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Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post H.S.C Diploma Courses

Programme Name	**: Diploma In Surface Coating Technology**		
Programme Code	**: SC**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Fourth**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	314301	2	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125
2	APPLICATION AND TESTING OF ARCHITECTURAL COATINGS	QCP	DSC	324323	-	4	-	4	-	8	4	3	30	70	100	40	25	10	50#	20	-	-	175
3	PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS	ARP	DSC	324324	2	4	-	4	-	8	4	3	30	70	100	40	25	10	50#	20	-	-	175
4	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	EDS	AEC	314014	-	1	-	2	1	4	2	-	-	-	-	-	50	20	25@	10	25	10	100
5	INSTRUMENTATION IN SURFACE COATING INDUSTRIES	ISC	GE	324016	-	2	-	4	2	8	4	-	-	-	-	-	25	10	50@	20	25	10	100
Elective-1 (Any - One)																								
6	ALLIED SURFACE COATING	ASC	DSE	324325	2	3	-	3	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
	BASICS OF INK TECHNOLOGY	INK	DSE	324326	-	3	-	3	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
Total					**6**	**17**		**17**	**6**		**20**		**120**	**280**	**400**		**150**		**200**		**100**		**850**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme										
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :
1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.
Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures/**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX**
Semester	**: Fourth**
Course Title	**: ENVIRONMENTAL EDUCATION AND SUSTAINABILITY**
Course Code	**: 314301**

I. RATIONALE

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary approach to study the environmental systems and sustainability approach to the diploma engineers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant Environmental issues in specified locality.
- CO2 - Provide the green solution to the relevant environmental problems.
- CO3 - Conduct SWOT analysis of biodiversity hotspot
- CO4 - Apply the relevant measures to mitigate the environmental pollution.
- CO5 - Implement the environmental policies under the relevant legal framework.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

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ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314301	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the need of studying environment and its components. TLO 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions TLO 1.3 Explain the Concept of 5 R w.r.t. the given situation TLO 1.4 Elaborate the relevance of Sustainable Development Goals in managing the climate change TLO 1.5 Explain the concept of zero carbon-footprint with carbon credit	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 1.4 Impact of Climate change, Factors contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Justify the importance of natural resources in sustainable development TLO 2.2 Explain the need of optimum use of natural resources to maintain the sustainability TLO 2.3 Differentiate between renewable and non-renewable sources of energy TLO 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**Unit - II Sustainability and Renewable Resources** 2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS-Concepts of Panchmahabhuta) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 2.3 Energy forms (Renewable and non-renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations
3	TLO 3.1 Explain the characteristics and functions of ecosystem TLO 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability TLO 3.3 Describe biodiversity assessment initiatives in India TLO 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India TLO 3.5 Explain the need of conservation of biodiversity in the given situation	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Classify the pollution based on the given criteria TLO 4.2 Justify the need of preserving soil as a resource along with the preservation techniques TLO 4.3 Maintain the quality of water in the given location using relevant preventive measures TLO 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms TLO 4.5 Compare the noise level from different zones of city with justification TLO 4.6 Describe the roles and responsibilities of central and state pollution control board	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man- made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city 4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain Constitutional provisions related to environmental protection TLO 5.2 Explain importance of public participation (PPP) in enacting the relevant laws TLO 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem TLO 5.4 Explain the role of information technology in environment protection	**Unit - V Enviornmental legislation and sustainable practices** 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

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Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution
Draft an article on India's Strategies to progress across the Sustainable Development Goals
Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source
Conduct the SWOT analysis of biodiversity hotspot in India
Prepare a mind-mapping for the zero carbon footprint process of your field
Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions
Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

- Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below: -

Unit 1: Living with climate change
Unit 2 : Water Management and Climate Action
Unit 3: Energy Management and Climate Action
Unit 4 : Waste Management and Climate Action
Unit 5 : Bio-cultural Diversity and Climate Action
If students complete all the five Units they are not required to undertake any other assignment /Microproject/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

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Technical analysis of nearby commercial RO plant.
Comparative study of different filters used in Household water filtration unit
Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainabilityand cost-benefit
IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion

Visit a local polluted water source and make a report mentioning causes of pollution
Any other activity / relevant topic related to the course suggested by the facilitator

Activities

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Prepare a report on the working and functions of the PUC Center machines and its relavance in pollution control.
Prepare and analyse a case study on any polluted city of India
Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority
Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool
Watch a video related to air pollution in India and present the summary
Any other assignment on relevant topic related to the course suggested by the facilitator

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	8	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	10	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	8	4	4	4	12
4	IV	Environmental Pollution	CO4	12	4	8	6	18
5	V	Enviornmental legislation and sustainable practices	CO5	7	4	4	4	12
Grand Total				**45**	**20**	**24**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignment/activities. (60 % weightage to process and 40 % to product)

Summative Assessment (Assessment of Learning)

- Online MCQ type Exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi
3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://sdgs.un.org/goals	United Nation’s website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-fo r-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Intiative for youth leadership for climate action

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Link / Portal	Description
6	https://eepmoefcc.nic.in/index1.aspx?lsid=297&lev=2&lid=1180&langid=1	GOI Website for public awareness on enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India’s Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analysis-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal conservation

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024 **Semester - 4, K Scheme**

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APPLICATION AND TESTING OF ARCHITECTURAL COATINGS **Course Code : 324323**

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Fourth**
Course Title : **APPLICATION AND TESTING OF ARCHITECTURAL COATINGS**
Course Code : **324323**

I. RATIONALE

The course 'Application and Testing of Architectural Coatings' introduces the students about the importance of surface preparation methods, application methods for architectural surfaces and paint testing methods. In addition, students will learn various standard test methods for liquid paint, dry paint films testing and functional properties of paint film. Students will also learn various aspects of architectural surfaces such as concrete, floors and wood.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Test paint materials and painted surfaces as per relevant specifications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Prepare architectural substrates for painting.
- CO2 - Explain application methods for architectural coatings.
- CO3 - Test wet paint properties.
- CO4 - Write test procedures for dry films properties of paint.
- CO5 - Explain the significance of functional properties of coating film.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324323	APPLICATION AND TESTING OF ARCHITECTURAL COATINGS	QCP	DSC	4	-	4	-	8	4	3	30	70	100	40	25	10	50#	20	-	-	175

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

APPLICATION AND TESTING OF ARCHITECTURAL COATINGS **Course Code : 324323**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify surface preparation methods. TLO 1.2 Describe chemical surface preparation methods. TLO 1.3 Explain surface preparation for concrete and flooring. TLO 1.4 Describe different types of substrates.	**Unit - I Preparation of architectural substrates** 1.1 Need for surface preparation. 1.2 Types of architectural substrates. 1.3 Mechanical surface preparation methods for different types of substrates such as concrete plaster, flooring, wood. 1.4 Types of sand papers. 1.5 Chemical surface preparation methods. 1.6 Surface preparation methods for different types of previously painted substrates.	Lecture Using Chalk-Board Presentations Demonstration Input-cum-discussion
2	TLO 2.1 Define wet edge time. TLO 2.2 Write advantages and limitations of brush applications. TLO 2.3 Explain paint system for interior and exterior cementitious surfaces.	**Unit - II Application methods for architectural coatings** 2.1 Types of brushes, rollers, putty knife used for paint application. 2.2 Advantages & limitations of brush & roller applications. 2.3 Architectural paint system for interior and exterior surfaces. 2.4 Advantages and limitations of spray painting for architectural coating.	Lecture Using Chalk-Board Presentations Demonstration Input-cum-discussion
3	TLO 3.1 Explain the importance of paint testing. TLO 3.2 Write test methods for fineness of grind. TLO 3.3 Explain significance of rheology in paint application.	**Unit - III Wet Paint Properties** 3.1 Scope of wet paint and dry paint film testing 3.2 Test methods of fineness of grind, viscosity by flow cups, skinning, settling, in-can stability. 3.3 Test methods of wet film thickness, drying time, dilution ratio, covering power, hiding power, 3.4 Testing of wet sample of architectural paint-rheology, sag index, brushability	Lecture Using Chalk-Board Demonstration Presentations Input-cum-discussion
4	TLO 4.1 Write test methods for measurement of dry film thickness. TLO 4.2 Explain DOI and gloss. TLO 4.3 Interpret delta E.	**Unit - IV Paint Dry Films Properties** 4.1 Testing of architectural film for wet scrub resistance, dry scrub resistance, mold growth resistance, stain resistance. 4.2 Dry film thickness, adhesion, flexibility, scratch hardness, pencil hardness, impact, abrasion, pull off adhesion and cupping. 4.3 Test methods for delta E, gloss, distinctness of image (DOI),	Lecture Using Chalk-Board Demonstration Presentations Input-cum-discussion
5	TLO 5.1 Explain significance of salt spray test. TLO 5.2 Describe procedure to determine chemical resistance of the coating film. TLO 5.3 Write procedure for determination of heat resistance of coating.	**Unit - V Coating Film Functional Properties** 5.1 Test methods for salt spray, cyclic corrosion test, accelerated UV resistance, water immersion, humidity 5.2 Chemical resistances-acid, alkali, lubricating oil and solvent. 5.3 Heat resistance, insulation resistance, breakdown voltage, pinhole testing (holiday test).	Lecture Using Chalk-Board Presentations Demonstration Input-cum-discussion

