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**UNIVERSITY OF MUMBAI**

**No. UG/171 of 2017-18**

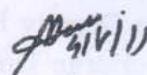
**CIRCULAR:-**

The Director, Garware Institute of Career Education & Development and the Principals of the affiliated Colleges in Arts, Science, Commerce & Technology and the Heads of recognized Institutions concerned are hereby informed that the recommendation made by the Advisory Committee & Board of Management of Garware Institute of Career Education & Development at its meeting held on 5<sup>th</sup> May, 2017 has been accepted by the Academic Council at its meeting held on 11<sup>th</sup> May, 2017 vide item No. 4.297 and subsequently approved by the Management Council at its meeting held on 17<sup>th</sup> May, 2017 vide item No.86 and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No.VI of 2017) and the Ordinances 6414 and 6415 and Regulations 9139 and 9140 and the syllabus as per the (CBCS) for the Bachelors in Paint Technology (Sem. I to VI) has been introduced, which is available on the University's website ([www.mu.ac.in](http://www.mu.ac.in)) and that the same has been brought into force with effect from the academic year 2017-18, accordingly.

MUMBAI – 400 032

8<sup>th</sup> August, 2017

To,

  
(Dr.M.A.Khan)  
REGISTRAR

The Director, Garware Institute of Career Education & Development and the Principals of the affiliated Colleges in Arts, Science, Commerce & Technology and the Heads of recognized Institutions concerned.

**A.C/4.297/11.05.2017**

**M.C/86/17.05.2017**

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No. UG/171 -A of 2017

MUMBAI-400 032

8<sup>th</sup> August, 2017

Copy forwarded with Compliments for information to:-

- 1) The Co-ordinator, Faculty of Arts, Science, Commerce and Technology,
- 2) The Offg. Director, Board of Examinations and Evaluation,
- 3) The Director, Board of Students Development.,
- 4) The Co-Ordinator, University Computerization Centre,

  
(Dr.M.A.Khan)  
REGISTRAR

....PTO



University of Mumbai's

**UNIVERSITY OF MUMBAI'S**



**Garware Institute of Career Education and Development**

**Proposed Syllabus for the course of**

**BACHELOR in PAINT TECHNOLOGY**

**(THREE YEAR FULL-TIME COURSE)**

**Credit Based Semester and Grading System with effect from the academic year**

**(2017-2018)**

**UNIVERSITY OF MUMBAI**  
**GARWARE INSTITUTE OF CAREER EDUCATION & DEVELOPMENT**  
**SYLLABUS RELATING TO THE**  
**GRADUATION IN PAINT TECHNOLOGY COURSE (FULL-TIME)**  
**(Revision w.e.f. the academic year 2017-2018 of Course introduced in 1985)**

**Preamble:**

- Paint industry is expanding at a fast rate.
- Production of paint, pigment and resins has increased manifolds.
- The area of application is very vast due to the requirement of both decorative and industrial coatings.
- This growth requires trained and qualified personnel to take up a leading role.
- At present the demand for paint technologists is more than supply from all institutions in India. This gap requires to be filled up.

**Objective:**

- To impart adequate knowledge and develop the skill requirements to meet the demands of the industry.
- To train the students in theory and practical to fit in well and perform in an excellent manner.
- To give exposure to manufacturing, quality control systems and modes of application.
- To Groom the students to take up executive and supervisory roles.

**Career Scope:**

- With growth in industry there are good job opportunities.
- The placements are in the manufacturing units of paint, pigments and resins. Application in automobiles, furniture, ship building, plastics and allied industries.
- The job positions start from supervisor in manufacturing, quality control executive, technicians, and techno- commercial jobs as well as become an entrepreneur or painting contractor.

## Syllabus Details:

	Subject Code	Core Subject	Assessment Pattern			Teaching Hours			Total Credits
		Topics	Internal Marks 60	External Marks 40	Total Marks (CA) 100	Theory Hours	Practical hours	Total Hours	
<b>Semester - 1</b>	1.1	Communication Skills - I	60	40	100	60	--	60	4
	1.2	Computer Lab	60	40	100	45	--	45	3
	1.3	Introduction to Paints & Surface Coatings	60	40	100	60	--	60	4
	1.4	Industrial Chemistry	60	40	100	45	--	45	3
	1.5	Construction Engineering	60	40	100	45	--	45	3
	1.6	Unit Operations	60	40	100	45	--	45	3
	1.7	Auto CAD	100		100	45	--	45	3
	1.8	Practicals	200	--	200	--	90	90	3
		<b>Total</b>	<b>660</b>	<b>240</b>	<b>900</b>	<b>345</b>	<b>90</b>	<b>435</b>	<b>26</b>
	<b>Semester - 2</b>	2.9	Pigments, Solvents and Additives	60	40	100	60	--	60
2.10		Resin Technology I	60	40	100	45	--	45	3
2.11		Basic Paint Manufacturing	60	40	100	60	--	60	4
2.12		Decorative Paints	60	40	100	45	--	45	3
2.13		Paint Application - I	60	40	100	45	--	45	3
2.14		Paint Application - II	60	40	100	60	--	60	4
2.15		Practicals	200	--	200	--	90	90	3
		<b>Total</b>	<b>560</b>	<b>240</b>	<b>800</b>	<b>315</b>	<b>90</b>	<b>405</b>	<b>24</b>

