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: SIX SEMESTERS **WITH EFFECT FROM 2014-15**

SEMESTER : FIFTH **DURATION : 16 WEEKS**

PATTERN : FULL TIME - SEMESTER **SCHEME : G**

SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									SW (17500)
							PAPER HRS	TH (1)		PR (4)		OR (8)		TW (9)		
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
1	Process Instrumentation	PIN	19529	03	--	03	03	100	40	--	--	--	--	25@	10	50
2	Technology of Paints - II	TOP	19530	03	--	03	03	100	40	50#	20	--	--	25@	10	
3	Application & Evaluation of Paints - II	WEP	19531	03	--	03	03	100	40	50#	20	--	--	25@	10	
4	Chemical Technology For Paint Industries	CTP	19532	03	--	03	03	100	40	--	--	--	--	25@	10	
5	Behavioral Science $	BSC	17075	01	--	02	--	--	--	--	--	25#	10	25@	10	
6	Entrepreneurship Development	EDP	19084	01	01	--	--	--	--	--	--	--	--	50@	20	
	TOTAL			**14**	**01**	**14**	**--**	**400**	**--**	**100**	**--**	**25**	**--**	**175**	**--**	**50**

Student Contact Hours Per Week: 29 Hrs.

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks : 750

@ Internal Assessment, # External Assessment, $ - Common to All Conventional Diploma, [ ] No Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work.

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subject are to be converted out of 50 marks as sessional work.
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

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							PAPER HRS	TH (1)		PR (4)		OR (8)		TW (9)		SW (17600)
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
01	Project and Seminar on In plant Training	--	19905	--	--	40	--	--	--	--	--	100#	40	100@	40	--
			TOTAL	--	--	**40**	--	--	--	--	--	**100**	--	**100**	--	--

Student Contact Hours Per Week: 40 HOURS PER WEEK FOR 20 WEEKS.
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.
Total Marks : 200

@ Internal Assessment, # External Assessment, $ – Common to All Conventional Diploma, [ ] No Theory Examination.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subject are to be converted out of 50 marks as sessional work.
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

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

Course Code **: SC**

Semester **: Fifth**

Subject Title **: Process Instrumentation**

Subject Code **: 19529**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
03	--	03	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

The subject will help to understand the process instruments used for various measurements like temperature, Pressure, Flow etc., These instruments are the essential part of any chemical industry.

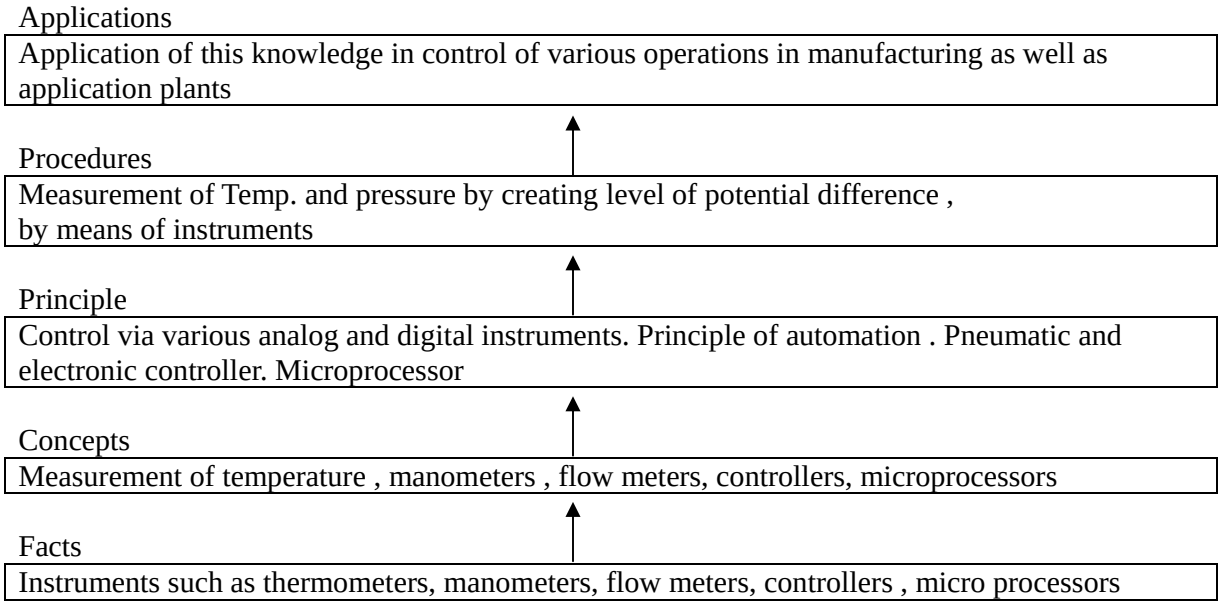
All these measurements are as much required in surface coating industry. The subject will also stress the importance of automation in process industries.

Objectives:

Student will be able to:

1. Identify instruments used for measurements of temp. pressure flow, level etc.
2. Describe working of these instruments.
3. Describe applications of micro processors in process control.

Learning Structure:



Contents: Theory

Topic and Contents	Hrs.	Marks
Topic 1: Temperature (Concept and Measurement) **Specific Objectives:** ➢ State the different types of thermometers & their utility ➢ Describe the construction & principle of working of these thermometer ➢ Describe the application areas of these thermometers Temperature scales, Temperature measuring devices such as Pressure Thermometers, Bimetallic thermometers, Resistance Temperature detectors, thermocouples, thermisters, Pyrometers – simple construction and working principle	10	20
Topic 2: Pressure (Concept and Measurement) **Specific Objectives:** ➢ Define the manometers & name types of manometer with their application areas ➢ Describe the construction & working principle of pressure gauges ➢ Sketch the neat labeled diagram of manometers & pressure gauges Pressure measuring devices such as U Tube, Inclined Manometer, Dead Weight and Piston Gauge, Bourdon Tubes, Bellows, Diaphragm, Capsule - Simple construction and working principle	08	20
Topic 3: Flow & Level measurement **Marks 20** **Specific Objectives:** ➢ Name the different flow measurement devices & their application areas ➢ Describe the construction & working principle of these flow meters ➢ Describe the various level measurement equipments with neat sketches Flow measurement methods such as Electromagnetic Flow Meters, Ultrasonic Flow meters, Turbine meters Level measurement methods Sight Glass method, Bob & Tape method, Float gauges, Indirect mechanical method, Pneumatic method . Capacitance Level Gauge, Ultrasonic method of level measurement	09	20
Topic 4: Displacements **Specific Objectives:** ➢ Describe principle construction & working of LVDT ➢ Describe the importance & applications of LVDT ➢ Describe principal construction & working of various types of strain gauges ➢ Describe the applications of types of strain gauges 4.1 Displacement measurements methods such as : LVDT – principle , specification, construction and working **Marks 10** 4.2 Synchro System - Pneumatic displacement gauge Strain gauges - Importance of strain measurements, working principle, types of strain gauges , strain gauge circuit **Marks 10**	06	20
Topic 5: Process Control & Microprocessor **Specific Objectives:** ➢ State the various automatic control systems ➢ Describe the construction & working of various control systems ➢ Compare different types of control systems	15	20