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

APPLICATION AND TESTING OF ARCHITECTURAL COATINGS **Course Code : 324323**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare concrete surface for painting using mechanical methods.	1	*Mechanical methods for preparation of concrete surface for painting.	4	CO1
LLO 2.1 Prepare wood surface for painting using mechanical methods.	2	Mechanical methods for preparation of wood surface for painting.	4	CO1
LLO 3.1 Prepare floor surface for painting using chemical methods.	3	Chemical methods for preparation of floor surface for painting.	4	CO1
LLO 4.1 Compare finish of brush/roller applied coating by varying viscosities.	4	*Comparison of finishes applied by brush/roller applied coating at different viscosities.	4	CO2
LLO 5.1 Apply composite interior/exterior architectural paint system.	5	Application and testing of composite paint systems for interior/exterior architectural.	4	CO2
LLO 6.1 Apply putty using putty knife and determine wet edge time.	6	Importance of wet edge time for application of putty using putty knife.	4	CO2
LLO 7.1 Determine fineness of grind, skinning and settling of paint.	7	*Measurment of fineness of grind, skinning and settling of paint.	4	CO3
LLO 8.1 Determine wet film thickness of paint film using tooth gauge/Inmont gauge	8	*Determination of wet film thickness of paint film using tooth gauge/Inmont gauge	4	CO3
LLO 9.1 Determine dilution ratio, drying time and hiding power of paint.	9	Measurement and calculation of dilution ratio, drying time and hiding power of paint.	4	CO3
LLO 10.1 Determine sag index of paint by varying viscosity	10	Experimental set up for determination of sag index of paint by varying viscosity	4	CO3
LLO 11.1 Determine Gloss, dry film thickness and adhesion of painted panels.	11	*Evaluation of paint film properties such as Gloss, dry film thickness and adhesion of painted panels.	4	CO4
LLO 12.1 Test flexibility, scratch and pencil hardness of painted panels.	12	*Determination of dry paint film properties such as flexibility, scratch and pencil hardness of painted panels.	4	CO4
LLO 13.1 Determine impact and cupping hardness of painted panels.	13	Testing of painted panel for the performance against the impact and cupping.	4	CO4
LLO 14.1 Determine resistance to salt spray of painted panels.	14	Preparation of panel, salt spray solution and determination of corrosion resistance of painted panel. .	4	CO5
LLO 15.1 Determine resistance to humidity and water immersion of painted panels.	15	Determination of resistance to humidity and water immersion of painted panels.	4	CO5
LLO 16.1 Determine resistance to chemicals (Acid, Alkali, solvents) of painted panels.	16	*Testing of paint performance against chemicals (Acid, Alkali, solvents) of painted panels.	4	CO5
LLO 17.1 Determine resistance to heat of painted panels.	17	*Determination of e resistance to heat of painted panels.	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Term work

- Prepare a report of consisting: a. List of laboratory experiences given. b. For each practical perform write (Scope, chemicals, instruments, process, observations, diagram, calculations and result etc) c. Arrange (b) chronologically (date wise) d. Prepare report for submission.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Asbestos panel	1
2	Sag index meter	10
3	Gloss-O-meter	11
4	DFT meter	11
5	Adhesion Tape	11
6	Cutter/Cutter guider	11
7	Conical Mandrel	12
8	Scratch Hardness Tester	12
9	Pencil hardness tester	12
10	Impact tester	13
11	Cupping Tester	13
12	Salt Spray Chamber	14
13	Humidity Chamber	15
14	Oven	17
15	Wooden panels	2
16	Rollers	4,5
17	Stop watch	4,5
18	Ford Cup B-4	4,5,10
19	Putty knife	5,6
20	Hegman gauge	7
21	Tooth gauge	8
22	Inmont gauge	8
23	Painted MS panel	All
24	Spatula	All
25	Beaker (250 ml, 500ml)	All
26	Sand Paper (80, 120, 320)	All
27	MS panels	All
28	Brush	All
29	Weighing Balance	All
30	Glass plate	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

APPLICATION AND TESTING OF ARCHITECTURAL COATINGS **Course Code : 324323**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Preparation of architectural substrates	CO1	12	2	4	8	14
2	II	Application methods for architectural coatings	CO2	12	2	4	8	14
3	III	Wet Paint Properties	CO3	12	2	4	8	14
4	IV	Paint Dry Films Properties	CO4	12	2	4	8	14
5	V	Coating Film Functional Properties	CO5	12	2	4	8	14
Grand Total				**60**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning assessment by report and seminars
- Term Work (60% weightage for process and 40% weightage for product)
- Mid term tests

Summative Assessment (Assessment of Learning)

- End of Term Examination
- Lab. performance
- Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	1	1	2			
CO2	3	2	1	-	2	2	2			
CO3	3	2	2	3	1	1	2			
CO4	3	2	2	-	-	-	2			
CO5	3	2	2	-	1	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	W. M. Morgan	Outlines of Paint Technology (3rd Edition)	CBS Publishers & Distributors Pvt. Ltd, 2000 ISBN: 9788123904306
2	V.C. Malshe and Meenal Sikchi	Basics of Paints Technology (Part II) (1st Edition)	Antar Prakash Centre for Yoga, India, 2004 ISBN: 9788190329842
3	Felix Konstandt	Organic Coatings: Properties and Evaluation	Chemical Publishing Co, New York; ISBN: 0820603066

APPLICATION AND TESTING OF ARCHITECTURAL COATINGS **Course Code : 324323**

Sr.No	Author	Title	Publisher with ISBN Number
4	Guy E. Weismantel	Paint Handbook	McGraw-Hill publication ISBN: 0070690618
5	Gardner Henry and George Sward	Paint Testing Manual Physical and Chemical Examination (13th Edition)	American Society for Testing and Materials, 1972; ASIN:B002SVE7B2
6	Dr. Swaraj Paul	Surface Coatings: Science & Technology (2nd Edition)	John Wiley and Sons Ltd.2014 ISBN:9788126552559
7	Shreekant Patil	Testing of Paints	Colour Publications (Pvt) Limited, ISBN: 9788190259453

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/ah5K8PUCwns?feature=shared	Safe Working Practice During Surface Preparation
2	https://youtu.be/qHR_u7WKVcM?feature=shared	Abrasive Blast
3	https://youtu.be/E6336AiBXQg?feature=shared	Flame Washing Technology
4	https://youtu.be/ss0WXNRK1zs?feature=shared	Underwater high pressure water blasting
5	https://youtu.be/6ObSmW8fYL0?feature=shared	Surface Coating Industry
6	https://youtu.be/kA4-srdjGFQ?feature=shared	How to measure dispersion
7	https://youtu.be/05ylwZvs_VE?feature=shared	Measure Wet Film Thickness
8	https://youtu.be/gL8c0sXktC8?feature=shared	Ultrasonic NDT thickness gauge
9	https://youtu.be/vUNX1q4wD_Y?feature=shared	Measurement of Viscosity
10	https://youtu.be/DFL-8XzcW6A?feature=shared	Flow Cup Viscometers
11	https://youtu.be/iCoovb7tdcM?feature=shared	Drying test ISO 9117-4 Automatic recorder
12	https://youtu.be/DmNjmhBTPt0?feature=shared	Drying test ISO 9117-5 modified Bandow Wolff
13	https://youtu.be/VlbKypjsaNo?feature=shared	Hiding power
14	https://youtu.be/4juwoXcndU8?feature=shared	Sag resistance ASTM D4400
15	https://youtu.be/CeJewuaCxBc?feature=shared	Wash and scrub resistance DIN 53778-2
16	https://youtu.be/oDznbpCqYGs?feature=shared	Pull-off adhesion ASTM D4541
17	https://youtu.be/yMScfISUB6g?feature=shared	Conical Mandrel Bend Tester
18	https://youtu.be/LS8h1n04NsU?feature=shared	Coating Flexibility Test
19	https://youtu.be/BgpVxWQ4yw4?feature=shared	Pencil Hardness Test
20	https://youtu.be/B0WwVOWZQHQ?feature=shared	Cross Cut Adhesion test
21	https://youtu.be/2_zUo9owKRY?feature=shared	Scratch hardness test
22	https://youtu.be/2gU0uyYeIl0?feature=shared	Impact test ASTM D2794
23	https://youtu.be/Nw5LljG1R78?feature=shared	Abrasion Resistance
24	https://youtu.be/MN-IxIlA6DA?feature=shared	CUPPING TEST
25	https://youtu.be/vP0Pl0-Gyug?feature=shared	Salt spray test
26	https://youtu.be/JWleZaw9790?feature=shared	Insulation Resistance Test
27	https://youtu.be/RhsdaPx2gCE?feature=shared	BDV Test
28	https://youtu.be/Jl71sq4xFDc?feature=shared	Testing for Pinholes

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

02-01-2025 11:00:44 AM

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Fourth**
Course Title : **PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS**
Course Code : **324324**

