

FORMULATION PRINCIPLES

SAPMA PAINT TECHNOLOGY COURSE

South African Paint Industry Training Institute

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Surface Coatings Technology: Formulation Principles SC08

The structure of this module is based on the Printmaker's Association Standard Unit – Formulation Principles.

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In this second South African Edition, certain toxic pigments such as Lead, Chromates and solvents such as Ethylene Glycol Ethers and their Acetates have been replaced as far as possible with safer materials.

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GENERAL INTRODUCTION

Welcome to the SAPMA Paint Technology Course – a study program designed for anyone who needs to develop an understanding of the technology of Surface Coatings and to ultimately obtain a recognised qualification in accordance with the South African National Qualifications Framework (NQF).

It is important that you spend some time studying this introductory section so that you have a thorough understanding of the program structure and the requirements for achieving the SAQA accredited qualification of “Surface Coatings Technologist”.

SAPMA and SAPITI

The study program is organised and run by the South African Paint Industry Training Institute (SAPITI) which is the training arm of the South African Paint Manufacturers Association (SAPMA).

SAPMA is the Trade Association for the surface coatings industry in South Africa. The Association has been in existence for over sixty years. It is open to membership to all segments of the Industry value chain including manufacturers, suppliers, retailers and applicators.

STATEMENT OF STRATEGIC INTENT

- **SAPMA** shall provide a forum for the exchange of ideas and information with a strict adherence to ethical business practises and legal conduct.
- The association shall serve as the industry’s chief representative and spokesperson before the government and public and shall act to influence matters that impact the industry from time to time.
- The association shall constantly promote to strengthen the industry’s commitment to continuous improvement in health, safety and environmental performance, including packaging and the handling and transportation of hazardous goods.
- To continuously advance and promote the theory and practice of paint technology in Southern Africa.
- To foster and promote International co-operation and standards.

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- Liaise with the Board of Trade and Tariffs to represent the industry's view relating to tariffs and tariff classification.
- The maintenance of Personal Protection System for manufacturing workers to assist members in discharging their duties in terms of the Occupational Safety and Health Act
- The association shall promote the paint and coatings industry's substantial contributions to all aspects of society.

The SAPMA and SAPITI Training and Development Manager can be contacted at:

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e-mail: training@sapma.org.za

website: <http://sapma.org.za>

HISTORY OF THE SAPMA/SAPITI SURFACE COATINGS TRAINING PROGRAM

SAPMA acquired the use of the learning material from the British Coatings Federation (BCF) (formerly known as the Paint Manufacturers Association of Great Britain) in 1987. Since then there have been a number of changes made to the notes in order to keep abreast with changes in the technology or adapt them to the South African environment. There have also been changes with respect to the method of presentation and facilitation.

One notable change was to convert the audio cassette tapes to CD (compact discs) and to provide written notes of the scripts to students. Another change took place during 1996 to 1998 when the BCF revised the learning material and these changes were incorporated in the South African version of the notes in 2001.

The most recent changes are the incorporation of three additional lessons namely "Project Management", "Information Management" and "Managing Interpersonal Relationships" in order to meet the requirements of the practical skills curriculum. The program has also been changed to align it with the requirements of the qualification assessment specification. The overall development of Formulation Principles for accreditation was facilitated by the Chemical Industries Education and Training Authority (CHIETA).

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MODULE PRE-REQUISITES

It is assumed that learners registering for Formulation Principles will have previously attained reasonably comprehensive knowledge of coatings components and test methods. This must have been achieved by successfully completing the earlier modules together with present or recent employment in the coatings or related industries.

Completion of the following Modules and achievement of the prescribed credits will normally be expected.

Learning	Credits	NQF Level
Basic Technology	9	4
Paint Application	9	5
Solvents and Binders	10	5
Pigments & Dispersion	12	5
Modifiers	7	5
Testing of Paint (Evaluation)	6	5
Convertible Binders	12	5
TOTAL CREDITS	65	

OCCUPATIONAL PROFILE: SURFACE COATINGS TECHNOLOGIST:

Occupational Purpose:

Surface Coatings Technologist develops surface coatings formulations, optimizes existing surface coatings formulations and provides technical support services to surface coatings manufacturers and end users.