➢ Explain the microprocessors & microprocessor based temperature control systems 5.1 Advantages of automatic control system, variables, Basic control actions, On-Off Control, Proportional control, proportional plus integral control, proportional plus derivative control. Proportional plus integral plus derivative control. **Marks 08** 5.2 Electronic controllers, comparison between pneumatic and electronic controller. Actuators such as electric motor actuator. Pneumatic actuators - spring actuator, Control valves- valve characteristics. Pneumatic valves, basic construction and working principles. **Marks 06** 53. Working of Micro-processor, microprocessor based Temperature control system **Marks 06**		
Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Identifying proper transducer, pressure, flow level measurements
2. Understanding working principles of instruments
3. Describing mentally experimental set up, conduct observations and inferences

Psychomotor Skills:

1. Handling measuring instruments
2. Setting of experimental conditions
3. Drawing the correct experimental diagrams
4. Drawing of graphs, calculating slopes and respective calculations

List of Experiments: [Minimum 10 experiments to be completed)

1. Measure frequency and voltage using CRO
2. Measure voltage (AC, DC) using analog and digital multi-meter
3. Plot resistance v/s temp. Characteristics of RTD (PT 100)
4. Plot characteristics of thermocouple
5. Plot LVDT characteristics
6. Measure pressure using Bourdon gauge and Strain gauge
7. Measure Pressure using Dead weight tester
8. Operate ON – OFF temperature controller
9. Compare the operation of various types of valves
10. Understand basic components of Pneumatic system
11. Operate of water level controller
12. Plot response of PID controller for step, ramp input
13. Level measurement using capacitance type level meter

Learning Resources:

Books:

Sr. No.	Author	Title of the Book	Publisher
1.	R.V. Jalgaonkar	Mechanical measurement & Control	Everest Publishing
2.	Forrest C Tyson	Industrial Instrumentation	D.B. Taraporwala
3.	B.C. Nakra & K.K.Chaudhari	Instrumentation Measurement & Analysis	Tata Mc Graw Hill Publishing
4.	Kirk & Rimboi	Instrumentation	D.B. Taraporwala
5.	W.G. Holzbock	Instrument for measurement & Control	Affiliated East West Press
6.	S.K.Singh	Industrial Instrumentation & Control	Tata Mc Graw Hill Publishing

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

Course Code **: SC**

Semester **: Fifth**

Subject Title **: Technology of Paints - II**

Subject Code **: 19530**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
03	--	03	03	100	50#	--	25@	175

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

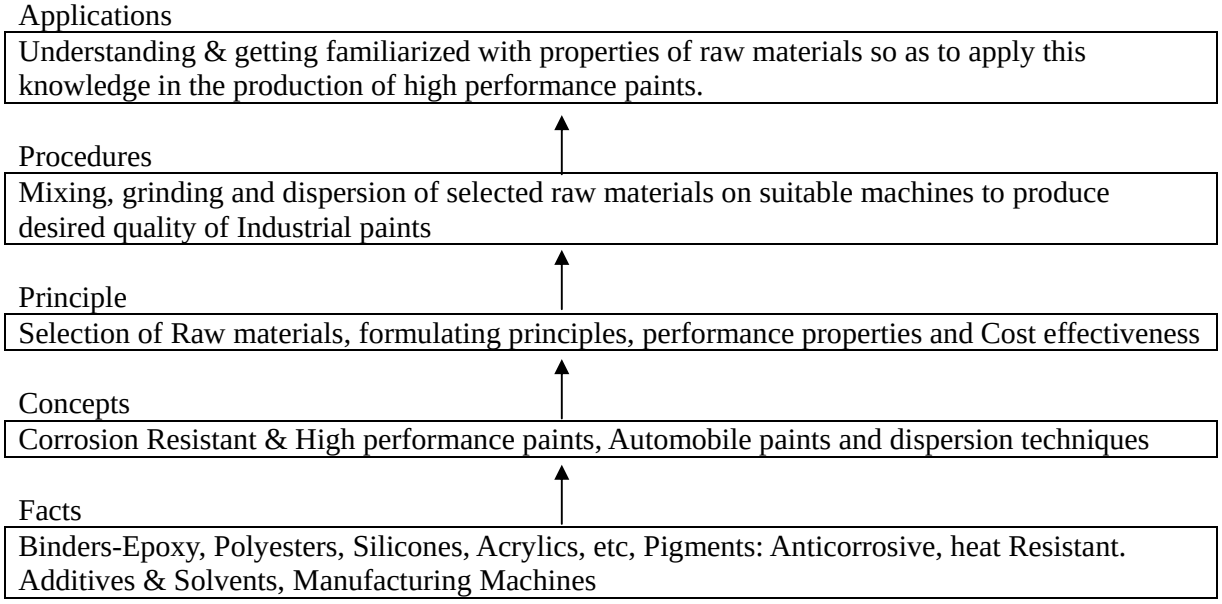
In this subject the students will learn about industrial paints and specialty coatings. The subject will deal with the protective aspects of paints. Further, the subject covers corrosion and the role of paints in reducing heavy losses due to corrosion. The subject also covers automobile paints and high performance coatings, like Marine Paints.

Objectives:

Student will be able to:

1. Describe corrosion and factors affecting corrosion.
2. Describe properties of automotive paints.
3. Design formulations for corrosion, Industrial & and automobile paints.

Learning Structure :



Contents: Theory

Name of the Topic	Hrs.	Marks
Corrosion Resistant Coatings **Specific Objectives:** ➢ Define the corrosion & factors responsible for it ➢ Describe types of corrosion ➢ Explain formulating principals of types of corrosion resistant coatings & their application areas **1.1 Corrosion** Marks: 10 Factors responsible for corrosion. Types of corrosion such as Direct oxidation, galvanic, electrochemical, galvanic, stress, differential etc. **1.2 Corrosion resistant coatings-** Marks: 10 Pigmented & unpigmented, formulating principals of corrosion resistant primers, coatings and their application areas	10	20
Topic 2: Industrial Paints / Finishes **Specific Objectives:** ➢ Define the Industrial paints & describe its need ➢ Explain the formulating principles for Industrial finishes ➢ Explain properties & application areas of Chemical resistant Coatings **1.1 Selection** Marks: 10 Factors governing choice of coatings for Industrial applications. Types of coatings used for domestic & Industrial products such as white goods, wood, plastic etc. **2.2 Chemical Resistant Paints** Marks: 10 based on epoxies, polyurethane, bitumen , vinyl and chlorinated rubber – their formulations , properties	10	20
Topic 3: Automotive Paints **Specific Objectives:** ➢ Describe the requirement of automotive coatings ➢ Explain the various types of coats applied on automobiles & their functions ➢ Describe the formulating principles of Automotive Coatings **3.1 Primers** Marks: 08 Surfacer, top coat. Clear coat, AED, CED Primers **3.2 Top coats** Marks: 12 Thermosetting acrylic, Polyester based top coat, PU , Requirements of paints for Automotive coatings , formulations , sound deadener, putty	10	20
Topic 4: Specialty Coatings: **Specific Objectives:** ➢ Describe the requirement & application areas of Specialty Coatings ➢ Explain formulating principals of types of Specialty coatings, Novelty finishes & their application areas **4.1 Specialty Coatings** Marks : 10 Heat Resistant, Fire retardant paints , Floor coatings, Road marking paints **4.2 Novelty finishes** Marks : 10	10	20