I. RATIONALE

This course enable students to use knowledge of pigments, resins, solvents & additives to formulate & prepare paints for architectural surfaces. The course includes selection of appropriate raw materials, basic calculations for formulating and testing of sample of paints. In addition to this, students will learn the concept of formulation principles & their effect of properties of paint.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Formulate & prepare paints for architectural surfaces.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select relevant raw material for paints.
- CO2 - Calculate basic requirements for formulation of paints.
- CO3 - Formulate types of architectural paints.
- CO4 - Select relevant machinery for preparation of Paints.
- CO5 - Explain new trends in architectural coatings.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324324	PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS	ARP	DSC	4	-	4	-	8	4	3	30	70	100	40	25	10	50#	20	-	-	175

Total IKS Hrs for Sem. : 2 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain functions of the paints & classify Paints TLO 1.2 List raw materials for paints. TLO 1.3 State requirements of coating for different applications.	**Unit - I Paint composition & Classifications** 1.1 Introduction to Paint and ancient Indian paint practices (IKS) 1.2 Classification of paints based on their functional applications, curing methods & solvent content. 1.3 Selection of raw materials & their Significance. 1.4 Selection of solvents in paint manufacturing with respect to their properties. 1.5 Requirements of Paints for different Surfaces in architecture .	Lecture Input -cum-discussion Assignment Presentation(PPTs) Demonstration
2	TLO 2.1 Define terms used in paint manufacturing. TLO 2.2 Calculate various physical parameters of paint composition. TLO 2.3 Calculate material requirement for a required batch size	**Unit - II Physical parameters** 2.1 Introduction to basic terms like NVM, % Solids, Density, Specific gravity, weight per liter, P/B ratio, PVC & CPVC in paint formulations 2.2 Calculation of P/B ratio, Specific gravity of Paint, PVC & CPVC 2.3 Volume of Paint, batch size calculation. 2.4 Calculate costing of prepared paint (based on raw materials)	Lecture Input -cum-discussion Assignment Presentation(PPTs) Demonstration
3	TLO 3.1 Classify architectural coatings. TLO 3.2 Formulate various compositions for architectural paints and coatings. TLO 3.3 Formulate various compositions for wood coatings.	**Unit - III Formulations of architectural paints** 3.1 Introduction to various types of architectural coatings. 3.2 Formulations of water based and solvent based primer, putty, enamel for different substrates. 3.3 Formulations of water based paints like oil bound distemper, acrylic distemper, cement putty, and emulsion paint 3.4 Formulation of solvent based wood coatings such as shellac, alkyd & NC lacquer.	Lecture Input -cum-discussion Assignment Presentation(PPTs) Demonstration
4	TLO 4.1 Name stages during paint manufacturing. TLO 4.2 Explain working of paint manufacturing machines with neat labelled diagrams. TLO 4.3 Explain safety aspects of paint manufacturing machines.	**Unit - IV Manufacturing process & working of machines** 4.1 Introduction to paint manufacturing stages. 4.2 Machines and other equipment used in manufacturing such as mixers, high speed stirrers, pug mill, ball mill, sand mill, attritors, dyno mill, basket Mill 4.3 Safety aspects of paint manufacturing machines.	Lecture Input -cum-discussion Assignment Presentation(PPTs) Demonstration
5	TLO 5.1 Explain significance of solar reflectance & road marking paints TLO 5.2 Explain working principle & application of lotus effect coatings. TLO 5.3 State properties of Re-dispersible polymers.	**Unit - V New trends in Architectural Paints** 5.1 Introduction to solar/heat reflectance coating. 5.2 Types & formulations of road marking paint. 5.3 Introduction to lotus effect in coatings. 5.4 Properties & uses of Re-dispersible polymer powder. 5.5 Introduction to preparation and application process of texture paints	Lecture Input -cum-discussion Assignment Presentation(PPTs) Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare wall putty/lambi samples	1	*Preparation of testing of wall Putty samples using pastel mortar	4	CO1
LLO 2.1 Prepare Dry Distemper samples.	2	*Preparation & testing of Dry distemper using laboratory Ball Mill	4	CO1
LLO 3.1 Prepare Emulsion paste/paint samples.	3	*Preparation & testing of emulsion paint using specified Pigment Binder ratio using stirrer.	4	CO1
LLO 4.1 Prepare Cement Primer	4	Preparation & testing of Cement Primer using concept of weight per liter, Pigment binder ratio, PVC using relevant method.	4	CO2
LLO 5.1 Prepare Red Oxide Metal Primer	5	*Preparation & testing of Red Oxide Metal Primer using concept of weight per liter, Pigment binder ratio, PVC using relevant method.	4	CO2
LLO 6.1 Prepare Cement Paint	6	*Preparation & testing of Cement Paint using laboratory using pastel mortar/Ball Mill	4	CO3
LLO 7.1 Prepare French Polish	7	Preparation & testing of French Polish using stirrer	4	CO3
LLO 8.1 Prepare NC lacquer	8	Preparation & testing of NC lacquer using stirrer	4	CO3
LLO 9.1 Prepare Alkyd Lacquer	9	Preparation & testing of Alkyd lacquer using stirrer	4	CO3
LLO 10.1 Prepare Interior Enamel	10	*Preparation & testing of Interior Enamel using concept of weight per liter, Pigment binder ratio, PVC using sand mill.	4	CO3
LLO 11.1 Prepare Exterior Enamel	11	Preparation & testing of Exterior Enamel using concept of weight per liter, Pigment binder ratio, PVC using sand mill.	4	CO4
LLO 12.1 Prepare Solvent based luster paint	12	*Preparation & testing of solvent based luster paint using Ball mill	4	CO4
LLO 13.1 Prepare Water based luster paint	13	Preparation & testing of water based luster paint using stirrer.	4	CO4
LLO 14.1 Preparation of Universal Stainer	14	Preparation & testing of universal stainer using Sand Mill/Ball mill/Pastel Mortar/Pigment Muller.	4	CO4
LLO 15.1 Preparation of Road marking paint	15	Preparation & testing of Road Marking Paint based on Emulsion using stirrer	4	CO5
LLO 16.1 Preparation of wall primer using RDP powder	16	*Preparation & testing of water-based wall primer based on Re dispersible powder.	4	CO5
LLO 17.1 Preparation of water based Interior Paint based on RDP Powder	17	Preparation & testing of water-based Paint based on Re dispersible powder.	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Prepare a chart of Classification of Paints.
- Prepare report on Paint Industry scenario for the current financial year.
- Prepare report on new developments in paint manufacturing machines

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

Term work

- Prepare a report of consisting: a. List of laboratory experiences given. b. For each practical perform write (Scope,chemicals, instruments, process, observations, diagram, calculations and result etc) c. Arrange (b) chronologically(date wise) d. Prepare report for submission.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Pastel Mortar	1,4,14
2	Sand Mill	10,11,14
3	Pigment Muller	14
4	Ball Mill/Jar Mill	2,5,12,14
5	Stirrer	3,7,8,9,13,15
6	Hegman Guage	4,5,10,11,12,14
7	Film applicator	4,5,10,11,12,14
8	Morest Chart	4,5,10,11,12,14
9	DFT meter	4,5,10,11,12,14
10	Gloss ‘O’ Meter	4,5,10,11,12,14
11	Oven	4,5,9
12	Gardner tube Viscometer	7,8,9
13	Weighing Balance	All
14	Spatula	All
15	Ford cup Viscometer	All
16	Specific gravity cup	All
17	Glassware	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Paint composition & Classifications	CO1	12	2	4	8	14
2	II	Physical parameters	CO2	12	2	4	8	14
3	III	Formulations of architectural paints	CO3	12	2	4	8	14
4	IV	Manufacturing process & working of machines	CO4	12	2	4	8	14
5	V	New trends in Architectural Paints	CO5	12	2	4	8	14
Grand Total				**60**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

Formative assessment (Assessment for Learning)

- Mid term tests
- Assignment, Self-learning and Terms work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- Lab. performance
- End of Term Examination
- Viva-voce
- Lab. performance

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	2	2	-	2			
CO2	3	2	-	-	1	-	2			
CO3	3	2	1	2	2	-	2			
CO4	3	2	1	2	2	-	2			
CO5	3	2	1	1	2	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	W. M. Morgan	Outlines of Paint Technology (3rd Edition)	CBS Publishers & Distributors Pvt. Ltd, 2000 ISBN: 9788123904306
2	Oil and Colour Chemists Association of Australia St (OCCA	urface Coatings, Vol I: Raw Materials and Their Usage	Chapman & Hall, 1993 ISBN: 9780412552106
3	H. F. Payne	Organic Coating Technology	John Wiley & Sons Inc (1961) ISBN: 9780471673538
4	V.C. Malshe and Meenal Sikchi	Basics of Paints Technology Part I	Antar Prakash Centre for Yoga, 2004 ISBN: 9788190329859
5	Dr. Swaraj Paul	Surface Coatings: Science & Technology (2nd Edition)	John Wiley and Sons Ltd.2014 ISBN:9788126552559
6	NIIR Board	Modern Technology of Paints, Varnishes & Lacquers (2nd Edition)	Asia Pacific Business Press Inc. 2007 ISBN: 8178330881

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=CyfDPAK3OLU	Properties of Paints