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Occupational tasks:

- a) Planning, researching and developing surface coatings design parameters for surface coatings products
- b) Optimising surface coatings formulations for surface coatings products
- c) Providing technical support on coatings to internal and external customers

Occupational Task 1:

Designing and developing surface coatings design parameters for surface coatings products

Unique Product or Service

Surface coatings design parameters developed

Knowledge Focus

- Surface coatings formulation principles and methodologies
- Basic chemistry and physics (bridging level)
- Chemistry of raw material for surface coatings
- Characteristics of substrates (surfaces that require painting)
- Paint testing methods
- Colour theory
- Paint testing apparatus
- Environmental factors (cold, hot, humid etc.)
- Project management skills
- Legislation: Occupational Health and Safety and Environment
- Consumer needs and requirements
- Computer skills: generic and specific programs
- Information Management techniques

Occupational Responsibility

Design parameters of surface coatings formulation

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Practical Skills

- a) Develop surface coatings design parameters
- b) Develop a project plan
- c) Assess and select surface coatings raw materials based on their characteristics and chemistry
- d) Develop surface coatings formulation
- e) Adapt or reformulate surface coatings design based on feedback

Occupational Context

Planning, researching and developing the design parameters of the surface coatings formula for a specific substrate using coatings testing equipment used in the laboratory and on the field according to workplace specific quality standards

- Paint testing equipment used in the laboratory and on the field
- Production machinery in the factory
- Material handling and storage processes and procedures
- Information management processes
- Internal and external customers, suppliers and fellow technologists
- Workplace specific quality standards

Work Experience

- a) Select raw material according to customer requirements
- b) Establish the available resources of the company (i.e. on production processes, laboratory instrumentation, product knowledge) applicable to the development of formulations
- c) Develop the design parameters by applying knowledge of colour theory, product knowledge, applicable technologies, substrates and exposure to elements
- d) Assess the product on a specific substrate
- e) Apply the requirements of applicable legislation and applicable standards when developing design parameters

Specific Contextual Workplace Knowledge

- Workplace Standard Operations Procedures (SOP)
- Safety, Health and Environmental (SHE) requirements
- Meeting procedures
- Hazard ratings, including Material Safety Data Sheets (MSDS)
- Workplace specific equipment
- Purchasing procedures and specifications of surface coatings raw material
- Manufacturer's specifications
- Packaging and transport requirements
- Storage and waste disposal procedures
- Maintenance and calibration of paint testing equipment

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- Paint testing equipment used in the laboratory and in the field
- Production machinery in the factory
- Material handling and storage processes and procedures
- Reporting structures
- Information management processes
- Internal and external customers, suppliers and fellow technologists
- Workplace specific quality standards

Occupational Task 2:

Optimising formulations for surface coatings products

Unique Product or Service

Optimised formulations for surface coatings products for production

Knowledge Focus

- Basic chemistry and physics (bridging level)
- Chemistry and physical properties of raw material for surface coatings
- Surface coatings formulation principles and methodologies
- Colour theory, including measuring and matching
- Paint application methods
- Paint testing methods
- Paint testing apparatus or instrumentation
- Characteristics of and coating requirement of substrates
- Legislation: Occupational Health and Safety and Environment
- Computer skills: generic and specific programs
- Environmental factors (cold, hot, humid etc.)
- Consumer needs and requirements (See note below)
- Consumer management
- Information Management techniques
- Meeting procedures
- Supervisory procedures, techniques and methods
- Project planning techniques and methods

Occupational Responsibility

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Ensure optimised field performance of the finished surface coatings product.

Practical Skills

- a) Prepare a small scale surface coatings sample
- b) Assess, evaluate and optimise surface coatings formulation
- c) Apply surface coating
- d) Design final technical literature and information

Occupational Context

- Optimize surface coatings formulations and transfer to production in the factory
- Paint testing equipment in the laboratory
- Production machinery in the factory
- Information Management
- Handling and storage of material
- Internal and external customers, suppliers and fellow technologists
- Quality Standards

Work Experience

- a) Develop trial surface coatings formulations and samples and test until optimised
- b) Transfer surface coatings formulations to production