	Subject Code	Core Subject	Assessment Patterns			Teaching Hours			Total Credits
			Internal Marks 60	External Marks 40	Total Marks (CA) 100	Theory Hours	Practical hours	Total Hours	
<b>Semester - 3</b>		<b>Topics</b>							
	3.16	In-Plant Training	200	--	200	--	3 Months	3 Months	12
	3.17	Industrial Coatings - I	60	40	100	60	--	60	4
	3.18	Printing Inks and Specialty Coatings	60	40	100	45	--	45	3
	3.19	Paint Technology	60	40	100	45	--	45	3
	3.20	Industrial Finishing - I	60	40	100	60	--	60	4
	3.21	Practicals	200	--	200	--	90	90	3
		<b>Total</b>	<b>640</b>	<b>160</b>	<b>800</b>	<b>210</b>	<b>3 months &amp; 90</b>	<b>3 months &amp; 300</b>	<b>29</b>
<b>Semester - 4</b>	4.22	Protective Coatings I	60	40	100	60	--	60	4
	4.23	Systems & Engineering Aspects in Surface Coating	60	40	100	45	--	45	3
	4.24	Basic Test Methods in Coatings	60	40	100	45	--	45	3
	4.25	Industrial Finishing - II	60	40	100	60	--	60	4
	4.26	Project Handling	60	40	100	45	--	45	3
	4.27	Economics of Painting	60	40	100	60	--	60	4
	4.28	Practicals	200	--	200	--	90	90	3
		<b>Total</b>	<b>560</b>	<b>240</b>	<b>800</b>	<b>315</b>	<b>90</b>	<b>405</b>	<b>24</b>

	Subject Code	Core Subject	Assessment Patterns			Teaching Hours			Total Credits
			Internal Marks 60	External Marks 40	Total Marks (CA) 100	Theory Hours	Practical hours	Total Hours	
<b>Semester - 5</b>		<b>Topics</b>							
	5.29	Communication Skills II APTIS	100	--	100	60	--	60	4
	5.30	Administration and Cost Management	60	40	100	60	--	60	4
	5.31	Factory Management	60	40	100	60	--	60	4
	5.32	Protective Coatings II	60	40	100	60	--	60	4
	5.33	Industrial Coatings II	60	40	100	60	--	60	4
	5.34	Resin Technology II	60	40	100	60	--	60	4
	5.35	Safety, Health and Environment	60	40	100	45	--	45	3
		<b>Total</b>	<b>460</b>	<b>240</b>	<b>700</b>	<b>405</b>	<b>--</b>	<b>405</b>	<b>27</b>
<b>Semester - 6</b>	6.36	Quality Management	60	40	100	60	--	60	4
	6.37	People Management	60	40	100	60	--	60	4
	6.38	Construction Chemicals	60	40	100	60	--	60	4
	6.39	Project Training	200	--	200	--	3 months	3 months	12
		<b>Total</b>	<b>380</b>	<b>120</b>	<b>500</b>	<b>180</b>	<b>3 months</b>	<b>180</b>	<b>24</b>
	<b>Total</b>	<b>3260</b>	<b>1240</b>	<b>4500</b>	<b>1770</b>	<b>6 months &amp; 360</b>	<b>6 Months &amp; 2130</b>	<b>154</b>	

**Two or Three Guest Lectures by Experts per Semester.  
One Industrial Visit per Semester for exposure to industry.**



	<b>Unit III</b> Office: Word, Excel, Power Point	9	3
	<b>Unit IV</b> Internet Browsing, Information on Programming Languages and Operating Systems, DBMS.	9	3
	<b>Unit V</b> PC Hardware Selection. Laptops, Client Server	9	3
	<b>Unit VI</b> Elementary understanding of Database.	3	1
	<b>Unit VII</b> Management Information Systems	3	1
1.3	<b>INTRODUCTION TO PAINTS AND SURFACE COATINGS</b>		
	<b>Unit I</b> Introduction to Paints and Paint Industry – trends in the paint industry.	6	2
	<b>Unit II</b> Classification of Surface Coatings.	6	2
	<b>Unit III</b> Paint Glossary – Paint, Lacquer, varnish, viscosity, Rheology consistency.	6	2
	<b>Unit IV</b> Binder – medium – vehicle.	6	2
	<b>Unit V</b> Development of Paints and coatings – Future trends.	6	2
	<b>Unit VI</b> Drying oils – constitution of oils; properties of oils – saponification value, Iodine value etc.	12	4
	<b>Unit VII</b> Extraction of oils – Treated oils.	6	2
	<b>Unit VIII</b> Polymer, functionality, Degree of polymerization, Minimum film formation, glass transition temperature.	12	4
1.4	<b>INDUSTRIAL CHEMISTRY</b>		
	<b>Unit I</b> Introduction, Units and dimensions, elements, compounds, atoms, molecules	3	1
	<b>Unit II</b> states of matter; solid, liquid and gases, valency, oxidation state	3	1
	<b>Unit III</b> chemical bonds, electro negativity, polarity, chemical reactions and equations.	3	1



