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	**: Second**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											Total Marks
						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		
																	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	ADVANCED RESIN TECHNOLOGY	ART	DSC	322316	0	4	-	4	-	8	4	3	30	70	100	40	25	10	50@	20	-	-	175
2	ADVANCED PIGMENT TECHNOLOGY	APT	DSC	322315	2	3	-	3	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
3	SAFETY IN SURFACE COATING INDUSTRIES	SCI	DSE	322317	0	3	-	3	-	6	3	3	30	70	100	40	25	10	25@	10	-	-	150
4	SOLVENTS AND ADDITIVES TECHNOLOGY	SAT	DSC	322318	0	3	-	3	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
5	PROFESSIONAL COMMUNICATION	PCO	SEC	312002	0	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
6	SOCIAL AND LIFE SKILLS	SFS	VEC	312003		-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
7	MATERIAL SYNTHESIS	MTS	DSC	322006	0	-	-	4	2	6	3	-	-	-	-	-	50	20	-	-	25	10	75
Total					**2**	**13**	**0**	**19**	**8**	**40**	**20**		**120**	**280**	**400**		**175**		**150**		**125**		**850**

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) : 4, Discipline Specific Elective (DSE) : 1, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 0, Skill Enhancement Course (SEC) : 1, GenericElective (GE) : 0

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 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/ 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/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: PROFESSIONAL COMMUNICATION**
Course Code	**: 312002**

I. RATIONALE

Communication is key to smooth and efficient functioning of any industry or business . Professional communication is the need of every organization to maintain ethics, quality and standards. The efficacy of business communication skills are essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at work place. Strong Communication skills are highly valued in the professional world and contribute to career growth and opportunities. Thus, this course has been designed to enhance the professional communication skills for effective presentation both in written and oral forms at workplace.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

1. Communicate effectively at workplace. 2. Issues can be identified and resolved by brainstorming solutions 3. Effective communication ensures strong decision making

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Communicate effectively (oral / spoken and Written) in various formal and informal situations minimizing the barriers.
- CO2 - Develop listening skills through active listening and note taking.
- CO3 - Write circulars, notices and minutes of the meeting.
- CO4 - Draft inquiry letter, complaint letter , Job application with resume / CV, Compose effective E - mails .
- CO5 - Write Industrial reports.

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	
312002	PROFESSIONAL COMMUNICATION	PCO	SEC	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50

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

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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 Describe the importance of professional communication in given situations TLO 1.2 Identify the types of communication barriers in given situations and suggestive remedies TLO 1.3 Use different types of verbal and non–verbal communication for the given situation	**Unit - I Professional Communication : An Overview** 1.1 Definition of professional communication- Importance, relevance, Elements and process of communication 1.2 7 C's of Professional Communication (Clarity, Conciseness, correctness, Coherent, concrete, courteous and Complete) 1.3 Types –Verbal (Oral-Written),Formal, Informal (Grapevine), Vertical 1.4 Barriers to communication,Types of barriers (Linguistic, Psychological, Technological)	Language lab Role plays Chalk board Reference books Case studies
2	TLO 2.1 Identify the difference between listening and hearing TLO 2.2 Differentiate the types of listening in various situations TLO 2.3 Take notes during lectures, seminars . Make use of types of note taking and note making for different subjects / topics	**Unit - II Listening & Note Taking** 2.1 Difference between listening & Hearing 2.2 Types of listening a)Active listening b)Passive listening c)Selective listening 2.3 Techniques of Note taking , Types of note taking (Outline notes, Mind Mapping, Flowcharts)	Language Lab Classroom learning NPTEL Role Play

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 Prepare notices / agenda for the given type of meeting / information TLO 3.2 Prepare minutes of meeting/s TLO 3.3 Draft a circular for a particular information/ event	**Unit - III Office Drafting** 3.1 Format of Notice and Circular 3.2 Drafting Agenda 3.3 Preparing Minutes of meeting	white board Language Lab Reference books Classroom learning
4	TLO 4.1 Compose cover letter and CV / Resume for jobs TLO 4.2 Apply E- mail Etiquette for professional purposes TLO 4.3 Compose E- mails for different official purposes	**Unit - IV Writing Skills for Professional Communication** 4.1 Job Application with Resume / CV 4.2 E-Mail Etiquettes 4.3 Writing official E- Mails to communicate intended purposes 4.4 Drafting Enquiry letter and Complaint letter	Language lab Classroom learning NPTEL Reference books
5	TLO 5.1 Compose technical reports TLO 5.2 Draft accident / Investigation/ Daily reports	**Unit - V Report Writing** 5.1 Introduction to report writing 5.2 Accident Report 5.3 Investigation Report 5.4 Daily Report	Chalk and talk Language Lab Collaborative learning Classroom learning

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 Draw communication cycle using real life examples and explain process of communication.	1	*Communication Process and Cycle	2	CO1
LLO 2.1 Undertake the Role play / Group discussion to illustrate types / barriers to communication	2	Role plays and Group Discussion	2	CO1
LLO 3.1 Listen to audios in the language lab and make notes of it.	3	*Active Listening	2	CO2
LLO 4.1 Give a presentation / Seminar using 7 C's of Communication.	4	*Presentations / Seminars	2	CO1
LLO 5.1 Explain the types of note taking with examples and make notes on any one topic related to your curriculum.	5	*Note taking and Note Making	2	CO2
LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	6	*Agenda and Minutes of the meeting	2	CO3
LLO 7.1 Draft circulars for the given situation .	7	*Office Drafting	2	CO3
LLO 8.1 Respond to job advertisements referring newspapers, LinkedIn. Write cover letter with resume /CV.	8	*Type Job Application with Resume / CV	2	CO4
LLO 9.1 Type Four (formal) E-mails using ethics and etiquette.	9	* E- Mail writing	2	CO4
LLO 10.1 Write a detailed report on Accident/ Investigation .	10	*Technical Report writing	2	CO5
LLO 11.1 Prepare a case study related to linguistic barriers : language ,pronunciation, punctuation, technical jargon and suggest remedies for the same.	11	*Barriers to Communication	2	CO1
LLO 12.1 Draft complaint / enquiry letter for various situations	12	Complaint and Enquiry letter	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 List psychological barriers to communication LLO 13.2 Prepare case studies on any two psychological barriers and suggest remedies to overcome the barriers	13	Psychological barriers to Communication	2	CO1
LLO 14.1 Draw flow chart and mind mapping for any topic related to the curriculum.	14	*Listening Skills	2	CO2
LLO 15.1 Face mock interview arranged by your teacher.	15	* Typed Job Application , Resume / CV/ formal dressing and Interview	2	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

- Conduct an interview of any person and follow the procedure (interview questions, photo with the interviewee etc.)
- Listening and Speaking are life long learnings . Explain with appropriate examples and real life case studies.
- Collect (four to five) emails with technical jargons, barriers, make required corrections and keep a record of both the mails (original and Corrected one)
- Complete any one certification course of (Two Weeks duration) from (MOOC/ NPTEL/ Coursera/ any other source)related to Communication Skills / Personality Development.
- Prepare a report on aspects of body language
- Prepare a case study on Technological /Psychological barriers to communication

Reading for vocabulary and sentence structure

- Read any motivational book and present a review of the book

Note :

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with software and internet facility	All
2	LCD Projector	All
3	Smart Board with networking	All
4	Printer	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term Work, Micro Project

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks using language lab

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	1	1		1	3	1			
CO2	1	1				3	1			
CO3	1					3	1			
CO4		1				3	1			
CO5		1	1			3	1			

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	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill Publication-ISBN 0070599521, 9780070599529
2	Sanjay Kumar and Pushp Lata	Communication Skills	Oxford University Press ISBN 9780199457069
3	MSBTE Textbook	Communication Skills	MSBTE
4	Robert King	Effective communication Skills	Audio Book -ISBN 978181667009742
5	N P Sudharshana , C Savitha	English for Technical Communication	Cambridge-ISBN 978-13-16640-08-1
6	C. Murlikrishna , Sunita Mishra	Communication Skills for Engineers	Pearson - ISBN 978-81-317-3384-4
7	Meenakshi Raman, Sangeeta Sharma	Technical Communication, Principles and Practice	Oxford University Press -ISBN 978-13-16640-08-1
8	K. K. Sinha	Business Communication	Galgotiya Publishing company, New Delhi - ISBN 9789356227064
9	Rajendra Pal, J.S. Korlahalli	Essentials of Business Communication	Sultan Chand & Sons, New Delhi ISBN 9788180547294

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.britishcouncil.in	conversations
2	https://www.coursera.org	certification courses

Sr.No	Link / Portal	Description
3	https://www.udemy.com	Communication skills training courses
4	http://www.makeuseof.com	Dale Carnegie's free resources

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 Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ 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/ 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/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: SOCIAL AND LIFE SKILLS**
Course Code	**: 312003**

I. RATIONALE

Rationale : Life skills can be defined as abilities that enable humans to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing , understanding attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confidence.