Specific Contextual Workplace Knowledge

- Workplace Standard Operations Procedures (SOP)
- Safety, Health and Environmental (SHE) requirements
- Hazard ratings, including Material Safety Data Sheets (MSDS)
- Workplace specific equipment
- Purchasing procedures and specifications of surface coatings raw material
- Manufacturer's specifications
- Packaging and transport requirements
- Storage and waste disposal procedures
- Maintenance and calibration of paint testing equipment
- Reporting structures
- Consumer needs and requirements
- Paint testing equipment in the laboratory
- Production machinery in the factory
- Information Management
- Handling and storage of material
- Internal and external customers, suppliers and fellow technologists
- Quality Standards

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Occupational Task 3:

Providing technical support on coatings to internal and external customers

Unique Product or Service

Technical support on all types of coatings provided

Knowledge Focus

- Types of finished surface coatings products
- Paint application methods
- Paint application tools and equipment
- Conditions of use of paint
- Computer skills: generic and specific programs
- Trouble shooting techniques (e.g. Ovens, U/V)
- Use of paint testing equipment
- Machinery and manufacturing processes
- Report writing: layout, content and recommendations
- Supervisory procedures, techniques and methods

Occupational Responsibility

Provide correct technical specifications, advice and information leading to satisfaction of internal and external customers

Practical Skills

- a) Provide correct diagnosis to surface coatings problems
- b) Generate a technical report or provide verbal advice
- c) Compare properties of equivalent products
- d) Meet customer needs and expectations in respect of surface coatings formulation problems

Occupational Context

Providing technical support on coatings to internal and external customers

- Internal and external customers, suppliers and fellow technologists
- Environmental conditions related to product properties and use
- Variety of substrates
- Coatings required for substrates
- Diagnostic tools and equipment
- Variety of products

Work Experience

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- a) Handle customer situations requiring technical support on coatings solution
- b) Assess problems and provide technical solutions and advice for surface coatings services
- c) Generate a report on coating specifications

Specific Contextual Workplace Knowledge

- Workplace Standard Operations Procedures (SOP)
- Safety, Health and Environmental (SHE) requirements
- Report formats
- Workplace specific equipment
- Manufacturer’s specifications
- Packaging and transport requirements
- Storage and waste disposal procedures\Maintenance and calibration of paint testing equipment
- Reporting structures

OCCUPATIONAL CURRICULUM: SURFACE COATINGS TECHNOLOGIST: 234201

Curriculum Scope:

Alignment with the OFO (Organising Framework of Occupations)

234201 Chemist (Skill Level 5)

The occupation, Surface Coatings Technologist will form a specialization within the Occupation of the Chemist and will lead to a National Certificate.

Relevant Unit Group

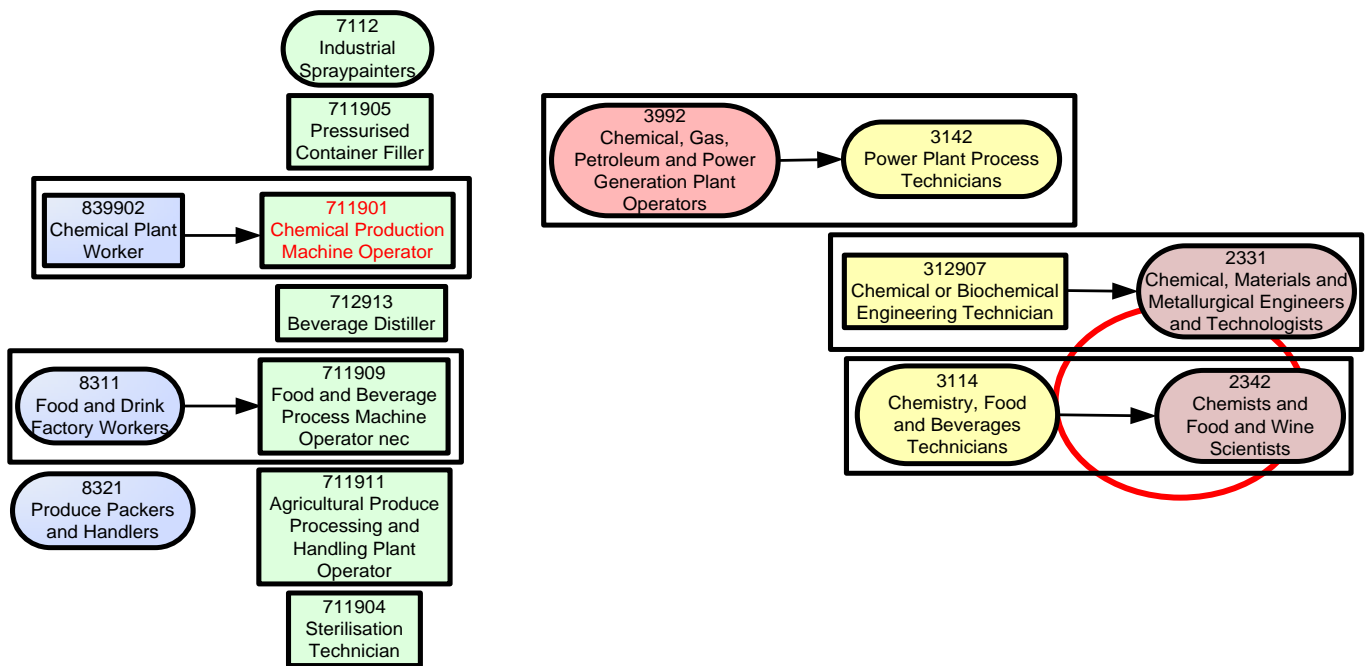
2342 Chemists and Food and Wine Scientists (Skill Level 5)