Hammer tone , Wrinkle Stipple Finishes, Multi Color finishes, Aircraft Finishes		
High Performance Coatings : **Specific Objectives:** ➢ Describe the requirement of High performance coatings ➢ Describe the formulating principles & application areas of Specialty Coatings ➢ Explain the manufacturing process, formulating principles & application areas of Powder Coating **5.1 High Built Coatings** Marks: 10 Coil coatings, Coatings for Marine, space applications, oil and gas pipe line paints **5.2 Powder Coating** Marks : 10 types of powders , formulations , manufacturing of powders, properties and uses in industry	08	20
Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Understanding the requirements of industrial coatings based on service conditions
2. Understanding the qualities and properties of raw materials required for Industrial Coatings
3. Understanding formulating principles of industrial coatings
4. Selection of dispersing machinery

Psychomotor Skills:

1. Handle, weigh and sequential addition of raw materials
2. Control optimum process parameters
3. Judge the end point stage wise
4. Enforce safety rules

List of Experiments: [Minimum 10 experiments to be completed]
OR
[Minimum 06 experiments with One Project of minimum two months duration]

1. Prepare and test a sample of Red Oxide zinc chrome primer as per IS: 2074
2. Prepare zinc chrome Yellow primer as per IS: 104
3. Prepare and test a sample of Etch Primer for aluminum
4. Prepare and test a sample of Aluminum paint
5. Prepare and test a sample of stoving paint
6. Prepare and test a sample of chemical resistant paint based on 2-pack epoxy
7. Prepare and test a sample of chemical resistant paint based on 2-pack polyurethane
8. Prepare and test a sample of coal tar epoxy paint

9. Prepare and test a sample of chlorinated rubber paint
10. Prepare and test a sample of thermosetting acrylic paint
11. Prepare and test a sample of epoxy-ester paint
12. Prepare and test a sample of heat resistant paint
13. Prepare and test a sample of fire retardant paint
14. Prepare and test a sample of hammer tone finish
15. Prepare and test a sample of wrinkle finish
16. Prepare and test a sample of zinc rich primer
17. Project on Development of Paint/Coating by research methodology in consultation with guide

Learning Resources :
Books:

Sr. No.	Author	Title of the Book	Publisher
1.	O C C A , Australia	Surface Coating Volume II	Tafe Educational Books
2.	R Wood Bridge	Principles of Paint Formulation	Chapman & Hall
3.	J Boxall & JA A Von Fraunhofer	Paint formulation – Principles & Practice	Industrial Press ,Inc
4.	Swaraj Paul	Surface Coatings	Hon Wiley & sons
5.	H.F.Payne	Organic Coatings Vol II	V C H Publisher
6.	W.M.Morgan	Outline of Paint Technology	Charles Griffin House

Course Name **: Diploma in Surface Coating Technology**
Course Code **: SC**
Semester **: Fifth**
Subject Title **: Applications & Evaluation of Paints - II**
Subject Code **: 19531**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
03	--	03	03	100	50#	--	25@	175

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

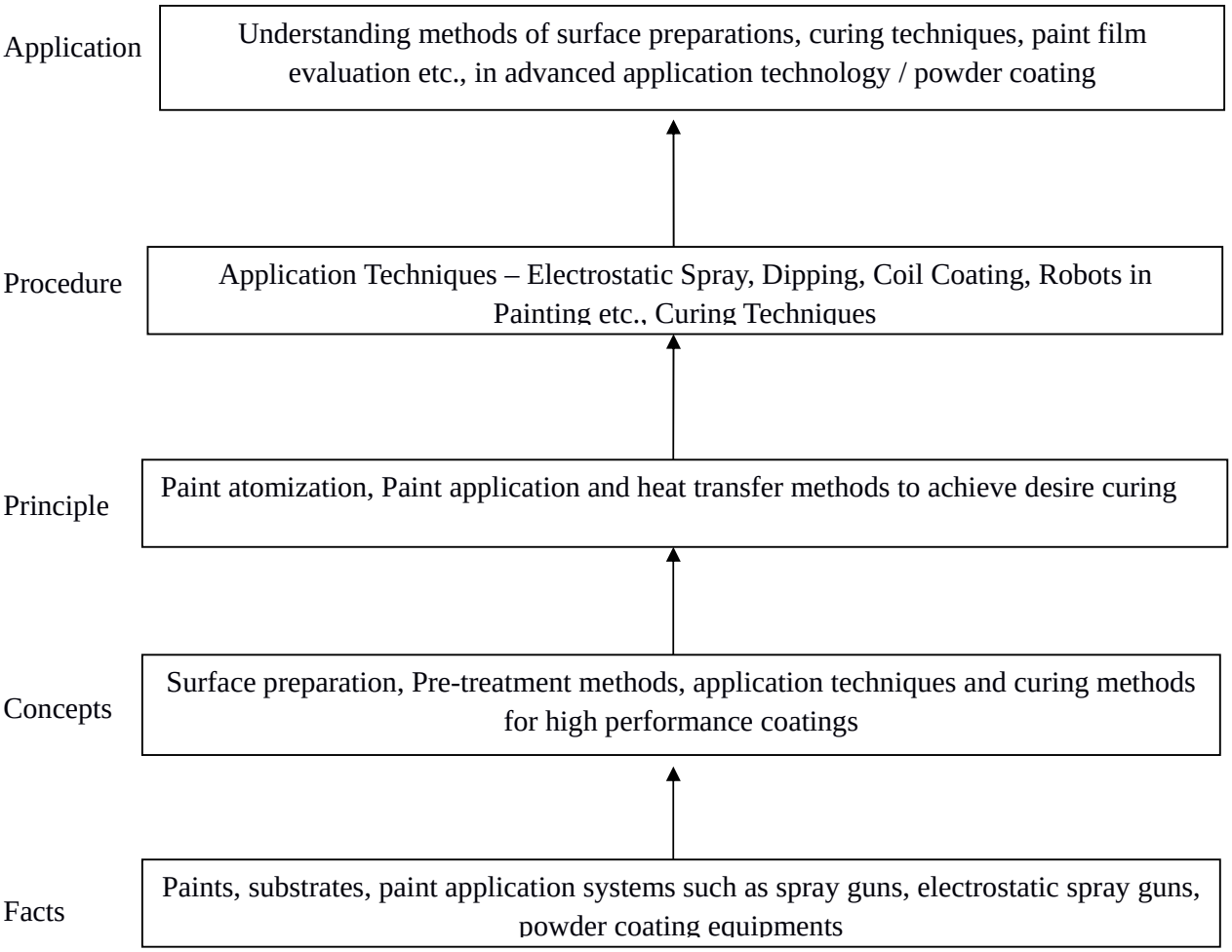
This subject will give an insight to students regarding advanced paint application methods such as Electrostatic Spray Painting, Micro Bell Paint Application, Robotic Paint application, Powder Coating etc. It will also give an insight as regards the curing methods and important properties, paint must possess in order to have excellent finish and durability