Note : The course offers five different alternatives(modules) for achieving above outcomes . Students must complete any one module from the following given options.

a. MODULE-I : Unnat Maharashtra Abhiyan (UMA)
b. MODULE-II : National Service Scheme (NSS)
c. MODULE-III : Unniversal Human Values
d. MODULE-IV: Value Education (Unnati Foundation)
e. MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into

consideration the resources required and resources available in the institute . Different group of students maybe offered different MODULE based on their choices .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude , integrity and self-confidence

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Develop ability to adapt to new challenges.
- CO2 - Manage emotions effectively.
- CO3 - Follow workplace ethics and practices
- CO4 - Manage time Effectively.
- CO5 - Increased self confidence to handle stress.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

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															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : Hrs

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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.

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1	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems TLO 1.3 Design a methodology for fieldwork TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations	**Unit - I MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc 1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuring equipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 1.9 Fieldwork : Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B 1.10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc 3. Observations of field visits and data collected.	i) Field visit ii) Field work iii) Expert lectures

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 Adoption of Village or Slum TLO 2.2 Survey and Problem Identification TLO 2.3 Conduct Project / Programs in the selected village / slum TLO 2.4 Undertake Special Camping Programme	**Unit - II MODULE II : National Service Scheme (NSS)** 2.1 Contacting Village/Area Leaders 2.2 Primary socio economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. 2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	(i) Field visit (ii) Field work (iii) Expert lectures
3	TLO 3.1 Love and Compassion (Prem and Karuna) TLO 3.2 Truth (Satya) TLO 3.3 Non-Violence (Ahimsa) TLO 3.4 Righteousness (Dharma) TLO 3.5 Peace (Shanti) TLO 3.6 Service (Seva) TLO 3.7 Renunciation (Sacrifice) Tyaga TLO 3.8 Gender Equality and Sensitivity	**Unit - III MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga 3.8 Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks by Practitioners ix) Site/Industry Visit

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.
4	TLO 4.1 Puntuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3 Responsibility TLO 4.4 Gratitude and Appreciations TLO 4.5 Determination & Persistence TLO 4.6 Respect TLO 4.7 Team Spirit TLO 4.8 Caring & Sharing TLO 4.9 Honesty TLO 4.10 Forgive and Forget	**Unit - IV MODULE-IV: Value Education (Unnati Foundation)** 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity 4.3 Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management 4.4 Gratitude and Appreciation , Asking Simple Questions & Asking for the price , Stress Management, Student Referral process ,Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/Objects, Refusal Skills, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and upskilling 4.8 Caring and Sharing , Handling Customer queries, Flexibility & Adaptibility, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Cooperative Learning vii) Chalk-Board

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.
		Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension 4.10 Forgive and Forget, Facing and Interview, OSCEM-Public Speaking , Attending a telephonic/Video interview & Mock Interview , Affirmation , Pat-a-Back & Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	
5	TLO 5.1 Literacy About Savings and Investments TLO 5.2 Literacy About Financial Planning TLO 5.3 Literacy About Transactions TLO 5.4 Literacy About Income, expenditure and budgeting TLO 5.5 Literacy About Inflation TLO 5.6 Literacy About Loans TLO 5.7 Literacy About the Importance of Insurance TLO 5.8 Literacy About the Dos and Donts in finances	**Unit - V MODULE-V : Financial Literacy** 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection 5.9 Dos and Donts in Financial planning and Transactions	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board vi) Collaborative learning

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

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

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

- Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation:
The activities under this sub-theme would inter-alia, include:

(i) plantation of trees, their preservation and upkeep
(ii) Construction & maintenance of village streets, drains
(iii) Cleaning of village ponds and wells;
(iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(v) Disposal of garbage & composting;
(vi) Prevention of soil erosion and work for soil conservation,
(vii) Watershed management and wasteland development
(viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

(i) Programme of mass immunization;
(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
(iii) Provision of safe and clean drinking water;
(iv) Integrated child development programmes;
(v) Health education, AIDS Awareness and preliminary health care.
(vi) Population education and family welfare programme;
(vii) Lifestyle education centres and counselling centres.
© Programmes aimed at creating an awareness for improvement of the status of women: (i) programmes of educating people and making them aware of women's rights both constitutional and legal;
(ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
(iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

(i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
(ii) work with the organisations of child welfare;
(iii) work in institutions meant for physically and mentally handicapped;
(iv) organising blood donation, eye pledge programmes;
(v) work in Cheshire homes, orphanages, homes for the aged etc.;
(vi) work in welfare organisations of women;
(vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

(i) working with people and explaining and teaching improved agricultural practices;
(ii) rodent control land pest control practices;
(iii) weed control;
(iv) soil-testing, soil health care and soil conservation;
(v) assistance in repair of agriculture machinery;
(vi) work for the promotion and strengthening of cooperative societies in villages;
(vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
(viii) popularisation of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

(i) assisting the authorities in distribution of rations, medicine, clothes etc.;
(ii) assisting the health authorities in inoculation and immunisation, supply of medicine etc.;
(iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
(iv) assisting and working with local authorities in relief and rescue operation;
(v) collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations: Activities in this field could include:

(i) adult education (short-duration programmes);
(ii) pre-school education programmes;
(iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
(iv) work in crèches;
(v) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;
(vi) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
(vii) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and
(ix) legal literacy, consumer awareness.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Simple engineering measurement devices GPS data collection tools GIS open source softwares- Google Earth and QGIS MS office suite	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self-Learning (Assignment)

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM : NOT APPLICABLE

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number

Sr.No	Author	Title	Publisher with ISBN Number
1	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA' Districts Economic survey reports	UNICEF
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
2	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
3	https://censusindia.gov.in/census.website/	A Website of Census of India
4	https://gsda.maharashtra.gov.in/english/	A Website of Groundwater Survey and Development Agency, GoM
5	https://mrsac.gov.in/MRSAC/map/map	A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.
6	https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx	A Website of Jal Jivan Mission, Government of India
7	https://cpcb.nic.in/	A Website of Central Pollution Control Board, Government of India
8	http://www.mahapwd.com/#	A Website of Public Works Department, GoM
9	http://tutorial.communitygis.net/	A Website for GIS data sets developed by Unnat Maharashtra Abhiyan

Sr.No	Link / Portal	Description
10	https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U	A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society
11	https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac	A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead
12	https://youtu.be/mKJj6j_1gWg?si=ajE8s4lfB2OM63Ng	A TED talk by Prof. Milind Sohoni, IIT Bombay, on Vernacular Science: The Science of Delivery
13	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skils. Unit 4 i.e. Course 4 is to be referred
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Second**
Course Title : **MATERIAL SYNTHESIS**
Course Code : **322006**

I. RATIONALE

The inclusion of course 'material synthesis' to the program Surface Coating Technology has very great significance. Surface Coating Technology is field where foundation of various courses is required to ensure the students well prepared for both theoretical and practical aspects. Material synthesis enables an interdisciplinary approach which is essential for students to develop a holistic understanding of the course.

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: • Prepare a material with given specification.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Prepare lacquers and varnishes.
- CO2 - Prepare a set up for pigment manufacturing.
- CO3 - Test the thinner.
- CO4 - Evaluate the efficiency of paint additives.