Alignment with the NOPF (National Occupational Pathway Framework)

Occupational Cluster: 8 Production Related Occupations

Occupational field: Chemical, Gas, Food and Beverages Production Occupations

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Detailed information on Unit Group (OFO)

234201 Chemist (Skill Level 5)

Studies the chemical and physical properties of substances, and develops and monitors chemical processes and production.

Alternative titles and specialisations:

Analytical Chemist

Industrial Chemist

Laboratory Chemist

Manufacturing Chemist

Pharmacologist (Non-Clinical)

Development Quality Partner

Chemical Industries Education & Training Authority (CHIETA)

2 Clamart Road, Richmond, 2092

P O Box 961, Auckland Park, 2006

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CODE OF CONDUCT TO BE SIGNED BY THE CANDIDATE

The candidate needs to complete the following before attempting the external summative assessment:

No.	INSTRUCTION	YES	No	COMMENT
1	Candidate was warned not to bring any books, notes or papers into the external summative assessment room.			
2	Candidate was informed that s/he may under no circumstances remove any question papers, drawings, tools, equipment or material from the external summative assessment venue.			
3	Candidate was informed that no communication is allowed between Candidates during an external assessment task. Failure to comply with this requirement may lead to disqualification. (Should the candidate be required to leave the venue during a task, s/he must be under supervision during the absence).			
4	Candidate was informed that any complaints or grievances regarding equipment, tools, material or the manner in which the external summative assessment was conducted must be made in writing and handed to the assessor before leaving the external summative assessment centre.			
5	Candidate was informed that he or she may not distribute or sell any information regarding the external summative assessment to the public. Failure to do so may lead to legal action.			
6	Candidate was informed that no money may be offered to an assessor or his or her assistant. Also that should any external summative assessment personnel ask for a fee, that it must be brought to the attention of the assessor immediately.			
7	Candidate was informed that external assessment result will be furnished after the external assessment, and if needed the Candidate may lodge a appeal			

I, the undersigned, have read and agreed to the above.

SURNAME AND INITIALS		TRADE	
SIGNATURE OF CANDIDATE		DATE	

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THE LEARNING PROCESS DESIGN

Formulating Principles is the final in the series designed to develop an understanding of the technology of Surface Coatings in terms of their components and test methods. In order to continue with this Module you would have successfully completed the preceding modules. For the purposes of the tutorials and TMA, "Basic Project Management" and "Managing Interpersonal Relationships in the Paint Industry" have been included in the learning material in Lessons 19 to 21.

The learning process design for Formulating Principles is made up of six sections namely:

Section	Title	Credits	NQF Level
A & B	Formulating Principles / Formulation Requirements	5	6
C	Practical Skills	16	6
D	Work Experience	60	5
E	Project & Information Management	6	4
F	Managing Interpersonal Relationships in the Paint Industry	6	4
	TOTAL CREDITS	93	

THE LEARNING PROGRAM

The assessment criteria requires that students complete a practical assignment (Section C) based on the knowledge acquired from the learning material in Sections A, B, E & F It is therefore logical that the student has an opportunity to first acquire this knowledge with the assistance of a Tutor. The criteria also includes a period of "work experience" during which students demonstrate their ability to apply the various practical facets of formulating principals, formulating, project management, communication and reporting writing skills as well as computer literacy

At the beginning of each semester students who have the achieved the Formulating Principles entry criteria may register for this final phase of the qualification and attend the tutorials as set out according to the prescribed schedule. (Refer below)

On completion of the tutorials the student is expected to commence the assignment for Section C and to this end present the assignment plan to his or her Tutor not later than eight weeks after the last tutorial (Lesson 21) Students should endeavour to complete their assignment and submit their project report to their tutor within a period not exceeding twelve months.