Objectives:

Student will be able to:

1. Describe various properties of paint.
2. Describe advanced paint application techniques.
3. Identify causes of paint failure.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

Learning Structure:



Contents: Theory

Activities	Hours	Marks
Topic 1: Surface Preparation **Specific Objectives:** ➢ Explain the types of surfaces & their surface preparation methods ➢ Explain the pretreatment process for metal in detail ➢ Explain the latest development in the pretreatment process 1.1 For industrial surfaces. Need for surface preparation, Methods of surface preparation - Mechanical and chemical. Hand Cleaning, Power cleaning, Abrasive blasting, shot blasting, Types of shots used, their significance & limitations. Types of recovery systems used for blasting operations **Marks: 10** 1.2 Metal conditioning , Degreasing, Derusting / Descaling, Conventional Phosphating , latest development in Nano technology based Pretreatment and chromatising, oxysilane types of bath its merits & limitations, Preparation of surfaces like copper , brass , aluminum and plastic **Marks: 10**	12	20
Topic 2: Application & Curing Techniques **Specific Objectives:** ➢ Describe the various paint application methods & their selection criteria ➢ Explain the various curing mechanisms used for drying of paints, their merits & demerits 1.1 Industrial conventional spraying application in OEM Paint application by Dipping, flow coating , electrostatic spraying of liquid paint by Bell , Micro Bell and electrostatic disc spraying , airless spraying , barreling and electro deposition method and coil coating ,Robotic application, angle of rotation, different axis of application & their significance **Marks:12** 2.2 Concept of curing , curing schedule , forced drying , radiation curing such as UV , IR, EB, and Vapo - Cure **Marks: 08**	10	20
Topic 3: Paint Shop **Specific Objectives:** ➢ Describe the types of spray booths, their merits & limitations ➢ Explain the various factors affecting the quality & output of paint shop ➢ Sketch &Describe the types of Ovens used their advantage & disadvantages **3.1 Lay Out of Paint Shop Marks : 12** Introduction to Spray booth, types of Spray booth- Dry type, Wet type, Essential Spray booth parameters-Air velocity, temp. & Humidity. Basics in Finishing automation, Ovens used in drying and baking - Types of Ovens used, types of fuels used, Significance of TTR in oven Validation **3.2 Environmental Aspects Marks : 08** Sludge handling , VOC management, & Water management in paint shop	08	20
Topic 4: Paint Film Defects **Specific Objectives:** ➢ Define & Describe the various paint film defects ➢ Explain the causes & cures for these film defects	10	20

Defects in paint film such as – Pin holing, cissing, popping, Craters , Sagging , Blisters , Orange Peel , Yellowing , Flaking, Chalking , Cracking , Peel Off- Causes and remedies		
Topic 5: Powder Coating **Specific Objectives:** ➢ Compare the powder coating verses liquid coating ➢ Sketch the diagram & explain the application process of powder coating application ➢ Describe the significant test methods used for evaluation of powder coating **5.1 Principle of powder application** **Marks 12** Pretreatment for powder application Application by electrostatic spraying. Air fluidized bed application. Electrostatic cloud Method of Application **1.2 Quality control** & Evaluation of film. Study of ISO : 13871 - 1993 **Marks 08**	08	20
Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Understand paint testing specifications
2. Select material, apparatus and method for evaluation of paint
3. Optimize process parameters and curing schedules

Psychomotor Skills:

1. Prepare substrates for Industrial painting
2. Take Precautions associated with respective painting processes
3. Assemble application equipment
4. Handle and disposal of hazardous waste material

List of Experiments: [Minimum 10 experiments to be completed]

1. Carry out Surface preparation of M.S/ Aluminum/Plastic panels
2. Conduct Chemical pretreatment process using seven - tank process
3. Carry out paint application by conventional spraying process
4. Check the finish by changing various parameters such as: pressure, nozzle, diameter, paint : thinner ratio by volume of spray Gun
5. Paint application by dipping and flow coating method, and evaluation of film.
6. Application of paint by electrostatic spray gun, and evaluation of film.
7. Application of paint by electrostatic spray gum by changing application parameters.
8. Evaluate film properties by varying flash off time
9. Apply powder coating using electrostatic spray gun
10. Evaluate mechanical & chemical properties of film - epoxy powder coating
11. Evaluate mechanical & chemical properties of film - hybrid powder coating
12. Evaluate Film properties of painted Panels by varying Baking Schedule

13. Carry out Aluminum paint testing as per IS : 2339 - 1976
14. Test & evaluate stipple & multicolor finishes
15. Test & Evaluate the effect of contaminants on Surface before painting
16. Report on factory visit – Paints / Powder Coating Industry

Learning Resources:
Books:

Sr. No	Author	Title of the Book	Publisher
1.	Dr. Dieter Stoye	Paints Coatings & Solvents	Velt Publishers Inc
2.	Gordon Fettis	Automotive Paints & Coatings	Velt Publishers Inc
3.	O CC A	Surface coatings , Vol II Paints & Their applications	Macarthur Press HSW
4.	D B Freeman	Phosphating & Metal Pretreatment	Industrial Press Inc
5.	Werner Rausch	The Phosphating of Metal	ASM International Finishing Publication

Course Name **: Diploma in Surface Coating Technology**
Course Code **: SC**
Semester **: Fifth**
Subject Title **: Chemical Technology for Paint Industries**
Subject Code **: 19532**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
03	--	03	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