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	
322006	MATERIAL SYNTHESIS	MTS	DSC	-	-	4	2	6	3	-	-	-	-	-	50	20	-	-	25	10	75

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 Refer TLOs of following course Code; Course code: 321304 and Course Code: 322316	**Unit - I Lacquers and Vanishes** 1.1 Refer Learning content of following course Code; Course code: 321304 and Course Code: 322316	Lecture Hands-on Demonstration
2	TLO 2.1 Refer TLOs of following course; Code Course code: 321305 and Course Code: 322315	**Unit - II Pigments** 2.1 Refer Learning content of following course Codes; Course code: 321305 and Course Code: 322315	Demonstration Chalk-Board Hands-on
3	TLO 3.1 Refer TLOs of following course Code; Course code: 322318	**Unit - III Solvents** 3.1 Refer Learning content of following course Code; Course code: 322318	Demonstration Chalk-Board Hands-on
4	TLO 4.1 Refer TLOs of following course Code; Course code: 322318	**Unit - IV Additives** 4.1 Refer Learning content of following course Code; Course code: 322318	Demonstration Hands-on 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 Prepare NC lacquer	1	Preparation and testing of NC lacquer.	4	CO1
LLO 2.1 *Synthesize stoving lacquer	2	*Synthesis and testing of stoving lacquer.	4	CO1
LLO 3.1 *Synthesize of two pack polyurethane lacquer.	3	*Synthesis and testing of two pack polyurethane lacquer.	4	CO1
LLO 4.1 Prepare oleo-resinous varnish.	4	Preparation and testing of oleo-resinous varnish.	4	CO1
LLO 5.1 Prepare Alkyd resin varnish.	5	Preparation and testing of Alkyd resin varnish.	4	CO1
LLO 6.1 *Synthesize Black Japan varnish.	6	*Synthesis and testing of Black Japan varnish.	4	CO1
LLO 7.1 Prepare Lead chromate.	7	Preparation and testing of Lead chromate.	4	CO2
LLO 8.1 *Prepare Prussian blue.	8	*Preparation and testing of Prussian blue.	4	CO2
LLO 9.1 *Synthesize Blanc fixe.	9	*Synthesis and testing of Blanc fixe.	4	CO2
LLO 10.1 *Prepare GP thinner for synthetic enamels.	10	*Preparation and testing of GP thinner for synthetic enamels.	4	CO3
LLO 11.1 Prepare NC thinner for NC paints.	11	Preparation and testing of NC thinner for NC paints.	4	CO3
LLO 12.1 *Prepare Stoving thinner for stoving paints.	12	*Preparation and testing of stoving thinner for stoving paints.	4	CO3
LLO 13.1 Synthesize alkyd emulsion.	13	Synthesis and testing of alkyd emulsion.	4	CO4
LLO 14.1 Evaluate Drier efficiency	14	Evaluation of Drier efficiency of paint drier like Co naphthenate, Pb naphthenate, Mn Octoate, mix drier etc.	4	CO4
LLO 15.1 *Test the effect of rheology modifier	15	*Testing of effect of rheology modifier	4	CO4
LLO 16.1 Test effect of anitifoamer and de-foamer	16	Testing the effect of anitifoamer and de-foamer	4	CO4

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

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

- Collect the information of plant utilities of resins manufacturing plant.
- Prepare a demo plant for pigment manufacturing plant.
- Prepare a demo plant for resin/varnish manufacturing.
- Prepare a report on pigment surface modification techniques.
- Prepare a project report on Thinner manufacturing plant.
- Prepare a report on safety provisions of resin/pigment/solvent manufacturing plant.
- Collect the data of Regulatory aspects of paint raw materials.

Assignment

- Prepare a flow sheet for resin manufacturing plant.
- Prepare a flow sheet for pigment manufacturing plant.
- Prepare a report on properties of lacquers, varnishes, solvents, pigments and additives.

Note :
These are just the suggestive topics, Faculty must design microprojects / Activities/ Assignments based on course outcome requirements.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Weighing balance (max 500gms, 0.1gms)	All
2	Heating Mantel (300OC)	4,5,6,7,8,9
3	Sp. Gr. Bottle	10,11
4	Spatula (6”)	All
5	Thermometer (360OC)	4,5,6,7,8,9
6	Automatic Muller	7,8,9
7	Oven (300Oc)	7,8,9
8	Conical Flasks (100ml & 250 ml)	All
9	Beaker (100 ml and 500 ml)	All
10	Glass rod (8”)	All
11	Glass plate (12”*12”)	All
12	Filter Paper (Whatman paper No.5)	7,8,9
13	Flow cup B-4	1,2,3,4,5,6,16
14	Metal Panel	1,2,3,14
15	Brush (1”)	1,2,3,14
16	Filtration flask	7,8,9
17	pH Mater	7,8,9
18	Measuring Cylinder (100ml)	All
19	Conductivity meter	10,11,12
20	High Speed stirrer	All
21	SS Pot (250 ml, 500ml)	4,5,6

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
22	Manual Puller (3inch Wide)	7,8,9
23	Drawdown paper	7,8,9
24	Petri dish (3 inch)	1,2,3,4,5,6
25	Brookfield Viscometer	16

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	Lacquers and Vanishes	CO1	0	0	0	0	0
Grand Total				**0**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

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

Summative Assessment (Assessment of Learning)

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	-	2	1	1	2			
CO2	3	1	1	2	1	1	2			
CO3	3	2	1	2	-	1	2			
CO4	3	2	1	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	Oil and Colour Chemists Association of Australia St (OCCA)	Surface 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	Dr. Ashok B. Karnik	Essentials of Pigments Application and Selection (1st Edition) 2009	Mrs. Prabha A. Karnik publishing co.,2009. ISBN: 978-81-901087-0-6

Sr.No	Author	Title	Publisher with ISBN Number
5	W. Herbst, K. Hunger	Industrial Organic Pigments, Production, Properties, Application	WILEY-VCH Verlag GmbH & Co. KGaA ISBN: 3-527-30576-9
6	Kishore M. Shah	Handbook of Synthetic Dyes and Pigments	Edu-tech publishing co.,1994 ISBN: 9788192666006
7	George Wypych	Handbook Of Solvents	Chem Tec Publishing Earswick Drive, Toronto, Ontario, Canada ISBN : 1-895198-24-0

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/6u2dPx4zAcE?si=3NsM_ZgbvB1JhOZ-	Polyurethane vs Lacquer vs Shellac: Pick Your Wood Finish
2	https://youtu.be/pHWGOOuEYBw?si=HnesIXK9SEMC6iuN	PAINT, VARNISH AND LACQUER
3	https://youtu.be/OwE14o0yMT8?si=r5yNBla_7iQJSIeD	CLASSIFICATION OF PAINTS AND COATINGS
4	https://youtu.be/LeFJwpqgH4c?si=AtXJZi3krHotnFtI	DRIERS FOR PAINTS AND COATINGS
5	https://youtu.be/VXIMBV3Bsbo?si=VxDxEKeqS58HJBK-	RESINS & POLYMERS (PART-3: NITROCELLULOSE LACQUER and OTHER CELLULOSIC POLYMERS)
6	https://youtu.be/EyGfRi5dkdg?si=YksTHnPRtHz_0M-N	resin reactor
7	https://youtu.be/5vjT7VdW6K8?si=-eAjsKmhRCmUO5x7	Black Japan varnish
8	https://youtu.be/mu_g49VbHbc?si=439gDQQdUxRDX52t	Preparation of lead chromate, practical lab
9	https://youtu.be/uqp1DCzHViY?si=DyPfCX9oUOQG_zI4	Preparation of Prussian Blue
10	https://youtu.be/dlC_ohpxGdc?si=uFzeQg0VwNlr_U-E	Prussian Blue
11	https://youtu.be/HxAW8l0mKDI?si=AgBP9DBAl-fWiJ4p	FORMULATION OF NC THINNER
12	https://youtu.be/nxB4WuJbjug?si=tokP8tO_nHga_p3j	Alky emulsion
13	https://youtu.be/YRL0NWcW8ZQ?si=S0kfm3Olj1OetWbm	Importance of Rheology Modifiers in our Paint system
14	https://youtu.be/n9tJTjP7VRQ?si=5EGu3nQeLCdj7JM0	Effect of rheology modifier on viscosity curve
15	https://youtu.be/ICjQ0UzE2Ao?si=sOUvuKz7D06AMR_r	An Introduction to Additive Manufacturing
16	https://youtu.be/Yp5efpgRVwM?si=XDiIBjr0LHrWneCX	ERTICAL SHAKING TEST For Defoamer / Antifoam DEFOAMER SIXIN 24 subscribers Subscribe

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Second**
Course Title : **ADVANCED PIGMENT TECHNOLOGY**
Course Code : **322315**

I. RATIONALE

This course will give knowledge about colour, colour pigments and their role in paints and coatings. This course includes names of pigments, types of pigments, processing, their properties and uses. The course gives knowledge about test methods of pigments. This course will deal with yellow, orange, blue, green, red, violet and dyes and toner pigments. This will facilitate the student to select the relevant pigment for coating formulation.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select relevant pigments for various applications.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Explain colour theory.
- CO2 - Test properties of yellow pigments.
- CO3 - Write properties and applications of red pigments.
- CO4 - Classify green pigments.
- CO5 - Use of novelty pigments in surface coating industries.