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With respect to Section D, the Work Experience Modules, these may commence at any time after a student has started with Formulating Principles. The work required for section D is set out in Section 12 of these guidelines and is done in the workplace. Normally the student's supervisor would sign off the work, verifying the student's competency. Alternatively a tutor may be assigned to do this.

The learning material for Sections A & B is arranged in topic sections divided into the number of lessons given below:

SECTION A – COATING FORMULATIONS – GENERAL PRINCIPLES

Lessons 1 - 6

(Objectives in accordance with those stipulated for each of the lessons in the learning material)

SECTION B – FORMULATING COATINGS

(Objectives in accordance with those stipulated for each of the lessons in the learning material)

- External Woodwork - Lessons 7 & 8
- Wood Finishing – Lesson 9
- High Performance Applications – Lessons 10 & 11
- Powder Coatings – Lessons 12 & 13
- Automotive Coatings – Original Finish – Lesson 14
- Automotive Coatings – Refinish – Lessons 15 & 16
- Linings for Food and Beverage Containers – Lessons 17 & 18
- Project Management – Lesson 19
- Information Management – Lesson 20
- Managing Interpersonal Relationships in the Paint Industry – Lesson 21

SECTION C – PRACTICAL SKILLS

The objectives for this section are as follows:

- i) Develop surface coatings design parameters
- ii) Develop a Project plan
- iii) Assess and select surface coating raw materials based on their characteristics and chemistry
- iv) Develop surface coating formulation
- v) Adapt and reformulate surface coatings design until the required specification parameters have been met.

The practical skills assessment is based on an assignment (project) that requires you to demonstrate your ability to apply the formulating principles in practice. The scope of the assignment is as follows:

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Scope: Conduct an investigative exercise involving a range of practical techniques concerning a coating for one major use. Your work shall include the following:

- Identify the major factors of the assigned problem making reference to the learning material or other relevant literature
- Devise a work schedule proposing conditions for experimentation
- Conduct a program of work which includes formulation, preparation, application and evaluation of a coating for a specific end use
- Describe the relevant Health and Safety aspects during manufacture, application and usage of the coating that you have developed (Prepare a Material Safety Data sheet for the product)
- Include a product cost calculations for your formulation/s and justify your choice in terms of cost and performance
- Interpret the results obtained
- Produce a written report in accordance with the layout and content as described in Lesson 20 “Communication and Report Writing”

You should aim to commence your assignment immediately after completion of the tutorials and complete the report for assessment within six to twelve months.

SECTION D – WORK EXPERIENCE

The objectives for this Section are to acquire work experience by completing the following occupational tasks and to demonstrate your competence in each of the tasks. (Refer also to **“Occupational Profile – Surface Coatings Technologist”**)

Occupational Task 1 :-

Planning, researching and developing design parameters for surface coating products.

The purpose of this work is to ensure that the student acquires the necessary understanding and practical skills required to ensure that procedural standards and conditions for developing a formulation for coatings are met through analysis and comprehensive documentation.

Occupational Task 2:-

Optimising Formulations for surface coatings products

The purpose of this work is to ensure that the student acquires the necessary practical experience in developing formulations that meet specifications through rigorous field testing and that the use of the formulation meets all the applicable industry standards and product requirements

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Occupational Task 3: –

Providing Technical support on surface coatings to internal and external customers

The purpose of this module is to equip the student to provide t effective and relevant technical support for internal and external customers

Students who have through their previous or current work experience acquired some or all of these skills may commence this section concurrently with Section C the Practical Skills assignment. For students who do not have such experience you may commence this after successful completion of your Practical Skills assignment.

The specific tasks as set out in Section D of your learning material shall be done in your own time, either in your work place or at a venue provided by SAPITI. Your Supervisor or Tutor will confirm your competence by signing off on each task as and when they have been completed.