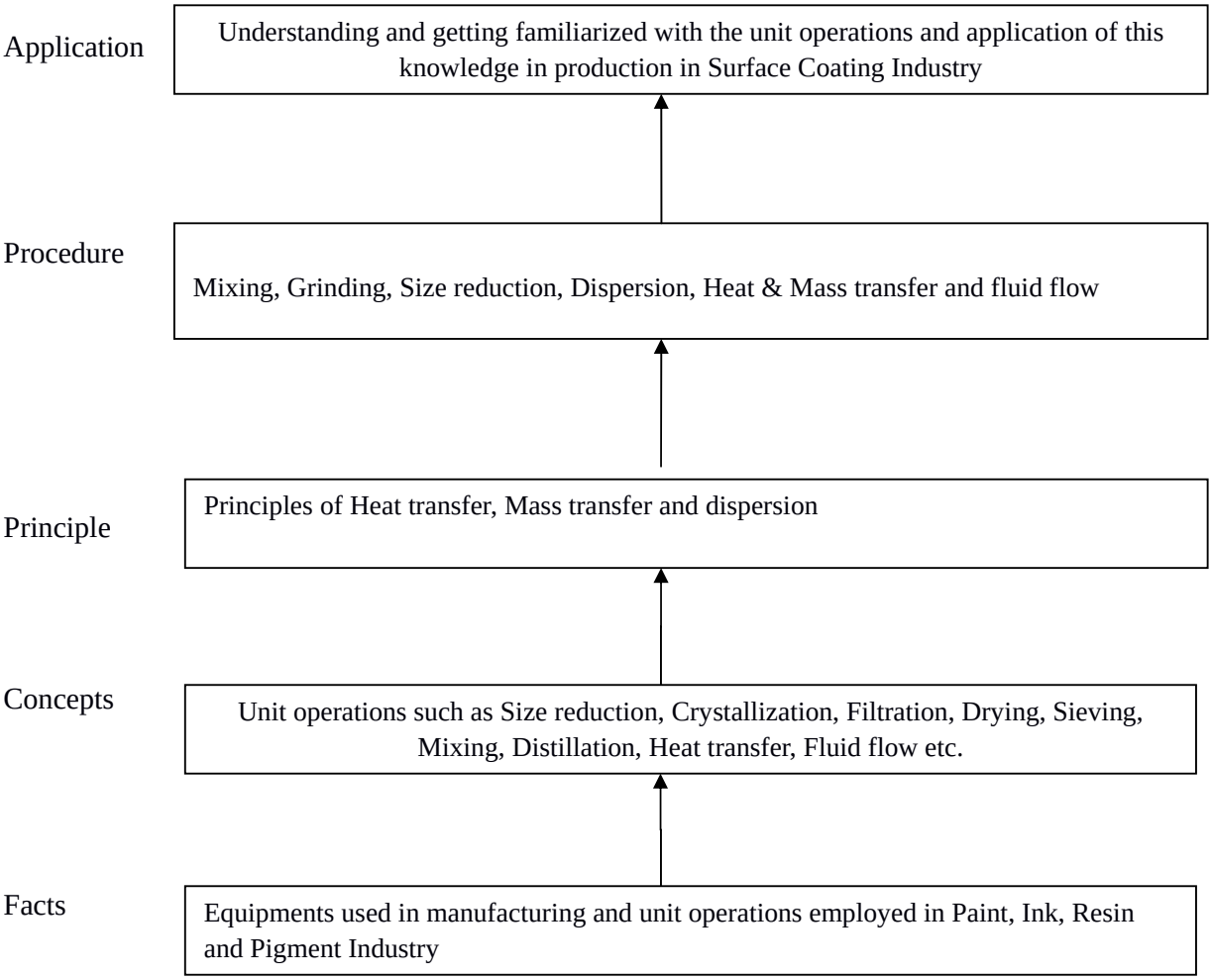
This is a very important subject as it covers all the major unit operations in the Surface Coating Industry such as Mixing, Grinding, Filtration, Drying etc. Besides, other important processes like fluid flow, Heat transfers etc. are covered in this subject. The Subject will help the Students to understand basic operations that are involved in the production and applications of paints and other Surface Coatings.

Objectives:

The Student will be able to:

1. Define unit operations in Surface Coating Industry
2. Identify applications of unit operations
3. Describe equipment used in various operations.

Learning Structure:



Contents: Theory

Topic and Contents	Hours	Marks
Fluid Flow **Specific Objectives:** ➢ Define & explain static fluid & fluid dynamics ➢ Explain use of manometers, derive expression for fluid flow through orifice & Venturi meter ➢ Sketch the diagram & explain working of Pumps, Blowers, compressors, valves **1.1 Nature of Fluid** Marks 12 Laminar and turbulent flow, Reynolds No. Bernoulli's theorm. Methods of flow measurements such as manometers, orifice meter, venture meter, Rotameter **1.2 Pumps** Marks 08 Reciprocating and Centrifugal pumps, Blowers and Compressors, Valves-Construction and working	10	20
Heat Transfer **Specific Objectives:** ➢ Describe the different modes of heat transfer ➢ Derive the expression for heat transfer through single slab & Composite slab ➢ Describe the types of distillation methods. **2.1 Mechanism of Heat Transfer** Marks: 12 Conduction, Convection, Radiation. Heat transfer equipment-Heat exchangers, Condensers, Evaporators-Horizontal, vertical type, multiple effect evaporation **2.2 Distillation** Marks: 08 Vacuum distillation, Distillation Columns, Simple construction & Working	12	20
Mixing **Specific Objectives:** ➢ Define & explain types of mixing operation in chemical Industries ➢ Explain the use of different types of mixers with neat diagrams ➢ Explain the application areas of different types of Mixers Solid-liquid, liquid-liquid, solid-solid mixing, viscous masses, types of mixers such as banbury mixer, sigma blade mixer, High speed stirrers	08	20
Topic 4: Size Reduction **Specific Objectives:** ➢ Define & explain the terms crushing & grinding ➢ Sketch the diagram & explain principal of working of types of Crushers & grinders ➢ Classify the types of Screens, Sketch the diagram & explain working of different types of Screens **4.1 Coarse Crusher** Marks : 10 Intermediate crushers, fine grinders, crushing Rolls, fine size reduction equipment-Ball Mills, Tube Mills **4.2 Screens** Marks : 10 Simple Screen equipment such as trammels, Grizzalies, Sieve analysis	10	20
Topic 5: Filtration & Drying **Specific Objectives:**	08	20

➢ Define & explain the terms Filtration , Drying; their significance in chemical industries ➢ Sketch the diagram & explain principal of working of different types of filters ➢ Sketch the diagram & explain principal of working of different types of Dryers **5.1 Filters** Marks: 12 Classification of filters, filter Press, Continuous Rotary Drum filter, Vacuum Filter-Simple Construction and working **5.2 Dryers** Marks: 08 Types of dryers such as tray dryer, Rotary Dryer, Spray Dryer		
Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Understand the concepts of unit operations and unit processes
2. Apply principles of conservation of mass and energy
3. Understand operation of transportation of liquids and Solids

Psychomotor Skills:

1. Preparing the instrument setup ready for experiment.
2. Accurate measurement of Chemicals using measuring devices.
3. Handle and disposal of hazardous waste material.

List of Experiments: [Minimum 10 experiment to be completed]

1. Determine porosity of Pigments/extenders
2. Determine rate of settling in pigments by sedimentation
3. Determine effect of temperature on viscosity of liquids using Red Wood Viscometer
4. Determine flash point of Solvents using Able's flash Point apparatus
5. Determine flash point of Solvents using Cleveland flash Point apparatus
6. Determine flash Point of Solvents using Pensky Martin's apparatus.
7. Determine Fire Point of Solvent/Oil using Open cup method
8. Determine Residue on Sieve by sieve analysis of pigments
9. Prepare Dry Distemper using Ball Mill
10. Separation of Solid-liquid mixer using Centrifuge
11. Separation of mixture of Solvents by simple distillation
12. Separation of mixture of Solvents by steam distillation
13. Determine NVM in Resins/Paints by heating

14. Visit to Industry to understand unit Operations

Learning Resources:
Books:

Sr. No.	Author	Title of the Book	Publisher
1.	Badger & Banchero	Introduction to Chemical Engineering	Mc Graw Hill Book Co
2.	McCabe & Smith	Unit Operations of Chemical Engineering	Mc Graw Hill Book Co
3.	Richardson & Coulson	Chemical Engineering Vol. I	E.L.B.S. & Pergramon Press
4.	Richardson & Coulson	Chemical Engineering Vol. II	Asian Book Pvt. Ltd
5.	R N Shreve	Chemical Process Industries	Mc Graw Hills Kogakusha Ltd
6.	R H Perry	Chemical Engineers Hand Book	Mc Graw International

Course Name : All Branches of Diploma in Engineering & Technology

Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/ EE/EP/CH/PS/CD/ED/EI/CV/FE/FG/IU/MH/MI/TX/TC/DC/AU/ML/FC/PN/ SC/TR

Semester : Fifth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/ EE/EP/CH/PS/AU/ML/FC/PN/SC/TR and Sixth for CD/MH/IU/CV/FE/FG/MI/ED/ EI/DC/TC/TX

Subject Title : Behavioural Science

Subject Code : 17075

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	--	25 #	25 @	50

Rationale:

With increased globalization and rapid changing business expectations, employers are looking for wide cluster of skills to cater to the changing demand. Personality traits and soft skills are playing a key role in a student's career in this changing scenario. Corporate houses look for soft skills that supplement hard skills.