PRINCIPLES OF ARCHITECTURAL PAINT FORMULATIONS **Course Code : 324324**

Sr.No	Link / Portal	Description
2	https://www.youtube.com/watch?v=0KuKP2u347A	Ingredients of Paints
3	https://www.youtube.com/watch?v=prWqENxWjsU	Protic & aprotic solvents
4	https://www.youtube.com/watch?v=lkHW-2vgFx0	Multi surfaces for painting
5	https://eramanath.wordpress.com/2012/04/	Paint Formulation guidelines
6	https://eramanath.wordpress.com/2012/04/09/measuring-viscosity-of-paint-using-ford-cup-b4/	Measuring viscosity of Paint by ford cup B-4
7	https://www.youtube.com/watch?v=BKgU5yDZMws	Principle of paint batch formulations
8	https://www.youtube.com/watch?v=1xpX7uyxRXo	How Paint is made
9	https://www.youtube.com/watch?v=TZyPJR4fYxo	Ball Mill principle advantages & disadvantages
10	https://www.youtube.com/watch?v=L6sgGXXYdEU	Ball Mill Critical Speed & working principle
11	https://www.youtube.com/watch?v=tL21JCLG9s8	Animation Demo & working site of Ball Mill
12	https://www.youtube.com/watch?v=PzIGr-vdS9M	Bead Mill
13	https://www.youtube.com/watch?v=4uCsActiRwM	Revolution in Basket Mill Technology
14	https://www.youtube.com/watch?v=XKopBrybSUE	Machine Safety
15	https://www.youtube.com/watch?v=1ol6de7-YjA	Machine Safeguards: The basics
16	https://www.youtube.com/watch?v=GnXv52fXxX8	Implementing Machine Safety
17	https://www.youtube.com/watch?v=-qyE-fHPZYk	Solar Reflectance Coating
18	https://www.youtube.com/watch?v=NOw5av9of28	Liquid thermoplastic traffic paint

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024 **Semester - 4, K Scheme**

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Agricultural Engineering/ Architecture/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Food Technology/ Instrumentation & Control/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Surface Coating Technology/ Textile Technology/ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AL/ AT/ DC/ DD/ FC/ IC/ IS/ IX/ IZ/ ME/ MK/ ML/ MU/ PG/ PN/ SC/ TC/ TR/ TX**
Semester	**: Fourth / Fifth / Sixth**
Course Title	**: ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS**
Course Code	**: 314014**

I. RATIONALE

Entrepreneurship and Startup is introduced in this curriculum to develop the entrepreneurship traits among the students before they enter into the professional life. By exposing and interacting with entrepreneurship and startup eco-system, student will develop the entrepreneurial mind set. The innovative thinking with risk taking ability along with other traits are to be inculcated in the students through micro projects and training. This exposure will be instrumental in orienting the students in transforming them to be job generators after completion of Diploma in Engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

• Develop project proposals for launching small scale enterprises and starts up.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify one's entrepreneurial traits.
- CO2 - Use information collected from stakeholder for establishing/setting up/founding starts up
- CO3 - Use support systems available for Starts up
- CO4 - Prepare project plans to manage the enterprise effectively

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314014	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	EDS	AEC	1	-	2	1	4	2	-	-	-	-	-	50	20	25@	10	25	10	100

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare advantages and disadvantages of Entrepreneurship TLO 1.2 Identify entrepreneurial traits through self-analysis TLO 1.3 Compare risk associated with different type of enterprise	**Unit - I Introduction to Entrepreneurship Development** 1.1 Entrepreneurship as a career – charms, advantages, disadvantages , scope- local and global 1.2 Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking, learning from failure 1.3 Types of enterprises and their features : manufacturing, service and trading	Presentations Lecture Using Chalk-Board
2	TLO 2.1 Explain Important factors essential for selection of product/service and selection of process TLO 2.2 Suggest suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. TLO 2.3 Suggest steps for the selection process of an enterprise for the specified product or service with justification. TLO 2.4 Plan a market study /survey for the specified enterprise	**Unit - II Startup Selection Process** 2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]	Presentations Lecture Using Chalk-Board

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain categorization of MSME on the basis of turnover and investment TLO 3.2 Describe support system provided by central and state government agencies TLO 3.3 State various schemes of government agencies for promotion of entrepreneurship TLO 3.4 Describe help provided by the non-governmental agencies for the specified product/service TLO 3.5 Compute breakeven point, ROI and ROS for the specified business enterprise, stating the assumptions made	**Unit - III Support System for Startup** 3.1 Categorization of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI-MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment (ROI) and return on sales (ROS).	Presentations Lecture Using Chalk-Board
4	TLO 4.1 Explain key elements for the given business plan with respect to their purpose/size TLO 4.2 Justify USP of the given product/ service from marketing point of view. TLO 4.3 Formulate business policy for the given product/service. TLO 4.4 Choose relevant negotiation techniques for the given product/ service with justification TLO 4.5 Identify risks that you may encounter for the given type of business/enterprise with justification. TLO 4.6 Describe role of the incubation centre and accelerators for the given product/service.	**Unit - IV Managing Enterprise** 4.1 Techno commercial Feasibility study, feasibility report preparation and evaluation criteria 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project 4.3 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 4.4 Preparing strategies of handling business: policy making, negotiation and bargaining techniques 4.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, definition of startup cycle, ecosystem , angel investors, venture capitalist 4.6 Incubation centers and accelerators : Role and procedure	Presentations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Collect information of successful entrepreneurial traits	1	*Preparation of report on entrepreneurship as a career	2	CO1
LLO 2.1 Identify different traits as an entrepreneur from various field LLO 2.2 Suggest different traits from identified problem	2	Case study on 'Traits of Entrepreneur'	2	CO1
LLO 3.1 Explore probable risks for identified enterprise.	3	*Case study on 'Risks associated with enterprise	2	CO1
LLO 4.1 Identify new product for development LLO 4.2 Prepare a newly developed product	4	*Preparation of report on 'Development of new Product'	2	CO1 CO2

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Identify Process for development of product for new startup	5	Preparation of Report on ' Process selection ' for new startup	2	CO1 CO2 CO3
LLO 6.1 Develop questioner for market survey	6	*Market survey for setting up new Start up	2	CO2 CO3
LLO 7.1 Interpret the use of Technology Life Cycle	7	A Case study on ' Technology life cycle' of any successful entrepreneur.	2	CO3
LLO 8.1 Use information related to support of startups from Government and non-government agencies' LLO 8.2 Prepare report for setting up startup	8	*Preparation of report on 'Information for setting up new startup' from MCED/MSME/KVIC etc	2	CO3 CO4
LLO 9.1 Compute ROI of successful enterprise.	9	Case study on 'Return on Investment (ROI)'of any successful startup	2	CO3
LLO 10.1 Calculate of ROS of any successful enterprise	10	Case study on 'Return on sales (ROS)'of any successful startup	2	CO3
LLO 11.1 Calculate Brake even point of any enterprise	11	Preparation of report on 'Brake even point calculation' of any enterprise.	2	CO3 CO4
LLO 12.1 Prepare feasibility report of given business	12	*Preparation of report on 'feasibility of any Techno-commercial business"	2	CO4
LLO 13.1 Plan a USP of any enterprise.	13	*A case study based on 'Unique selling Proposition (USP) of any successful enterprise	2	CO4
LLO 14.1 Prepare a project report using facilities of Atal Incubation center.	14	*Prepare project report for starting new startup using 'Atal incubation center (AIC)	2	CO1 CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare a ' Women entrepreneurship business plan ' Choose relevant government scheme for the product/service
- Prepare a 'Pitch- desk' for your start up
- Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d. Repair and Maintenance agency e. Tour and Travel agency
- Prepare a 'Social entrepreneurship business plan, plan for CSR funding.
- Prepare a business plan for identified projects by using entrepreneurial eco system for the same (Schemes, incentives, incubators etc.)