The time frame for completing your Work Experience tasks will be a minimum of six months and a maximum of eighteen months.

Having successfully completed this section you will be required to write your final TMA based on all the learning material of Sections A to F which serves as the final assessment for the qualification of “National Certificate - Surface Coatings Technologist”

Your results of all the work successfully completed will then be forwarded to the CHIETA for ratification and certification.

SECTION E – BASIC PROJECT MANAGEMENT & SECTION F – MANAGEMENT OF INTERPERSONAL RELATIONSHIPS IN THE PAINT INDUSTRY.

The objectives of these two sections are covered in Lessons 19 to 21 of the learning material and are aimed at providing basic principles to assist you in completing the sections of Practical Skills and during your Work Experience Tasks.

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THE LEARNING SCHEDULE

The Module will commence at the beginning of a semester, with tutorials according to the following study guide and schedule

a) **Section A – Formulating Principles**

Lesson No.	Notional Study Time	Objective	Task
1	2 Hours	1.1	
2	2 Hours	1.2 – 1,4)	
3	1.5 Hours	2.1 – 2,2	
4	1.5 Hours	2.3	
5	1.5 Hours	2.4	Complete CMA 1
6	1.5 Hours	2.5	

b) **Section B, E & F – Formulation Requirements/Project Management / Interpersonal Skills**

Lesson No.	Notional Study Time	Objective	Task
7	1.5 Hours	3.1 (a)	
8	1.5 Hours	3.1 (a)	
9	2 Hours	3.1 (b)	
10	2 Hours	3.1 (c)	
11	2 Hours	3.1 (c)	Complete CMA 2
12	1.5 Hours	3.1 (d)	
13	2 Hours	3.1 (d)	
14	2 Hours	3.1 (e)	
15	2 Hours	3.1 (e)	
16	1.5 Hours	3.1 (e)	

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17	1.5 Hours	3.1 (f)	
18	1.5 Hours	3.1 (f)	Complete CMA 3
19	2 Hours	5.1	
20	1 Hour	5..1	
21	2 Hours	5.2	

c) **Section C - Practical Skills Assignment**

Phase	Notional Study Time	Objective	Outcome
1	17 hours	Select a coating system for particular use of your choice and develop a Project Plan	Agree selection and plan with your Tutor
2	17 hours	Assess and select suitable raw materials for the system that you have chosen	List of raw materials and justification for final choice including cost considerations
3	50 hours	Develop the system by producing laboratory scale batches for evaluation	Lab prepared sample/s of formulation/s
4	50 hours	Prepare test panels for evaluation and carry out tests according to predetermined test regime	Test panels and results

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5	50 hours	Evaluate and adjust the system formulation/s to achieve the required end use properties and specification	Repeat of phase 3 & 4
6	16 hours	Write a technical report in accordance with the guidelines in Lesson 20	Submit report together with your test panels and other supporting material to your Tutor for assessment

d) **Section D – Work Experience**

Task	Approx. Time	Subject	Purpose	Outcome
1	200hrs	Planning, researching and developing design parameters for surface coatings	Ensure that procedural standards and conditions for developing a formulation for coatings are met through analysis and proper documentation	Supporting evidence of work experience record signed off by Supervisor or Tutor
2	200hrs	Optimising formulations for surface coatings products	Ensure that formulations being developed meet specifications through rigorous field testing and that the use of the formulation meets all applicable industry standards and product requirements	Supporting evidence of work experience record signed off by Supervisor or Tutor

3	200hrs	Providing technical support on surface coatings to internal and external customers	Provide laboratory and field support to internal and external customers	Supporting evidence of work experience record signed off by Supervisor or Tutor
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GENERAL NOTES

There are a few points which you need to take note of before you start the module.

Firstly the CALENDAR

This indicates the dates when you should be expected to complete the lessons and complete the CMA's.

Secondly the **CMA's** The main value of the CMA's is an aid to your learning process, First try to answer the questions before referring to the learning material as this will give you an idea of how much you have learnt and understood. It is essential that this work is complete and signed off by your Tutor before you start your **Practical Skills Assignment**.

