MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME FOR POST H.S.C. DIPLOMA COURSES.

COURSE NAME : DIPLOMA IN SURFACE COATING TECHNOLOGY

COURSE CODE : SC

DURATION OF COURSE: 6 SEMESTER — **WITH EFFECT FROM 2019-20**

SEMESTER : FIRST — **DURATION : 16 WEEKS**

PATTERN : FULL TIME - SEMESTER — **SCHEME : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory							Practical					
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total	
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	English	ENG	22101	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
2	Industrial Chemistry	ICT	24112	3	-	4	7	3	70	28	30*	00	100	40	50@	20	50	20	100	40	200
3	Resin Technology-I	BHK	24113	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
4	Pigment Technology-I	BFO	24114	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200
5	Fundamentals of ICT	ICT	22001	2	-	2	4	--	--	--	--	--	--	--	25@^	10	25~	10	50	20	50
			Total	**14**	**-**	**16**	**30**	**--**	**280**	**--**	**120**	**--**	**400**	**--**	**200**	**--**	**200**	**--**	**400**	**--**	**800**

Student Contact Hours Per Week: **30 Hrs.** Medium of Instruction: **English**

Theory and practical periods of 60 minutes each. Total Marks : **800**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination , ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

Program Name : Diploma in Food Technology/ Diploma in Printing Technology / Diploma in Surface Coating Technology / Diploma in Travel & Tourism / Diploma in Hotel Management & Catering Technology / Diploma in Architecture Assistantship / Diploma in Medical Laboratory Technology.

Program Code : FC / PC / PN / SC / TR / HM / AA / ML

Semester : First

Course Title : English

Course Code : 22101

1. RATIONALE

English language skills have become inevitable in the era of globalization. The skills of language contribute substantially to the career of engineering profession, where almost all the service manuals, installation and commissioning manuals of the various equipment are in English and technologist has to interpret them correctly. Competency in English is need of the hour, not only for Indian industry, but also worldwide, where diploma engineers have the employable opportunity. Therefore, the basic English skills- listening, speaking, reading and writing have become almost mandatory for employability. This course is therefore designed to help the students to communicate in English effectively.

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- **Communicate in English in spoken and written form effectively.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Formulate grammatically correct sentences.
b. Summarise comprehension passages.
c. Compose dialogues and paragraphs for different situations.
d. Use relevant words as per context.
e. Deliver prepared speeches to express ideas, thoughts and emotions.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken

during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.
Legends: *L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

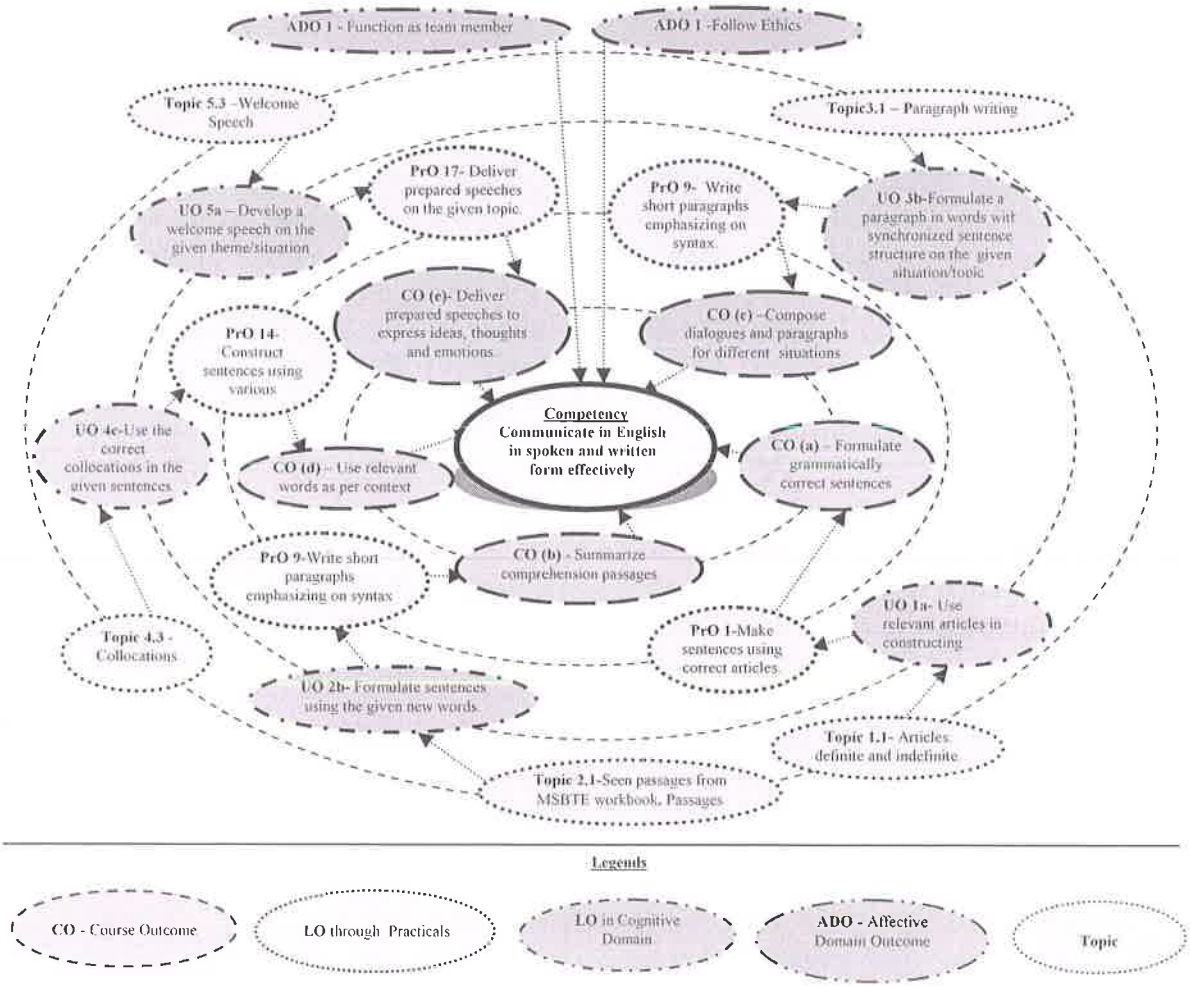

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Use 'language laboratory' for different practical tasks		
1	Make sentences using correct articles.	I	2
2	Construct sentences using correct prepositions.	I	2*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Formulate sentences using correct conjunctions/connectors.	I	2
4	Rewrite sentences using relevant forms of verbs.	I	2*
5	Change the voice from active to passive and vice –versa.	I	2*
6	Change the narration direct to indirect and vice –versa.	I	2*
7	Repeat words on Language Lab software after listening to them.	I	2*
8	Deliver oral presentations using correct grammar.	I	2*
9	Write short paragraphs emphasizing on syntax.	II	2*
10	Compose dialogues on various situations.	III	2
11	Enact a role play.	III	2*
12	Construct sentences using idioms.	IV	2*
13	Narrate anecdotes of various situations.	IV	2
14	Construct sentences using various collocations.	IV	2
15	Answer questions based on the given passage.	IV	2
16	Use correct pronunciations and voice modulation while reading articles from different sources.	IV	2*
17	Deliver prepared speeches on the given topic.	V	2*
18	Repeat dialogues on Language Lab software after listening to them.	V	2*
	Total		**36**

Note

i. *A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S.No.	Performance Indicators	Weightage in %
a.	Setting up of language laboratory	10
b.	Using the language laboratory skillfully	30
c.	Follow Safety measures	10
d.	Work in teams	20
e.	Respond to given questions	10
f.	Self-learning	20
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Maintain Cleanliness.
c. Demonstrate working as a leader/a team member.
d. Follow ethics.

Acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Language Lab with relevant software and Computer system with all necessary components like: Motherboard, Random Access Memory (RAM), Read-Only Memory (ROM), Graphic cards, Sound Cards, Internal Hard Disk Drives, DVD drive, Network Interface Card	All
2	LCD Projector with document reader	All
3	Smart Board with networking	All

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Applied Grammar	1a. Use relevant articles in constructing sentences. 1b. Apply prepositions to construct meaningful sentences. 1c. Identify conjunctions to connect phrases and clauses in the specified sentences. 1d. Use correct form of tenses in given situation. 1e. Change the active and passive voice from the specified passage/list. 1f. Change the narration for the given situation.	1g. Formulate grammatically correct sentences for the specified situation. 1h. Use relevant Prepositions for the situation mentioned. 1i. Apply relevant conjunctions to use idiomatic language for the given situation. 1j. Apply the relevant voice in formal communication for the given passage. 1k. Use relevant narrations for the given situation.	1.1. Articles: Definite and Indefinite 1.2. Prepositions: Usage 1.3. Conjunctions: Coordinating and Subordinating 1.4. Types of sentences: Assertive, Imperative, Exclamatory, Interrogative 1.5. Tenses - Present Tense (Simple, Continuous, Perfect) - Past Tense (Simple, Continuous, Perfect) - Future Tense (Simple) 1.6. Active and Passive Voice 1.7. Direct and Indirect Speech