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computers with internet and printer facility	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Entrepreneurship Development	CO1	5	0	0	0	0
2	II	Startup Selection Process	CO2	4	0	0	0	0
3	III	Support System for Startup	CO3	3	0	0	0	0
4	IV	Managing Enterprise	CO4	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

Summative Assessment (Assessment of Learning)

- End of Term Examination - Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	-	-	3	2			
CO2	2	2	2	2	-	3	2			
CO3	2	2	2	2	-	3	2			
CO4	2	2	2	2	-	3	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS **Course Code : 314014**

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN-2023,978-93-93577-70-2
2	Gujral, Raman	Reading Material of Entrepreneurship Awareness Camp	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad
3	Chitale, A K	Product Design and Manufacturing	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
4	Charantimath, Poornima	Entrepreneurship Development Small Business Entrepreneurship	Pearson Education India, New Delhi; ISBN: 9788131762264
5	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.mced.nic.in/allproduct.aspx	MCED Product and Plan Details
2	http://niesbud.nic.in/Publication.html	The National Institute for Entrepreneurship and Small Business Development Publications
3	http://niesbud.nic.in/docs/1standardized.pdf	Courses : The National Institute for Entrepreneurship and Small Business Development
4	https://www.nabard.org/content1.aspx?id=23andcatid=23andmid=530	Government Schemes
5	https://www.nabard.org/Tenders.aspx?cid=501andid=24	NABARD - Information Centre
6	http://www.startupindia.gov.in/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandcontent_type=Actionandsubmenupoint=action	Start Up India
7	http://www.ediindia.org/institute.html	About - Entrepreneurship Development Institute of India (EDII)
8	http://www.nstedb.com/training/training.htm	NSTEDB - Training

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Fourth**
Course Title : **INSTRUMENTATION IN SURFACE COATING INDUSTRIES**
Course Code : **324016**

I. RATIONALE

The course 'Instrumentation in Surface Coating Industries' is included in Diploma in Surface Coating Technology to enable students to understand fundamentals of process instrumentation used in surface coating industries. The course will enable students to learn, practice and analyze data and information for monitoring surface coating processes.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Analyze data and information for monitoring surface coating processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Describe fundamentals of process instrumentation.
- CO2 - Use temperature and pressure measuring devices.
- CO3 - Apply principles of displacement.
- CO4 - Explain actuators and Programmable Logic Controller (PLC).
- CO5 - Apply data monitoring and recording for surface coating process.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324016	INSTRUMENTATION IN SURFACE COATING INDUSTRIES	ISC	GE	2	-	4	2	8	4	-	-	-	-	-	25	10	50@	20	25	10	100

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Define resistance lag, capacitance lag, dead time, inertia. TLO 1.2 Describe process load, transient time, process lag, self-regulation. TLO 1.3 Draw block diagram of various instruments.	**Unit - I Fundamentals of process instrumentation** 1.1 Concepts and characteristics of process instrumentation like Process load, transient time, process lag, self -regulation 1.2 Process dynamics: resistance lag, capacitance lag, dead time, inertia. 1.3 Various measuring instruments: Cathode Ray Oscilloscope, Multimeter. 1.4 Testing probes: active probe and passive probe. 1.5 Electronic component resistor-types and applications.	Lecture Using Chalk-Board, Demonstration, Presentations, Input-cum-discussion
2	TLO 2.1 Explain four temperature measurement scales. TLO 2.2 Describe pressure and temperature measuring devices. TLO 2.3 Draw diagram of temperature and pressure measuring devices.	**Unit - II Measurement of Temperature and pressure** 2.1 Transducers – definition, classification based on external power source, output types. 2.2 Temperature and its various scales (degree Celsius, degree Kelvin, degree Fahrenheit, degree Rankine). 2.3 Construction and working of temperature measuring devices: resistance temperature detector, thermocouples, pyrometers- radiation and optical. 2.4 Functions- pressure measuring devices: U Tube Manometer, Bourdon tubes.	Lecture Using Chalk-Board, Demonstration, Presentations, Input-cum-discussion
3	TLO 3.1 Describe Pneumatic displacement gauge. TLO 3.2 Draw labelled diagram of Linear Variable Displacement Transformer. TLO 3.3 Explain different level measuring devices.	**Unit - III Measurement of Displacement and level** 3.1 Introduction to displacement. 3.2 Construction and working of Linear Variable Displacement Transformer. (LVDT). 3.3 Construction and working of Pneumatic displacement gauge. 3.4 Construction and working of load cell-hydraulic and pneumatic load cells. 3.5 Level measurement devices: Bob & Tape, Float gauge.	Input-cum-discussion, Lecture Using Chalk-Board, Presentations, Demonstration
4	TLO 4.1 Define actuators. TLO 4.2 Classify control valves. TLO 4.3 Explain circuit diagram of microcontroller. TLO 4.4 Explain PLC based control system.	**Unit - IV Actuators and Programmable Logic Controller (PLC)** 4.1 Actuators-pneumatic and hydraulic directional control valves. 4.2 Servo motor actuators. 4.3 Micro controller -Block diagram, advantages, disadvantages, applications. 4.4 Introduction to PLC. 4.5 Working and application of PLC based control system.	Lecture Using Chalk-Board, Presentations, Demonstration, Input-cum-discussion
5	TLO 5.1 Explain Digital acquisition system. TLO 5.2 Write functions of data logger. TLO 5.3 Describe recording systems used in process industries. TLO 5.4 Write advantages and limitations of strip chart recorder.	**Unit - V Data monitoring and recording** 5.1 Digital acquisition system (DAS). 5.2 Concept of oven temperature data logger. 5.3 Applications of data logger. 5.4 Strip chart recorder. 5.5 X-Y recorder-block diagram. 5.6 Basics of USB interfacing devices.	Lecture Using Chalk-Board, Presentations, Demonstration, Input-cum-discussion

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Measure voltage and current using multimeter.	1	*Application of multimeter.	4	CO1
LLO 2.1 Check earth resistance for electrostatic spray application for job.	2	*Testing with coated and uncoated jigs for electrostatic spray application for job.	4	CO1
LLO 3.1 Compare resistance of a resistor using color code and multimeter.	3	Interpretation and calculate resistance of a resistor using color code and multimeter.	4	CO1
LLO 4.1 Determine voltage and frequency.	4	Calculate voltage and frequency by using Cathode Ray Oscilloscope	4	CO1
LLO 5.1 Use of “Resistance Temperature Detector” (RTD) PT 100 for temperature measurement.	5	*Interpret temperature using “Resistance Temperature Detector” (RTD) PT 100.	4	CO2
LLO 6.1 Test temperature by using “thermocouple”.	6	Measurement of temperature by using “thermocouple”.	4	CO2
LLO 7.1 Measure pressure using Bourdon gauge.	7	Check pressure using Bourdon gauge.	4	CO2
LLO 8.1 Determine pressure using U Tube Manometer.	8	*Use U Tube Manometer for pressure measurement.	4	CO2
LLO 9.1 Measure displacement using linear variable displacement transducer. (LVDT)	9	*Determination of displacement using linear variable displacement transducer. (LVDT)	4	CO3
LLO 10.1 Measure liquid level using bob and tape gauge.	10	*Check liquid level using bob and tape gauge.	4	CO3
LLO 11.1 Measure liquid level using float gauge.	11	Measurement of liquid level using float gauge.	4	CO3
LLO 12.1 Develop ladder diagram for temperature controller	12	Temperature control using ladder diagram for temperature controller	4	CO4
LLO 13.1 Prepare ladder diagram for ON-OFF controller for motor	13	*Development of ladder diagram for ON-OFF controller for motor	4	CO4
LLO 14.1 Develop ladder diagram for pneumatic control valves control of lamp using timer and counter.	14	Development of ladder diagram for pneumatic control valves control of lamp using timer and counter.	4	CO4
LLO 15.1 Find dry film thickness of coating using data logger.	15	Analyze paint film thickness using data logger instruments.	4	CO5
LLO 16.1 Calculate DFT using digital acquisition system.	16	*Data acquisition from the device for paint film thickness.	4	CO5
LLO 17.1 Use microcontroller based system for surface coating process control	17	Applications of microcontroller for controlling surface coating process.	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Describe fundamentals of process instrumentation.
- Explain actuators and Programmable Logic Controller (PLC).
- Draw a labeled diagram for various measuring instruments.

Micro project

INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

- Compare data of various pressure measuring devices used in surface coating industries.
- Collect information of different conveyors used in coating industries.
- Draw diagrams for Pneumatic system for different applications. (min 5 applications)
- Compile data of various temperature measuring devices used in surface coating industries.
- Conduct market survey for various advancements in PLCs.
- Prepare album data of circuit diagram of various process control devices.
- Collect information of different weighing machines.
- Draw neat-labeled diagram of various displacement measuring devices used in surface coating industries. (min 5 applications)
- Draw neat-labeled diagram of various flow measuring devices used in surface coating industries. (min 5 applications)
- Collect data of various level measuring devices used in surface coating industries.

Term work

- Prepare a report consisting of: a. List of laboratory experiences given. b. For each practical performed write (Scope, chemicals, instruments, process, observations, diagram, calculations and result etc) c. Arrange (b) chronologically (date wise) d. Prepare report for submission.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Mulitmeter	1,2,3,5,6
2	Resistor	1,3
3	Bob and tape	10
4	level controller kit	10,11
5	Container for water storage	10,11
6	Float gauge	11
7	PLC	12,13,14
8	Computer	12,13,14,17
9	Control valves	13
10	Pneumatic kit	14
11	Data Scanner	15,16
12	Interfacing cables-USB	15,16
13	Microcontroller development board	17
14	Cathode ray oscilloscope	4
15	RTD (PT 100)	5
16	Glass thermometer	5,6
17	Heating Mantle	5,6
18	Beaker	5,6
19	Thermocouple (k type)	6
20	Bourdon gauge	7
21	Air blower	7,8

INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
22	U tube manometer	8
23	LVDT kit	9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of process instrumentation	CO1	6	0	0	0	0
2	II	Measurement of Temperature and pressure	CO2	6	0	0	0	0
3	III	Measurement of Displacement and level	CO3	6	0	0	0	0
4	IV	Actuators and Programmable Logic Controller (PLC)	CO4	6	0	0	0	0
5	V	Data monitoring and recording	CO5	6	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid term tests
- Term Work (60% weightage for process and 40% weightage for product)
- Assignment, Self-learning assessment and seminars

Summative Assessment (Assessment of Learning)