	<p><b>Unit IV</b> Acids, bases, mineral acids and salts, pH, titrations, indicators, oxidation and reduction.</p> <p><b>Unit V</b> Molecular weight Organic Chemistry Fundamentals:</p> <p><b>Unit VI</b> Hydrocarbons – Aliphatic, Aromatic, Oxygenated Compounds, Oils, Amines, Isocyanates, etc..</p> <p><b>Unit VII</b> Important organic chemicals, solvents, lubricants, corrosion inhibitors, antioxidants, Stabilizers etc.</p> <p><b>Unit VIII</b> Inorganic compounds of different functional groups and their relevance in paint industry.</p> <p><b>Unit IX</b> <b>Fuels:</b> Types of industrial fuels, calorific values and efficiency of utilization of fuels. Products of combustion of fuels.</p> <p><b>Unit X</b> Quality of water supplies; nature of impurities.</p> <p><b>Unit XI</b> Purification and treatment of water, Deionization of Water</p>	3	1
		3	1
		3	1
		6	2
		6	2
		6	2
		3	1
		6	2
1.5	<p><b>CONSTRUCTION ENGINEERING</b></p> <p><b>Unit I</b> Different forms of buildings and Main Principles in construction</p> <p><b>Unit II</b> Elements of building, function of each element, building materials and their uses.</p> <p><b>Unit III</b> Common faults, defects in buildings.</p> <p><b>Unit IV</b> Aesthetic principles relating to the interior and exterior appearance of the building.</p> <p><b>Unit V</b> Engineering drawings, Plans and Elevation of Solids.</p> <p><b>Unit VI</b> Scales of Drawings, Recognition of various Engineering Drawings.</p> <p><b>Unit VII</b> Sealing, Plastering, and Surface preparation.</p>	6	2
		6	2
		6	2
		6	2
		6	2
		6	2
		9	3

1.6	<p><b>UNIT OPERATIONS</b></p> <p><b>Unit I</b> Industrial Operations, Systems in the manufacturing of pigments, resins and paints.</p> <p><b>Unit II</b> Different operations like mixing, agitation, Heat transfer, filtration, drying, pulverisation, grinding etc.</p> <p><b>Unit III</b> Paint filtration, sludge, filtration – plate and frame filters.</p> <p><b>Unit IV</b> Fluid flow, Laminar-stream line flow</p> <p><b>Unit V</b> Turbulent flow, Rheology, flow properties</p> <p><b>Unit VI</b> Pumps, gravity flow</p> <p><b>Unit VII</b> Transfer of solvents, resins, oils, pigments and other ingredients.</p>	6 6 9 9 6 3 6	2 2 3 3 2 1 2
1.7	<p><b>AUTO CAD</b></p> <p><b>Unit I</b> The Basics</p> <ul style="list-style-type: none"> <li>• Introduction to Auto CAD</li> <li>• What makes Auto CAD special?</li> </ul> <p><b>Unit II</b> A first look at Auto CAD</p> <ul style="list-style-type: none"> <li>• The Drawing Editor, Using Pull Down Menus, Toolbars, Keyboards Etc.</li> </ul> <p><b>Unit III</b> Working with Auto CAD</p> <ul style="list-style-type: none"> <li>• Opening an existing file, saving a file, closing Auto CAD</li> </ul> <p><b>Unit IV</b> Creating The First Drawing</p> <ul style="list-style-type: none"> <li>• Specifying Relative Cartesian Co- Ordinates</li> <li>• Specifying Distances with Polar Co- Ordinates</li> </ul> <p><b>Unit V</b> Using various modes (ortho, osnap polar etc.) Zoom and Pan</p> <p><b>Unit VI</b> Standard Object Selection Methods Along with Erasing Inquiry commands and using HELP.</p> <p><b>Unit VII</b> DRAW - Circle, Arc, Ellipse, Donut Polygons, Polylines, Point with its use for Divide and Measure.</p>	3 3 3 6 6 3 6	1 1 1 2 2 1 2

	<b>Unit VIII</b> MODIFY – Rotate, Scale, Stretch, Move, Copy Mirror, Array Offset, Chamfer, Fillet etc., Trim, Extend, Break, Align etc., Miscellaneous commands <b>Unit IX</b> CONCEPT OF LAYERS BLOCKS – Creating, Inserting, Exploding the blocks WBLOCKS- Use of work blocks, creating library of drawings, use of library.	9	3
1.8	<b>PRACTICALS</b>	90	3
	<b>SEMESTER II</b>	<b>Total Hours</b>	<b>Session of 3 hrs each</b>
2.9	<b>PIGMENTS, SOLVENTS AND ADDITIVES</b>  <b>Unit I</b> Pigments: Definition, classification of pigments, forms of colourants, selection criteria of pigments, colour and structure of pigments, properties of pigments. <b>Unit II</b> Inorganic pigments: TiO <sub>2</sub> , Prussian Blue, Iron Oxide, Chrome Pigments, Carbon Black, anti-corrosive pigments, Extenders, CaCO <sub>3</sub> , BaSO <sub>4</sub> , Silicates etc. Zinc Oxide, White Lead etc. <b>Unit III</b> Organic Pigments, Important parameters in the manufacturing of organic pigments. <b>Unit IV</b> Toluidine Reds, Hansa Yellow, Benzidine Yellow, Phthalocyanines, High Performance Pigments. <b>Unit V</b> Solvents: Types of solvents, Characteristics of Solvents, Solvent power, Solvent Index, Rate of Evaporation of Solvents, Thinners, Diluents, Dilution Ratio. <b>Unit VI</b> Additives: Dryers, Levelling agents anti-skinning agents, wetting and dispersing agents, anti-settling agents, biocides, UV Light stabilizers etc.	9 12 6 9 12 12	3 4 2 3 4 4
2.10	<b>RESIN TECHNOLOGY I</b>  <b>Unit I</b> Oils, Classification, Linseed, Soyabean, Tung Oil, DCO, Treated Oils, Modification of Oils, Stand Oils – Application. <b>Unit II</b>	9	3

