Placed at the meeting of
Academic Council
held on 12.12.2019

APPENDIX - C
MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)
Syllabus for New Course
Diploma in Industrial Chemistry
(One year) Semester Pattern
Under UGC sponsored Community College Courses
(With effect from the Academic year 2018-2019 onwards)
Regulations and Scheme of Examinations

Objectives

The objective of the Diploma in Industrial Chemistry course is to attain new heights in industrial teaching and research, to provide trained man power to vast developing Indian industries to develop the young entrepreneur as a premier precision tool for future creation. Diploma in Industrial Chemistry is a potential base to educate the students from rural area who will get employment on large scale in Indian Chemical industries. The course is designed to teach the essential skills and knowledge involved in industrial chemistry. A key skill emphasized is problem solving, both quantitative and qualitative. Chemical formulas and equations are not necessary.

Learning outcomes

- An appreciation of the critical historical events for industrial chemistry
- To gain knowledge on the basic and advanced level of aspects in industrial chemistry and to gain analytical and problem solving skills.
- To get an exposure on recent trends in industrial chemistry.

Eligibility of the Course

Admission to the Diploma in Industrial Chemistry course will be opened to the candidates who passed 10+2 examination with conventional schooling without any background of vocational training. Equal weightage should be given to vocational subjects at +2 level while considering the students for admission into CC for recognition of skills credits.

Duration of the Course

The Duration of the Diploma in Industrial Chemistry course is one year consisting of two semesters each semester spanning for 6 months of minimum 180 working days. Period of courses from June to November and December to April.

Teaching facilities

1. One Co-ordinator, Two Assistant Professors.
2. Inter and intra faculty, contributory staff, professors, Industrial personnel etc with qualification of teacher for Diploma in Industrial Chemistry.

Course Structure

- All theory papers will have 6 periods per week, including 1 period for assignments, discussion, presentations, etc.
- There shall be 6 practical classes per week for Industrial Chemistry.
- In addition, there shall be one qualifying paper in self-learning mode called Field work/Mini project/Project work.
- Each Theory and Practical Paper shall be of 100 marks
- Each semester will have theory examination of two papers 100 marks each with 75 marks for university examination and 25 marks for internal
- Each semester will have two practical examinations each (60 marks for External + 40 marks for experimental work)
- Each semester will have one Field work/Mini project work with presentation (25 marks internal + 75 marks External)
- Total Number of Papers : 10

Scheme of Examinations – Diploma in Industrial Chemistry

Semester-I

Sem-I	Paper Name	Credit	Hours per week	Internal	External	Total	External	
							Duration	Total
Paper 1	Industrial Processes and Waste Management	6	6	25	75	100	3	75
Paper 2	Practical : Environmental Chemistry - I	6	6	40	60	100	3	60
Paper 3	Chemical Industries	6	6	25	75	100	3	75
Paper 4	Preparation of Cottage Industrial Goods Practical – II	6	6	40	60	100	3	60
Paper 5	Fieldwork / Mini project	6	6	25	75	100	3	75

Semester - II

Sem-II	Paper Name	Credit	Hours per week	Internal	External	Total	External	
							Duration	Total
Paper 1	Fertilizer Technology	6	6	25	75	100	3	75
Paper 2	Analysis of Fertilizers, Soaps, Oil and Fats. Practical - III	6	6	40	60	100	3	60
Paper 3	Perfume Industry and Marketing and Entrepreneurial Development	6	6	25	75	100	3	75
Paper 4	Extraction of Essential Oils Practical – IV	6	6	40	60	100	3	60
Paper 5	Field work / Mini project	6	6	25	75	100	3	75

Scheme for semester exam

Internal – 25 marks
External – 75 marks
Total - 100 marks

Scheme for Internal assessment (Theory)

Test - 15 marks (average of the best of two)
Assignment - 5 marks
Quiz - 5 marks
Total - 25 marks

Scheme for Internal assessment and External (Practical)

S.No.	Components	Internal	External
1	Attendance	10	-
2	Record note	10	15
3	Lab work	20	25
4	Presentation	-	10
	Total	**40**	**60**

Scheme for Internal assessment (Project)

S.No.	Components	Internal marks	External marks
1	Attendance	5	-
2	Report	15	20
3	Mock-viva	5	-
4	Presentation	-	40
	Total	**25**	**60**

Question Paper Pattern

Marks : 75 **Duration : 3 hrs.**

Section-A : Answer all the questions (one question from each unit) 5 x 2 = 10 marks
Section-B : Either or type (one question from each unit) 5 x 7 = 35 marks
Section-C : Answer any three out of five questions 3 x 10 = 30 marks
(one question from each unit).