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	
322315	ADVANCED PIGMENT TECHNOLOGY	APT	DSC	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.

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 State concept of colour. TLO 1.2 Explain colour theory. TLO 1.3 Write process to determine mass tone of pigments.	**Unit - I Colour Technology** 1.1 Concept of Color. 1.2 Origin of colors: Chromophore & Auxochrome. 1.3 Color theory: Hue, Chroma, Value, Undertone & Mas-tone, Tinting strength, Reducing power and Shade, Additive and subtractive color mixing, Complimentary colors. 1.4 Colour perception. 1.5 Concept of Delta 'E'	Chalk-Board Presentations Video Demonstrations Demonstration
2	TLO 2.1 Write properties of yellow iron oxide pigments. TLO 2.2 Draw the structure of benzidine yellow. TLO 2.3 Explain the properties of barium chromates.	**Unit - II Yellow and Orange pigments** 2.1 Introduction, Properties & Applications of Inorganic Pigments: Yellow iron Oxide. 2.2 Introduction, Properties & Applications of inorganic Zinc Chromes, Barium Chromates & Lead Chromates. 2.3 Introduction, Properties & Applications of Organic Pigments: Benzidine Yellows, Hansa Yellows. 2.4 Introduction to high-performance yellow pigments.	Chalk-Board Presentations Demonstration Video Demonstrations
3	TLO 3.1 Describe methods of red oxide manufacturing. TLO 3.2 Explain the properties of various red / violet pigments. TLO 3.3 Explain applications of red / violet pigments.	**Unit - III Red and Violet Pigments** 3.1 Introduction, Properties & Applications of Inorganic Pigments: Red oxide, Mixed metal oxide. 3.2 Introduction, Properties & Applications of Organic Pigments: Toluidine Red, Signal Red. 3.3 Introduction, Properties & Applications of Red Lake C, Lithol Red, Rubine Toner. 3.4 Introduction, Properties & Applications of Permanent Red. Quinacridone Red, dioxazines volet.	Chalk-Board Presentations Demonstration Video Demonstrations
4	TLO 4.1 Test properties of blue and green inorganic and organic blue/ green pigments. TLO 4.2 Explain flocculation and flooding of pigment. TLO 4.3 Draw the structures of blue and green pigments.	**Unit - IV Blue & Green Pigments** 4.1 Introduction, Properties & Applications of Inorganic Pigments: Prussian blue, Ultramarine blue. 4.2 Introduction, Properties & Applications of Chrome green, Chrome oxide green. 4.3 Introduction, Properties & Applications of Organic Pigments: Phthalocyanine blue, Phthalocyanines green. 4.4 Flocculation and flooding of blue and green pigments.	Chalk-Board Presentations Demonstration Video Demonstrations
5	TLO 5.1 List the novelty pigments. TLO 5.2 Write properties and application of novelty pigments. TLO 5.3 Explain the mechanism of special effects.	**Unit - V Novelty pigments** 5.1 Introduction to Fluorescent, phosphorescent, and pearlescent pigment. 5.2 Properties and application of metallic pigments: Aluminum and Copper pigments. 5.3 Introduction to dyes and toner pigments. 5.4 Properties and uses of PMA and PTMA toners (pink, violet and blue) 5.5 Introduction to ancient dyes and coloring materilas	Chalk-Board Presentations Demonstration Video Demonstrations

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 Compare Mass tone and Under tone of pigment.	1	Comparison of Mass tone and Under tone of pigment using draw down method.*	3	CO1
LLO 2.1 Determine tinting strength of pigment.	2	Determination of tinting strength of pigment using drawdown method.*	3	CO1
LLO 3.1 Determine reducing strength of pigment.	3	Determination of reducing strength of pigment using drawdown method.	3	CO1
LLO 4.1 Compare opacity of pigments.	4	Comparison of opacity of organic and inorganic yellow/orange pigments by Morest chart.*	3	CO2
LLO 5.1 Determine moisture content of pigments.	5	Determination of moisture content of organic and inorganic yellow/orange pigment using oven.	3	CO2
LLO 6.1 Determine bleeding behavior of pigments.	6	Determination of bleeding behavior of organic and inorganic yellow/orange pigment by filtration.*	3	CO2
LLO 7.1 Determine residue on sieve.	7	Determination of residue on sieve of Red/Violet pigment using sieve analysis.	3	CO3
LLO 8.1 Determine oil absorption of pigments.	8	Determination of oil absorption of red/violet pigments using burette.	3	CO3
LLO 9.1 Test pH of pigment.	9	Testing of pH of red/violet pigments using pH paper.*	3	CO3
LLO 10.1 Prepare shade.	10	Preparation of shade using red/violet pigments.*	3	CO3
LLO 11.1 Determine bulk density of of the pigments.	11	Determination of bulk density of blue/green pigments using taping method.	3	CO4
LLO 12.1 Determine Specific gravity of pigments.	12	Determination of specific gravity of blue/green pigments using specific gravity bottle.	3	CO4
LLO 13.1 Determine acid resistance of pigments.	13	Determination of acid resistance of organic and inorganic blue/green pigment.	3	CO4
LLO 14.1 Determine flocculation of pigments.	14	Determination of flocculation of blue/green pigment by rub out method.*	3	CO4
LLO 15.1 Compare pigment and dyes.	15	Comparison of pigment and dyes using hiding power.	3	CO5
LLO 16.1 Determine alkali resistance of pigment.	16	Determination of alkali resistance of dyes pigment.	3	CO5
LLO 17.1 Compare pigment and dyes using solvent solubility.	17	Comparison of pigment and dyes using solvent solubility.*	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

- Collect data of various synthetic and natural pigments with properties and application.
- Collect MSDS of various reagents, chemicals and pigments used in laboratories.
- Collect data of various modifications of pigments with properties influenced due to modification and their applications.
- Collect information of pigment industries.
- Collect information of pigments manufacturing processes.
- Compare various organic and In-Organic pigments.
- Collect information of surface treatment processes for pigments.
- Collect MSDS for Organic pigments.

- Prepare a report on various safety measures while handling of pigments.

Term work

- 1. Prepare journal for laboratory work.

Assignment

- Prepare a chart of classifications of colour pigments.
- Write name of raw materials for pigment synthesis with structures.
- Enlist the properties and applications of pigments required for industrial coatings.
- Write a report on nano pigments.
- Write CI (Color index) names of various colour pigments.

Note :
These are just the suggestive topics, Faculty must design microprojects / Activities/ Assignments based on the course outcome requirements.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Spatula	All
2	Glass Plate	All
3	Weighing balance	All
4	Automatic Muller	1,2,3,4,10
5	Puller Spatula	1,2,3,4,10,14
6	pH meter	9
7	Test tube stand	6,17
8	Petri dish	5
9	Beaker (50 ml, 100 ml)	All
10	Conical Flask (50 ml, 100 ml)	13,16
11	Oven	5
12	Thermometer (0-100 0C, 0-360 0C range)	5
13	Sieve analysis set	7
14	Measuring Cylinder (50 CC, 100 CC)	11
15	Sp. Gr. Bottles	12
16	Test tube set	6,17
17	Morest chart	4,15
18	Glass Rod	6,13,14

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	Colour Technology	CO1	9	2	4	8	14
2	II	Yellow and Orange pigments	CO2	9	2	4	8	14
3	III	Red and Violet Pigments	CO3	9	2	4	8	14
4	IV	Blue & Green Pigments	CO4	9	2	4	8	14
5	V	Novelty pigments	CO5	9	2	4	8	14
Grand Total				**45**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid Term Test (Average of two sessional examinations)

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

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			
CO2	3	2	-	3	1	-	2			
CO3	3	1	-	1	1	-	2			
CO4	3	1	1	-	2	-	2			
CO5	3	2	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
1	Kishore M. Shah	Handbook of Synthetic Dyes and Pigments	Edu-tech publishing co.,1994 ISBN: 9788192666006
2	W M Morgan	Outline of Paint Technology (3rd Edition)	CBS Publishers & Distributors Pvt. Ltd, 2000 ISBN: 9788123904306
3	H F Payne	Organic Coating Technology vol-II	John Wiley & Sons Inc, 1961 ISBN: 9780471673538
4	V C Malshe and Meenal Sikchi	Basic of Paint Technology-I	Antar Prakash Centre for Yoga,2004 ISBN: 9788190329859
5	Dr. Swaraj Paul	Surface Coating Science and Technology	John Wiley & Sons Ltd, 2007 ISBN: 9788126552559
6	Oil and Colour Chemists Association of Australia (OCCA)	Surface Coatings, Vol-I Raw Materials and Their Usage	Chapman & Hall, 1993 ISBN: 9780412552106
7	W. Herbst, K. Hunger	Industrial Organic Pigments, Production, Properties, Application	WILEY-VCH Verlag GmbH & Co. KGaA ISBN: 3-527-30576-9
8	Dr. Ashok B. Karnik	Essentials of Pigments Application and Selection (1st Edition) 2009	Mrs. Prabha A. Karnik publishing co.,2009. ISBN: 978-81-901087-0-6

