oils, Natural & Synthetic resins.	100 %

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**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470105</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Practical : Analysis of Architectural Coatings</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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	100 %

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**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470106</b>		<b>Total Credit: 1</b>
<b>Title Of Paper: Comprehensive Viva</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Oral Questions on All Subject of 1st Semester M.Sc (SCT)	100 %

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**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470107</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Process Control &amp; Instrumental Analysis</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	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	25 %
II	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.	25 %
III	Instrumental Analysis, Sample conditioning for process analyzers, Application of on line analyzers in paint industries, IR process analyzers	25 %
IV	UV/VIS absorption analyzers. Process gas and process liquid chromatography, HPLC, GC, TLC, Column, Paper. Use of ion-exchange resin in chemical analysis.	25 %

**Basic Text & Reference Books:-**

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

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**Semester: I**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470108</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Fundamental Mechanical Engineering for Coating Technologist</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Introduction; Engineering Materials & Their Properties	25 %
II	Elements of power transmission, Couplings & Seals	25 %
III	Metal Cutting Machines; Sheet Metal Operations; Welding & Casting;	25 %
IV	Abrasive Machining Process; Hydraulic & Pneumatic systems; Nozzles & Spray Guns; Spraying Systems; Robotics; Forging & Rolling	25 %

**Basic Text & Reference Books:-**

- Basic Mechanical Engineering, by R B Arora & B K Raghunath, Atul Prakashan
- Robotics: Principal & Practice, Dr K.C. Jain, Dr. L.N. Aggarwal, Khanna Publications
- Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, PHI Pvt. Ltd.
- Introduction to Hydraulics (3rd ed), John Pippenger, Tyler Hicks, Mc-Graw Hill Book Co.,
- Oil Hydraulic Systems: Principles & maintenance, Majumdar S.R.
- Hydraulics & Pneumatics: A Technician's & Engineers' guide, Andrew Parr, Jaico Publishing House

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**Programme & Subject: M.Sc (Surface Coating Technology)**  
**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470201</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Technology of Resins for Surface Coating - I</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	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.	25 %
II	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.	25 %
III	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.	25 %
IV	Chemistry and Technology of Oils and Natural resins like rosin, shellac, Bitumen, Asphalts and Coal tar – Their modifications & uses	25 %

**Basic Text & Reference Books:-**

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

**CVM UNIVERSITY**  
**Programme & Subject: M.Sc (Surface Coating Technology)**  
**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470202</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Chemistry &amp; Technology of Organic Pigments, High Performance Pigments, Additives &amp; Solvents</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	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.	25 %
II	Technology & Applications of High Performance Pigments & Special Effect Pigments	25 %
III	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	25 %
IV	Solvents: Classification of Solvents, their characteristics, uses and application. Plasticizers: Classification, Characterization, Theory and application	25 %

**Basic Text & Reference Books:-**

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

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**Programme & Subject: M.Sc (Surface Coating Technology)**  
**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470203</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Coating Properties &amp; Analysis of Coating</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Study of important characteristics of surface coating viz. Rheological properties, Optical Properties	25 %
II	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.	25 %
III	Characterization of Varnishes according to ASTM, BIS and BSS Standards. Durability of coatings- Natural and Accelerated methods.	25 %
IV	Surface Coating defects: Defects in liquid paints, during application and cure and in dry film exposure.	25 %

**Basic Text & Reference Books:-**

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

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**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470204</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Instrumental Analysis &amp; Analysis Of Additives, Solvents &amp; Raw Material For Resin</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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.	100%

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**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470205</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Practical : Analysis Of Industrial Coatings &amp; Inks</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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.	100 %

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**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470206</b>		<b>Total Credit: 1</b>
<b>Title Of Paper: Comprehensive Viva</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Oral Question on all Subject of 2nd Semester M.Sc (SCT)	100 %

**CVM UNIVERSITY**  
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**Semester: II**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470207</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Chemical Engineering Operations</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Concept of Unit Operations, Transportation of Fluids, Types of Pumps, Principles of Operation of Pumps	25 %
II	Size reduction – crushing and grinding, Sedimentation, Filtration	25 %
III	Drying; Distillation; Mixing	25 %
IV	Mode of heat transfer, types of heat transfer, different types of heating media.	25 %

**Basic Text & Reference Books:-**

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

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<b>Paper Code: 101470208</b>		<b>Total Credit: 4</b>
<b>Title Of the Paper: Economics &amp; Industrial Management</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weight age (%)</b>
I	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;	25 %
II	Industrial Management: Management: Concept, Nature, Functions: Planning, Organizing, Directing, Control, Decision Making, Business: Concept & Objectives, Forms of Business Organization	25 %
III	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	25 %
IV	Standardization: Concept of International standardization, Need of standardization, Understanding of Important standardizations.	25 %

**Basic Text & Reference Books:-**

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

**CVM UNIVERSITY**  
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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470301</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Technology of Resins for Surface Coating - II</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	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.	25 %
II	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 of these resins for surface coatings.	25 %
III	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 of these resins for surface coatings.	25 %
IV	Chemistry and Technology of Cellulosic film formers e.g. Nitrocellulose and CAB.	25 %

**Basic Text & Reference Books:-**

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

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470302</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Technology of Paint Manufacturing</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	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	25 %
II	Theory of pigment Wetting and dispersion; Dispersion technology	25 %
III	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.	25 %
IV	Plant Location & Paint Factory Layout; Important concepts of production management , Pollution & its control in paint industry; Safety & Hygiene in Paint Industry	25 %

**Basic Text & Reference Books:-**

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

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470303</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Technology of Architectural Coating and Industrial Coatings</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Classification of coatings; Mechanisms of film formation in surface coatings, Technology of solvent based architectural & industrial coatings	25 %
II	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	25 %
III	Specific application Paints and Coatings: Wood Finishes, Road Marking Paint, Automotive coatings and refinishes, Novelty Finishes	25 %
IV	Technology of Varnishes & lacquers and Recent trends in Coating Industry	25 %

**Basic Text & Reference Books:-**

- The Technology of Paints, Varnishes & Lacquers, 1st ed., C.R. Martens, Roberts E Kniger Pub. Co-Oprat, 1974.
- Surface Coatings – Raw Materials & Their Usage, OCCA-VOI I “Chapman and Hall”, NY, 1993
- “Paints and surface coatings -Theory & Practice”, 2<sup>nd</sup> ed., R. Lambourne & T.A. Stevens, William Andrew Publishing, 1999.
- Water borne and Solvent based Coatings, Resins & Their Applications – Vol 1, OLDRING, 1996.
- Emulsion Polymers and Emulsion Polymerization, BASSETT.
- Waterborne Coatings: Emulsions And Water Soluble Paints. ‘C.R. Martens’. Van Nostrand Reinhold Company, 1981
- WM Morgan, “Outlines of Paint Technology.”, 3<sup>rd</sup> ed, CBS Publishers & Distributors, 1996.
- Principles of Emulsion Technology; Bacher & Paul
- “Organic Coating Technology - VOI II”, HF Payne, 3<sup>rd</sup> ed John Wiley & Sons Ltd, 1967
- Protective & Decorative Coatings, Vol I, II & III, J.J. Mattiello
- Powder coatings: A Practical Guide to equipments, Process & Productivity at a profit, Vol II, Howell David M, John Willey, 2000.

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470304</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Practical - Processing of Surface Coatings - I</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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.	100 %

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470305</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Practical - Processing of Surface Coatings - II</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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.	100 %

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470306</b>		<b>Total Credit: 1</b>
<b>Title Of Paper: Comprehensive Viva</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Oral Question on all Subject of 3rd Semester M.Sc (SCT)	100 %

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470307</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Chemical Reaction Engineering</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Classification of Chemical Reactors; Design equations for isothermal and adiabatic operation	25 %
II	Multiple reactor system, Recycle reactors, constant volume and constant pressure reactors	25 %
III	Kinetics of reversible, complex (Parallel and Series) and Autocatalytic reactions	25 %
IV	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	25 %

**Basic Text & Reference Books:-**

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

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**Semester: III**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470308</b>		<b>Total Credit: 4</b>
<b>Title Of the Paper: Technology of Packaging and Printing Inks</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weight age (%)</b>
I	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.	25 %
II	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,	25 %
III	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.	25 %
IV	Plastic as packaging material in different forms- flexible polymeric films, metallic foils, orientation and metallization. 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.	25 %

**Basic Text & Reference Books:-**

- Printing Ink Manual; by R. H. Leach & R. J. Pierce
- Handbook on Printing Technology
- Modern Printing Technology
- Complete Book on Printing Technology
- Handbook of Package Engineering by Joseph F. Hanlon
- Edible Coatings & Soluble Packaging by Roger Daniels

**CVM UNIVERSITY**  
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**Semester: IV**  
**Syllabus with Effect from: June – 2020**

<b>Paper Code: 101470401</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Coating Application &amp; Specialty Coatings</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Techniques of Surface Preparation: Need for Surface Preparation; Manual and Mechanical methods of Surface Preparation, e.g. Sand blasting and Flame clearing	25 %
II	Conversion Coatings and Pretreatment Chemicals for Ferrous and Non-Ferrous Substrate; Surface Preparation for Plastic Substrates; Rust Converters	25 %
III	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	25 %
IV	Study of Coil Coating, UV cured coating, Powder Coatings, Non Stick coatings, Smart Coatings, Hygienic Coatings	25 %

**Basic Text & Reference Books:-**

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

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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470402</b>		<b>Total Credit: 4</b>
<b>Title Of the Paper: Corrosion Technology &amp; Heavy Duty Protective Coatings</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weight age (%)</b>
I	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.	25 %
II	Practical forms of corrosion (in practice) I. Uniform corrosion, II. 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	25 %
III	III. Miscellaneous-Hydrogen damage, radiation damage, caustic embrittlement. (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. (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. (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; (d) Corrosion Inhibition	25 %
IV	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. 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 & Harbour Installation. Testing of Marine Paints as per IS: 1470, 1419.	25 %

**Basic Text & Reference Books:-**

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

**CVM UNIVERSITY**  
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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470403</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Technology of Construction Chemicals</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Concrete Admixtures: Mineral and Chemical Admixtures	25 %
II	Waterproofing materials in Construction Concrete Repair/ Grouts: Cementitious and Polymer modified	25 %
III	Industrial Flooring: Floor Screeds & Toppings, Surface Treatments, ESD - Anti Static/ Dissipative/Conductive Floor Coatings, Road /Floor Marking Coatings	25 %
IV	Sealants: Polysulphides, Polyurethanes, Silicone Bonding agents: SBR, Acrylic Anchoring materials: Epoxy Other related materials such as curing agents, Mould release agents, surface retarders, expansive agents, etc	25 %

**Basic Text & Reference Books:-**

- Technology Of Building Materials And Chemicals With Processes (hand Book)
- Building Construction Materials and Techniques by P.Purushothama Raj
- Building Materials (Thirdrevisededition) S. K. Duggal
- Construction Chemicals Manufacturing Formulations Book (Grouts, Chaulks, Sealants, Putties & Adhesive) Paperback – 2016 by Dr.Javid Ahmad Dar. Ph.D

**CVM UNIVERSITY**  
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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470404</b>		<b>Total Credit: 8</b>
<b>Title Of Paper: Practical: Project</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	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	100 %

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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470405</b>		<b>Total Credit: 1</b>
<b>Title Of Paper: Comprehensive Viva</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
	Oral Question on all Subject of 4th Semester M.Sc (SCT)	100 %

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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470406</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Marketing Management</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Basic concepts of marketing, Product, Price, Promotion and Distribution Functions of Marketing Management	25 %
II	Building customer satisfaction, strategic planning, marketing planning, MIS and marketing research, consumer behavior, marketing mix, business and competition analysis	25 %
III	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	25 %
IV	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	25 %

**Basic Text & Reference Books:-**

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

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**Semester: IV**  
**Syllabus with Effect from: June - 2020**

<b>Paper Code: 101470407</b>		<b>Total Credit: 4</b>
<b>Title Of Paper: Environmental Management</b>		
<b>Unit</b>	<b>Description in detail</b>	<b>Weightage (%)</b>
I	Concept of Green Chemistry & Technology, Introduction to environmental Legislations pertaining to paint & coating industries	25 %
II	Basic Environmental Chemistry Management of water pollution, air pollution & hazardous waste	25 %
III	Advanced technologies for environmental management Cost benefit analysis of pollution abatement Energy Conservation & renewable resource of energies	25 %
IV	ISO standards for Environmental Management, Concept of Carbon Credit and Life Cycle Assessment. Environment, Health and Safety (EHS): SDS, H-Phrase, GHS Labeling	25 %

**Basic Text & Reference Books:-**

- Green Chemistry: Theory and Practice, Paul T. Anastas and John C. Warner. New York: Press, 1998.
- Wastewater Engineering: Treatment, Disposal, Reuse by Metcalf & Eddy, Tata McGraw, New Delhi
- Basic Environmental Engineering , by R C Gaur
- Environmental Engineering, 6<sup>th</sup> ed, Nelson L. Nemerow (Editor), Franklin J. Agardy (Editor), Joseph A. Salvato (Editor) by John Wiley & Sons, Inc.
- Handbook of chemical and environmental engineering calculations, by Joseph P Reynolds, John S Jeris, Louis Theodore, John Wiley & Sons, Inc.
- Air Pollution by M N Rao, McGraw, New Delhi
- Environmental Chemistry by A K De, Wiley Eastern Ltd
- Non-Conventional Energy Sources by G.D.Rai