Model Question Paper – Industrial Processes and Waste Management

Maximum marks : 75 **Duration : 3 hours**

Section-A (5x2=10 Marks) – Answer all the questions.

1. Define Chemical technology
2. State the Principles of distillation.
3. Mention the type of pollution.
4. Define chemical hazard.
5. Define adsorption .

Section-B (5 x 7 = 35 Marks) Answer all the questions.

6 Explain the principles of chemical technology (or) Write notes on importance of chemuical technology.
7 Explain about the solvent extraction (or) Explain in detail about the separation by absorption and adsorption.
8 Write notes on Air pollution (or) Explain about causes of pollution.
9 Write down the safety signs and colours used in industries. (or) Explain the preventive measures used in industries.

10 Explain in detail about the treatment of mineral effluents by ion-exchange method.
(or) How will you classify effluents ?

Section-C (3 x 10 = 30 Marks) – Answer any three out of five questions.

11. Explain in detail about the designing and modeling of chemical plants.
12. Discuss in detail about clean technology.
13. Define water pollution. Explain sources and type of water pollution.
14. Discuss about dust hazard and electrical hazard.
15. Explain the treatment of organic effluents by biological oxidation and chlorination method.

Semester – I

1. Industrial Processes and Waste Management

No. of Credits-6 **No. of Instructional Hours: 6 per week**

Unit I: Principles of chemical technology : Introduction – basic principles of chemical technology - importance of chemical technology – classification of technological process – designing and modeling of chemical plants – unit process and unit operations.

Unit II: Industrial unit processes : Basic principles of distillation - solvent extraction - solid-liquid leaching and liquid - liquid extraction - separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology. Scaling up operations in chemical industry - Introduction to clean technology.

Unit III: Environmental management : Introduction-definition- Cause of pollution, types of pollution, such as air and water pollution.

Unit IV: Industrial hazards and safety measures : Safety signs and colours used in industries- Industrial hazards – Definition – Chemical hazard – Dust hazard – Electrical hazard - Preventive measures.

Unit V : Industrial effluent treatment : Classification of effluents - Treatment of mineral effluents by Ion-exchange, Reverse osmosis and Reagents methods - Treatment of organic effluents by biological oxidation, chlorination and adsorption.

Text Book: B.K.Sharma, Industrial Chemistry, Goel publishing House, Edn.XIV, 2004.

References:

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., II edn, Meerut 1989, Chs, 5-7.
2. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

2. Practical : Environmental Chemistry - I

No. of Credits-6 **No. of Instructional Hours: 6 per week**

1) Determination of dissolved oxygen in water.
2) Determination of Chemical Oxygen Demand (COD)
3) Determination of Biological Oxygen Demand (BOD)
4) Percentage of available chlorine in bleaching powder.
5) Measurement of chloride, sulphate and salinity of water samples by simple titration method. ($AgNO_3$ and potassium chromate)
6) Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
7) Measurement of dissolved CO_2.

3. Chemical Industries

No. of Credits-6 **No. of Instructional Hours: 6 per week**

UNIT – I : Surface Coatings : Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. (Elementary ideas only).

UNIT – II : Pesticides : Introduction – methods of pest controls – methods of using pest controls – lead arsenate, paris green, DDT, gammaxane – Adverse environmental effects of pesticides.

UNIT – III : Chlor-Alkali Industry : Manufacture of Soda ash, Caustic Soda, Chlorine & Hydrogen.

UNIT – IV : Sugar Industries : Sugar industry in India - Sugar cane and sugar beet - Manufacture of cane sugar - Ethanol from molasses by fermentation – manufacture of wine, beer, methylated spirit.

UNIT – V : Preparation of domestically useful chemical products : Washing powder – cleaning powder – phenyls (white, black and coloured), shampoo, liquid blue, blue, red and green inks, Soap oil, face powder, pain balm.

Text Book: B.K. Sharma, Industrial Chemistry, Goel publishing House, Edn.XIV, 2004.

References:

1. Jayashree Ghosh, Fundamentals concepts of Applied Chemistry, S. Chand Company, 2008.
2. R. D. Madan, Advanced inorganic chemistry, Latest edition 2006.

