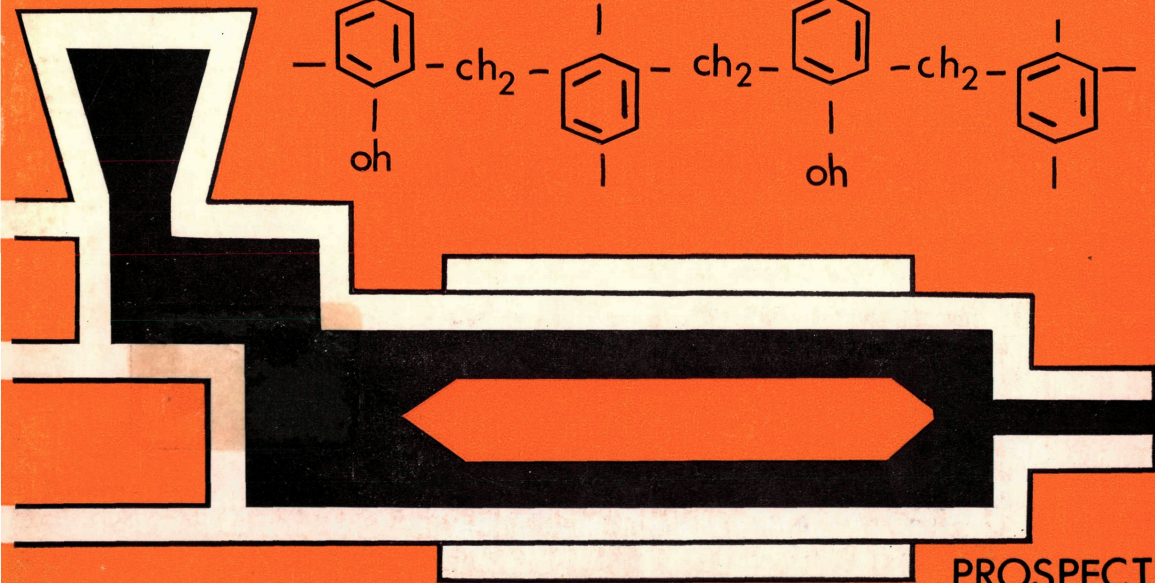
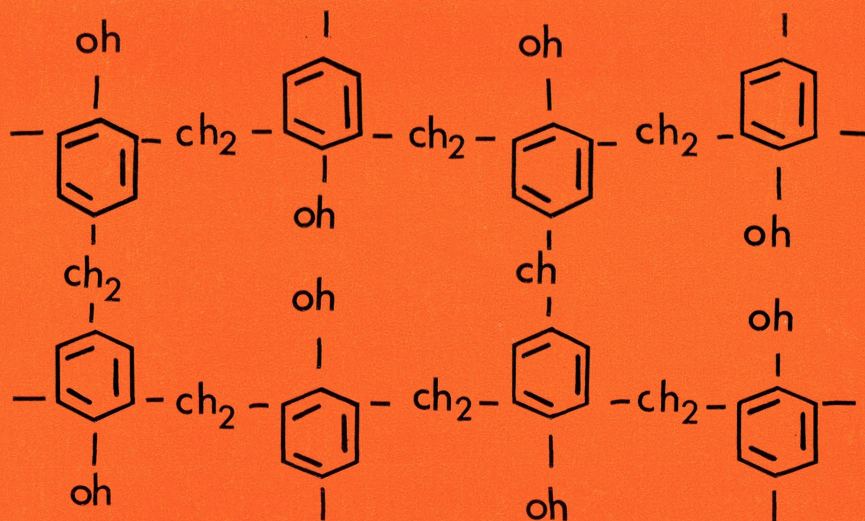




INSTITIUT TEKNOLOJI MARA
(Mara Institute of Technology)
SCHOOL OF APPLIED SCIENCE

COURSES IN:
RUBBER TECHNOLOGY
PLASTICS TECHNOLOGY



CONTENTS

	Page
I. INTRODUCTION - - - - -	1
II. CAREERS - - - - -	—
III. ENTRANCE REQUIREMENTS TO THE COURSE AT THE M.I.T. - - - - -	—
IV. THE COURSES AND THEIR REQUIREMENTS - - -	2-3
V. COURSE STRUCTURE - - - - -	4
VI. OUTLINE OF SYLLABUS FOR THE COURSE IN DIPLOMA OF PLASTICS TECHNOLOGY (D.P.I.) - - - - -	5
VII. OUTLINE OF SYLLABUS FOR LICENTIATESHIP OF THE INSTITUTION OF THE RUBBER INDUSTRY - - -	6-8

Pengarah :

Arshad bin Ayub - - - P.D.L.N., B.Sc. (Hons.) (Wales);
Dip. Bus. Adm. (IMEDE) (Lausanne);
Dip. Agric.; M.B.I.M.; A.I.S.