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=poL7nDmqjmk	Colour perception
2	https://www.youtube.com/watch?v=aJLzyjH6Dcc	Dyes and pigment

Sr.No	Link / Portal	Description
3	https://www.youtube.com/watch?v=L1CK9bE3H_s&t=182s-	Colour theory
4	https://www.youtube.com/watch?v=PdwtCFgFEeU	Tinting strength
5	https://www.youtube.com/watch?v=7Y0yGaT3EZQ&t=81s	Reducing strength
6	https://www.youtube.com/watch?v=QS3l-BKUl3g	Complementary colour
7	https://www.youtube.com/watch?v=5-x4bpnr9-o	Iron oxide yellow
8	https://www.youtube.com/watch?v=x6e2CxFlVJw&t=101s	Iron oxide red
9	https://www.youtube.com/watch?v=lKy2Vr9XkRw	Chrome pigments
10	https://www.youtube.com/watch?v=4VspOqaJ3gc&t=129s	Automatic muller
11	https://www.youtube.com/watch?v=mF4CT-EuHgs	pH test
12	https://www.youtube.com/watch?v=HXKsPb2kl84	Heat stability
13	https://www.youtube.com/watch?v=cvs1-8-V0ng	Prussian blue
14	https://www.youtube.com/watch?v=Mnx6PBFBGik	Phthalocyanine
15	https://www.youtube.com/watch?v=v90I7lTEWDs	Glow pigments
16	https://www.youtube.com/watch?v=_DRMBAQyIXc	Dyes

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Second**
Course Title : **ADVANCED RESIN TECHNOLOGY**
Course Code : **322316**

I. RATIONALE

The inclusion of the course 'Resin Technology' to Diploma program in Surface Coating Technology is essential because of the significant role of resin in coating formulations. Resin is main ingredient in paint formulations. Inclusion of this course will facilitate student about advancements in resin technology. This course introduces students about the different type of resins, raw materials, properties and applications of several resins. This course mainly includes acrylic resin, epoxy resin, polyamide resins, polyurethane resin and silicon resin.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Select relevant resins for preparation of paints and coatings.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Write manufacturing process of acrylic resin.
- CO2 - Explain curing reaction of epoxy resin.
- CO3 - Test polyamide resin.
- CO4 - Draw chemical structure of isocyanate.
- CO5 - State applications of silicon resin.

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	
322316	ADVANCED RESIN TECHNOLOGY	ART	DSC	4	-	4	-	8	4	3	30	70	100	40	25	10	50@	20	-	-	175

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 Classify acrylic resins TLO 1.2 Draw chemical structures of acrylic monomers. TLO 1.3 Explain Manufacturing techniques for acrylic resins	**Unit - I Acrylic Resin** 1.1 Introduction to acrylic resin. 1.2 Classification of acrylic resins. 1.3 Raw materials for acrylic resins. 1.4 Manufacturing reactions of acrylic resins. 1.5 Manufacturing Techniques of acrylic resins. 1.6 Cross linking reactions of acrylic resins. 1.7 Properties and application of acrylic resins. 1.8 Introduction to VAM, Pure acrylic emulsion, styrenated emulsion	Lecture Demonstration Assignment Seminar PPTs
2	TLO 2.1 Calculate “n” value of epoxy resins. TLO 2.2 Write crosslinking reactions of epoxy resins. TLO 2.3 Explain properties and application of epoxy resins.	**Unit - II Epoxy Resin** 2.1 Introduction to epoxy resin 2.2 Raw materials for epoxy resins. 2.3 Formulating principles of epoxy resins. 2.4 Manufacturing of epoxy resins and reactions involved. 2.5 Curing reactions of epoxy resins. 2.6 Properties and application of epoxy resins. 2.7 Modifications of epoxy resins: Epoxy ester, water-base epoxy resins, epoxy-bitumen systems	Lecture Demonstration Chalk-Board Presentations
3	TLO 3.1 Classify polyamide resins. TLO 3.2 Write manufacturing reactions of polyamide resins. TLO 3.3 List properties and application of polyamide resins	**Unit - III Polyamide Resin** 3.1 Classification of polyamide resins. 3.2 Raw materials of polyamide resins. 3.3 Introduction to amine adduct. 3.4 Manufacturing reactions of polyamide resins. 3.5 Manufacturing process for polyamide resins. 3.6 Curing reactions of polyamide resins. 3.7 Properties and applications of polyamide resin.	Lecture Demonstration Presentations Chalk-Board Flipped Classroom
4	TLO 4.1 Draw chemical structure of raw materials used for polyurethane. TLO 4.2 Write reactions of isocyanate. TLO 4.3 Explain preparation of PU adduct.	**Unit - IV Polyurethane Resin** 4.1 Introduction to polyurethane resins. 4.2 Raw materials for polyurethane resins. 4.3 Reaction of Isocyanate. 4.4 Types of polyurethane resins. 4.5 Crosslinking reactions of polyurethane resins. 4.6 Properties and application of polyurethane resins.	Lecture Presentations Chalk-Board Demonstration Collaborative learning
5	TLO 5.1 Write manufacturing reactions of silicone resin. TLO 5.2 Explain importance of alkyl group. TLO 5.3 Explain modifications of silicon resins	**Unit - V Silicone Resin** 5.1 Introduction to silicon resin. 5.2 Raw materials for silicon resins. 5.3 Manufacturing reactions of silicone resins. 5.4 Modifications of silicon resin. 5.5 Properties and application of silicone resin.	Chalk-Board Presentations Demonstration Lecture

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 Determine acid value of acrylic resins using KOH solution.	1	Determination of acid value of acrylic resins using KOH solution.*	4	CO1
LLO 2.1 Determine hydroxyl value of acrylic resins.	2	Determination of hydroxyl value of acrylic resins.	4	CO1
LLO 3.1 Determine viscosity of acrylic resin by flow cup method.	3	Determination of viscosity of acrylic resin by flow cup method.*	4	CO1
LLO 4.1 Test solvent tolerance of acrylic resins sample.	4	Testing of solvent tolerance of acrylic resins sample.	4	CO1
LLO 5.1 Determine Epoxy equivalent of epoxy resins.	5	Determination of Epoxy equivalent of epoxy resins.*	4	CO2
LLO 6.1 Determine percentage non-volatile matter/volatile matter of epoxy resin.	6	Determination of percentage non-volatile matter/volatile matter of epoxy resin.	4	CO2
LLO 7.1 Test compatibility of epoxy resin with other resins.	7	Testing of compatibility of epoxy resin with other resins.*	4	CO2
LLO 8.1 Test Salt spray resistance of epoxy-polyamide resin system.	8	Testing of Salt spray resistance of epoxy-polyamide resin system.	4	CO2
LLO 9.1 Determine amine value of polyamides.	9	Determination of amine value of polyamides.*	4	CO3
LLO 10.1 Determine the pot life of epoxy polyamide resin system.	10	Determination of the pot life of epoxy polyamide resin system.*	4	CO3
LLO 11.1 Test Chemical resistance of epoxy-polyamide resin system:	11	Testing of Chemical resistance of epoxy-polyamide resin system:	4	CO3
LLO 12.1 Determine percentage " – NCO" content.	12	Determination of percentage " – NCO" content.*	4	CO4
LLO 13.1 Test Chemical resistance of acrylic Polyurethane resin system	13	Testing of Chemical resistance of acrylic Polyurethane resin system	4	CO4
LLO 14.1 Test Solvent resistance of acrylic Polyurethane resin system	14	Testing of Solvent resistance of acrylic Polyurethane resin system	4	CO4
LLO 15.1 Test Heat resistance of silicon resin film.	15	Testing of Heat resistance of silicon resin film.*	4	CO5
LLO 16.1 Test Solvent tolerance of silicone resin.	16	Testing of Solvent tolerance of silicone resin	4	CO5
LLO 17.1 Determine compatibility of silicon resin with other resins.	17	Determination of compatibility of silicon resin with other resins.	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)