	Natural Resins: Rosin, Ester gum, shellac – their Application. <b>Unit III</b> Synthetic Resins: Chemistry, Raw Materials for manufacture, Process of manufacturing. <b>Unit IV</b> Properties and Application. <b>Unit V</b> Alkyds, Modified Alkyds, Long Oil, Medium Oil and short oil alkyds. <b>Unit VI</b> Saturated and unsaturated polyesters, phenolic resins, amino resins UF and MF	6 9 6 6 9	2 3 2 2 3
2.11	<b>BASIC PAINT MANUFACTURING</b>  <b>Unit I</b> Simple guide lines to paint formulations. <b>Unit II</b> Inputs and information to formulation, Rheology, Viscosity and flow properties, Oil absorption, Pigment volume concentration (PVC) and critical Pigment volume concentration (CPVC), Variation in the properties of coatings with change` in PVC. <b>Unit III</b> Pigment Dispersion, wetting and grinding, Dispersion and stabilization, Daniel flow point method – importance – mill base formulations. <b>Unit IV</b> Dispersion Equipment/machinery. <b>Unit V</b> Ball Mill, Pug Mills, Sand Mill, Double and Triple Roll Mills, Attritors, High Speed Dispersers, turbo Mills, Dyno Mills etc.	6 15 12 12 15	2 5 4 4 5
2.12	<b>DECORATIVE PAINTS</b>  <b>Unit I</b> Classification, Solvent Thinnable / Water Thinnable, Interior/Exterior, Powder/Paste/Liquid etc. <b>Unit II</b> Lime Wash, Powder Distemper, Oil bound distemper, acrylic distemper, acrylic emulsion and premium emulsion, Enamel paint and texture finishes etc. <b>Unit III</b> Tinters, Universal stainers, importance and usage of stainers. <b>Unit IV</b> Paint system, Primer – Primer surfacers and Top Coat. <b>Unit V</b>	9 12 9 9	3 3 3 3

	Dealer tinting systems and colourants.	6	2
2.13	<p><b>PAINT APPLICATION – I</b></p> <p><b>Unit I</b> Application of Decorative and architectural paints.</p> <p><b>Unit II</b> Surface preparation, importance of sanding and area inspection for interior and exterior painting, Pre-treatment of wood, masonry, and cementaceous surfaces.</p> <p><b>Unit III</b> Importance of putties, water proofing chemicals, crack filling and Plaster of Paris, various application methods with their advantages and limitations, Brushing, roller coating and spraying, Type of brushes and rollers – selection criteria, guidelines for applications.</p> <p><b>Unit IV</b> Requirement of paint for different end applications, methods of application, dilution ratios and good work practice, Masking and cleaning measures.</p> <p><b>Unit V</b> Tools and equipment required, care and maintenance of equipment, Painter kits, Painting procedures. Do's and Don'ts for better paint application.</p> <p><b>Unit VI</b> Safety measures, use of ladders, scaffoldings, Measurement technique.</p> <p><b>Unit VII</b> Colour selection and shade matching at site.</p> <p><b>Unit VIII</b> Introduction to dealer tinting system.</p>	3 9 9 9 6 3 3 3	1 3 3 3 2 1 1 1
2.14	<p><b>PAINT APPLICATION – II</b></p> <p><b>Unit I</b> Various substrates for paint application like metal, plastics, wood, paper etc.,</p> <p><b>Unit II</b> Impurities on the surface, surface preparation, pre-treatment, Methods of pre-treatment, Different processes like degreasing, derusting, phosphating.</p> <p><b>Unit III</b> Batch, Semi-automatic and automatic processes.</p> <p><b>Unit IV</b> Industrial paint application methods – spraying conventional, airless, electrostatic and hot spraying, dipping, flow coating, tumbling etc.</p>	9 15 12 15	3 5 4 5

	<b>Unit V</b> Special requirements of coatings for application	9	3
2.15	<b>PRACTICALS</b>	90	3
	<b>SEMESTER III</b>	<b>Total Hours</b>	<b>Session of 3 hrs each</b>
3.16	<b>IN-PLANT TRAINING</b> For a period of 3 months in pigment, paint, resin manufacturing industries. In-plant training report is to be submitted. This is followed by presentation and VIVA VOCE.	3 Months	
3.17	<b>INDUSTRIAL COATINGS - I</b> <b>Unit I</b> Characteristics of Industrial coatings, Types of coatings - Lacquers and non convertible. <b>Unit II</b> Convertible coatings and chemically cured coatings. <b>Unit III</b> Stoving types - advantages, Novelty finishes, Flamboyant finishes, wrinkle and hammer tone finishes. <b>Unit IV</b> Thermosetting acrylic systems. <b>Unit V</b> Refinish and maintenance coatings, OEM. Coatings, General Engineering, Domestic appliances. Clear Coatings for metal, chemical resistant coatings. <b>Unit VI</b> Special requirements of specific industries like paper, chemical industries, food processing etc. <b>Unit VII</b> High performance coatings, Heat resistant coatings.	9 9 12 6 9 12 3	3 3 4 2 3 4 1