Dekan Hal Ehwal Ilmiah :

Mansor Haji Ali - - - B.A. (Econs. and Bus. Admin.);
B.A. (Marketing) (Puerto Rico);
Diploma Kaufmann (West Germany)

Pendaftar :

Ali bin Saad - - - LL.B. (Taiwan);
M.A. (Pol. Studies)
(Queen's Univ. Ontario)
Management Analyst
(D.A.U. P.M.'s Dept.)

Dekan Hal Ehwal Penuntut2 :

Ahmad Taib - - - M.Sc. (Edu.) Indiana
Univ. U.S.A.
Cert. in Edu. (Malaya)
Cert. in Edu. (Queensland)

Bendahari :

Alias Sulaiman - - - B.A. (Hons.) (Malaya)

Perpustakaan :

Rogayah Rashid - - - A.L.A. (London North Western Poly.)
F.L.A. (London)

Ketua Kajian :

Yee Chee San - - - B.Sc. (Hons.);
M.Sc. (Malaya)

Tutor Kursus :

Lee Kok Keong - - - M.Sc. (Eng.) (London)
D.I.C. (London)
B.Sc. (Hons.) (Malaya)

I.

INTRODUCTION

During the last century and a half, two closely related classes of materials, rubber and plastics, have been introduced. These materials not only give rise to a challenge to the natural materials like wood, metal, cotton, leather, stone etc. but also make possible the manufacture of new products. Rubber and Plastics are used for the making of materials for road and air transport, in the clothing industry, domestic electricity, television, radio and the many domestic articles of everyday use.

In the last thirty years the importance of plastics as a commercial material has grown enormously, not as cheap substitutes or as novelties but alongside other materials such as metals and wood.

Rubber is a unique and remarkable material. With synthetic or man-made rubbers it is possible to a very large degree, to tailor properties to suit requirements. It has the elasticity required for many functions, besides abrasion and heat resistance, solvent resistance, chemical resistance and strength.

II.

CAREERS

With the increasing use of plastics and rubber materials in industries and in the home, the Rubber and Plastics Industries have attractive careers to offer to those with technical or scientific qualifications connected in these fields. They require the chemical engineers to manufacture the raw plastic materials, the Rubber and Plastics Technologists to mould, extrude and shape the raw materials by dozens of different processes to finish particles, the salesmen to sell the products etc. While most of the senior positions are held by University graduates, particularly chemists, physicists, and engineers, nevertheless those who have not had the opportunity of an academic training are able to reach a senior technical position by obtaining professional qualifications from the Rubber and the Plastics Institute (U.K.).

III. ENTRANCE REQUIREMENTS TO THE COURSE AT THE M.I.T.

1. S.C. or M.C.E. with credits in English, General Science and Mathematics.
- or 2. S.P.M. These students are admitted to a preliminary Special Course conducted at the Mara Institute of Technology and will enter the course proper only after passing the Special Course Examination.

IV. THE COURSES AND THEIR REQUIREMENTS

At present the courses available are

1. Licentiate course in Rubber

- a. L.I.R.I. — Licentiate of the Institute of the Rubber Industry.
A one-year full-time course to prepare students to sit for the Licentiate examination of the Institute of the Rubber Industry.
- b. D.R.T. — Diploma in Rubber Technology.

This is a continuation of the L.I.R.I. course and is designed to emphasize on Business Studies, rubber processing technology and further practical training. The duration of this course is six months after the L.I.R.I. course. A Diploma in Rubber Technology (M.I.T.) will be awarded for the successful completion of the study course in Rubber Technology.

Applicants for the above two courses must have attained the age of 17 and possess a G.C.E. (Ordinary Level) or its equivalent in English, Mathematics and two other subjects, one of which is a science subject.