NA

- Term work

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Test tubes (15 ml capacity)	All
2	Measuring Cylinders (10 ml, 50ml 100ml)	All
3	Beakers (50, 100, 250 ml)	All
4	Burette (50ml, L.C.: 0.1 ml)	1,2,5,9,12
5	Conical Flasks (100 ml, 250 ml)	1,2,5,9,12
6	Volumetric flask (100, 250, 500 ml)	1,2,5,9,12
7	Pipette (10 ml, 25 ml)	1,2,5,9,12
8	Glass rod (6 mm/10 mm)	All
9	Weighing Balance (Digital Display, 300 g, Sensitivity. 0.01 g)	All
10	Petri Dish (size-3")	6
11	Ovens (Max temp-250oC)	6,8,11,13,15
12	Flow Cup B-4	3
13	Stop Watch (Analogue)	3
14	Spirit Level	3
15	Metal Panels (MS panel, 75*100*0.8mm)	8,11,13,14,15
16	Brush (Soft Brush, 1" rectangular)	8,11,13,14,15
17	Salt spray chamber	8

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	Acrylic Resin	CO1	12	2	4	8	14
2	II	Epoxy Resin	CO2	12	2	4	8	14
3	III	Polyamide Resin	CO3	12	2	4	8	14
4	IV	Polyurethane Resin	CO4	12	2	4	8	14
5	V	Silicone Resin	CO5	12	2	4	8	14
Grand Total				**60**	**10**	**20**	**40**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid Term Test (Average of two sessional examinations)
- Assignment, Self-learning assessment by report and seminars
- Term Work (60% weightage for process and 40% weightage for product)

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			
CO2	3	2	1	-	1	-	2			
CO3	3	1	2	2	1	2	2			
CO4	3	1	1	-	1	-	2			
CO5	3	1	1	-	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) ISBN: 9788123904306	CBS Publishers & Distributors Pvt. Ltd, 2000
2	Oil and Colour Chemists Association of Australia St (OCCA)	Surface Coatings, Vol I: Raw Materials and Their Usage ISBN: 9780412552106	Chapman & Hall, 1993
3	H. F. Payne	Organic Coating Technology ISBN: 9780471673538	John Wiley & Sons Inc
4	V.C. Malshe and Meenal Sikchi	Basics of Paints Technology Part I ISBN: 9788190329859	Antar Prakash Centre for Yoga, 2004
5	Dr. Swaraj Paul	Surface Coatings: Science & Technology (2nd Edition) ISBN:9788126552559	John Wiley and Sons Ltd.2014
6	NIIR Board	Modern Technology of Paints, Varnishes & Lacquers (2nd Edition) ISBN: 8178330881	Asia Pacific Business Press Inc.

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/YVfRzSlBwwY?si=dKAj44yNexM6XAEI	Acrylic resin reactor
2	https://youtu.be/EyGfRi5dkdg?si=OANRqFcvWm7Hmrs_	Reactor for resin
3	https://youtu.be/DaKf7CQu6IQ?si=riOXOposkr7x5z47	Acrylic emulsion
4	https://youtu.be/cQEz7UjWliY?si=0OOfSfXFjgL6o1GC	Epoxy resin plant
5	https://youtu.be/eXvOma44cBI?si=pkcCkeXL19ArtSuY	Resin Plant
6	https://youtu.be/s6qPo84herU?si=5jBUgyAvLHL11ro9	Epoxy resin reaction
7	https://youtu.be/ufmLsE5hp6Y?si=ZWAaOzcii4m3Atfl	reactions of epoxy resin
8	https://youtu.be/kTxr4Z4mwj0?si=ZaqFFpgWxkQbovT3	Epoxy vs Polyurethane
9	https://youtu.be/kTxr4Z4mwj0?si=ZaqFFpgWxkQbovT3	Preparation of epoxy
10	https://youtu.be/ur3kdchsVDk?si=XUwHVkMjZkgX_yad	Photoconducting polymers
11	https://youtu.be/0T_2c7G7XaI?si=i_-w84jwPlaLiP7k	Mechanism of epoxy
12	https://youtu.be/tuRjaJdDLdQ?si=CWGLQvGj44UjwK-C	Polyamide resin

Sr.No	Link / Portal	Description
13	https://youtu.be/nhs947JrrnU?si=g2KpMdpff0aItMDy	Effects of Different Isocyanates on Polyurethanes
14	https://youtu.be/Sx7cjRjkZvU?si=D5NyX1q_DtrEU9kP	Preparation of silicone
15	https://youtu.be/WOArkEVsZCw?si=PRNGnA8CQB7sONfg	Polymer cross linking

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Second**
Course Title : **SAFETY IN SURFACE COATING INDUSTRIES**
Course Code : **322317**

I. RATIONALE

Coating industries, which encompass activities like paint manufacturing, painting, powder coating, and surface treatment, involve various chemicals, processes, and equipment that can pose significant risks to workers, the environment, and to the general public. Because of this, the inclusion of course 'Safety in Coating Industries' in the program of Surface Coating Technology is of high importance. Implementing and adhering to safety protocols, providing adequate training, and staying updated with industry best practices and regulations are all essential for maintaining a safe and successful coating operation.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply safe working practices in surface coating industries.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Conduct 5S of workplace
- CO2 - Use personal protective equipment.
- CO3 - Write safe operating procedure.
- CO4 - Operate fire preventing techniques
- CO5 - Practice first aid operation.

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	
322317	SAFETY IN SURFACE COATING INDUSTRIES	SCI	DSE	3	-	3	-	6	3	3	30	70	100	40	25	10	25@	10	-	-	150

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 Explain importance of housekeeping. TLO 1.2 Write concept of 5 S. TLO 1.3 Explain structure and role of safety committee.	**Unit - I Basics of Industrial Safety** 1.1 Introduction to Safety: Definition of Safety, Need of safety, Safety organization. 1.2 Importance of housekeeping in safety and Concept of 5S. 1.3 Organizing safety: Safety committee, Role of management, supervisors and workers, Role of Safety officer, Workplace air monitoring, Management of Change	Demonstration Presentations Chalk-Board Lecture Flipped Classroom
2	TLO 2.1 Explain sections of factories acts and Maharashtra factories rule related to safety. TLO 2.2 Write powers of factory inspectorate Director of Industrial safety and Health (DISH). TLO 2.3 Classify personal protective equipment (PPE).	**Unit - II The Factories Act 1948** 2.1 Introduction to factories act 1948 2.2 Maharashtra factories rules 1963. 2.3 Definition of factories, occupier, competent person, hazards process and workers. 2.4 Power of Director of Industrial safety and Health (DISH). 2.5 Personal protective equipment. 2.6 Categories of petroleum products.	Lecture Demonstration Assignment Seminar PPTs
3	TLO 3.1 List causes and preventive measures of accident. TLO 3.2 Write Safe operating procedures. (SOPs) for given process. TLO 3.3 Identify type of machine guards.	**Unit - III Accident Prevention** 3.1 Definition of accident. 3.2 Causes of accidents. 3.3 Prevention of accidents. 3.4 Safe operating procedures (SOPs). 3.5 Guarding of machineries. 3.6 Maintenance of equipment. 3.7 Onsite emergency plan.	Lecturer Demonstration Assignment Seminar PPTs

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.
4	TLO 4.1 Classify fires. TLO 4.2 List different fire preventive techniques. TLO 4.3 Explain Instrumentation for safe and efficient plant operation.	**Unit - IV Fire Safety** 4.1 Classification of fire. 4.2 Tetrahedron of fire. 4.3 Electric fire. 4.4 Fire preventing techniques: Fire extinguishers, Fire hydrant system, Smoke detectors, Water sprinklers, CO2 flooding systems. 4.5 Instrumentation for safe and efficient operation of plant.	Demonstration Presentations Chalk-Board Lecture
5	TLO 5.1 Explain work place ventilation and illumination. TLO 5.2 Classify first aid procedure with respect to injury. TLO 5.3 Prepare Material safety data sheet. (MSDS).	**Unit - V Industrial Hygiene and First Aid** 5.1 Definition of industrial hygiene. 5.2 Workplace Ventilation, illumination. 5.3 Fundamentals of first aid. 5.4 First aid procedures for: Burn, Suffocation, Toxic ingestion, Insect and animal bites, Bandaging 5.5 Fracturs, Cardio pulmonary resuscitation (CPR) 5.6 Material safety data sheet (MSDS)	Lecture Demonstration Assignment Seminar PPTs