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	**Speaking Skills**	
Unit– II Comprehension	2a. Answer the given questions of the specified passage. 2b. Formulate sentences using the given new words 2c. Use correct syntax to construct meaningful sentences for the given situation. 2d. Answer the questions on the given unseen passage.	2e. Pronounce the words correctly in the given passage. 2f. Give oral instructions with correct pronunciation and intonation for the given situation. 2g. Answer the questions orally on the given unseen passage with correct pronunciation.	2.1 Seen Passages From Msbte Work Book 2.2 Importance Of Comprehension 2.3 Unseen Passages 2.4 Interpretation Of Passages In Written And Spoken Form
Unit– III Paragraph and Dialogue Writing	3a. Differentiate the given types of paragraphs with justification. 3b. Formulate a paragraph in words with synchronized sentence structure on the given situation / topic. 3c. Explain the theme on given paragraph precisely.	3d. Summarise the given paragraph with correct pronunciation and intonation. 3e. Take part in debates with correct pronunciation, intonation and using verbal and non-verbal gestures on the given themes.	3.1 Types of Paragraph i. Technical ii. Descriptive iii. Narrative iv. Compare and Contrast 3.2 Dialogue Writing i. Greetings ii. Development of Dialogue iii. Closing Sentence
Unit– IV Vocabulary Building	4a. Remove the spelling errors in the given sentences/paragraph . 4b. Use relevant words to correctly express for the given themes/situation. 4c. Use the collocations correctly. 4d. Construct sentences using given idioms.	4e. Speak in specified formal situations with correct pronunciation. 4f. Speak in specified informal situations with correct pronunciation. 4g. Speak sentences using relevant collocations	4.1. Rules of Spelling 4.2. Words Often Confused 4.3. Collocations 4.4. Idioms
Unit-V Speeches	5a. Develop a welcome speech on the given theme/situation. 5b. Develop a farewell speech for the given theme/situation.	5e. Introduce oneself with correct pronunciation, intonation and using verbal and non-verbal gestures. 5f. Give extempore talks	5.1. Importance of Public Speaking 5.2. Characteristics of Good Speech 5.3. Welcome Speech 5.4. Farewell Speech

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	5c. Formulate a speech for introducing a guest in the given situation. 5d. Develop a vote of thanks for the given situation.	with correct pronunciation, intonation and using verbal and non-verbal gestures for the given theme/ situation.	5.5. Introducing a Guest 5.6. Vote of Thanks

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Blooms's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Applied Grammar	12	02	04	08	14
II	Comprehension	20	05	06	13	24
III	Paragraph and Dialogue Writing	06	02	04	06	12
IV	Vocabulary Building	06	02	04	06	12
V	Speeches	04	02	02	04	08
Total		**48**	**13**	**20**	37	**70**

***Legends**: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect good articles from newspapers and find and write the meanings of words.
b. Listen to TV news.
c. Read articles from magazines/newspapers.
d. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the

development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

a. Arrange various communication activities using functional grammar.
b. Show video/animation films to develop listening skills and enhance vocabulary.
c. Use real life situations for explanation.
d. Prepare and give oral presentations.
e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

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 which are in fact, an integration of practicals PrOs, UOs and ADOs. 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 ***16 (sixteen) 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:

a. Develop language games, activities, crossword puzzles enhancing word power to be used in English language.
b. Prepare advertisement for five technical projects using contextual vocabulary.
c. After studying standard English newspapers, prepare a booklet identifying various grammatical aspects of sentences.
d. Prepare a booklet of the interviewing any successful person in your locality in context with his life journey, inspiration, social contribution, role model and keys to success.
e. Prepare a booklet of the contribution of eminent Indian scientists and develop well organized paragraphs.
f. Summarise the contents of a famous book/books.[fiction/non fiction]
g. Prepare a collage using different idioms with their origins and their contextual usage.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	English Workbook	MSBTE	MSBTE, Mumbai, 2017
2	Effective English with CD	Kumar, E. Suresh; Sreehari, P.; Savithri, J.	Pearson Education, Noida, New Delhi, 2009 ISBN: 978-81-317-3100-0
3	English Grammar at Glance	Gnanamurali, M.	S. Chand and Co. New Delhi, 2011 ISBN:9788121929042
4	Essential English Grammar	Murphy, Raymond	Cambridge University Press, New Delhi, Third edition, 2011, ISBN: 9780-0-521-67580-9

S. No.	Title of Book	Author	Publication
5	Living English Structure	Allen, W.S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN:108131728498,99

14. SOFTWARE/LEARNING WEBSITES

a. https://www.britishcouncil.in/english/learn-online
b. http://learnenglish.britishcouncil.org/en/content
c. http://www.talkenglish.com/
d. languagelabsystem.com
e. www.wordsworthelt.com

Program Name : **Diploma in Surface Coating Technology**

Program Code : **SC**

Semester : **First**

Couse Title : **Industrial Chemistry**

Couse Code : **24112**

1. RATIONALE

This course will help to understand the fundamentals of chemistry. Student will familiarize with raw materials and specialty chemicals and its applications in surface coating industries. It will also explain the principle of electrochemistry along with area of application in industries. Besides, another important topic of sewage and industrial waste water treatment, factors responsible for pollution and environmental protection will be deal with it.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply the principles of industrial chemistry for characterizing the chemical materials.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Prepare solutions of various concentrations.
b. List various oils used in surface coating with their properties and applications.
c. Judge quality of water with justification.
d. Understand principles of electrochemistry and corrosion.
e. Test application properties of specialty materials.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
				Theory							Practical						
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	--	4	7	3	70	28	30*	00	100	40	50@	20	50	20	100	40	

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos, @: with external examiner.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

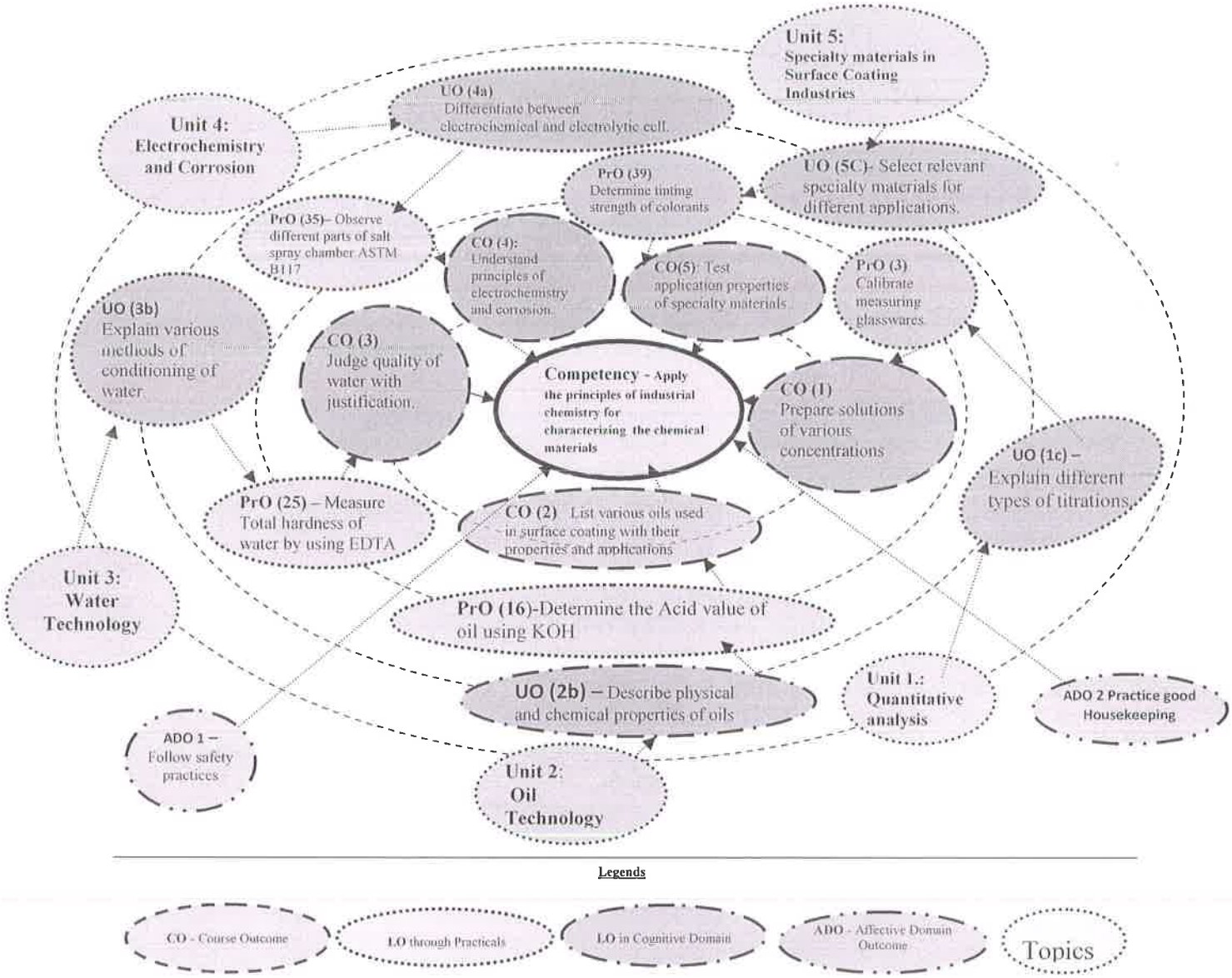

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Use of personal protective equipments.	I	2
2	Identify given measuring glassware with their specifications.	I	2
3	Calibrate measuring glasswares.	I	2*
4	Prepare Phenolphthalein indicator as per given specification.	I	2
5	Prepare Methyl Orange indicator as per given specification.	I	
6	Prepare primary standard solution using Oxalic acid as per given specification. (Part I: Preparation of regents)	I	2*