3.18	<p><b>PRINTING INKS AND SPECIALITY COATINGS</b></p> <p><b>Unit I</b> Difference between paint and printing inks, Classification of printing inks.</p> <p><b>Unit II</b> Printing ink formulations, Different printing processes, substrate characteristics.</p> <p><b>Unit III</b> Printing ink application methods, selection criteria and choice of process.</p> <p><b>Unit IV</b> Drying characteristics, film properties, etc.</p> <p><b>Unit V</b> Inks for plastic, glass substrate</p> <p><b>Unit VI</b> Coatings for leather, paper, plastics etc</p>	6 9 9 6 6 9	2 3 3 2 2 3
3.19	<p><b>PAINT TECHNOLOGY</b></p> <p><b>Unit I</b> Drying mechanism and processes, Film formation by various mechanisms, Properties of these films.</p> <p><b>Unit II</b> Specifications, use of specification and importance. Different types of specifications used in the Paint Industry and for application.</p> <p><b>Unit III</b> Explanation and usage of IS, Defense, ASTM and BS specification.</p> <p><b>Unit IV</b> Specific testing methods based on usage of paint.</p> <p><b>Unit V</b> Specialty coatings – Texture finishes, application and usage. Traffic paints – Different types, rectification and repair requirements.</p> <p><b>Unit VI</b> Road marking paints, specialty of these coatings – Application requirements.</p> <p><b>Unit VII</b> Phosphorescent coatings Luminescent coatings Specific properties of these coatings and application.</p>	6 9 6 6 6 6	2 3 2 2 2 2
3.20	<p><b>INDUSTRIAL FINISHING – I</b></p> <p><b>Unit I</b> OEM Paint shop – Flow of components/ articles for painting. Present pre-treatment processes, state-of-the-art method</p>	15	5

	for phosphating, Advantages over the earlier systems. <b>Unit II</b> Quality control systems. On-line quality control, advantages – Application in a large paint shop – Rectification of rejected items, Analysis of rejection. <b>Unit III</b> Electrostatic application, Ransburg no. 1 and Ransburg No. 2 processes requirements and selection of spray heads. <b>Unit IV</b> Electro-deposition – Types – Principle involved and general mechanism of electro-deposition. <b>Unit V</b> Why electro-deposition, Throwing power and turnover ratio. <b>Unit VI</b> pH control, Tank Control Systems.	15 9 6 9 6	5 3 2 3 2
3.21	<b>PRACTICALS</b>	90	3
	<b>SEMESTER IV</b>	<b>Total Hours</b>	<b>Session of 3 hrs each</b>
4.22	<b>PROTECTIVE COATINGS</b> <b>Unit I</b> Powder coatings – Types, classification of powder coatings, manufacturing of powders. <b>Unit II</b> Merits and Demerits of powder coatings. <b>Unit III</b> Surface preparation of substrates for powder coatings, Methods of application of powder coatings, properties and usage. <b>Unit IV</b> Marine Coatings, Types of coatings required in painting of a ship, surface preparation, Blast primers, Finishing of decks, hull, <b>Unit V</b> Top sides etc. Corrosion, Fouling, Anti Fouling Coatings, High Performance Coatings.	9 9 15 15 9	3 3 5 5 3



	<b>Unit VI</b> Coil coatings, Types, Method of application, curing, usage,	3	1
4.23	<b>SYSTEMS &amp; ENGINEERING ASPECTS IN SURFACE COATING</b> <b>Unit I</b> Systems in Paint Application, Handling, Safety, Energy, Effluent, Recycling, Paint Circulation Systems. <b>Unit II</b> Spray booths, Function, types, selection of spray booths, requirements. <b>Unit III</b> Pre-treatment Plants, Tanks, Construction and Material of Construction, Baskets, cradles and tackles. <b>Unit IV</b> Stoving Ovens – Function, types of Ovens, Batch Type, Continuous Straight –through type Camel Back Ovens, Convection and Infra Red Type. <b>Unit V</b> Type of Fuels, Economy. <b>Unit VI</b> Electro deposition Plant requirement, ultra filtration system, Anolyte, Catholyte boxes.  <b>Unit VII</b> Conveyorisation and transporter system	9 6 6 9 3 6 6	3 2 2 3 1 2 2
4.24	<b>BASIC TEST METHODS IN COATINGS</b> <b>Unit I</b> Importance of Testing. Testing in Paint, Resin, Pigment manufacturing units specifications and standardisation. <b>Unit II</b> Testing of Solvents Quality Control Systems. <b>Unit III</b> Testing of Paints, Dry tests, wet tests, Performance tests. Sampling, Preparation of Panels. <b>Unit IV</b> Testing for Film Properties, Mechanical properties and Chemical resistance, corrosion resistance, weathering tests, salt spray, impact resistance, Hardness tests, Gloss and DOI. <b>Unit V</b> Humidity tests, Humidity cabinet.	9 6 9 12 9	3 2 3 4 3