Addition of behavioural science in curriculum is intended to enhance the efficiency of a person so that he can contribute to overall growth of organisation. It aims at developing insight into leadership, team building, motivation, interpersonal relationship, problem solving, decision making and aspects of personality in a technician's profile. Addition of the topic of organizational culture will further mould him/ her in the organisational role.

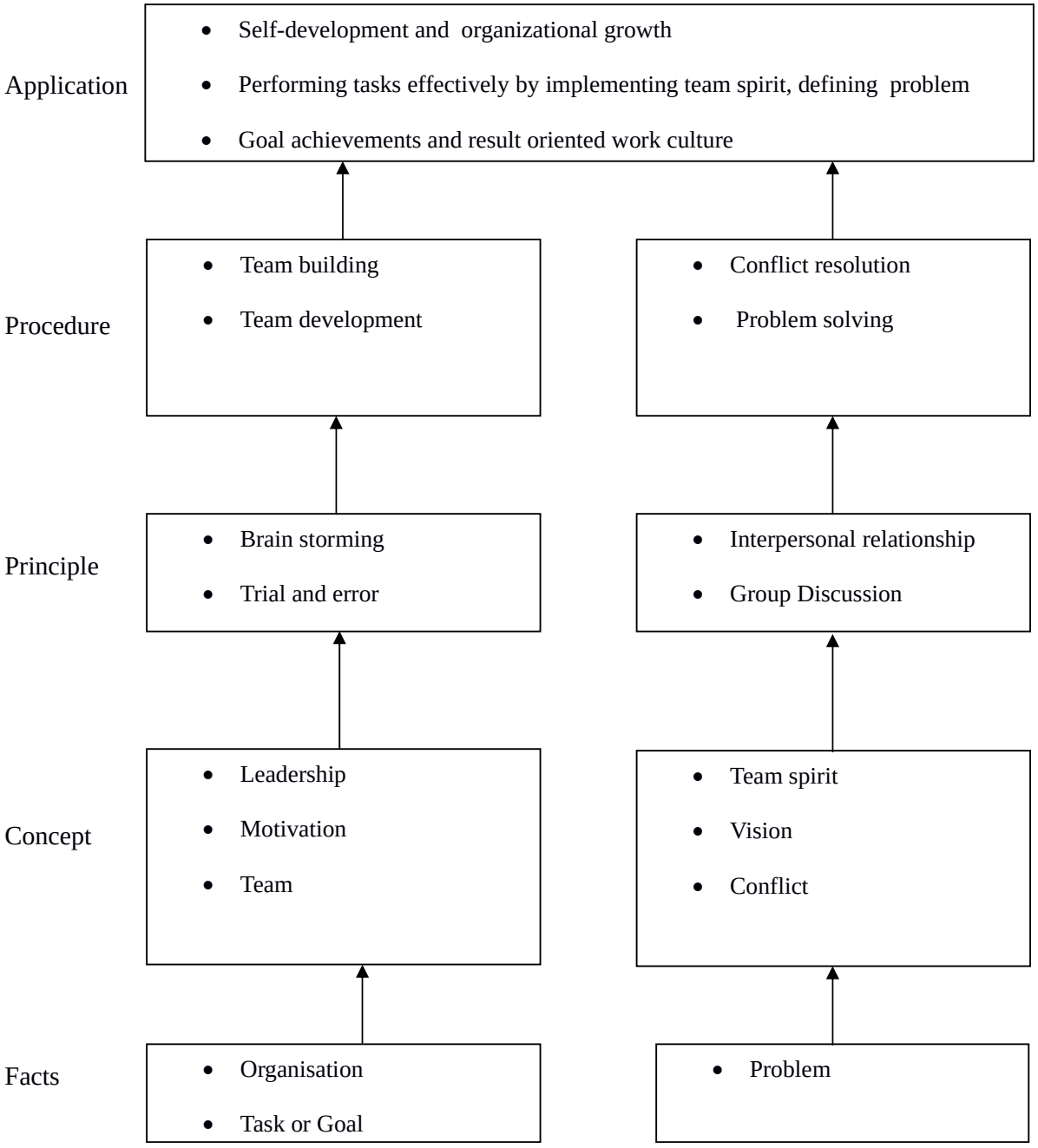
This subject of 'Behavioural Science' provides a broad base in which a technician can develop a successful career in the world of work.

General Objectives:

After studying this subject, the students will be able to:

1. Develop him/her as Team leader.
2. Use self-motivation and motivate others.
3. Build a team and develop team spirit among the team members.
4. Improve the interpersonal relationship skills.
5. Learn Problem solving and decision making skills.
6. Discuss a particular topic in a group and face the interview.

Learning Structure:



Theory:

Topic and Contents	Hours
Topic 1: Leadership 1.1 Management Education-History, Development, Importance, Areas of specialization, need and importance of behavioural science. 1.2 Meaning and Types of Leaders, Qualities of leader, Examples 1.3 Leadership- Definition, importance, leadership in various organizations 1.4 Leadership styles-task -people matrix. Persuasive, Authoritative, Democratic, Delegative Leadership styles. Maturity of followers, situational leadership	02
Topic 2: Motivation 2.1 Meaning 2.2 Importance of Motivation 2.3 Types of Motivation- Intrinsic, Extrinsic, Examples 2.4 Maslow's motivation theory- pyramid of needs, individual and industrial applications 2.5 Tips for Motivation	02
Topic 3: Emotional Intelligence 3.1 Major concepts - emotion, families of emotion, components of emotional expressions 3.2 Emotional intelligence, cognitive intelligence 3.3 Basic emotional competencies	02
Topic 4: Team Building 4.1 Team- Need, Definition, Difference between group and team 4.2 Characteristics of a good team 4.3 Steps in team formation- forming, norming, storming, performing, adjourning 4.4 Roles of team members 4.5 Characteristics of a good team member 4.6 Types of teams-Work, mgmt, cross functional, quality circle, self-managed team	03
Topic 5: Conflict Resolution 5.1 Definition, types (interpersonal, intrapersonal, groups), indicators of conflicts 5.2 Sources of conflict - ego, poorly defined authority and responsibility, power, interests, greed, difference in value system, complex work situations 5.3 Skills for conflict resolution 5.4 Steps in conflict management -Mapping of conflict, negotiation- steps in negotiation, 5.5 Styles of conflict management- collaborating, competing, cooperating, avoiding, compromising	03
Topic 6: Decision Making 6.1 Importance of decision making 6.2 Definition Characteristics of good decision 6.3 Characteristics of good decision 6.4 Types of decisions- programmed, non programmed, strategic, tactical, impulsive 6.5 Group decision making 6.6 Steps of decision making	02
Topic 7: Interview Techniques 7.1 Job search opportunities 7.2 Development of résumé´ and cover letter- essentials of a good résumé´,	**02**

	contents of Résumé´, layout of résumé´, cover letter	
7.3	Group discussion- objectives, do's and don'ts for effective participation, evaluation parameters, suggested topics	
7.4	Psychometric tests- Aptitude test, guidelines for preparations for aptitude test, Personality test	
7.5	Personal interview-guidelines for preparing for job interviews, common questions	
	Total	**16**

Practical:
Skills to be developed:

Intellectual Skills:

- Develop ability to find his strengths
- Select proper source of information.
- Follow the technique of time and stress management.
- Set the goal.