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 Illustrate 5S applications for laboratories	1	Illustration for 5S applications at different laboratories *	3	CO1
LLO 2.1 Prepare checklist for housekeeping.	2	Preparation of checklist for housekeeping for various workstations.*	3	CO1
LLO 3.1 Practice respiratory protective equipment.	3	Use of respiratory protective equipment.	3	CO2
LLO 4.1 Practice Non-respiratory protective equipment.	4	Use of Non-respiratory protective equipment.*	3	CO2
LLO 5.1 Prepare maintenance chart for machine / Equipment.	5	Preparation of maintenance chart for machine / Equipment.*	3	CO3
LLO 6.1 Prepare standard operating procedure.	6	Preparation of standard operating procedure for various machine and equipment	3	CO3
LLO 7.1 Practice hand / power tools for safe handling.	7	Use of hand / power tools for safe handling.	3	CO3
LLO 8.1 Identify guarding of machines.	8	Identification and marking of guarding of machines.*	3	CO3
LLO 9.1 Use portable fire extinguisher.	9	Operate different portable fire extinguisher for fire extingushing.*	3	CO4
LLO 10.1 Use of fire hydrant system.	10	Practice fire hydrant system.	3	CO4
LLO 11.1 Use fire alarm system.	11	Operation of fire alarm system for fire detection	3	CO4
LLO 12.1 Practice lung function test.	12	Perform lung function test.	3	CO4
LLO 13.1 Use of sound level meter.	13	Determination of sound level using sound level meter.	3	CO5
LLO 14.1 Use of lux meter.	14	Determine light intensity by using lux meter.*	3	CO5
LLO 15.1 Use of Anemometer.	15	Determine air velocity using Anemometer.	3	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Practice cardio pulmonary resuscitation (CPR)	16	Perform cardio pulmonary resuscitation (CPR)*	3	CO5
LLO 17.1 Use bandaging.	17	Practice of bandaging for different injuries	3	CO5
LLO 18.1 Prepare a plant layout.	18	Preparation of plant layout.	3	CO5
LLO 19.1 Prepare a chart on chemical compatibility.	19	Preparation of chart on chemical compatibility.	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)

NA

- NA

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Dust Masks	4
2	PVC apron	3
3	Canisters	4
4	Half face masks	4
5	Full Face masks	4
6	Safety shoes	3
7	Safety Goggles	3
8	Hand gloves	3
9	Drilling machine	7
10	Screw drivers	7
11	Hammer	7
12	Dry Chemical powder (ABC types) Fire extinguisher	9
13	Fire hydrant system	10
14	Sound level Meter	13
15	Lux meter	14
16	Anemometer	15

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	Basics of Industrial Safety	CO1	9	4	4	6	14
2	II	The Factories Act 1948	CO2	9	4	4	6	14
3	III	Accident Prevention	CO3	9	4	4	6	14
4	IV	Fire Safety	CO4	9	4	4	6	14
5	V	Industrial Hygiene and First Aid	CO5	9	4	4	6	14
Grand Total				**45**	**20**	**20**	**30**	**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 Test (Average of two sessional examinations)

Summative Assessment (Assessment of Learning)

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

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	2			
CO2	2	1	-	2	1	1	2			
CO3	2	-	-	-	-	1	2			
CO4	2	-	-	2	1	1	2			
CO5	2	-	-	2	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
1	A.M. Sarma	Industrial Health and safety Management	Himalaya Publishing House, Mumbai, 2008 ISBN No. : 9788178664514
2	D.M. Dhar	Industrial Safety Management	Everest Publishing House, Pune ISBN: 9788176601284
3	Labor Law Agency, Mumbai	The Factories Act, 1948	Labor Law Agency, Mumbai, 2018
4	National Safety Council, Mumbai	A Practical Guide on Safety, Health & environment Vol-III	National Safety Council, Mumbai, 2010
5	National Safety Council, Mumbai	A Practical Guide on Safety, Health & environment Vol-II	National Safety Council, Mumbai, 2010

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/wDjCnPmNKuc?si=40rqjwNgRX9o-H-9	Industrial Housekeeping
2	https://youtu.be/MGW0JvUAmho?si=sS7t4Sndmdn_9nM4	5S Workplace Organization

Sr.No	Link / Portal	Description
3	https://youtu.be/dse9B9wlla4?si=Mi8VAAcXMUbMGoBc	Lean - 5S
4	https://youtu.be/hRY0XjOp0Ws?si=3UXFbHh9NFm5xzjd	Safety Tip: Respiratory Protection
5	https://youtu.be/wGSwsaagWoY?si=Biveh3MASRSBDcVq	Personal Protective Equipment for Management
6	https://youtu.be/GpzsY8bwUWk?si=uBFfgGP9LiC5ReGJ	Respiratory protection - CERVA (2/2019)
7	https://youtu.be/N089MSgFOgE?si=Gbx4J824oTycgKDd	Best Respirators
8	https://youtu.be/DfhmLyMF2W0?si=jICQ27mD7lb2SXbl	Forklift Safety
9	https://youtu.be/vdbg6nJaoEU?si=u-ikAZ2DfZyZbdds	Safety at work
10	https://youtu.be/gre00m4_f3E?si=HoXrFq-Nr-WXPG7Y	What Is A Class C Fire Extinguisher?
11	https://youtu.be/0Pgxvw9TyPU?si=ElDh96KhiAfM6g-k	Extinguisher Training
12	https://youtu.be/d8WB25WV1x0?si=vdrgm51acTgFZMM6	Fire Extinguishers
13	https://youtu.be/EAdKk0swycU?si=3cFwSzhOR6aDp8ql	Best Class K Fire Extinguishers
14	https://youtu.be/d9btBXMocsc?si=eZYIMfHnoj5sopd6	Ventilation Basics
15	https://youtu.be/1K8STobSufY?si=qqE8KhvestXoazqg	Industrial Smoke Ventilation: A Case Study
16	https://youtu.be/jk03LDfLlNI?si=aPLKtYCXjMgdrDET	What should be in a first aid kit?
17	https://youtu.be/5KlQN_p3upM?si=TlDeYZXT7oS5Lqol	How to Bandage an Elbow
18	https://youtu.be/T7zq4TLxSEY?si=lCuRmgHslqsoNop9	How Smoke Detectors Work - Introduction to Fire Alarms

Programme Name/s : **Surface Coating Technology**
Programme Code : **SC**
Semester : **Second**
Course Title : **SOLVENTS AND ADDITIVES TECHNOLOGY**
Course Code : **322318**

I. RATIONALE

This course introduces basic knowledge of solvents and additives used in paints and coatings. It includes testing and understanding of test methods and results. In addition to this it will explore working mechanism of materials to students. Students also get awareness about safe handling of materials.

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: • Classify solvents and additives used in surface coating industries.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Classify solvents.
- CO2 - Test relevant solvent for coatings.
- CO3 - Select relevant additives for water-based coatings.
- CO4 - Select relevant additives for solvent based coatings.
- CO5 - Explain significance of special purpose additives.

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	
322318	SOLVENTS AND ADDITIVES TECHNOLOGY	SAT	DSC	3	-	3	2	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