- End of Term Examination
- Lab. performance
- Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	-	1	1	1	2			
CO2	2	2	-	2	1	1	2			
CO3	2	1	2	1	-	1	2			
CO4	2	1	1	1	1	1	2			
CO5	2	1	1	-	1	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number

INSTRUMENTATION IN SURFACE COATING INDUSTRIES **Course Code : 324016**

Sr.No	Author	Title	Publisher with ISBN Number
1	R V Jalgaonkar	Mechanical measurement & control	Everest Publishing House ISBN:8186314261
2	S. K. Singh	Industrial Instrumentation & Control	Tata Mc Grow Hill Publishing Company Ltd ISBN:007451914X
3	Kirk & Rimboi	Instrumentation	D. B. Taraporwala Sons & Co. ISBN: 978-0826934222
4	B.C. Nakra & K.K. Chaudhary	Instrumentation Measurement & Analysis (3rd Edition)	M Graw Hill Education (I) Pvt. Ltd ISBN:9780070151277
5	Barry E Jones	Instrumentation measurement and feedback	M Graw Hill Education (I) Pvt. Ltd ISBN: 0070993831
6	Sol D. Prensky Richard L. Castellucis	Electronic Instrumentation (3rd Edition)	Prentice-Hall ISBN: 013251611X
7	Madhuchhanda Mitra and Samarjit Sen Gupta	Programmable Logic controllers and Industrial Automation	PENRAM International Publication Pvt Ltd ISBN: 9788187972631
8	Ajit Pal	Microcontroller principles and applications	PHI learning Publications ISBN: 9788120343924

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=2EpFIhUHm28-	Process control loop
2	https://www.youtube.com/watch?v=iDYWfBGwT1w-	Lag factor
3	https://www.youtube.com/watch?v=ae0fy435zJA-	Voltage lag, current lag
4	https://www.youtube.com/watch?v=85gm5aqeY44-	RTD
5	https://youtu.be/InAZWHvylr0 :	Non contact type thermometer
6	https://www.youtube.com/watch?v=4mQ3o1t4Ssg- https://youtu.be/X2lqQzi4b9w :	Temperature sensor
7	https://youtu.be/rUkvHeXsPWs	Multimeter
8	https://www.youtube.com/watch?v=4zJ-H0kD3o4	U tube manometer
9	https://www.youtube.com/watch?v=anCnrtjNLQM –	Working of LVDT
10	https://youtu.be/e6Z0BjaHxPM	Data logger
11	https://youtu.be/TPowbUhf0_Q	Data acquisition system
12	https://youtu.be/mGhVo81YgBo	Servomotor actuator
13	https://www.youtube.com/watch?v=8_UPBYucUM0 –	Pneumatic controller
14	https://youtu.be/PbAGl_mv5XI	PLC basics
15	https://youtu.be/fS7FFOaC_iQ	Microprocessor
16	https://www.youtube.com/watch?v=_3L_WtEvWRE	Recorder chart
17	https://www.youtube.com/watch?v=pIZREjck9jg	USB cables
18	https://www.youtube.com/watch?v=dcNk0urQsQM	Microcontroller

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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ALLIED SURFACE COATING **Course Code : 324325**

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Fourth**
Course Title : **ALLIED SURFACE COATING**
Course Code : **324325**

I. RATIONALE

The course 'Allied Surface Coating' is included in fourth semester of Diploma in Surface Coating Technology to enable student to understand applications of surface coating principles, process and techniques in allied industries. The course will enable students to learn and practice floor coating, cosmetics, polishes, water proofing and marine coatings. This course will also help students develop an insight into developing entrepreneurship.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry-identified competency through various teaching-learning experiences: Apply industrial Allied Surface Coating techniques.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain principles and applications of Floor Coating.
- CO2 - Classify types of Polishes processes.
- CO3 - Describe raw materials requirement for cosmetics.
- CO4 - Describe waterproofing processes.
- CO5 - Test performance properties of Marine coating materials.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324325	ALLIED SURFACE COATING	ASC	DSE	3	-	3	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

ALLIED SURFACE COATING **Course Code : 324325**

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify types of floor. TLO 1.2 Explain importance of mixing ratio of floor coating materials. TLO 1.3 Describe floor coating application methods.	**Unit - I Floor Coating** 1.1 Types of floors. 1.2 Types of floor coating. 1.3 Purpose of floor coating. 1.4 Onsite mixing of floor coating material. 1.5 Application methods of floor coating.	Lecture, Input-cum-discussion, Presentation (PPTs), Demonstration and Assignment
2	TLO 2.1 Describe process of polishing. TLO 2.2 Explain the importance of buffing and polishing. TLO 2.3 Write properties of rubbing compounds. TLO 2.4 Explain applications of wood polishes.	**Unit - II Polishes** 2.1 Composition aspects of polishing compound. 2.2 Proprieties and application of Industrial polishes. 2.3 Techniques of polishing. 2.4 Test the properties like gloss, finish appearance and Distinctness of image. 2.5 Introduction to wood polishes. 2.6 Properties and applications of wood polishes.	Lecture, Group discussion, Presentation (PPTs), Model Demonstration, Simulation
3	TLO 3.1 Explain properties and composition of talcum powder. TLO 3.2 Describe process to prepare lipstick. TLO 3.3 Write formulation of nail polish.	**Unit - III Cosmetics** 3.1 Importance of cosmetics. 3.2 Traditional Indian cosmetics. (IKS) 3.3 FDA norms and regulations for cosmetics. 3.4 Composition, properties, and uses of Talcum powders. 3.5 Composition, properties, and uses of Lipsticks. 3.6 Composition, properties, and uses of Nail Polish and removers.	Lecture Input-cum-discussion, Presentation (PPTs), Video Demonstrations, Flipped Classroom, Simulation
4	TLO 4.1 Describe waterproofing techniques. TLO 4.2 Write applications of waterproofing. TLO 4.3 Describe testing process for water permeability. TLO 4.4 Explain various safety aspects of waterproofing.	**Unit - IV Waterproofing** 4.1 Introduction to waterproofing. 4.2 Need of waterproofing. 4.3 Raw material used in waterproofing. 4.4 Techniques of waterproofing. 4.5 Test waterproofing materials. 4.6 Application areas of waterproofing. 4.7 Safety aspects during water proofing of buildings.	Lecture Input-cum-discussion, Presentations, Flipped Classroom, Demonstration
5	TLO 5.1 Describe types of marine coatings. TLO 5.2 Write formulations for marine coatings. TLO 5.3 Explain application areas of marine coatings.	**Unit - V Marine coating** 5.1 Introduction to marine coatings and antifouling coating. 5.2 Requirements of marine coatings. 5.3 Types of marine coatings. 5.4 Formulations of marine coatings like antiskid and antifouling. 5.5 Testing of marine coating. 5.6 Surface preparation and application methods of marine coatings.	Lecture, Group discussion, Presentation (PPTs), Demonstration, Assignment ,Simulation

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

ALLIED SURFACE COATING **Course Code : 324325**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare surface for floor coating.	1	*Surface preparation for floor coating.	3	CO1
LLO 2.1 Prepare floor coating material.	2	*Preparation, application, and testing of floor coating material.	3	CO1
LLO 3.1 Calculate consumption of floor coating material.	3	Calculation of consumption of floor coating material.	3	CO1
LLO 4.1 Determine pot life, gel time and exotherm.	4	Evaluation of floor coating material for its pot life, gel time and exotherm.	3	CO1
LLO 5.1 Test effect of particle size of sand, mixing ratio of components on floor coating properties.	5	Determination of effect of parameters like particle size of sand, mixing ratio of components on floor coating properties.	3	CO1
LLO 6.1 Prepare a sample of rubbing compound for painted surfaces.	6	*Preparation of rubbing compound for painted surfaces.	3	CO2
LLO 7.1 Prepare a sample of leveling compound for painted surfaces.	7	Preparation of leveling compound for painted surfaces.	3	CO2
LLO 8.1 Test aesthetic property of polished surfaces by using gloss-o-meter.	8	Measure aesthetic property of polished surfaces by using gloss-o-meter.	3	CO2
LLO 9.1 Prepare & test talcum powder.	9	*Prepare & test talcum powder.	3	CO3
LLO 10.1 Prepare & test nail polishes.	10	*Prepare & test nail polishes.	3	CO3
LLO 11.1 Prepare & test vanishing cream.	11	Prepare & test vanishing cream.	3	CO3
LLO 12.1 Prepare and test nail remover.	12	Prepare and test nail remover.	3	CO3
LLO 13.1 Prepare and test nail remover.	13	*Prepare waterproofing material for the given surface.	3	CO4
LLO 14.1 Test physical properties water proofing materials.	14	Testing of physical properties of prepared water proofing materials.	3	CO4
LLO 15.1 Test water permeability of water proofing material.	15	*Testing of water permeability of given water proofing material.	3	CO4
LLO 16.1 Test chemical resistance of proofing materials.	16	Testing of acid and alkaline resistance of proofing materials.	3	CO4
LLO 17.1 Prepare epoxy coal tar paint	17	Formulation, preparation and testing of antiskid paint for boot top.	3	CO5
LLO 18.1 Test physical properties	18	Test physical properties of prepared marine paints.	3	CO5
LLO 19.1 Test performance of marine coating material.	19	*Testing of performance of given marine coating material.	3	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare an album of advanced cosmetics.
- Collect information for testing and evaluation of marine coatings.
- Prepare a design of 3-D floor coating.