The third point is that you should not rely entirely on your notes for INFORMATION. Use the references mentioned below, ask your Tutor, discuss difficult points with experienced colleagues or consult the World Wide Web

Some recommended Reading Matter:

- (i) **Paint Formulation Principles and Practice** by: J. Boxall and J A von Fraunhofer (ISBN 0-7114-5519-8 - Published by Longman Group (UK) Ltd
- (ii) **Surface Coatings Vol 2** ISBN 0-908237-89-8 Published by TAFE Educational Books. Obtainable from: Oil and Colour Chemists Association, England.

MATERIALS AND EQUIPMENT REQUIRED

Included in your notes are the following:

- One Assignment Header sheet
- One Health and Safety Form

You will need to have access to facilities equipped to carry out the practical work requirements of both the Work Experience and Practical Skills (Assignment) tasks. If you do not have direct access to such facilities, discuss this with your Tutor who will assist you in obtaining access to a suitable facility.

TIME SCALE

- The indicated time required for each section set out in the LEARNING SCHEDULE are only approximate and for practical reasons, they are flexible within reason.
- The Learning Material which will presented over a period of a semester (approximately 16 weeks during which times your CMA's need to be submitted.
- On completion of the learning material, you will be required to complete a TMA1 before starting your practical work assignment. Marks for this TMA will count towards your final mark and you will need to obtain a minimum of 50% in order to proceed with your assignment.

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- You may commence your Work Experience at any time during the course of the program but it would be expected that all the required work will be complete within a period not exceeding fifteen months.

ASSESSMENT ANALYSIS

	Marks	%
CMA	200	10
ASSIGNMENT	900	45
TMA 1 (MIDTERM)	300	15
TMA 2 (FINAL)	600	30
TOTAL	2000	100
WORK EXPERIENCE	All work completed and signed off	

QUALIFYING REQUIREMENTS

A minimum of 50% is required in each of the three assessments – i.e. CMA's, Practical Assignment and final TMA.

Your Work Experience task lists shall be fully completed to the satisfaction of your Supervisor and Tutor.

MERIT PASS – an overall total percentage of 80% and completion of Work Experience tasks

DISTINCTION – an overall total percentage mark of 90% or more

THE COMPUTER MARKED ASSESSMENT

The CMA is a multiple-choice test, and must be completed as soon as you have completed the relevant study lesson. These are completed via e-learning.

HEALTH AND SAFETY

In your notes, and in the PAX notes, you will find a lot of material dealing with the subject of Health and Safety in the coatings industry, refer to the "Guide to Health and Safety in the Workplace".

In journals and magazines catering for the coatings industry, you will find an increasing number of articles on the subject.

And, if you were to attend technical symposia or conferences, an increasing number of the speakers would be delivering technical papers on the subject.

There are many good reasons for this

Firstly, in our industry, we use a number of potentially hazardous chemicals as raw materials. This means that we must be aware of the hazards, and do all that is possible to reduce these

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hazards to a safe level, and thus protect all those who come into contact with these materials from the potential hazards.

Secondly, our products are used in a wide variety of situations and by a wide variety of people. Again, we have to protect these people from any potential hazards.

Thirdly, through better knowledge and understanding, we have become more aware of the consequences of our actions, and of the need to protect ourselves and our environment from damage as a consequence of unthinking or uncaring actions.

A fourth reason could be that governments throughout the world have produced some very strict laws governing health and safety in the workplace, and equally strict laws aimed at protecting the environment.

This background is intended to impress on you the fact that our insistence on a strict approach to health and safety – both in theory notes and in the PAX sessions – is not just an attempt to make more work for you, but is a genuine effort to help you to deal effectively with the subject.

The latest South African legislation – the Occupational Health and Safety Act (Act no 85 of 1993) – is an example of current thinking on the subject, and should guide your approach.

In essence, it places the responsibility squarely on the shoulders of employers AND employees – which means YOU!

YOU are responsible for any of YOUR actions (or omissions) which might endanger the welfare of yourself, other employees, or people who use your company's products.

In order for you to accept this responsibility, it is necessary that you have sufficient understanding of the subject – and that is the reason behind the material found in this course.

You need to know the answers to these questions

What do we mean by a hazardous material?

What materials are hazardous?

How do we deal with these hazards?

Most importantly, you need to develop the correct thinking or philosophy towards the subject.

Identify the materials you are dealing with (often the components of a coating)

Identify the potential hazards associated with these materials (or with the operations or processes involved)

Consider whether the hazards can be removed or neutralised.