2. **Diploma Course in Plastics**

- a. **D.P.I. — Diploma of the Plastics Institute.**

A one-year full-time course to prepare candidates to sit for the Diploma of the Plastics Institute examinations. Successful candidates will be awarded Diploma from the Plastics Institute.

- b. **D.P.T. — Diploma in Plastics Technology.**

This is a continuation of D.P.T. Course and is designed to emphasize on Business Studies and further practical training. The duration of this course is six months after the D.P.T. Course. A diploma in Plastics Technology (M.I.T.) is awarded for the successful completion of the study course in Plastic Technology.

Applicants for the above two courses must have attained the age of 17 and must have passes in four subjects in G.C.E. examination with one of the subjects being Chemistry or Physics at advanced level and the other at ordinary level.

Future Development of the Rubber and Plastics Technology Course.

When staff and facilities are available it is the intention of the Institution to include the following examinations.

a) Associateship Course in Rubbers

A three-year full-time course to prepare candidates to sit for the Associateship of the Rubber Industry examinations. Successful candidates will be eligible for the Associateship of the Rubber Industry (A.I.R.I.).

b) G.P.I. — Graduate of the Plastics Institute

A three-year full-time course to prepare candidates to sit for the Graduateship of the Plastics Institute examinations. Successful candidates will be eligible for the Graduateship of the Plastics Institute.

Applicants for the A.I.R.I. and G.P.I. courses must possess

- i) General Certificate of Education with passes in five subjects including passes in Chemistry and either Physics or Mathematics at Advanced Level
- or ii) a G.C.E. with passes in subjects including Chemistry, Physics and Mathematics at Advanced Level.

Examinations And Syllabuses

The examinations for the L.I.R.I., A.I.R.I., D.P.I. and G.P.I. Courses are conducted by the Institute of Rubber Industry and the Plastics Institute (U.K.) and their syllabuses are therefore as laid down by these Institutes.

The examinations for the D.R.T. and D.P.T. are conducted internally.

V. COURSE STRUCTURE

The courses of studies are divided into two parts :

Part I consists of General Studies and Part II of Professional Studies. In the first two years of the course which are classified under General Studies students are prepared for the General Certificate of Education (Advanced Level).

Below is the list of subjects studies in the various years.

Part I. — General Studies

1st. Year

English
Chemistry
Physics
Mathematics
Economics

2nd. Year

English
Chemistry
Physics
Mathematics
Technical Drawing

Part II. — Professional studies

3rd. Year — Licentiate Course

Raw Material and Compounding
Rubber Chemistry
Rubber Physics and Physical Testing
Machinery and Processing
English

3rd. Year — Diploma in Plastics Course

Manufacture of Plastics Materials
Properties of Plastics Materials
Plant, equipment and mould design.

At present lectures, tutorials and practicals are held in Mara Institute of Technology, Jalan Othman, Petaling Jaya.

The building in Shah Alam will be ready late 1972.

Vi. **OUTLINE OF SYLLABUS FOR THE COURSE IN DIPLOMA OF PLASTICS TECHNOLOGY (D.P.I.)**

1. Chemical nature of plastics — definition of plastics and classification on the basis of heat-hardening and heat-softening properties and of chemical constitution, the chemical structure of plastics materials, and the relationship between this structure and their physical properties.
2. Thermosetting materials
 - a. Phenol — formaldehyde plastics — sources and relevant physical and chemical properties of phenol, cresols, formaldehyde. Resin — forming processes, plant required for industrial working of these processes.

Manufacture of moulding materials, plant required for mixing, grading and blending moulding materials, properties of mouldings made from these materials.
 - b. Amino Plastics
Sources and relevant physical and chemical properties of urea. Chemistry of resin — forming processes. Application of resins in the manufacture of moulding materials. Properties of mouldings made from these materials.
 - c. Compression moulding technique.
Fundamental principles. Meaning of the terms bulk factor and flow properties as applied to moulding materials. Simple tests for state of cure of finished mouldings. Causes and effects of common moulding faults.
Preheating.
 - d. Mould design.
Open flesh moulds; semi-positive moulds with horizontal and vertical flash. Transfer moulds, essential mould details.