4.25	<p><b>INDUSTRIAL FINISHING – II</b></p> <p><b>Unit I</b></p> <p>Paint Film Defects, Run-down sagging, bitty finish, blistering, orange peel, cissing – causes and remedial measures.</p> <p><b>Unit II</b></p> <p>Rework, rejection and rectification, Refinishing, reasons for refinishing,</p> <p><b>Unit III</b></p> <p>Types of systems available.</p> <p><b>Unit IV</b></p> <p>Automation, Introduction to Robotics.</p> <p><b>Unit V</b></p> <p>Comparison of different modes of application, Choice of a specific type.</p> <p><b>Unit VI</b></p> <p>Criteria for the selection, Transfer efficiency, optimisation etc.</p>	12 6 9 12 12 9	4 2 3 4 4 3
4.26	<p><b>PROJECT HANDLING</b></p> <p><b>Unit I</b></p> <p>Introduction to types of projects, Projects in Decorative and Industrial Paints.</p> <p><b>Unit II</b></p> <p>Meaning of a project – starting a project.</p> <p><b>Unit III</b></p> <p>Internal Flat / Building Painting, External Building Painting, Safety Compliance.</p> <p><b>Unit IV</b></p> <p>Work related issues based on actual requirements, Scaffolding and other requirements.</p> <p><b>Unit V</b></p> <p>Inspection during the project.</p> <p><b>Unit VI</b></p> <p>Conformance to specification and requirements.</p> <p><b>Unit VII</b></p> <p>Technical and Commercial proposals, drawings, data collection, inspection.</p> <p><b>Unit VIII</b></p> <p>Decision making – Execution of work, role of a supervisor. Quotations, Control of Project, Tracking progress of a project, Managing smooth flow of project, Factors affecting the project – completion within the stipulated time.</p> <p><b>Unit IX</b></p> <p>Projects on industrial coatings, Proposals and Systems for the process.</p>	3 3 3 6 3 3 3 6 3	1 1 1 2 1 1 1 2 1

	<p><b>Unit X</b> Colour schemes for painting, selection of colour, Modern trends. Terminology related to building and apartments.</p> <p><b>Unit XI</b> Knowledge of construction materials, Leakage/seepage, trouble shooting.</p> <p><b>Unit XII</b> Prompt execution of work, Estimation of project time. Handing over after completion of the project.</p>	6 3 3	2 1 1
4.27	<p><b>ECONOMICS OF PAINTING</b></p> <p><b>Unit I</b> Components of Cost of Painting. Methods of Calculation of remuneration to labour on the basic of work done, Bonus System.</p> <p><b>Unit II</b> Minimum wages and compliance.</p> <p><b>Unit III</b> Accounting of idle time – achieving maximum utilization of labour – multi skilling.</p> <p><b>Unit IV</b> Direct and Indirect expenses – cost record and principles involved Fixed cost, variable cost – wastage and scrap – Accounting procedures and methods.</p> <p><b>Unit V</b> Duties of work execution – Difference in working in a plant and executing work on the basis of painting contracts.</p> <p><b>Unit VI</b> Tenders, meaning of tenders – Procedure of floating a tender – activities involved.</p> <p><b>Unit VII</b> Measurements – importance – Right way of taking measurements – Demonstrating with actual examples such as 1BHK, 2 BHK flats – critical measurements.</p> <p><b>Unit VIII</b> Reading of drawings – Actual terminology involved. Estimation – How to give estimation, what are the essential and significant components involved.</p> <p><b>Unit IX</b> Quotations – Generating quotations – Basis to arrive at the quotations – submission of quotations.</p>	9 3 3 15 6 6 3 6 6	3 1 1 5 2 2 1 2 2

	<b>Unit X</b> Billing – Requirements for billing – Registration of firm with various government bodies – PWD etc.	3	1
4.28	<b>PRACTICALS</b>	90	3
	<b>SEMESTER V</b>	<b>Total Hours</b>	<b>Session of 3 hrs each</b>
5.29	<b>COMMUNICATION SKILLS II</b> <b>Unit I</b>  APTIS – Grooming and skill Development to fit in well to the industrial Environment.	60	20
5.30	<b>ADMINISTRATION AND COST MANAGEMENT</b> <b>Unit I</b>  Administration Function, Discipline, Security measures, Welfare activities, Personnel management, Services including Canteen cooperative stores, Transport etc. <b>Unit II</b> cleanliness of Premises. Marking of area and Locations, use of colours ' Red & green, Alert system, Safety of the Plant ,Networking . <b>Unit III</b> Scheme of Government – small scale industries, Export benefits, current and future trends. <b>Unit IV</b> Costing Cost-concepts, Fixed costs, Variables Costs. Direct cost, indirect cost, over heads working Capital, Balance sheet.  <b>Unit V</b> Budgetting , Amortization, Inventories, Return on Investment(ROI), Decision on Capital investment.	15  15  9  15  6	5  5  3  5  2
5.31	<b>FACTORY MANAGEMENT.</b> <b>Unit I</b> Management principles , Introduction to production and operations management, classification of jobs ,processes and procedure. <b>Unit II</b> Conversion of raw materials into finished products. <b>Unit III</b> Production planning and control-Function ,planning Horizon, Dovetailing of plans ,PPC as a corporate strategy.	15  3  15	5  1  5