7	Prepare primary standard solution using Oxalic acid as per given specification. (Part II: Standardization of Oxalic acid solution)	I	2*
8	Prepare primary standard solution Sodium carbonate as per given specification. (Part I: Preparation of regents)	I	2
9	Prepare primary standard solution Sodium carbonate as per given specification. (Part II: Standardization of Sodium carbonate solution)	I	2
10	Prepare KOH solution of various normalities.	I	2*
11	Prepare NaOH solution of various normalities.	I	2
12	Prepare HCl solution of various normalities.	I	2*
13	Prepare Acetic Acid solution of various normalities.	I	2
14	Test pH of acid and alkali solutions using pH meter, pH paper and indicator	I	2*
15	Determine ash content of given compound using furnace.	I	2
16	Determine Acid value of oil using KOH	II	2*
17	Determine saponification value of oils.	II	2
18	Determine iodine value of oils using Wij's solution	II	2
19	Determine density of oils using Hydrometer	II	2
20	Determine density of oils using Weight per liter cup	II	2
21	Determine density of oils using Specific gravity Bottle	II	2*
22	Determine viscosity of oils using flow cup	II	2*
23	Determine viscosity of oils using Gardner tube viscometer.	II	2
24	Compare viscosities of oils by varying the temperature by Redwood viscometer.	II	2
25	Measure Total hardness of water by using EDTA method	III	2*
26	Measure Magnesium hardness of water by using EDTA method	III	2
27	Determine chloride content of water by silver nitrate	III	2
28	Measure Calcium hardness of water by Murexide method	III	2
29	Measure P alkalinity of water.	III	2*
30	Measure M alkalinity of water.	III	2
31	Measure Conductivity of water by conductivity meter.	III	2
32	Measure pH of Water by pH meter.	III	2
33	Prepare distilled water using simple distillation method.	III	2*
34	Verify Faraday's Law of electrochemistry	IV	2*
35	Observe different parts of salt spray chamber ASTM B117	IV	2*
36	Observe different parts of salt spray chamber IS 101	IV	2
37	Determine rate of corrosion in acidic solution	IV	2*
38	Determine adhesive strength of adhesive	V	2
39	Determine tinting strength of colorants	V	2*
40	Determine water absorptivity for water proofing materials	V	2
	Total		48

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical needs to be performed, out of which, the practicals marked as '' are compulsory, so that the*

student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
a.	Arrangement of available glassware/equipment	10
b.	Setting and operation	20
c.	Safety measures and Housekeeping	20
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Weighing Balance (Digital , 0.01gm)	All PrOs
2	Burette (50ml)	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
3	Burette Stand	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
4	Pipette (10ml,25ml)	2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,18,25,26,27, 28,29,30,31,32
5	Conical Flask (25 ml,50ml,250ml)	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
6	Volumetric Flask (50ml,250ml,500ml,1000ml)	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Weighing Balance (Digital , 0.01gm)	All PrOs
7	Measuring Cylinder (10ml,100ml)	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
8	Gloss Rod (6mm Diameter)	2,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
9	Beaker (100ml,250ml,500ml,1000ml)	2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,18,19,20,21, 22,23,24,25,26,27,28,29,30,31,32,33,34,37,40
10	Specific Gravity bottle (15ml)	21
11	pH Meter	14,32
12	Hydrometer	19
13	Weight per liter Cup (50cc,100cc)	20
14	Gardner Tube Viscometer	23
15	Furnace	15
16	Conductivity Meter	31
17	Water Condenser	33
18	Thermometer (0^0C to 110^0C)	22,24,33
19	Round Bottom Flask (500 ml)	17,33
20	Salt Spray Chamber ASTM B117	35
21	Salt Spray Chamber IS 101	36
22	Redwood Viscometer	24
23	Flow Cup B4	22
24	Stopwatch (Analogue)	22
25	Watch Glass (3")	2,4,5,6,7,8,9,10,11,12,13,16,17,18,25,26,27,28, 29,30
26	Metal Panel (100mm X 150 mm)	34,37
27	Silicon Crucible	15
28	Glass Plate	39
29	Spatula	39
30	Spring Balance	38
31	Electroplating Assembly	37
32	Air Condenser	17
33	Test Tube (15 ml)	2,3,4,5,6,7,8,9,10,11,12,13,16,17,18, 25,26,27,28, 29,30

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Quantitative Analysis	1a. Define terms related to volumetric analysis. 1b. Describe terms related to volumetric analysis 1c. Explain different types of titrations. 1d. Calculate terms related to volumetric analysis. 1e. Explain principle of gravimetric analysis.	1.1 Basic Concepts, definition & significance of atomic weight, molecular weight & equivalent weight of materials. 1.2 Concepts of Molar solutions, Molal solutions and Normal solutions, Types of titrations. 1.3 Preparation of Solutions- Primary & Secondary Standards, Types of Indicators, Selection of Indicators, 1.4 Calculations in volumetric analysis. 1.5 Introduction and Principle of gravimetric analysis.
Unit– II Oil Technology	2a. Classify different types of oils 2b. Describe physical and chemical properties of oils. 2c. Explain drying mechanism of oil. 2d. State uses of oils in paints and varnish industries. 2e. Determine oil length of binder.	2.1 Classification of oils, 2.2 Physical and chemical proprieties of Oils. 2.3 Drying mechanism of Oils. 2.4 Uses of Oils in paints and Varnish industries. 2.5 Concept of oil length in binders.
Unit-III Water Technology	3a. Define conditioning, purification and softening of water. 3b. Explain various methods of conditioning of water. 3c. Describe various water pollutants. 3d. Describe sewage water treatment. 3e. Sate significance of IS-10500 and IS-3025	3.1 Properties & uses of water. 3.2 Conditioning, purification and softening of water. 3.3 Methods of conditioning, Ion exchange resin, demineralization, distillation process, precipitation methods, phosphate conditioning, silica, iron and oxygen removal, Municipal water purification. conditioning of seawater. 3.4 Introduction to Water Pollution and various water pollutants. Sewage water treatment. 3.5 IS-10500, IS-3025
Unit-IV Electrochemistry and Corrosion	4a. Differentiate between electrochemical and electrolytic cell. 4b. State Faraday's law of electrolysis. 4c. Define anode and cathode. 4d. State applications of electrochemistry in industries. 4e. Describe the corrosion.	4.1 Introduction to Electro chemistry. 4.2 Faraday's laws of electrolysis. 4.3 Electro chemical series, 4.4 Introduction to Anode, Cathode and their reactions. 4.5 Applications of electrochemistry in various industries. 4.6 Introduction to corrosion and effects of corrosion.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit V: Specialty materials in Surface Coating Industries	5a. Describe types of specialty materials used in surface coating related areas. 5b. State properties of adhesives. 5c. Select relevant specialty materials for different applications.	5.1 Types of colorants. 5.2 Types, properties and applications of adhesives. 5.3 Applications of polymer in construction industries. 5.4 Introduction to sealants and underbody.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Quantitative Analysis	10	02	04	08	14
II	Oil Technology	10	02	04	08	14
III	Water Technology	10	02	04	08	14
IV	Electrochemistry and Corrosion	09	02	04	08	14
V	Specialty materials in Surface Coating Industries	09	02	04	08	14
Total		48	**10**	**20**	**40**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

1. Collect information regarding damages /consequences caused due to corrosion.
2. Collect information of various calibration methods of glasswares.
3. Visit to any paint and allied industry.
4. Visit to exhibitions and conferences.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Correlate subtopics with paint and allied industry.
g. Use Flash/Animations to explain various concepts, solutions preparations and analysis methods.
h. Before starting practical, teacher should demonstrate the working methodology.
i. Instructions to students regarding care and maintenance of measuring equipments.
j. Show video/animation films to explain principles of industrial procedures.
k. Teacher should ask the students to go through instruction and Technical manuals.