Motor Skills:

- Follow the presentation of body language.
- Work on internet and search for information.
- Prepare slides / transparencies for presentation.

List of Assignments:

01	Case study: Employee motivation and leadership.
02	To build a tower from a given material as a team activity
03	To prepare Jigsaw puzzles (common shapes) from the given jigsaw pieces as a team.
04	Case study on conflict Resolution
05	Assess your style of conflict resolution
06	Decision making activity: of Selection of the best suitable company.
07	Participate in a guided group discussion
08	Assessment of self-aptitude in numerical computation, estimation, data interpretation, mechanical, spatial and abstract reasoning
09	Assessment of self-aptitude in Verbal ability and data checking.
10	Development of résumé´ and covering letter

Note: Subject teacher shall guide the students in completing the assignments based on above practicals.

Learning Resources:
Books:

Sr. No.	Author	Name of Book	Publication
1	Subject Experts-MSBTE	Handbook and assignment book on Development of Life Skills-II	MSBTE
2	Dr. Kumkum Mukherjee	Principles of management and organizational behaviour	Tata McGraw Hill Education Pvt Ltd.
3	Dr.T.Kalyana Chakravarti Dr.T.Latha Chakravarti	Soft Skills for Managers	Biztantra
4	Barun K Mitra	Personality Development and soft skills	Oxford University Press
5	Priyadarshini Patnaik	Group discussion and interview skills	Foundation Books

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

Course Code **: SC**

Semester **: Sixth**

Subject Title **: Entrepreneurship Development**

Subject Code **: 19084**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
01	01	--	--	--	--	--	25@	25

Rationale:

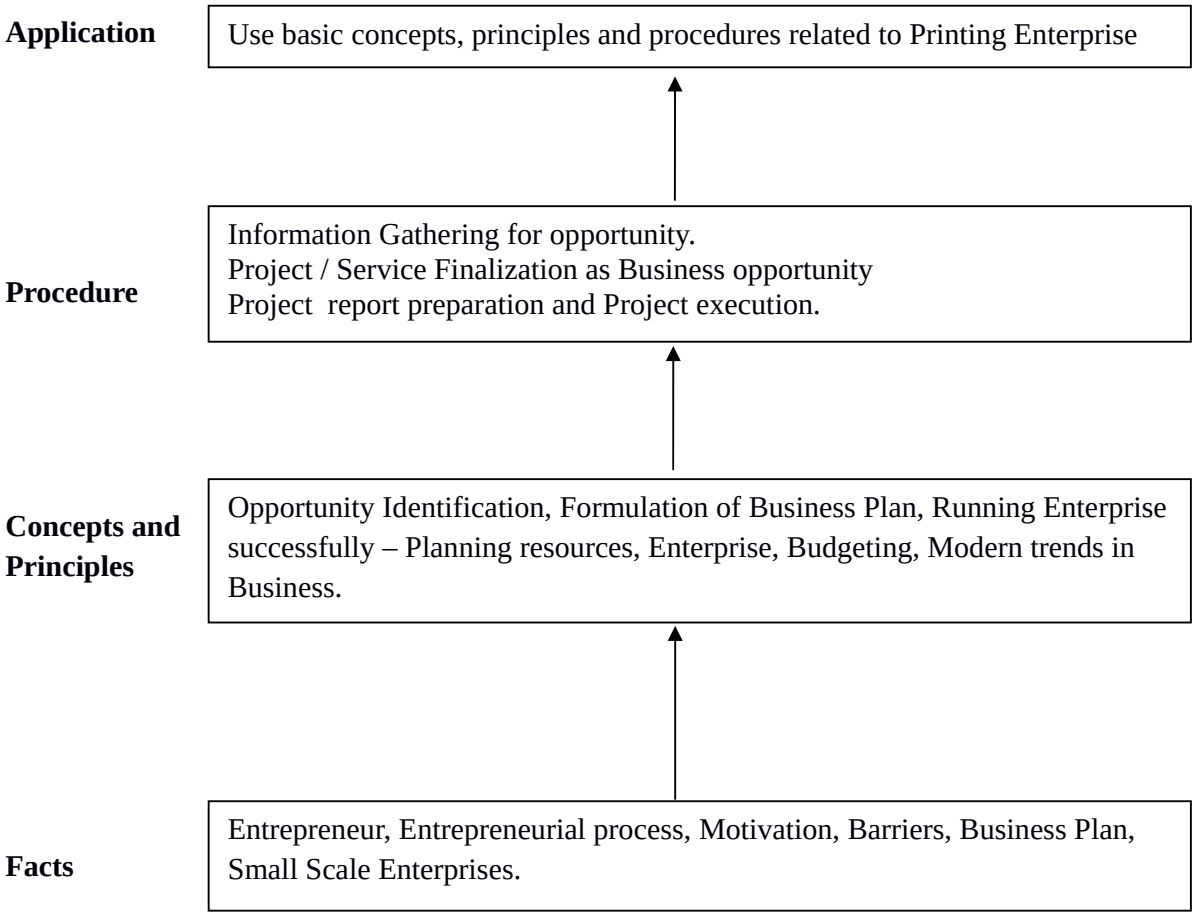
Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. The educational institutions should also demonstrate their uniqueness in the creation of enterprising personalities in their colleges. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

General Objectives:

The students will be able to

1) Appreciate the concept of Entrepreneurship
2) Identify entrepreneurship opportunity.
3) Develop entrepreneurial values and attitude
4) Collect and use the information to prepare project report for business venture

Learning Structure:



Content:
Entrepreneurship Development

Theory:

Topic	Name of Topic	Hours
01	**Entrepreneurship, Creativity & Opportunities** • Concept, Classification & Characteristics of Entrepreneur • Creativity and Risk taking, Risk Situation, Types of risk & risk takers. • Business Reforms. • Process of Liberalization. • Reform Policies. • Impact of Liberalization. • Emerging high growth areas. • Business Idea Methods and techniques to generate business idea. • Transforming Ideas in to opportunities transformation involves • Assessment of idea & Feasibility of opportunity • SWOT Analysis	03
02	**Information and Support Systems** • Information Needed and Their Sources: • Information related to project, Information related to support system, Information related to procedures and formalities • Support Systems • Small Scale Business Planning, Requirements. • Govt. & Institutional Agencies, Formalities • Statutory Requirements and Agencies.	02
03	**Market Assessment** • Marketing -Concept and Importance • Market Identification, Survey Key components • Market Assessment	02
04	**Business Finance & Accounts** **Business Finance** • Cost of Project • Sources of Finance • Assessment of working capital • Product costing • Profitability • Break Even Analysis • Financial Ratios and Significance **Business Account** • Accounting Principles, Methodology • Book Keeping • Financial Statements • Concept of Audit	03