4. Preparation of Cottage Industrial Goods - Practical – II

No. of Credits-6 **No. of Instructional Hours: 6 per week**

1. Preparation of talcum powder.
2. Preparation of shampoo.
3. Preparation of enamels.
4. Preparation of hair remover.
5. Preparation of face cream.
6. Preparation of Aspirin and its analysis.
7. Preparation of nail polish and nail polish remover.
8. Estimation of glucose in food sample

5. Field Work / Mini Project

No. of Credits-6 **No. of Instructional Hours: 6 per week**

Every student should undergo Field work/mini project for the preparation and characterization (chemical as well as physical) of an industrial useful chemical/ any other investigatory project, in order to promote innovativeness, under the guidance and supervision of concerned faculty of college.

Semester – II

1. Fertilizer Technology

No. of Credits-6 **No. of Instructional Hours: 6 per week**

UNIT – I Fertilizer : Definition – nutrients for plants – role of various elements in plants growth - classification of fertilizers – important example of fertilizers – fertilizer industry in india – ill effects of fertilizers

UNIT – II Nitrogenous fertilizer : Role of Nitrogenous fertilizer, sources and properties of hydrogen, nitrogen and ammonia, properties and uses, manufacture of urea by total recycle process - Ammonium nitrate: properties, manufacturing process and uses - Ammonium

sulfate: properties, manufacturing processes and uses. D Ammonium chloride properties, manufacturing processes and uses

UNIT – III Potassium fertilizer : Role of potassium as fertilizer, properties, and sources of potash and production of KCl.

UNIT – IV Phosphatic fertilizer : Role of potash as fertilizer, types of rock phosphate, production of elemental phosphorus (yellow or red) manufacture. of phosphoric acid by wet method, electric arc furnace method, production of normal and super triple phosphate, ammonium phosphate, major engineering problem of such industries.

UNIT – V Mixed fertilizer : Manufacture and granulation of mixed fertilizer and bulk blending

Text Book:

1. Chemistry and Technology of Fertilizers – Vincent Sauchelli, Reinhold Publications Corporation.

2. Analysis of Fertilizers, Soaps, Oil and Fats - Practical - III

No. of Credits-6 **No. of Instructional Hours: 6 per week**

1. Detection of
    i. Nitrogen
    ii. Potassium
    iii. Phosphorous in fertilizers

2. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.

3. Perfume Industry and Marketing and Entrepreneurial Development

No. of Credits-6 **No. of instructional hours: 6 per week**

Unit – I Perfume industry: Introduction – esters – alcohols – ketones – diphenyl compounds - Production of natural perfumes – flower perfumes – Jasmine – lily – orange – rose – artificial flavours - Banana compounds – Grape compounds – apple compounds – pine apple compounds

Unit – II Production Management : Scope of production facility, location types of manufacturing system and layout. layout planning and analysis. Export promotion. production planning and control, material and handling, principles, stores management. Work environment, industrial safety management.

Unit – III Entrepreneurial Development

Process of generating business ideas, Technical and economic feasibility – developing detailed project report for implantation, legal provision, knowledge of laws & bye laws. Legal formalities of import & export license. International Business and entrepreneurship, entrepreneurship development. Role of management education, Total Quality management (TQM) cost befit analysis. PERT & CPM.

Unit – IV Financial Management : Financial Management objectives , Management of working capital, management of earning, profit planning, corporate planning and Beak Even analysis . Taxation and financial planning and policies Expansion and Diversification strategies, investment portfolio, decisions with reference to financial organizations like Banks., Trusts and insurance companies etc.

Unit – V Small scale industries and cottage industries : Small scale industries and cottage industries with emphasis on soaps, Detergents, cardamom and other cosmetics industries. Role of Small scale industries in developing economy of India. Sources for financial assistance to start small scale industry.

Text Book:

1) Perfume flowers & essential oil industries by S.B. Srivastava.
2) Manufacture of perfumes, cosmetics, & Detergents by Giriraj Prasad
3) Financial Management By S.N. Maheshwari
4) Marketing Management By . Sheriekar
5) Human Resource Management By K. Ashwathappa

4. Extraction of Essential Oils - Practical – IV

No. of Credits-6 **No. of Instructional Hours: 6 per week**

Extraction of essential oils:.

a. Lemon grass oil
b. Lemon oil
c. Eucalyptus oil
d. Orange oil
e. Clove oil
f. Rose oil
g. Jasmine oil
h. Cardamom oil

Mini Project / Field Work

No. of Credits-6 **No. of Instructional Hours: 6 per week**

The mini project / field work may include in plant training in an Industry / Short term work in the department / other educational institutes / R&D organization/Data mining / Review of current literature / Theoretical methods / Computer applications. Experimental work may involve studies on Synthesis/Measurements, Study of properties / Characterization by physic - chemical methods / activities for reported / unreported research or any suitable combination there of.

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