12. SUGGESTED MICRO-PROJECTS

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. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably 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. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. 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 ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Determine hardness and pH of water samples from different places.
b. Collect information about different types of edible oil with their physio-chemical properties.
c. Compare minerals present in potable water and waste water.
d. Collect information on waste water treatment plant.
e. Collect information of dust collector, scrubbing operations.
f. Collect information regarding different equipments present in market for water purification.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Quantitative Inorganic Analysis	Arthur I. Vogel	Woolwich Polytechnic, London ISBN : 9780582463219
2	Solvents, Oils, Resins& driers	Thos H Durrans	London ISBN : 9781295455638
3	Chemical Process Industries	R. Norris Shreve	McGraw-Hill Book Company, London ISBN: 0070858144

S. No.	Title of Book	Author	Publication
4	Fundamentals of Electrochemistry	V. S. Bagotsky	John Wiley & Sons, Inc., Hoboken, New Jersey ISBN: 978-0-471-70058-6
5	Concrete Technology	Dr.R.P.Rethaliya	Charotar Publishing House Pvt. ISBN-:78-93-80358-20-8
6	Wastewater Engineering Treatment and Reuse	Metcalf and Eddy	Tata Mc-Graw Hill Publishing Company Limited New Delhi ISBN:0-07-0495394

14. SOFTWARE/LEARNING WEBSITES

a) https://www.youtube.com/watch?v=vRvm5zrHxjI
b) https://www.youtube.com/watch?v=CWH4P2JVfcg
c) https://www.youtube.com/watch?v=6qutTkJ4rO8
d) https://www.youtube.com/watch?v=TjFlY9lkVAQ
e) https://www.youtube.com/watch?v=gvoQdRScZWY
f) https://www.youtube.com/watch?v=m8t4btjJd5Y
g) https://www.youtube.com/watch?v=OxhCU_jBiOA
h) https://www.youtube.com/watch?v=uzYVK7aa5oU
i) https://www.youtube.com/watch?v=J1ljxodF9_g
j) https://www.youtube.com/watch?v=8hvnqgN8cYg
k) https://www.youtube.com/watch?v=xxNfJLMNS4E
l) https://www.youtube.com/watch?v=Ag9Dym0Fwd0
m) https://www.youtube.com/watch?v=OnV9kq6j3Tk
n) https://www.youtube.com/watch?v=CtVNRJDj-ec
o) https://www.youtube.com/watch?v=5C-yyZfDhl8
p) https://www.youtube.com/watch?v=wRAo-M8xBHM
q) https://www.youtube.com/watch?v=6Kd0qIczD24
r) https://www.youtube.com/watch?v=uPkEGAHo78o
s) https://www.youtube.com/watch?v=QQL4-FOkzn4
t) https://www.youtube.com/watch?v=Q7yuDJUcJ74
u) https://www.youtube.com/watch?v=i4SF47hjnjQ

Program Name : **Diploma in Surface Coating Technology**

Program Code : **SC**

Semester : **First**

Couse Title : **Resin Technology-I**

Couse Code : **24113**

1. RATIONALE

This course introduces resins as a vehicle, medium, binder, film forming material and as a polymer in surface coatings. It includes raw materials, basic chemistry, manufacturing processes, properties and applications of resins. The course explains the function of resin in a particular paint and thereby affecting the performance during paint application, post application, during life cycle of paint.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Select relevant resins for preparation of paints and coatings.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Explain various polymers and polymerization techniques.
2. Select raw materials for resins.
3. State properties and applications of resins.
4. Determine physico-chemical properties of resins.
5. Select relevant resin for paints and coatings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

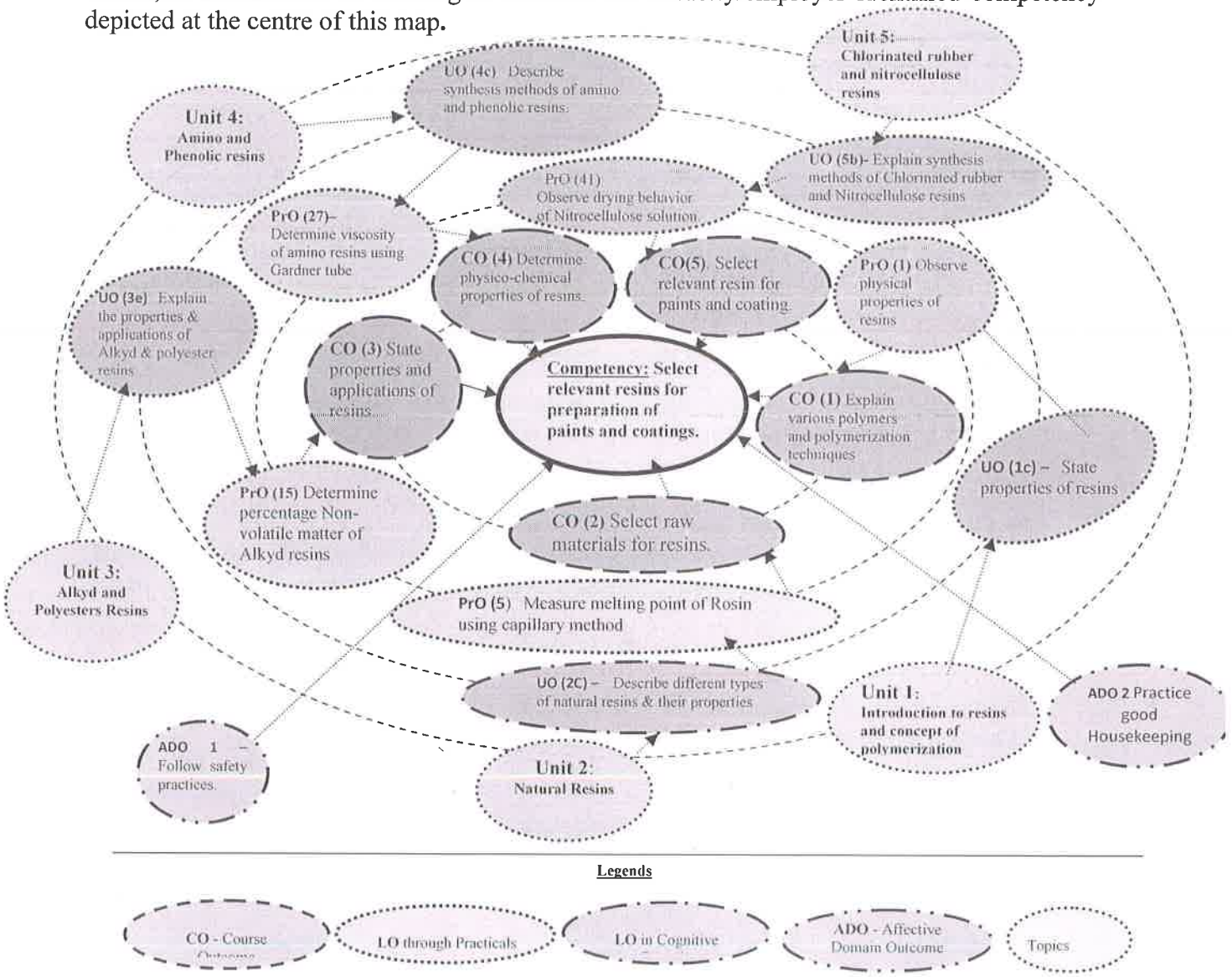

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Observe physical properties of resins.	I	2*
2	Measure electrolyte stability of emulsion using acid and alkali solution.	I	2*
3	Measure viscosity of emulsion using Brookfield viscometer.	I	
4	Measure melting point of Rosin using ring and ball method.	II	2
5	Measure melting point of Rosin using capillary method.	II	2*

6	Measure melting point of Shellac using ring and ball method.	II	2
7	Measure melting point of Shellac using capillary method.	II	2
8	Test solvent solubility of natural resin samples.	II	2
9	Determine the acid value of natural resin using KOH solution: (Part-I: Preparation and standardization of reagents)	II	2*
10	Determine the acid value of natural resin using KOH solution: (Part-II: Determination)	II	2*
11	Determine acid value of alkyd resin using KOH solution: (Part-I: Preparation and standardization of reagents)	III	2*
12	Determine acid value of alkyd resin using KOH solution: (Part-II: Determination)	III	2*
13	Determine acid value of polyester resin using KOH solution: (Part-I: Preparation and standardization of reagents)	III	2
14	Determine the acid value of polyester resin using KOH solution: (Part-II: Determination)	III	2
15	Determine percentage non-volatile matter of Alkyd resins.	III	2*
16	Determine viscosity of alkyd resins using flow cup method	III	2
17	Determine percentage non-volatile matter of polyester resins.	III	2
18	Determine viscosity of polyester resins using flow cup method	III	2*
19	Test the drying behavior of alkyd resin by varying concentration of drier.	III	2
20	Test the drying behavior of alkyd resin by varying parentage non-volatile matter.	III	2
21	Test the drying behavior of alkyd resin by varying wet film thickness.	III	2
22	Test acid, alkali resistance of alkyd resin film	III	2*
23	Test acid, alkali resistance of polyester resin film.	III	2
24	Determine the Hydroxyl value of alkyd resins. (Part-I: Preparation and standardization of Reagents)	III	2
25	Determine the Hydroxyl value of alkyd resins. (Part-II: Determination)	III	2
26	Determine viscosity of amino resins using flow cup method.	IV	2
27	Determine the viscosity of amino resins using Gardner tube viscometer.	IV	2*
28	Determine percentage non-volatile matter of amino resins.	IV	2
29	Determine melting point of solid phenolic resin using ring and ball method.	IV	2*
30	Determine melting point of solid phenolic resin using capillary method.	IV	2
31	Determine compatibility of phenolic resin with drying and nondrying oils.	IV	2
32	Determine optimum baking schedule of alkyd-amino resins with varying ratios. (Part –I: Preparation of panels)	IV	2*
33	Determine optimum baking schedule of alkyd-amino resins with varying ratios. (Part II: testing of panels)	IV	2*
34	Prepare chlorinated rubber solution.	V	2
35	Test viscosity and adhesion of chlorinated rubber film.	V	2
36	Determine percentage non-volatile matter of chlorinated rubber	V	2

	solution.		
37	Determine solubility of chlorinated rubber solution.	V	2
38	Test color and clarity of nitrocellulose solution.	V	2*
39	Determine viscosity of nitrocellulose solution.	V	2
40	Determine percentage non-volatile matter of nitrocellulose solution.	V	2
41	Observe drying behavior of Nitrocellulose solution.	V	2*
42	Observe compatibility of nitrocellulose solution with various resins.	V	2
	Total		48

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 24 or more practical needs to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment, raw materials, reagents etc.	05
b.	Setting and operation	20
c.	Safety and housekeeping	15
d.	Observations and Recording	20
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year

- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Test tubes (15 ml capacity)	01, 02, 8, 31, 37
2	Measuring Cylinders (10 ml, 50ml 100ml)	01, 02, 08, 22, 23, 31, 34, 36, 37, 38, 42
3	Beakers (50, 100, 250 ml)	All PrOs
4	Burette (50ml, L.C.: 0.1 ml)	02, 09, 10, 11, 12, 13, 14, 24, 25
5	Conical Flasks (100 ml, 250 ml)	02,09, 10, 11, 12, 13, 14, 24, 25
6	Volumetric flask (100, 250, 500 ml)	09, 10, 11, 12, 13, 14, 24, 25
7	Brookfield Viscometer (Manual Model)	03,
8	Ring and Ball Apparatus	04,06, 29,
9	Melting Point Apparatus	05, 07, 30
10	Capillaries	05, 07, 30
11	Thermometer (0-100 and 0-360^{O}C)	04, 05, 06, 07, 16, 18, 26, 27, 29, 30, 35
12	Pipette (10 ml, 25 ml)	09, 10, 11, 12, 13, 14, 24, 25
13	Glass rod (6 mm/10 mm)	All PrOs
14	Weighing Balance (Digital Display, 300 g, Sensitivity. 0.01 g)	09, 10, 11, 12, 13, 14, 15, 17, 20, 24, 25, 28, 35, 39
15	Petri Dish (size-3")	15, 17, 20, 28, 35, 40
16	Ovens (Max temp-250^{o}C)	15, 17, 20, 28, 32, 33, 40
17	Flow Cup B-4	16, 18, 26, 35, 39
18	Stop Watch (Analogue)	16, 18, 19, 20, 21, 22, 23, 26, 27, 40, 35, 39
19	Spirit Level	16, 18, 26, 34, 38
20	Metal Panels (MS panel, 75*100*0.8mm)	19, 20, 21, 22, 23, 32, 33, 41
21	Brush (Soft Brush, 1" rectangular)	19, 20, 21, 22, 23, 32, 33, 41
22	WFT Applicators (10, 25, 50, 100 micron)	21
23	Water Condenser	24, 25
24	Gardner Tube Viscometer	27

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Introduction to resins and concept of polymerization	1a. List various binders. 1b. Classify resins. 1c. State properties of resins. 1d. Write reactions of polymerization. 1e. Explain various methods of polymerization.	1.1 Concept of binders, resins and film former. 1.2 Classification of binders with examples. 1.3 Properties of resins. 1.4 Concept of polymerization. 1.5 Reactions of polymerization. 1.6 Methods of polymerization.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Natural Resins	2a. Name various sources of natural resins. 2b. List natural resins. 2c. Describe different types of natural resins & their properties 2d. State modification of natural resins. 2e. State properties & applications of natural resins. 2f. State application of varnishes. 2g. List properties and application of bituminous & hydrocarbon resins.	2.1 Introduction to natural resins and their sources. 2.2 Processing methods of natural resins. 2.3 Properties & applications of natural resins. 2.4 Modification of natural resins. 2.5 Introduction to varnishes. 2.6 Properties and applications of bituminous compounds and hydro carbon resins.
Unit-III Alkyd and Polyesters Resins	3a. Classify alkyd and polyester resins. 3b. Describe different raw materials for alkyd and polyester resins. 3c. Write esterification reactions for formation of alkyd and polyester resins. 3d. Explain manufacturing method of alkyd and polyester resin. 3e. State properties & applications of alkyd & polyester resins. 3f. Describe modifications of alkyd and polyester resins.	3.1 Introduction to alkyd resins. 3.2 Classification of alkyd resins. 3.3 Raw materials for alkyd resins. 3.4 Esterification reactions of alkyd. 3.5 Manufacturing methods of alkyd. 3.6 Properties & applications of alkyd. 3.7 Modifications of alkyd resins. 3.8 Introduction to polyester resins. 3.9 Classification of polyester resins. 3.10 Raw materials for polyester resins. 3.11 Esterification reactions of polyester. 3.12 Manufacturing methods for polyester resins. 3.13 Properties and application of polyester resin. 3.14 Significance of styrene in polyesters as a reactive diluent.
Unit –IV Amino and Phenolic resins	4a. Classify amino resins. 4b. List raw materials for amino and phenolic resins. 4c. Describe synthesis methods of amino and phenolic resin. 4d. State properties & applications of amino and phenolic resins. 4e. State significance of P: F ratio in synthesis of phenolics. 4f. Describe phenolic resins as an insulating resin. 4g. List application of phenolic resin based insulating varnishes. 4h. Differentiate amino and phenolic resins.	4.1 Introduction to amino resins. 4.2 Classifications of amino resins. 4.3 Raw materials for amino resins. 4.4 Chemistry of amino resins. 4.5 Properties and applications of amino resins. 4.6 Comparison of urea formaldehyde and melamine formaldehyde resins. 4.7 Types of phenolics. 4.8 Raw materials and reactions of phenolics. 4.9 P: F ratio and its significance. 4.10 Properties and application of Phenol Formaldehyde resins. 4.11 Modifications of phenolic resins. 4.12 Applications of phenolic resins in oleo-resinous and insulating varnishes.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.13 Comparison of amino and phenolic resins.
Unit-V Chlorinated Rubber and Nitrocellulose resins	5a. State importance of chlorinated rubber as a binder. 5b. Explain synthesis method of Chlorinated rubber and Nitrocellulose resins. 5c. State significance of dampening 5d. State properties and application of CR and NC. 5e. Describe compatibility of CR and NC with other resins. 5f. State application parameters of CR and NC.	5.1 Introduction to Chlorinated rubber (CR). 5.2 Process of Chlorination for rubber. 5.3 Properties and application of chlorinated rubber resins. 5.4 Fire retarding properties and chemical resistance of CR. 5.5 Compatibility of chlorinated rubber with other synthetic resins 5.6 Introduction to Nitrocellulose (NC). 5.7 Preparation of NC lacquers. 5.8 Properties and application of NC.

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to resins and concept of polymerization	08	2	4	6	12
II	Natural Resins	10	3	4	7	14
III	Alkyd and Polyesters Resins	12	3	5	10	18
IV	Amino and Phenolic resins	10	3	4	7	14
V	Chlorinated Rubber and Nitrocellulose resins	08	2	4	6	12
Total		48	**13**	**21**	**36**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Market survey of resin manufacturing industries.
b. Collect standards test methods for resin testing.
c. Visit to resin manufacturing plant/resin testing laboratories.
d. Collect the technical paper published in various technical journals regarding new developments in resin technology.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Correlate properties and application of resins for preparation of coatings.
g. Use relevant raw materials calculations for formulating resins systems.
h. Use Flash/Animations to explain various reactions, manufacturing methods of resin manufacturing,
i. Before starting practical, teacher should demonstrate the principle, working mechanism and experimental set up used for conducting practical.
j. Instructions to students regarding care and maintenance of measuring equipments.
k. Before starting practical, teacher should instruct various safety precaution need to take while handling instrument and chemicals,
l. Teacher should ask the students to go through instruction, technical specifications and MSDS

12. SUGGESTED MICRO-PROJECTS

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. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably 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. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. 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 ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Collect data of various synthetic and natural resins with properties and application.
b. Compare different viscometer under different condition.
c. Collect solubility data of various resins and solvents.
d. Collect MSDS of various reagents, chemicals and resins, used in laboratories.
e. Collect formulating principles for various synthetic resins.
f. Collect data of various modifications of resins with properties influenced due to modification and their applications.
g. Collect the crosslinking reaction behaviors of various resins systems.

13. SUGGESTED LEARNING RESOURCES

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

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=M0ERRJ885GI
b. https://www.youtube.com/watch?v=1vUCtP0iRM0
c. https://www.youtube.com/watch?v=PfKnvqEIkb0
d. https://www.youtube.com/watch?v=KV3TBgRN6Bw
e. https://www.youtube.com/watch?v=QWGD8w1e2Ww
f. https://www.youtube.com/watch?v=MsZfUcagJZE
g. https://www.youtube.com/watch?v=tKmSLiDBfGI
h. https://www.youtube.com/watch?v=Jajxa5iCanU
i. https://www.youtube.com/watch?v=dDArpD6UTcY
j. https://www.youtube.com/watch?v=8Z1SOOt_k2U
k. https://www.youtube.com/watch?v=tEro9DJYfiI
l. https://www.youtube.com/watch?v=C_PQ0edV3gg
m. https://www.youtube.com/watch?v=5yvIq_Z87mA

Program Name : **Diploma in Surface Coating Technology**

Program Code : **SC**

Semester : **First**

Couse Title : **Pigments Technology - I**

Couse Code : **24114**

1. RATIONALE

This course will give basic knowledge about pigments and their application in paints and coatings. This part- I of the course will deal only with black and white pigments and extenders. This will make the students' grasping easier as this is a new course for students. The course will include the names of pigments, processing and their properties and uses.