05	**Business Plan & Project Report** • Business plan steps involved from concept to commissioning • Activity Recourses, Time, Cost • Project Report • Meaning and Importance • Components of project report/profile (Give list) **Project Appraisal** 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis	03
06	**Enterprise Management And Modern Trends** **Enterprise Management:** • Essential roles of Entrepreneur in managing enterprise • Product Cycle: Concept and importance • Probable Causes Of Sickness • Quality Assurance: Importance of Quality, Importance of testing • E-Commerce: Concept and Process **Global Entrepreneur** • Assess yourself-are you an entrepreneur? • Prepare project report and study its feasibility	03

Tutorial:

Sr. No.	Assignments
1	Assess your self – are you an entrepreneur?
2	An Interview with an Surface Coating entrepreneur.
3	Feasibility study of Surface Coating related Business proposals
4	Prepare a project report for starting a small scale business.

Learning Resources:

1) Reference Books:

Sr. No.	Name of Book	Author	Publisher
1	Entrepreneurship	Trehan	Dream Tech Press
2	Entrepreneurship 2/e	Rajeev Roy	Oxford University Press
3	Entrepreneurship and Small Business	Schaper	Wiley India Publication
4	Entrepreneurship Development	Colombo plan staff college for Technical education.	Tata Mc Graw Hill Publishing co. ltd. New Delhi.

5	Poornima M. Charantimath	Entrepreneurship Development of Small Business Enterprises	Pearson Education
6	Entrepreneurship Development	E. Gorden K.Natrajan	Himalaya Publishing. Mumbai

2) VIDEO CASSETTES

No.	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmedabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
2	Assessing Entrepreneurial Competencies	
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur Skill	

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

Course Code **: SC**

Semester **: Sixth**

Subject Title **: Project & Inplant Training**

Subject Code **: 19905**

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER Hrs.	TH	PR	OR	TW	TOTAL
--	--	40	--	--	--	100#	100@	200

* 40 hrs per week for 20 weeks

Rationale:

The Sixth semester training of students is arranged preferably in Application, in a paint manufacturing or allied company, where the students may learn about paint application methods, evaluation of paint and defects etc., in a professional manner. The industrial training provides an opportunity to students to actually see and use sophisticated instruments. Students will know about formulating principles, modern application methods equipment and causes & cures of paint failure. The training also provides an opportunity to get accustomed to the industrial work atmosphere.

Objectives:

Student will be able to:

1. Learn formulating principles of Paints
2. Able to handle application equipment
3. Apply the proper application & evaluation methods
4. Learn Coating defects & rectification

Learning Structure:

Application

Getting desired results, learning methods followed in industry and preparation of comprehensive training reports

Procedure

Getting accustomed with work culture, work procedure, working towards achieving set goals by following norms of hard work and safety

Principle

Principle of working in groups, i.e team work in order to achieve set targets within prescribed time limit and set procedures

Concepts

Working with machinery and equipment so as to be able to produce desired results under the guidance of superiors

Fact

Industry, work place, equipment, Instruments, procedures. Men and machinery, knowledge of methods

TRAINING: General guide lines

General

1. Duration of training covers 20 weeks
2. The in-plant training is approved by the Board of Apprenticeship Training. (BOAT)
3. The Sixth semester training will usually be from December to April every year
4. The students will be placed in a Paint application/manufacturing company related to surface coating for training.

Role of Students

1. During the training period the student has to be regular and punctual in his/her duties
2. The students will follow all rules, regulations and instructions prescribed by the company management
3. He/she will get a chalked out training program for the training period
4. The student has to show keen interest in learning practical aspects of the principles that has been studied in theory classes in earlier semesters.
5. With the permission of authorities, students will keep day to day records of the actual work carried out by him/her. Such information helps the students preparing the report for exam.
6. The 6^{th} sem. students will carry out work relating to paint application/paint manufacturing in paint and coatings industry.
7. The students are expected to learn how to judge the quality of finished paint and quality of finish/coatings
8. The student is expected to learn modern application/manufacturing methods and its principle

Role Industry

1. The institute will be in touch with the industry as regards the performance of the students during training. Regular feedback will be obtained from the industry.

Examination

1. The students fulfilling the eligibility criteria for appearing VIth Semester examination as per MSBTE rules, will be allowed to appear for final examination on Project & Seminar on Inplant training for this semester
2. Students will have to submit his diary of training period along with final project report to the Institute on or before prescribed date.
3. As per examination scheme, student will be evaluated during his examination by internal & external examiner

Skills To Be Developed

Intellectual Skills

1. Getting acquainted with the factory routine
2. earning Preparation of production & execution methodology
3. Handling and controlling sequential operations

PROJECT REPORT

1. After satisfactory completion of the training of the student, the student will be given about one week to submit in-plant training report
2. The report must be type written (computer copy) A-4 size bond paper and running in nearly 30 – 40 pages with proper margin and line spacing.
3. The report must include actual work done by the student during the training period. The paint, Coatings tested, tests carried out by him, results obtained.
2. Before writing of final report, students will prepare handwritten manuscript and will get it certified with company official. Based on this student shall prepare the final project report on the work actually he/she carried out in industry.
3. The report should contain only the information which is permitted by the factory. A copy of the report must be submitted to the company.
4. The report must be accompanied by a certificate from the company authorities regarding completion of the training by the student. (A photocopy of the certificate maybe attached in the report and original certificate must be preserved for the final examination.
5. The report must also be accompanied by the student's submission and institutes certificate. With the permission of the factory, the student may attach / submit samples specimens, photographs panels along with the reports in deliver order to make the report more effective.
6. The students have to the seminar in presence of students and examiners. He will be evaluated by the external examiners on the basis of seminar talk and the report submitted by him.

FORMAT OF THE PROJECT REPORT

1. Contents
2. Acknowledgement and certificate
3. Introduction to the company
4. Brief details about the training program
5. Products manufactured by the company
6. Testing /evaluation methods
7. Actual work done by the student. This should be in details. The report should be such that it should cover the actual work done by the students, and details of testing carried out. The content of the report should not have directly taken form the text books, industry website & company presentation etc.
8. The report must also have necessary diagrams and photographs to make understanding clear and effective.
9. The students should give his observations and suggestions.

EXAMINING

1. The students must have complete knowledge about everything given in the report
2. He/she must show confidence while delivering the talk as well answering questions
3. The performance of the students will be evaluated by external and internal examiners on the basis of the training report and the presentation made in the hall.
4. Evaluation will be carried out by External & Internal examiner on following aspects
   a) Content of Presentation
   b) Sequence in presentation
   c) Presentation skill
   d) Questions & answers.