ALLIED SURFACE COATING **Course Code : 324325**

- On the basis of inputs provided in theory classes, practical's and web references student will search floor coating methods, practices and procedure in the industry/ field.
- Collect information of waterproofing products and techniques available in market.
- Prepare a report on advancement in marine coatings.
- Make a album of floor coating finishes.
- Conduct a market survey of allied coatings for human beings
- Prepare a chart of advanced polishing tools available in the market.
- Compare polishing products available in the market.

Assignment

- Prepare an album for floor coatings objects.
- Search various waterproofing manufacturer in India and prepare a report
- Visit cosmetic coating lab, industry and draw flow diagram for manufacturing plant.
- Write advanced techniques in marine coating for corrosion resistance.

Term work

- Prepare a report consisting of: a. List of laboratory experiences given. b. For each practical perform write (Scope, chemicals, instruments, process, observations, diagram, calculations and result etc) c. Arrange (b) chronologically (date wise) d. Prepare report for submission

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Floor grinder machine	1
2	Shot blasting machine	1
3	Scrubber pad/ Stiff bristles broom	1,5,6,7
4	Beaker 200 ml	13,14,15,16
5	Adhesion tester	14
6	Flow cup	14,18
7	Weight per lit cup	14,18
8	Water bath	16
9	Sand mill	17
10	Hegman guage	18
11	Salt spray chamber	19
12	High speed stirrer	2,3,4,10,11
13	Tooth head roller	3,4
14	Notches	3,4
15	Thermometer 360 degree	4
16	Stop watch	4
17	Brookfield viscometer	4

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
18	Thermometer (100 degree)	4,5,6,7
19	Heating mantle	5,11
20	Gloss-o-meter	8
21	Mixer-grinder	9
22	Weighing balance (Digital)	All
23	Spatula	All
24	Metal panels	All
25	OVEN	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Floor Coating	CO1	9	2	4	8	14
2	II	Polishes	CO2	9	2	4	8	14
3	III	Cosmetics	CO3	9	2	4	8	14
4	IV	Waterproofing	CO4	9	2	4	8	14
5	V	Marine coating	CO5	9	2	4	8	14
Grand Total				**45**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Seminar/Presentation
- Mid-term tests
- Assignment, Self-learning and Terms work

Summative Assessment (Assessment of Learning)

- End of Term Examination
- Viva-voce
- Lab. performance

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	-	2	1	2			
CO2	2	2	2	1	2	1	2			
CO3	2	1	-	-	3	2	2			
CO4	3	1	2	1	2	1	2			
CO5	2	2	2	-	1	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

ALLIED SURFACE COATING **Course Code : 324325**

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Michael T. Kubal	Waterproofing Handbook Second Edition	The McGraw-Hill Companies, Inc., 2000 ISBN: 9780071489737
2	NPCS Board of Consultants & Engineers	Wax Polishes Manufacturing Handbook with Process and Formulae	NIIR Project Consultancy Services, ISBN:978-8193733936
3	Joseph Stephan Jellinek	Formulation and function of cosmetics	Wiley-Interscience.,1970 ISBN: 9780471441502
4	NIIR BOARD OF CONSULTANTS & ENGINEERS	THE COMPLETE TECHNOLOGY BOOK ON WAX AND POLISHES	NATIONAL INSTITUTE OF INDUSTRIAL RESEARCH,ISBN:978-8178330129
5	Dr L V Vigneshwaran	Textbook of Cosmetic Science	IP Innovative Publication Pvt Ltd, ISBN: 9789391208820
6	P.P.Sharma (Author)	COSMETICS : Formulation, manufacturing and Quality Control (Fifth Ed., 2014)	Vandana Pub, ISBN-13 978-8190595780
7	Frank Dreher,	Handbook of Cosmetic Science and Technology 5th Edition 2022	CRC Press,ISBN:9780367469979
8	Claire Hellio, Diego Yebra	Advances in Marine Antifouling Coatings and Technologies	Elsevier Science;ISBN:9781845696313
9	Louis D. Vincent	The Marine Coatings User’s Handbook (e-Book)	Coatings and Linings , Maritime, ISBN: 1575902818
10	Simone Dürr, Jeremy C. Thomason	Paint and Coatings Technology for the Control of Marine Fouling	WILEY; ISBN:9781405169264
11	Patricia K Gerald	Complete Guide for Epoxy Floor: The beginner's steps-by-steps book on epoxy flooring and coating	ISBN-13 ? : ? 979-8868347641

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=S_s-TjSrmo4	Composition, properties, and uses of Talcum powdershttps://www.youtube.com/watch?v=S_s-TjSrmo4
2	https://www.youtube.com/watch?v=7rYuGRM2PLE&t=39s	PU flooring application procedure step by step
3	https://www.youtube.com/watch?v=oD2Cio0m3TM	Epoxy vs Polyurethane Flooring: Understand the differences
4	https://www.youtube.com/watch?v=qxg2AsowTFM	Purpose of floor coating.
5	https://www.youtube.com/watch?v=bCkyUoe_yoQ	Application of PU coating
6	https://www.youtube.com/watch?v=Cs3hwVpf1L8	Buffing polishing
7	https://www.youtube.com/watch?v=5XJfRd0ZHWI	SANDING AND POLISHING TOOL
8	https://www.youtube.com/watch?v=dT-OgpqBuBc	Wood polishing
9	https://www.youtube.com/watch?v=yUVTSMCipN8	Pu Wood Polish Full Work
10	https://www.youtube.com/watch?v=MlPNyLYXOr4	composition properties and uses of nail polish

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Sr.No	Link / Portal	Description
11	https://www.youtube.com/watch?v=lE3VaX8Lkuc	FDA norms and regulations for cosmetics.
12	https://www.youtube.com/watch?v=tHzgNxhvfBQ	Introduction to waterproofing.
13	https://www.youtube.com/watch?v=jizVcOrFh8A	Application areas of waterproofing.
14	https://www.youtube.com/watch?v=jizVcOrFh8A	Introduction to marine coatings and antifouling coating.
15	https://www.youtube.com/watch?v=Mu6Qrjs1bvQ	marine coatings and antifouling coating.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024 **Semester - 4, K Scheme**

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BASICS OF INK TECHNOLOGY **Course Code : 324326**

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Fourth**
Course Title : **BASICS OF INK TECHNOLOGY**
Course Code : **324326**

I. RATIONALE

Inclusion of 'Basics of Ink Technology' course to Diploma in Surface Coating Technology program will facilitate the understanding of fundamentals of ink technology as essential for achieving high print quality, durability and sustainability across a wide range of applications. Understanding ink composition, printing techniques, applications and new trends allows students to make decisions for achieving industry needs.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry-identified outcome through various teaching-learning experiences: • Test different properties of printing ink

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Write requirement of printing inks.
- CO2 - Select raw materials for printing ink
- CO3 - Explain construction and working of ink manufacturing machines
- CO4 - Describe purpose of special purpose inks.
- CO5 - Select relevant drying mechanism for printing inks

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324326	BASICS OF INK TECHNOLOGY	INK	DSE	3	-	3	2	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

BASICS OF INK TECHNOLOGY **Course Code : 324326**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Differentiate ink and paint. TLO 1.2 Explain types of inks and requirements of inks as per process and as per applications. TLO 1.3 Describe ink properties such as pH, viscosity, thixotropic, length, tack, bulk value, specific gravity, hiding power.	**Unit - I Fundamentals of Ink Technology** 1.1 The nature of printing inks. 1.2 Difference between ink and paint. 1.3 Types of inks-Solvent based, oil based and water based. 1.4 Requirements of inks as per process and as per applications. 1.5 Properties of inks-pH, viscosity, thixotropic, length, tack, bulk value, specific gravity, hiding power. 1.6 RGB, CMYK and Pantone color systems in printing. 1.7 Applications of ink for different surfaces.	Video Demonstrations Flipped Classroom Site/Industry Visit Lecture Using Chalk-Board
2	TLO 2.1 Write role of different raw materials used for ink. TLO 2.2 Explain function of vehicles and resins. TLO 2.3 Describe the use of additives in ink.	**Unit - II Raw Materials of Ink** 2.1 Resins and vehicles for ink- drying vehicles, nondrying vehicles, natural resins, synthetic resins. 2.2 Pigments-organic and inorganic. 2.3 Solvents - hydrocarbons, aliphatic, alcohols, wash up solvents. 2.4 Additives - plasticizers, waxes, wetting agents, anti-set off compounds, shortening compounds, reducers, stiffening agents. 2.5 Driers - liquid driers, paste driers, inhibitors, accelerators.	Video Demonstrations Hands-on Flipped Classroom Site/Industry Visit
3	TLO 3.1 Explain liquid ink manufacturing process. TLO 3.2 Describe three roll mill. TLO 3.3 Write test procedures for properties of ink.	**Unit - III Ink Manufacturing and Testing** 3.1 Liquid ink manufacturing –mixing & milling – ball mill, HSD. 3.2 Paste ink manufacturing –mixing & milling – three roll mill, Pug mixer. 3.3 Ink proofing kit. 3.4 Ink Testing – color and tinting strength, rub and scuff resistance, adhesion, flexibility, block resistance, skid resistance, light fastness, heat seal resistance, lamination tests, optical properties- opacity, gloss.	Video Demonstrations Site/Industry Visit Lecture Using Chalk-Board
4	TLO 4.1 Describe requirement of special purpose ink. TLO 4.2 Explain importance of special purpose ink. TLO 4.3 Write applications of special purpose inks.	**Unit - IV Special Purpose Inks** 4.1 Concept of special purpose ink. 4.2 Specialty inks – leaser jet-toners, ink jet inks, magnetic inks, Optical Character Recognition inks (OCR), scratch off inks, water washable inks, water sensitive inks, invisible inks, thermo-chromic ink, anti-forgery inks, fluorescent inks, food wrapper inks, UV curable inks. 4.3 Requirement and applications of special purpose ink.	Lecture Using Chalk-Board Hands-on Demonstration
5	TLO 5.1 Explain drying of ink by absorption and Oxidation. TLO 5.2 Differentiate IR, UV and EB. TLO 5.3 Describe drying of ink by solvent evaporation and precipitation.	**Unit - V Mechanism of Ink Drying** 5.1 Absorption by substrate. 5.2 Oxidation & polymerization. 5.3 Solvent evaporation and precipitation. 5.4 Heat set and cold set curing. 5.5 Radiation curing-IR, UV and EB.	Video Demonstrations Site/Industry Visit Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