	<p><b>Unit IV</b> Materials management, purchase function, reorder levels, Store management- function, Receiving ,inspection ,issuers stores .</p> <p><b>Unit V</b> accounting , stock taking and inventories Maintenance management, Preventive maintenance Total productive maintenance Quality management , system (QMS) QS 9000 Factory Acts, Batch costing. Production costing.</p>	12	4
		15	5
5.32	<p><b>PROTECTIVE COATINGS-II</b></p> <p><b>Unit I</b> Coatings for structure , buildings, chemicals plants, fly-overs, girders etc.</p> <p><b>Unit II</b> Floor coatings , coatings for swimming pools ,ponds, water tankers etc .</p> <p><b>Unit III</b> Coating for chimneys , furnaces, kilns refractory linings.</p> <p><b>Unit IV</b> High temperature resistant coatings, coatings for steels ,maintenance and submerged under water ,Specialty products Food can protection, Corrosion and Chemical resistant Coatings.</p> <p><b>Unit V</b> Coating for fasteners, coatings for metal containers, Aerospace Coatings, Intumescent coatings, can coatings</p>	6	2
		9	3
		9	3
		21	7
		15	5
5.33	<p><b>INDUSTRIAL COATINGS II</b></p> <p><b>Unit I</b> Coatings for Automobiles, Development of Automobiles Coatings, Solid colours, Metallic colours, Different resins and polymers used pigments for metallic coatings, Base and clear coat Combination, Underbody coatings function, Type of Coatings ,sealers, special coatings.</p> <p><b>Unit II</b> Coatings for plastics- Reason for using plastic, Purpose of coating, plastics, preparation and pretreatment of plastics, Type of plastics used TPO, the growing exterior plastics, Different types of Coatings used for plastics, application, coating composition colour and matching .</p> <p><b>Unit III</b> Refinishing paints- Types and usage, repairs.</p> <p><b>Unit IV</b> Texture finishes- application and usage.</p>	15	5
		15	5
		6	2
		6	2

	<b>Unit V</b> Road marking paints	6	2
	<b>Unit VI</b> Customer complaints, Handling Customer complaints, soft skills for painters and contractos.	12	4
5.34	<b>RESIN TECHNOLOGY II</b> <b>Unit I</b>  Alkyd resin, processes ,comparison of processes, effect of oil modification, DCO alkyds, manufacture of alkyd resin, non drying alkyd ,styrenated alkyds . <b>Unit II</b> Amine resin, lacquer grade UF resin, Preparation, MF resin, properties of UF & MF resins <b>Unit III</b> Epoxide resin, properties reaction with phenol and UF resin, cold cure epoxy resins, Epoxy resins esters. <b>Unit IV</b> Unsaturated polyester resin, basic constituents, cross-linking reaction, uses of additives, general property. <b>Unit V</b> Polyamide resins, physical property and structure, resins for conventional paints. <b>Unit VI</b> Polyurethane resin, isocyanate reaction, hazards, catalysts properties of Lacquers, speed of drying and curing, film flexibility, application, metal finishes, wood finishes ,Rubber lacquers ,wire enamels, fabric coatings ,urethane oils. <b>Unit VII</b> Silicon resins, preparation, properties application. <b>Unit VIII</b> Acrylic resins - Types - properties and application water dilutable - soluble emulsions, modified resins.	9 3 6 6 6 15 9 6	3 1 2 2 2 5 3 2
5.35	<b>SAFETY , HEALTH AND ENVIRONMENT</b> <b>Unit I</b>  Safety at manufacturing and application of paint, Materials used in paint shops. Toxicity of materials. Behavior of solvents , Flash point , odour etc. Handling, storage , transportation and usage of materials. flammability of solvents. <b>Unit II</b> Explosive limits- Inhalation of solvent vapors. Safety at shop floor. Occupatomal and Threshold limits <b>Unit III</b> Safety and well being of employees, Health and welfare provisions, change rooms, safety requirement for the	15 9 6	5 3 2

	<p>processes eg. Abrasive blasting, Electrostatic application, Airless spraying and electrodeposition</p> <p><b>Unit IV</b> First Aid fire fighting</p> <p><b>Unit V</b> Noise levels – protection from noise, ventilation, wash room</p> <p><b>Unit VI</b> Packaging – packaging material composition, labelling, warning for toxins and poisons.</p> <p><b>Unit VII</b> MSDS, symbols, personal protective equipments Working at height</p>	3	1
		3	1
		6	2
		3	1
<b>SEMESTER VI</b>			
		<b>Total Hours</b>	<b>Session of 3 hrs each</b>
6.36	<p><b>Quality Management</b></p> <p><b>Unit I</b> Meaning of Quality-Quality assurance input and out-put quality,</p> <p><b>Unit II</b> Production quality. Quality as Corporate strategy standards and specifications.</p> <p><b>Unit III</b> Statistical quality Control methods</p> <p><b>Unit IV</b> Problem solving Techniques-</p> <p><b>Unit V</b> QMS, EMS and OSHA standards Relation of Quality global standards,</p> <p><b>Unit VI</b> Quality Concepts.,</p> <p><b>Unit VII</b> productivity and growth. Inspection</p> <p><b>Unit VIII</b> And quality checks, First time right Concept.</p>	12	4
		12	4
		3	1
		3	1
		6	2
		9	3
		9	3
		6	2
6.37	<p><b>People Management</b></p> <p><b>Unit I</b> Human Resource Development in organizational Context, Team building Soft skills, Behaviour and etiquettes.</p> <p><b>Unit II</b> Personnel management environment, Interaction with different stakeholdes Traning and Development.</p> <p><b>Unit III</b> Career planning</p>	6	2
		9	3
		3	1