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

- **Select relevant pigments for various applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

1. Understand pigments and extenders.
2. Classify organic and inorganic pigments.
3. Select raw materials for pigments preparation.
4. Determine properties of pigments.
5. Select processes for pigment preparation.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

***Legends:** **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

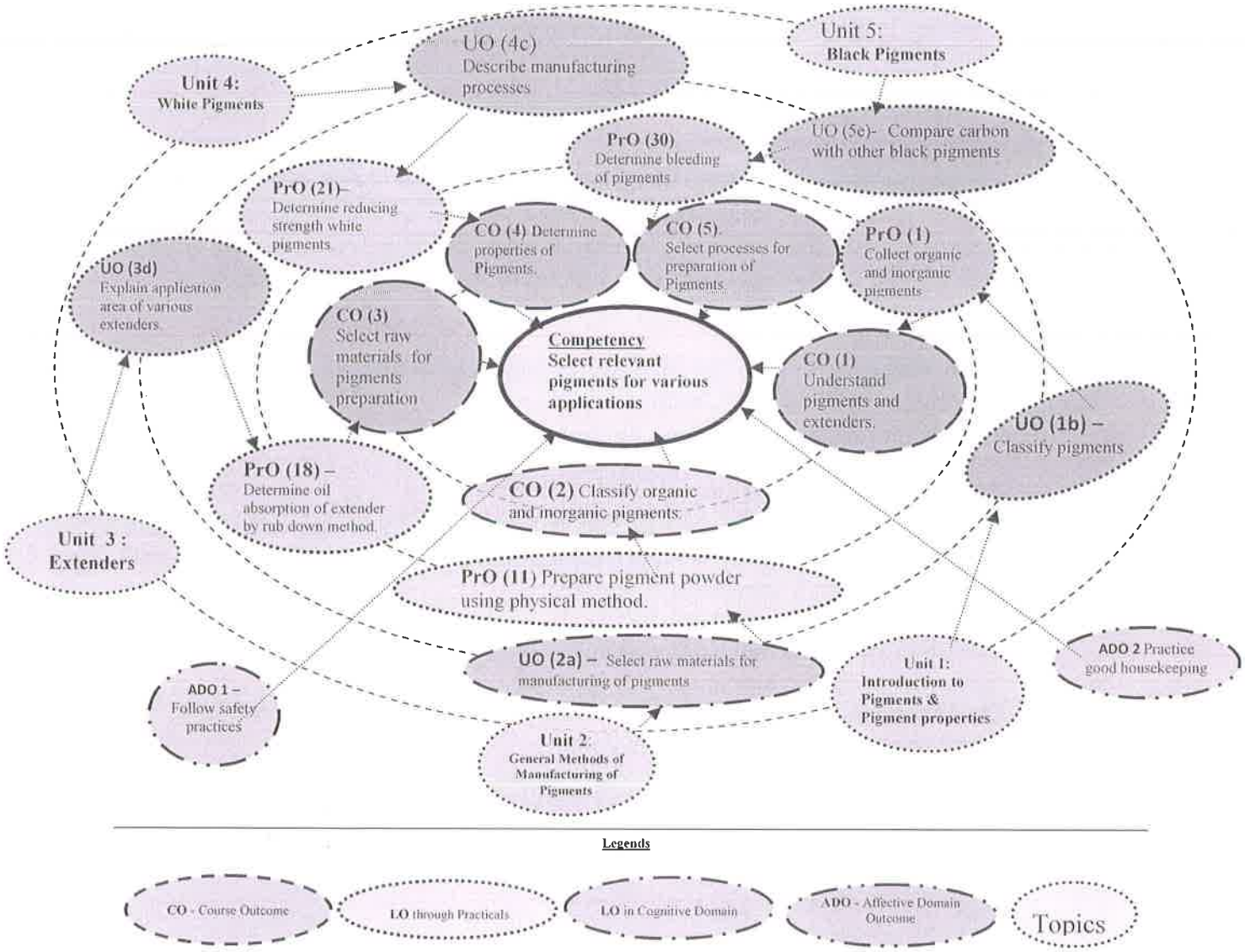

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Collect organic and inorganic pigments.	I	02*
2	Identify different components of microscope.	I	02
3	Classify color of organic and inorganic pigments.	I	02

4	Measure bulk density of pigment using taping method.	I	02*
5	Measure specific gravity of pigments using *Specific Gravity* bottle.	I	02*
6	Identify shape of pigments using microscope.	I	02
7	Determine oil absorption of true pigments by rub down method.	I	02*
8	Measure hiding power of true pigments using Morest chart	I	02*
9	Prepare drawdown of pigment using automatic muller.	I	02
10	Determine residue using 45-micron sieves.	II	02
11	Prepare pigment powder using physical method.	II	02*
12	Measure particle size and bulk density of prepared pigment sample	II	02*
13	Prepare barytes by chemical method.	II	02
14	Measure oil absorption and hiding power of prepared barytes sample.	II	02
15	Determine moisture content of extenders by heating method.	III	02*
16	Compare heat resistance of the pigments using oven.	III	02*
17	Test pH of extenders using water suspension method.	III	02
18	Determine oil absorption of extender by rub down method.	III	02
19	Compare hiding power of extenders and true pigments using Morest chart.	III	02*
20	Identify shape of extenders using microscope.	III	02
21	Determine reducing strength of white pigments.	IV	02*
22	Determine oil absorption of TiO_2.	IV	02
23	Determine oil absorption of ZnO.	IV	02
24	Determine oil absorption of Lithophone.	IV	02
25	Compare hiding power of TiO_2 with barytes extender.	IV	02*
26	Determine acid and alkali resistance (Part I: Sample Preparation)	I/IV	02*
27	Determine acid and alkali resistance (Part II: Comparison with original)	I/IV	02*
28	Determine oil absorption of black pigments	V	02
29	Determine hiding power of black pigments	V	02*
30	Determine bleeding of pigments	V	02*
31	Determine heat resistance of black pigments	V	02
32	Determine tinting strength of black pigments	V	02
	Total		**48**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical needs to

be performed, out of which, the practical's marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *Evaluation of pigment properties mentioned in above PrOs are based on IS 33, 34.*

iii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

Sr. No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	10
b.	Setting and operation	20
c.	Safety measures and housekeeping	10
d.	Observations and Recording	20
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field-based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Maintain tools and equipment.
f. Follow ethical Practices.

The ADOs are not specific to any one PrO but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Spatula	All PrO
2	Glass Plate	All PrO
3	Weighing balance	04,05,07,08,09,10,11,12,13,14,15,17, 18, 19, 21,22,23,24,25,26,27,28,29,30,31
4	Automatic Muller	09

S. No.	Equipment Name with Broad Specifications	PrO. No.
5	Puller Spatula	08, 16, 17, 19, 21, 25, 26, 27, 29, 31, 32
6	pH meter	17, 26, 27
7	Stirrer Assembly	13
8	Petri dish	01, 10, 15, 16, 17, 26, 27, 31
9	Beaker (50 ml, 100 ml)	05, 07, 08, 09, 13, 14, 16, 17, 18, 19, 21,22, 23, 24, 25, 26, 27, 28, 29, 30, 32
10	Conical Flask	17, 26, 27
11	Oven	13, 15, 16, 17, 26, 27, 31
12	Thermometer (0-100 ^{0}C, 0-360 ^{0}C range)	13, 15, 16, 17, 26, 27, 31
13	Sieve analysis set	10, 12
14	Microscope	02,06,20
15	Measuring Cylinder (50 CC, 100 CC)	04, 12, 26, 27
16	Conical Flask (50 ml, 100 ml)	13, 17, 26, 27
17	Sp. Gr. Bottle	05
18	Test tube set	30
19	Morest chart	08, 14, 19, 25, 29
20	Jar mill	11
21	Glass Rod	13, 17, 20,26,27,30

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Introduction to Pigments & Pigment properties	1a. List the pigments. 1b. Classify pigments. 1c. List applications of pigments. 1d. Select pigments for various coatings. 1e. State physical and chemical properties of pigments.	1.1 Introduction of pigments. 1.2 Classification of Pigments. 1.3 Application of Inorganic and Organic pigments in coatings. 1.4 Difference between pigments and extenders. 1.5 General Properties, Evaluation of Pigments as per IS: 33 & 34
Unit– II General Methods of Manufacturing of Pigments	2a. Select raw materials for manufacturing of pigments. 2b. Write basic composition of different pigments. 2c. Describe the parameters affecting on the pigment's properties. 2d. Describe the various stages used in pigment manufacturing.	2.1 General methods of pigment manufacturing. 2.2 Stages Involved in the manufacturing of white Pigments. 2.3 Dry and wet Grinding techniques. 2.4 Sampling & Blending of Pigments. 2.5 Concept of aggregates, agglomerates and individual particles. 2.6 Survey of Pigment Industry in India.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-III Extenders	3a. State the source of extenders 3b. Describe the raw materials for manufacturing of various extenders 3c. Explain properties of various extenders. 3d. Explain application area of various extenders.	3.1 Properties and applications of compounds of Calcium. 3.2 Properties and applications of compounds of Magnesium. 3.3 Properties and applications of compounds of Barium. 3.4 Properties and applications of compounds of Aluminum. 3.5 Properties and applications of compounds Silicates.
Unit –IV White Pigments	4a. Write composition of white pigments. 4b. State properties of white pigments. 4c. Describe manufacturing processes. 4d. Compare properties interior & exterior pigments.	**Titanium Dioxide** 4.1 Introduction to TiO_2. 4.2 Raw material for TiO_2 manufacturing. 4.3 General manufacturing methods. 4.4 Properties and uses of TiO_2 4.5 Pigment surface modification. **Other white Pigments:** 4.6 Composition, Properties & uses of Zinc Oxide, Zinc Phosphate. 4.7 Composition, Properties & uses of Lithopone & Antimony Oxide.
Unit-V Black Pigments	5a. List the raw material. 5b. Select methods for manufacturing. 5c. Describe various types of black pigments. 5d. Describe manufacturing process. 5e. Compare carbon with other black pigments	**Organic Black Pigments:** 5.1 Introduction, types, composition of black pigments. 5.2 Raw materials for pigments manufacturing. 5.3 Methods of black pigments manufacturing. 5.4 Properties and application of Black pigments. 5.5 Dispersion of black pigments. **In-Organic Black Pigments:** 5.6 Properties and uses of black pigments like graphite, black Iron oxide 5.7 Comparison of organic and inorganic black pigments. 5.8 Properties and application of Black pigments.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Pigments & Pigment properties	10	03	04	08	15
II	General Methods of Manufacturing	10	03	04	08	15