Decide on any precautions necessary.

The OHS Act spells it out that the first line of defence is to get rid of the hazard! It is far better (and more logical) to get rid of harmful solvent vapour than to wear an uncomfortable and impractical respirator.

You will find more information later in your notes, and particularly when you get to the PAX sessions.

Remember that successful outcome to your study of the subject will ensure

THAT NONE OF YOUR ACTIONS ARE A THREAT TO THE HEALTH AND SAFETY OF YOURSELF, YOUR FELLOW WORKERS, YOUR CUSTOMERS, OR OUR ENVIRONMENT.

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THAT FORMULATING CHEMISTS HAVE EVALUATED ALL RAW MATERIALS USED AND MADE EVERY EFFORT TO ENSURE THAT THE PRODUCT IS AS SAFE TO USE AS POSSIBLE OR THAT SUITABLE WARNINGS / LABELS ARE PROPOSED.

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OBJECTIVES

SECTION A - COATING FORMULATION – GENERAL PRINCIPLES

As per notes on page 37 or at the start of each lesson pg 43, 57, 71 etc

SECTION B - FORMULATION REQUIREMENTS

As per notes on page 38 or at the start of each lesson pg 113, 175, 211, 245 etc

SECTION C - PRACTICAL SKILLS ASSIGNMENT

4. Conduct an investigative exercise involving a range of practical techniques, concerning **coating system** for one major area of use:
 - 4.1 Identify and document the formulating design parameters of your selected end use application
 - 4.2 Develop a detailed project plan (refer Guidelines for Work Plan)
 - 4.3 Develop or adapt surface coating formulations in accordance with your assignment
 - 4.4 Conduct a program of work, based on your formulations, which includes selection of raw materials, formulation, preparation, application, testing, interpretation of results and recommendations for optimisation.
 - 4.5 Specify the relevant health and safety aspects during manufacture, application and usage of the material developed.
 - 4.6 With the aid of suitable computer software such as Microsoft Office, produce a report with supporting charts and tables which includes a critical review of the work completed and suggestions for any further work considered necessary. The report shall also include the Health and Safety aspects and recommendations for scale up to plant.

Refer to literature or any other supporting references or documents you may have used during your work
 - 4.7 Submit a 1 litre sample of each of your formulations, all test panels and any other relevant exhibits together with your written report to your Tutor

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SECTION D – WORK EXPERIENCE

The objectives for this Section are to acquire work experience by completing the following occupational tasks and to demonstrate your competence in each of the tasks. (Refer also to subheading 5 above “Occupational Profile – Surface Coatings Technologist”)

SECTION E – PROJECT MANAGEMENT, INFORMATION MANAGEMENT AND COMPUTER LITERACY

PROJECT MANAGEMENT

5.

5.1 After studying Lessons 19 and 20 you should be able to:

- 5.1.1 Apply basic principles and techniques of Project Management to various formulating projects
- 5.1.2 Evaluate project proposals against business objectives and priorities
- 5.1.3. Determine plant and equipment required for plant scale production
- 5.1.4 Allocate and prioritise tasks and prepare an estimate of man hours required for the project
- 5.1.5 Prepare product cost estimates
- 5.1.6 Prepare a comprehensive project report of your findings, recommendations and conclusions using Graphic User Interface tools to demonstrate your level of computer literacy

INFORMATION MANAGEMENT AND COMPUTER LITERACY

5.2 At the end Lesson 20 (COMPUTER LITERACY) you should be able to:

- 5.2.1 Discuss the principles of problem solving, information gathering and analysis, synthesizing and interpretation skills and be able to do further research on the topics and apply them in the workplace
- 5.2.2 Discuss the basic principles of communication and report writing and apply them in the workplace
- 5.2.3 Identify your own computer skills, assess areas for further training and justify such training

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SECTION F - MANAGING INTERPERSONAL RELATIONSHIPS

- 5.3 After studying Lesson 21 you should have a basic understanding of the dynamics of Managing Interpersonal Relationships with respect to:
- 5.3.1 Effective interaction with internal departments
 - 5.3.2 Effective team structures
 - 5.3.3 Managing diversity
 - 5.3.4 Developing self-directed work teams
 - 5.3.5 Empowering team members
 - 5.3.6 Building capacity among team members
 - 5.3.7 Interactive and effective communication skills

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