- e. Mould making.
Steel for moulding tools and their treatment. Simple mould production — hobbing processes.
- 3. Thermoplastics materials
 - a. Vinyl — Chloride polymers and principle copolymers, cellulose plastics, and nylon plastics. Methods and nature of polymerization and industrial control of the process. Plant required for large-scale manufacture. Compounding of ingredients to form moulding, extension and calendering compounds.

Properties of articles made from these materials, fabrication techniques and conditions, and typical applications of these polymers.

Plant : Injection plant: simple hydraulic and mechanical injection machines.
Extruders : extruders for thermoplastics and thermosetting materials.
- 4. Testing.
 - i. Identification of plastics.
 - ii. Methods of testing for tensile strength.
 - iii. Methods to establish manufacturing conditions.
 - iv. Use of testing for quality control.

VII. OUTLINE OF SYLLABUS FOR THE LICENTIATESHIP OF THE INSTITUTION OF THE RUBBER INDUSTRY.

(a) CHEMISTRY

- i. Inorganic Chemistry :— Nature of Chemical change; changes occurring in the air; the major constituents of air and their properties.

Water : solvent properties, crystallisation, composition, hydrogen.

Laws of chemical combination, atomic theory symbols and formulae, valency, equivalents, atomic and molecular weights; equations and calculations. Acids, bases and salts; standard solutions.

Study of the following and their more familiar compounds :— Carbon, Nitrogen, Sulphur, Halogens, Halides, and Hydrohalic acids, Phosphorus, Oxygen, Boron. Sodium, Potassium, Copper, Magnesium, Calcium, Zinc, Aluminium, Lead, Iron, Barium, Chromium, Magnesium, Antimony, Ammonium compounds.

- ii. Physical Chemistry :— Chemical equilibrium and law of mass action. Solutions; Gas laws, Avogadro's hypothesis, calculations of Atomic Weights from Molecular Weights. Ionic theory and applications and elementary treatment of Colloids.

Organic Chemistry :— elementary principles of organic chemistry; definition of homologues, isomers, polymers Preparation and properties of the following compounds and their simple derivatives; methane, ethane, ethylene, acetylene, chloroform, carbon tetrachloride etc. Principal hydrocarbon constituents of petroleum and coal tar.

(b) PHYSICS

- i. Mechanics and properties of matter :— Velocity and acceleration. force, mass, momentum, energy, power; units and dimensions. Hooke's law, Young's modulus, Poisson's ratio. Density, specific gravity Poiseuille's and Stoke's formulae.
- ii. Heat :— Thermal conduction, convection and radiation, Gas laws, simple kinatic theory of gases and vapour pressure.
- iii. Magnetism and electricity :— The properties of magnet and magnetic fields; Electricity, current electricity, Ohm's law and heating effect of a current.
- iv. Light :— Reflection and refraction at plane and simple curved surfaces and application to mirrors, prisms and lenses, etc.

(c) RUBBER SCIENCE AND TECHNOLOGY

- i. Raw materials :— Sources, types and properties. Natural rubber and latex, synthetic rubbers, reclaimed rubbers, vul-

canising agents, accelerators, antionidents, retarders, carbon blacks, fillers and pigments, softeners and plasticisers, blowing agents, solvents and dusting agents.

- ii. Rubber Chemistry :— elementary consideration of (i) the chemical composition, structure and properties of natural rubber latex, etc. and (ii) the chemistry of vulcanisation and of ageing.
- iii. Rubber Physics :— Physical properties of raw and soft and hard vulcanised rubbers: plasticity, effects of mastication and of vulcanisation.

Electrical properties, permeation by gases, thermal properties, conductivity and change of state.

- iv. Test Methods :— including a knowledge of the basic principles of the methods and apparatus employed.

Latex, unvulcanised rubbers, plasticity and scorching.

- v. Compounding :— General principles of compounding; formulation of basic compounds of natural and the synthetic rubbers listed above; compounding for hardness and modulus tensile strength, etc.
- vi. Works Practice :— General processes; mastication, mixing, calendering, extruding, moulding, spreading, dipping and vulcanisation.

Outlines of methods of manufacture and formulation of compounds for the following : tyres, belting, cables, footwear, play balls, hose and other products.



Di-cetak oleh :
UTUSAN MELAYU (MALAYSIA) BERHAD
46M, JALAN CHAN SOW LIN • KUALA LUMPUR