BASICS OF INK TECHNOLOGY **Course Code : 324326**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Determine colour, shade difference, mass-tone, undertone of printing inks	1	*Determination of colour, shade difference, mass-tone, undertone of printing inks	3	CO1
LLO 2.1 Evaluate the shade of printing inks on different types of papers.	2	Evaluation of shade of printing inks on different types of papers.	3	CO1
LLO 3.1 Measure specific gravity and bulk value of ink using ink pipette.	3	*Measurement of specific gravity and bulk value of ink using ink pipette.	3	CO1
LLO 4.1 Measure drying time of ink by varying dosages of drier.	4	*Measurement of drying time of ink by varying dosages of drier.	3	CO2
LLO 5.1 Select suitable type of a raw materials for various types of ink.	5	Determination of suitable type of a raw materials for various types of ink.	3	CO2
LLO 6.1 Test acids, alkali resistance of printing innk.	6	Testing of acids and alkali resistance of printing ink.	3	CO2
LLO 7.1 Determine viscosity using falling bar viscometer	7	*Measurement of viscosity using falling bar viscometer	3	CO3
LLO 8.1 Determine viscosity using Brookfield viscometer	8	Determination of viscosity using Brookfield viscometer	3	CO3
LLO 9.1 Determine the opacity using ink proofing kit.	9	*Measurement of the opacity using ink proofing kit	3	CO3
LLO 10.1 Compare density of a same image printed with different printing processes.	10	Comparison of density of a same image printed with different printing processes.	3	CO3
LLO 11.1 Test flexibility of ink printed panels.	11	Testing flexibility of ink printed panels.	3	CO3
LLO 12.1 Determine the water washability of inks.	12	Determination the water washability of inks.	3	CO4
LLO 13.1 Compare rub resistance of given wrapper using scrub tester.	13	Comparison rub resistance of given wrapper using scrub tester.	3	CO4
LLO 14.1 Measure gloss of ink using Gloss-O-meter.	14	*Measurement of gloss of ink using Gloss-O-meter.	3	CO4
LLO 15.1 Analyze ink drying by absorption method .on art card and maplitho papers.	15	*Evaluation of ink drying by absorption method on art card and maplitho papers.	3	CO5
LLO 16.1 Determine the drying time by solvent evaporation methods.	16	Evaluation of drying time by solvent evaporation methods.	3	CO5
LLO 17.1 Evaluate the ink film rub resistance, adhesion, cured by radiation curing.	17	Evaluation the ink film rub resistance, adhesion, cured by radiation curing.	3	CO5
LLO 18.1 Test tack, length, fineness of grind of given sample of ink.	18	*Testing of tack, length, fineness of grind of given sample of ink.	3	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Collect the technical brochures of the different specialty ink used for various processes from the local market/internet to present in report form.

- Observe the safe work procedures in ink companies.
- Give seminar on relevant topic of ink manufacturing process.
- Visit the Ink making factory / Printing Press nearby your institute and study the testing methods and write a report.
- Observe waste management approaches used by ink manufacturers in nearby town or city.
- Prepare list of new types of inks introduced for special purpose.
- Collect the technical paper on any one area of Ink (Manufacturing or Testing) and write a report.

Term work

- Prepare a report of consisting: a. List of laboratory experiences given. b. For each practical perform write (Scope,chemicals, instruments, process, observations, diagram, calculations and result etc) c. Arrange (b) chronologically(date wise) d. Prepare report for submission.

Micro project

- Collect Information about of inks used in different printing processes.
- Survey ink manufacturing companies and write a report
- Collect Information about unit cost for different types of inks
- Survey the energy source used for different ink drying methods and write a report.
- Enlist the safety rules followed by ink manufacturing industry
- Survey the type of substrate and ink type used for it.
- Collect Information about green printing and write a report about it.
- Prepare list of Mechanical, Chemical and Optical Properties of Printing Ink
- Analyze the impact of surface characteristics and ink appearance.
- Prepare a table for applications of special purpose inks.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Spectrophotometer	1,2
2	Densitometer	10
3	Laser jet printer	10
4	ink jet printer	10
5	Rub Resistance Tester	13
6	Gloss-O-meter	14
7	Oven (up to 100 degree)	17
8	UV curing setup	17
9	IR oven	17
10	Hegman Gauge	18
11	Ink Pipette	3
12	Muller machine	5
13	Falling Bar Viscometer	7
14	Brookfield Viscometer	8

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
15	Ink Proofing Kit	9
16	Weighing Balance (Digital Display, 300 g, Sensitivity. 0.01 g)	All
17	Spatula	All
18	Scraper	All
19	Draw down paper	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Ink Technology	CO1	9	2	4	8	14
2	II	Raw Materials of Ink	CO2	9	2	4	8	14
3	III	Ink Manufacturing and Testing	CO3	9	2	4	8	14
4	IV	Special Purpose Inks	CO4	9	2	4	8	14
5	V	Mechanism of Ink Drying	CO5	9	2	4	8	14
Grand Total				**45**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid term tests
- Assignments
- Self-learning
- Term work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Examination
- Viva
- Demonstration

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	-	1	1	2			
CO2	2	2	1	1	-	1	2			
CO3	2	2	-	1	1	1	2			
CO4	2	1	1	1	-	1	2			
CO5	2	2	1	-	2	1	2			

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Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Bob Thompson	Printing Materials Science and Technology	Pira lnternational Printing Guide ISBN 1858029813,978185802981
2	L. C. Young	Materials in Printing Processes	Focal Library Library of Printing Technology ISBN: 0240507568,9780240507569
3	R.H. Leach, Ray Pierce	The Printing Ink Manual	Springer ISBN: 9789401170994, 9789401170994
4	Nelson Richards Eldred	Chemistry for the Graphic Arts	GATF, USA ISBN: 9780883622490
5	NIIR Board	The complete technology book on Printing Inks	Asia Pacific Business Press Inc. ISBN: 8178330482
6	Surjeet Gupta	A guide to Printing Inks	Print India Journal, Delhi
7	Norman Underwood	The Chemistry and Technology of Printing Inks	University of Michigan Library
8	Alfred Seymour	Modern Printing Inks	Forgotten Books. ISBN: 0266596924 / 9780266596929
9	Ernest W. Flick	Printing Ink Formulations	Noyes Pubns. ISBN: ? 0815510144 / 9780815510147
10	Mander-Kidd Ltd	How Printing Ink is Made	Mander-Kidd Ltd Publications

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=Fypi6dAJB8E	Ink Manufacturing
2	https://www.youtube.com/watch?v=ILg7TYt2ysc	Ink Factory
3	https://www.youtube.com/watch?v=zpcqOjopmk4	Raw Materials Mixup
4	https://www.youtube.com/watch?v=bJD_zDfMNxE	Ink Durability Tester-Ink Rub Test
5	https://www.youtube.com/watch?v=aA87xbiCNpA	Ink Adhesion
6	https://www.youtube.com/watch?v=VvHILU6BhRw	UV Ink Adhesion
7	https://www.youtube.com/watch?v=gTUTrv73erw	Ink Proofing Kit
8	https://www.youtube.com/watch?v=rTBtELJAItc&list=WL&index=8	Ink Viscosity measurement
9	https://www.youtube.com/watch?v=F1tklxUiTPU&list=WL&index=	Pigment Dispersion
10	https://www.youtube.com/watch?v=w01ioE-4PNE&list=WL&index=10	Manual Ink Proofing
11	https://www.youtube.com/watch?v=Fypi6dAJB8E	Ink Making and Testing
12	https://www.youtube.com/watch?v=ILg7TYt2ysc	Ink Shade Making

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students