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 Explain role of solvents, Diluents, polar & non Polar Solvents TLO 1.2 Write common usages of solvents in Industries TLO 1.3 List different precautions for storage and handling of solvents	**Unit - I Introduction to Solvents** 1.1 Introduction to solvents and diluents. 1.2 Classification of solvents. Aliphatic, Aromatic, Alcohols Esters, Ketone, Ethers, Water. 1.3 General uses of solvents in paint industries. 1.4 Safe handling and storage of solvents.	Chalk-Board Presentations Demonstration Video Demonstrations
2	TLO 2.1 List properties of solvents. TLO 2.2 Write application of type of solvents in respective polymer & coatings TLO 2.3 Write procedure for testing of solvents.	**Unit - II Hydrocarbon and Oxygenated solvents** 2.1 Properties and application of; MTO, Xylene, Toluene, Isopropyl alcohol, MEK, MIBK, Butyl acetate, Ethyl acetate, Pine oil 2.2 Testing of solvents: Color and Clarity, Flash point, Specific gravity, Solvent power, Distillation range, Evaporation rate, Refractive index 2.3 Conductivity, Acidity and alkalinity, Boiling point	Chalk-Board Presentations Demonstration Video Demonstrations
3	TLO 3.1 Classify Surface active agents. TLO 3.2 Explain working mechanism of additives in water based coatings. TLO 3.3 Explain importance of additive dosage in water based coatings.	**Unit - III Additives for water based coatings** 3.1 Introduction of additives for water based systems & Classification of surface active agents 3.2 Working mechanism of Thickeners, Wetting & Dispersing agents, Emulsifier, Coalescent agents, Antisettling agents, Antifoamers and Defoamers 3.3 Use of Perseverative, Biocides in paints	Chalk-Board Presentations Demonstration Video Demonstrations
4	TLO 4.1 Explain significance of additives in solvent based coatings TLO 4.2 Explain working mechanism of additives in solvent based coatings TLO 4.3 Explain importance of additive dosage in solvent based coating.	**Unit - IV Additives for solvents based coatings** 4.1 Introduction to additives for Solvent based systems. 4.2 Working mechanism, of; Rheology modifiers, Wetting and Dispersing agents, Antisettling agents, Antiskinning agents, Driers 4.3 Flow and leveling agents, UV Stabilizers, Adhesion promoters, Slip and mar resistance.	Chalk-Board Presentations Demonstration Video Demonstrations
5	TLO 5.1 Explain role of special purpose additives. TLO 5.2 Explain working mechanism of special purpose additives. TLO 5.3 Explain applications of special purpose additives.	**Unit - V Special purpose additives** 5.1 Explain role of special purpose additives such as; Plasticizers, Photoinitiators, Wax additives, 5.2 Anti floating/anti flooding agents, Flame retardant additives, 5.3 Matting agents, Conductivity modifiers, Corrosion inhibitors.	Chalk-Board Presentations Demonstration Video Demonstrations

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 Test out color & clarity of Solvent samples.	1	Testing of Color & clarity of Solvent samples using colorimeter.*	3	CO1
LLO 2.1 Test Miscibility of Solvents.	2	Testing of Miscibility of different solvent based on their chemical classification.*	3	CO1
LLO 3.1 Test Compatibility of Solvents.	3	Testing of compatibility of solvents in various polymers with respect to thier functionality.*	3	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Measure Viscosity of Solvents	4	Measurement of viscosity of solvents using Ostwald's viscometer.	3	CO2
LLO 5.1 Determine Flash Point of Solvent samples.	5	Determination of Flash Point of solvents using Abel's Flash Point apparatus.	3	CO1
LLO 6.1 Determine specific gravity of solvent	6	Determination of specific gravity of solvent using Hydrometer & specific gravity bottle.*	3	CO2
LLO 7.1 Determine Refractive Index of Solvent.	7	Determination of refractive index of solvent using Refractometer.	3	CO2
LLO 8.1 Determine Distillation Range of Solvent.	8	Determination of distillation range of solvent using distillation apparatus.	3	CO2
LLO 9.1 Determine efficiency of anti-settling agent.	9	Determination of effect of settling in paints using anti-settling agents.	3	CO3
LLO 10.1 Determine efficiency of surface active agent.	10	Determination of effect of surface active agent in paints.	3	CO3
LLO 11.1 Measure Viscosity of Thickeners	11	Measurement of viscosity of thickener in water at different concentration.	3	CO3
LLO 12.1 Test effect of Defoamers for water-based paint.	12	Testing efficiency of Defoamers for water-based paint at different concentration.*	3	CO3
LLO 13.1 Prepare oil in water emulsion using emulsifier.	13	Preparation of Oil in water emulsion using emulsifier and test stability of emulsion.*	3	CO3
LLO 14.1 Test effect of flow & levelling agent.	14	Testing of Flow & levelling agent in paint at different concentration by testing with sag Index meter.	3	CO4
LLO 15.1 Measure drying time of alkyd resin film using driers.	15	Measurement of drying time of alkyd resin film using driers at different dosage.*	3	CO4
LLO 16.1 Test efficiency of adhesion promoter.	16	Testing efficiency of adhesion promoter in the applied coating using cross cut adhesion tester.	3	CO4
LLO 17.1 Test effect of Antiflooding & anti-floating agents.	17	Testing of Antiflooding & anti-floating agents in paints to test uniform dispersion	3	CO4
LLO 18.1 Measure effect of matting agents.	18	Measurement of effect on gloss for paint film with use of matting agents in paints.	3	CO5
LLO 19.1 Measure Conductivity of Polar & Non polar Solvents.	19	Measurement of conductivity of polar & nonpolar solvents using conductivity meter.	3	CO5
LLO 20.1 Test effect of plasticizers in coating.	20	Measurement of effect of plasticizer additive in coating using scratch hardness test & adhesion test.*	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 chart of Solvents based on their chemical classification
- Write report on types of solvents & their soluble resin
- Collect information of Diluents, Classification & their types
- Prepare report on important physical properties of types of solvents
- Collect information about safe handling practices for solvents
- Collect Information about government regulations about storage, transportation & safety standards

- Prepare report on Important laboratory tests to test purity of solvents
- Write report on classification of surfactants & Important additives classified under each group
- Collect Information about types of additives used for water based paints
- Prepare project report on principle of working /working mechanism for water based additives
- Prepare report on dosage of additives & their calculations used for water based paints
- Collect Information about types of additives used for solvent based paints
- Prepare project report on principle of working /working mechanism for solvent based additives
- Prepare report on dosage of additives & their calculations used for solvent based paints
- Collect information on types of Plasticizers, classification & their applications
- Prepare report on types of Flame retardant additives & their working principles used in fire resistant coating
- Prepare report on types of silicon additives used in coating Industries
- Write report on principles of conductivity modifiers, classification & their available types

Term work

- 1. Prepare journal for laboratory work

Assignment

- Prepare a chart of role of Solvents & Additives
- Write Report on chemical classification of Solvents
- Prepare report on types of surface active agents

Note :
These are just the suggestive topics, Faculty must design microprojects / Activities/ Assignments based on the course outcome requirements.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Colorimeter	1
2	Glassware	1,2,3,9,10
3	Ostwald Viscometer	4
4	Abel's Flash Point apparatus	5
5	Hydrometer	6
6	Specific gravity bottle	6
7	Refractometer	7
8	Laboratory Distillation unit	8
9	Conductivity meter	19
10	B-4 Viscometer cup	11
11	Laboratory stirrer	12,13,15,16,17,20
12	Film applicator	14
13	Cross cut adhesion tester	16
14	Gloss-o-Meter	18

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 Solvents	CO1	9	2	4	8	14
2	II	Hydrocarbon and Oxygenated solvents	CO2	9	2	4	8	14
3	III	Additives for water based coatings	CO3	9	2	4	8	14
4	IV	Additives for solvents based coatings	CO4	9	2	4	8	14
5	V	Special purpose additives	CO5	9	2	4	8	14

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
Grand Total				45	10	20	40	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid term tests
- Seminar/Presentation
- Assignment, Self learning

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	-	-	2	-	2			
CO2	3	1	-	-	1	-	2			
CO3	3	2	1	-	1	-	2			
CO4	3	2	1	-	2	-	2			
CO5	3	2	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)	Surface 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=kT--nI_16AA	Use of solvents in paints
2	https://homesteady.com/info-8705621-difference-between-solve nt-diluent.html	Difference between Diluents & thinners
3	https://www.youtube.com/watch?v=iWqHUS2pdgA	Protic & aprotic solvents
4	https://www.youtube.com/watch?v=IvEj2dubGh8	Classification of Solvents
5	https://www.youtube.com/watch?v=cxl20zyb7pg	Physical properties of solvents
6	https://lab-training.com/factors-deciding-choice-solvents-la boratory/	Important lab tests for solvents
7	https://www.youtube.com/watch?v=ulG05K1Klm4	Safe handling of solvents in chemical plants
8	https://www.youtube.com/watch?v=yM-8Ixl1yDU	Understanding additives for paint
9	https://slideplayer.com/slide/3717285/	Additives for architectural paint
10	https://www.youtube.com/watch?v=UaD1f3FLMEI	Additives secret for controlling performance
11	https://paintsandcoatingsexpert.com/2020/06/04/silicone-addi tives-with-low-cyclic-siloxanes-eu-reach-compliant-silicone-additives-byk-tutorials/	Silicone additive es with low cyclic siloxanes
12	https://www.youtube.com/watch?v=iEoADLYj-Os	Introduction to chemistry for UV coating
13	https://www.youtube.com/watch?v=u3fLggd2whA	Introduction to electrically conductive coatings, paints & Ink
14	https://www.youtube.com/watch?v=VpRrP3sqQLw	How corrosion Inhibitors protect metal