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	of Pigments					
III	Extenders	10	03	04	08	15
IV	White Pigments	10	03	04	08	15
V	Black Pigments	08	02	02	06	10
	Total	**48**	**14**	**18**	**38**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare/Download the specifications of followings;
   i. Physical testing methods of pigment.
   ii. Chemical testing methods of pigment.
   iii. Pigment manufacturing plant equipment.
b. Visit to any pigment Industry and prepare a report consisting of
   i. Overview of manufacturing methods.
   ii. Plant layout.
   iii. Various standards practices.
   iv. Working of Effluent Treatment Plant.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Correlate subtopics with Pigment industries system and equipment.
g. Use proper equivalent analogy to explain different concepts.
h. Use Flash/Animations to explain various components, operation and maintenance of various equipment used in pigments industry.

i. Before starting practical, teacher should demonstrate the working procedure of practical.
j. Instructions to students regarding care and maintenance of measuring equipments.
k. Show video/animation films to explain functioning of various pigments.
l. Teacher should ask the students to go through instruction and Technical manuals.

12. SUGGESTED MICRO-PROJECTS

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. In the first four semesters, the micro-projects are group-based. However, in the fifth and sixth semesters, it should be preferably 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. In special situations where groups must be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. 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 ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Collect information of pigment industries.
b. Collect information of pigments manufacturing processes.
c. Compare various organic and In-Organic pigments.
d. Collect information of surface treatment processes for pigments.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Handbook of Synthetic Dyes and Pigments	Kishore M. Shah	Edu-tech publishing co.,1994 ISBN: 9788192666006
2	Outline of Paint Technology (3rd Edition)	W M Morgan	CBS Publishers & Distributors Pvt. Ltd, 2000 ISBN: 9788123904306
3	Organic Coating Technology vol-II	H F Payne	John Wiley & Sons Inc, 1961 ISBN: 9780471673538
4	Basic of Paint Technology-I	V C Malshe and Meenal Sikchi	Antar Prakash Centre for Yoga,2004 ISBN: 9788190329859
5	Surface Coating Science and Technology	Dr. Swaraj Paul	John Wiley & Sons Ltd, 2007 ISBN: 9788126552559
6	Surface Coatings, Vol-I Raw Materials and Their Usage	Oil and Colour Chemists Association of Australia (OCCA)	Chapman & Hall, 1993 ISBN: 9780412552106

14. SOFTWARE/LEARNING WEBSITES

a. https://www.youtube.com/watch?v=Ww2QRpSG4fA
b. https://www.youtube.com/watch?v=MikiTYpg2aQ
c. https://www.youtube.com/watch?v=GvLkNoWjKz0
d. https://www.youtube.com/watch?v=lmZDtrwe_7o
e. https://www.youtube.com/watch?v=CtiKkJrB-ag
f. https://www.youtube.com/watch?v=Hqs_VqLcc0Q
g. https://www.youtube.com/watch?v=1B5R4ndvycQ
h. https://www.youtube.com/watch?v=bdwUicNFCn8
i. https://www.youtube.com/watch?v=oVaAeRJnVB0
j. https://www.youtube.com/watch?v=VqSwHLpOd88
k. https://www.youtube.com/watch?v=4OILhf4QuHg
l. https://www.youtube.com/watch?v=QqxfwpUtEoQ
m. https://www.youtube.com/watch?v=s1KuwKZ4SPg
n. https://www.youtube.com/watch?v=bnc0ddBMLww
o. https://www.youtube.com/watch?v=8vAeV5aWK3U
p. https://www.youtube.com/watch?v=x6e2CxFlVJw
q. https://www.youtube.com/watch?v=AM-NrQoRIYY
r. https://www.youtube.com/watch?v=U6qnDuZ0xn0
s. https://www.youtube.com/watch?v=7Y0yGaT3EZQ
t. https://www.youtube.com/watch?v=rsPQ8G9-GgI
u. https://www.youtube.com/watch?v=L1CK9bE3H_s
v. https://www.youtube.com/watch?v=3pMkGgrgzRM
w. https://www.youtube.com/watch?v=lMF53-EwXtY
x. https://www.youtube.com/watch?v=pOPg7ImWOYI

Program Name : **Diploma in Food Technology/ Diploma in Printing Technology / Diploma in Surface Coating Technology / Diploma in Travel & Tourism / Diploma in Hotel Management & Catering Technology.**

Program Code : **FC / PC / PN / SC / TR / HM**

Semester : **First**

Couse Title : **Fundamentals of ICT**

Couse Code : **22001**

1. RATIONALE

In any typical business setup in order to carry out routine tasks related to create business documents, perform data analysis and its graphical representations and making electronic slide show presentations, the student need to learn various software as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use computers for internet services, electronic documentation, data analysis and slide presentation.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Use computer system and its peripherals.
b. Prepare business document using word processing tool.
c. Interpret data and represent it graphically using spreadsheet.
d. Prepare professional presentations.
e. Use different types of web browsers.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical				
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	--	2	4	--	--	--	--	--	--	--	25@^	10	25~	10	50	20

*(~[1]): For the courses having **ONLY practical** examination, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 15 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 10 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*

***Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C ...*
***ESE** - End Semester Examination; **PA** - Progressive Assessment; # No theory exa...*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