	<p><b>Unit IV</b> Motivation and Productivity</p> <p><b>Unit V</b> Economic background and Employee Compensation Regulatory framework for Industrial relations, Industrial relation</p> <p><b>Unit VI</b> Employer Discipline</p> <p><b>Unit VII</b> Grievance handing and suggestion schemes.</p> <p><b>Unit VIII</b> Industrial conflict resolution, workers `participation in management, Leadership styles, group dynamics.</p> <p><b>Unit IX</b> Customer orientation and satisfaction.</p>	12	4
		6	2
		6	2
		9	3
		6	2
		3	1
6.38	<p><b>Construction Chemicals</b></p> <p><b>Unit I</b> Function and importance of construction chemicals.</p> <p><b>Unit II</b> Different types of construction problems and diagnosis.</p> <p><b>Unit III</b> Identification of causes of leakages and dampness in the structure.</p> <p><b>Unit IV</b> Different types of chemicals, cement and polymer,</p> <p><b>Unit V</b> polymer modified mortars(PMM) and Epoxy/PU system.</p> <p><b>Unit VI</b> Their Properties performance and economics.</p> <p><b>Unit VII</b> Repairs and restoration, different method available, processes and application.</p>	9	3
		15	5
		12	4
		12	4
		6	2
		3	1
		3	1
6.39	<p><b>PROJECT TRAINING -</b></p> <p>For a period of three months in a Paint application, Quality control, Techno Commercial work, Marine application etc., - Submission of project , Training report – presentation &amp; viva voce</p>	<b>3 months</b>	
	<p><b>Reference:</b> Organic Coating Technology, Volume 1 &amp; 2 By <b>Henry Fleming Payne</b> Outlines of Paint Technology 3rd Edition by W. M. Morgans Polymer Sewer</p>		



by n. v. vishwanatham Hess's Paint Film Defects, Their Causes and Cure, 3rd Edition 3rd Edition by H. R. Hamburg (Author) Production operation management by panneerselvam Basic of Paint Technology Part 1 & Part 2 By V. C. Malshe Organic Coating Technology, Volume 1 & 2 By Henry Fleming Payne Paint Technology Manuals Volume 1 to 6 By Chapman & hall Industrial paint application By W. H. Tatton, E. W. Drew Powder Coating By Bob Utech		
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**PASSING STANDARD AND PERFORMANCE GRADING:**

MARKS	GRADE POINTS	GRADE
75 TO 100	7.5 TO 10.0	O
65 TO 74	6.5 TO 7.49	A
60 TO 64	6.0 TO 6.49	B
55 TO 59	5.5 TO 5.99	C
50 TO 54	5.0 TO 5.49	D
0 TO 49	0.0 TO 4.99	F (FAILS)

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

The Semester Grade Point Average (SGPA) will be calculated in the following manner:

$SGPA = \frac{\sum CG}{\sum C}$  for a semester, where C is Credit Point and G is Grade Point for the Course/Subject.

The Cumulative Grade Point Average (CGPA) will be calculated in the following manner :

$CGPA = \frac{\sum CG}{\sum C}$  for all semesters taken together.

**R. \_\_\_\_\_ PASSING STANDARD FOR ALL COURSES :**

Passing 50% in each subject /Course combined Progressive Evaluation (PE)/Internal Evaluation and Semester-End/Final Evaluation (FE) examination taken together. i.e. (Internal plus External Examination)

R. \_\_\_\_\_

- A. Carry forward of marks in case of learner who fails in the Internal Assessments and/ or Semester-end examination in one or more subjects (whichever component the learner has failed although passing is on total marks).
- B. A learner who PASSES in the Internal Examination but FAILS in the Semester-end Examination of the Course shall reappear for the Semester-End Examination of that Course. However his/her marks of internal examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.
- C. A learner who PASSES in the Semester-end Examination but FAILS in the Internal Assessment of the course shall reappear for the Internal Examination of that Course. However his/her marks of Semester-End Examination shall be carried over and he/she shall be entitled for grade obtained by him/her on passing

**R. \_\_\_\_\_ ALLOWED TO KEEP TERMS (ATKT)**

- A. A learner shall be allowed to keep term for Semester II irrespective of number of heads/courses of failure in the Semester I.
- B. A learner shall be allowed to keep term for Semester III wherever applicable if he/she passes each of Semester I and Semester II.

**OR**

- C. A learner shall be allowed to keep term for Semester III wherever applicable irrespective of number of heads/courses of failure in the Semester I & Semester II.
- D. A learner shall be allowed to keep term for Semester IV wherever applicable if he/she passes each of Semester I, Semester II and Semester III.

**OR**

- E. A learner shall be allowed to keep term for Semester IV wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, and Semester III
- F. A learner shall be allowed to keep term for Semester V wherever applicable if he/she passes each of Semester I, Semester II, Semester III and Semester IV.

**OR**

- G. A learner shall be allowed to keep term for Semester V wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, Semester III, and Semester IV.

- H. The result of Semester VI  
wherever applicable OR final semester shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV , Semester V wherever applicable.

**OR**

- I. A learner shall be allowed to keep term for Semester VI wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, Semester III, Semester IV and Semester V.