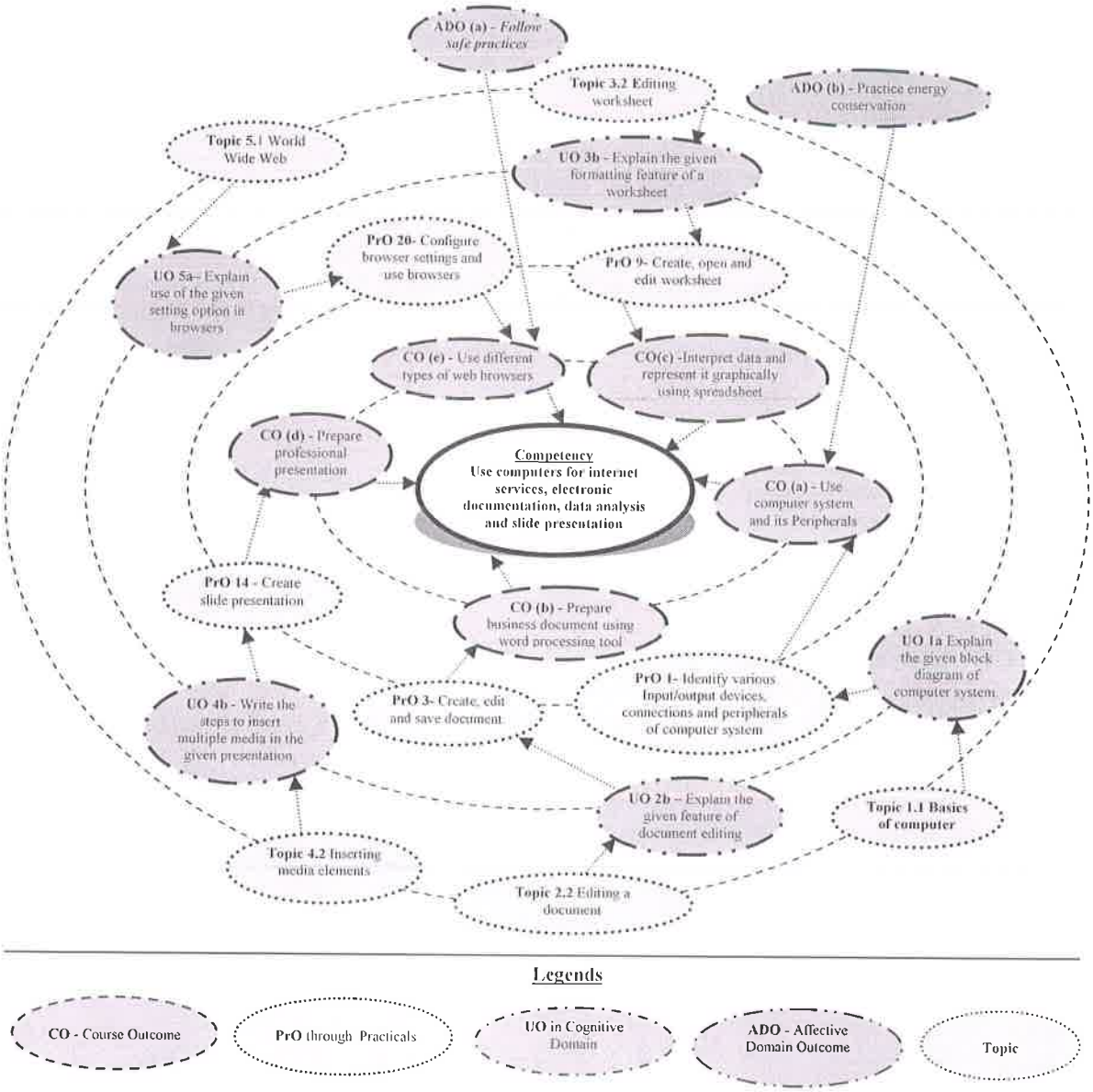

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	Computer system and Operating system:		
1	Identify various Input/output devices, connections and peripherals of computer system	I	1*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Manage files and folders : Create, copy, rename, delete, move files and folder	I	1
	Word Processing		
3	Create, edit and save document : apply formatting features on the text - line, paragraph	II	2*
4	Use bullets, numbering, page formatting	II	2
5	Insert and edit images and shapes, sizing, cropping, colour, background, group/ungroup	II	2
6	Insert and apply various table formatting features on it.	II	2
7	Apply page layout features i. Themes, page background, paragraph, page setup ii. Create multicolumn page iii. Use different options to print the documents	II	2*
8	Use mail merge with options.	II	1
	Spreadsheets		
9	Create, open and edit worksheet i. Enter data and format it, adjust row height and column width ii. Insert and delete cells, rows and columns iii. Apply wrap text, orientation feature on cell.	III	2*
10	Insert formulas, "IF" conditions, functions and named ranges in worksheet.	III	2
11	Apply data Sort, Filter and Data Validation features.	III	2*
12	Create charts to apply various chart options.	III	2
13	Apply Page setup and print options for worksheet to print the worksheet.	III	1
	Presentation Tool		
14	Create slide presentation i. Apply design themes to the given presentation ii. Add new slides and insert pictures/images, shapes	IV	2*
15	i. Add tables and charts in the slides. ii. Run slide presentation in different modes iii. Print slide presentation as handouts	IV	2
16	Apply animation effects to the text and slides.	IV	1
17	Add audio and video files in the given presentation	IV	1
	Internet Basics		
18	Configure Internet connection	V	1
19	Use internet for different web services.	V	2*
20	Configure browser settings and use browsers.	V	1*
	Total		**32**

'': compulsory practicals to be performed.*

Note

i. *A suggestive list of practical UOs is given in the above table, more such PrOs can be added to attain the COs and competency.*

ii. *Hence, the 'Process' and 'Product' related skills associated with each PrOs of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem (Process)	40
b.	Quality of output achieved (Product)	30
c.	Complete the practical in stipulated time	10
d.	Answer to sample questions	10
e.	Submit report in time	10
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of PrOs, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card.	1
2	Double side printing laser printer.	1,6,12,13
3	Hubs, Switches, Modems.	1, 16,17
4	Any operating system.	2 to18
5	Any Office Software.	2 to 15
6	Any browser.	16,17,18

Note: *There are no specifications fixed for the above listed systems, devices and instruments. Depending on the availability in the institute they can be utilized for the purpose.*

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Computer System	1a. Explain the given block diagram of computer system. 1b. Classify the given type of software 1c. Explain characteristics of the specified type of network. 1d. Describe procedure to manage a file /folder in the given way. 1e. Describe application of the specified type of network connecting device	1.1 **Basics of Computer System:** Overview of Hardware and Software: block diagram of Computer System, Input/Output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit 1.2 **Internal components:** processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives) 1.3 **External Devices:** Types of input/output devices, types of monitors, keyboards, mouse, printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive 1.4 **Application Software:** word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editing software, graphics manipulation software System Software compilers, linkers, device drivers, operating systems and utilities 1.5 **Network environments**: network interface cards, hubs, switches, routers and modems, concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth 1.6 **Working with Operating Systems**: Create and manage file and folders, Copy a file, renaming and deleting of files and folders, Searching files and folders, application installation, creating shortcut of application on the desktop.
Unit– II Word Processing	2a. Write steps to create the given text document. 2b. Explain the specified feature for document editing. 2c. Explain the given page setup features of a document. 2d. Write the specified table formatting feature.	2.1. **Word Processing:** Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting application. 2.2. **Editing a Document:** Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting Paragraphs, Line and paragraph spacing, using FIND and REPLACE, Setting line

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		spacing, add bullet and numbers in lists, add borders and shading, document views, Page settings and margins, Spelling and Grammatical checks 2.3. **Changing the Layout of a Document:** Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, Insert and clear tabs. 2.4. **Inserting Elements to Word Documents**: Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, Resize and reposition a picture 2.5. **Working with Tables:** Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, Repeat table headings on subsequent pages, Merge and split cells. 2.6. **Working with Columned Layouts and Section Breaks:** a Columns, Section breaks, Creating columns, Newsletter style columns, Changing part of a document layout or formatting, Remove section break, Add columns to remainder of a document, Column widths, Adjust column spacing, Insert manual column breaks.
Unit– III Spreadsheets	3a. Write steps to create the given spreadsheet. 3b. Explain the specified formatting feature of a worksheet. 3c. Write steps to insert formula and functions in the given worksheet. 3d. Write steps to create charts for the specified data set. 3e. Explain steps to perform advance operation on the given data set.	3.1. **Working with Spreadsheets:** Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook. 3.2. **Editing Worksheet:** Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, - Freeze Panes, hiding/unhiding rows and columns. 3.3. **Formatting Cells and sheet:** Setting Cell Type, Setting Fonts, Text options, Rotate Cells, Setting Colors, Text Alignments, Merge and Wrap, apply Borders and Shades, Sheet Options, Adjust Margins, Page

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		Orientation, Header and Footer, Insert Page Breaks, Set Background. 3.4. **Working with Formula:** Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, power, applying conditions using IF. 3.5. **Working with Charts:** Introduction to charts, overview of different types of charts, Bar, Pie, Line charts, creating and editing charts. Using chart options: chart title, axis title, legend, data labels, Axes, grid lines, moving chart in a separate sheet. 3.6. **Advanced Operations:** Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.
Unit– IV Presentation Tool	4a. Write the steps to create the specified slide presentation. 4b. Write the steps to insert multiple media in the given presentation. 4c. Write steps to apply table features in the given presentation 4d. Write steps to manage charts in the given presentation	4.1 **Creating a Presentation:** Outline of an effective presentation, Identify the elements of the User Interface, Starting a New Presentation Files, Creating a Basic Presentation, Working with textboxes, Apply Character Formats, Format Paragraphs, View a Presentation, Saving work, creating new Slides, Changing a slide Layout, Applying a theme, Changing Colours, fonts and effects, apply custom Colour and font theme, changing the background, Arrange Slide sequence, 4.2 **Inserting Media elements:** Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format Graphical Objects on a Slide, Group Graphical Objects on a Slide, Apply an Animation Effect to a Graphical Object, Add Transitions, Add Speaker Notes, Print a Presentation. 4.3 **Working with Tables:** Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.4 **Working with Charts:** Insert Charts in a Slide, Modify a Chart, Import Charts from Other Office Applications.
Unit– V Basics of Internet	5a. Explain use of the given setting option in browsers. 5b. Explain features of the specified web service. 5c. Describe the given characteristic of cloud. 5d. Explain the specified option used for effective searching in search engine.	5.1 **World Wide Web**: Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers-history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively for searching the content. 5.2 **Web Services**: e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking.

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not Applicable -

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Prepare journal of practicals.
b. Prepare a sample document with all word processing features.(Course teacher shall allot appropriate document type to each students)
c. Undertake micro projects

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Guide student(s) in undertaking various activities in the lab/workshop.
g. Demonstrate students thoroughly before they start doing the practice.
h. Show video/animation films for handling/functioning of instruments.
i. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student 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 which are in fact, an integration of PrOs, UOs and ADOs. 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 ***16 (sixteen) 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:

a. **Word documents**: Prepare Time Table, Application, Notes, Reports .(Subject teacher shall assign a document to be prepared by the each students)
b. **Slide Presentations:** Prepare slides with all Presentation features such as: classroom presentation, presentation about department, presentation of report. (Subject teacher shall assign a presentation to be prepared by the each student).
c. **Spreadsheets:** Prepare Pay bills, tax statement, student's assessment record using spreadsheet. (Teacher shall assign a spreadsheet to be prepared by each student).

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Computer Fundamentals	Goel, Anita	Pearson Education, New Delhi, 2014, ISBN: 978-8131733097
2	Computer Basics Absolute Beginner's Guide, Windows 10	Miller, Michael	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Linux: Easy Linux for Beginners	Alvaro, Felix	CreatevSpace Independent Publishing Platform- 2016, ISBN: 978-1533683731
4	Microsoft Office 2010: On Demand	Johnson, Steve	Pearson Education, New Delhi India, 2010; ISBN: 9788131770641
5	Microsoft Office 2010 for Windows: Visual Quick Start	Schwartz, Steve	Pearson Education, New Delhi India, 2012, ISBN:9788131766613
6	OpenOffice.org for Dummies	Leete, Gurdy, Finkelstein Ellen, Mary Leete	Wiley Publishing, New Delhi, 2003 ISBN: 978-0764542220
7	Computer Fundamentals	Dr. Rajendra Kawale	Devraj Publications, Dist Solapur, Maharashtra

14. SOFTWARE/LEARNING WEBSITES

a. https://www.microsoft.com/en-in/learning/office-training.aspx
b. http://www.tutorialsforopenoffice.org/
c. https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf