# FR. Conceicao Rodrigues College Of Engineering

Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50

**Department of Humanities & Sciences**

**F.E. (Production) (Semester II) (2018-2019)**

**Lesson Plan**

**Subject: Applied Chemistry-II (FEC203)**

**Credits-3.5**

## Syllabus:

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Pract. | Tut. | Theory | TW / Pract | Tut. | Total |
| FEC203 | Applied Chemistry–II | 03 | 01 | -- | 03 | 0.5 | -- | **3.5** |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | | | |
| | | Internal Assessment | | | End Sem Exam | Term Work | Pract | Or al | Total |
| | | Test1 | Test2 | Av of Test1 &2 | | | | | |
| FEC203 | Applied Chemistry–II | 15 | 15 | 15 | 60 | 25 | -- | -- | **100** |

**Objectives**

1. To provide necessary background in applied chemistry relevant to chemical industries.
2. To provide exposure in conducting experiments and interpret and report the results in professional format.

| Module | Detailed Contents | Hrs. |
|---|---|---|
| **01** | **Corrosion:**<br>Introduction: Types of Corrosion - (I) Dry or Chemical Corrosion-i) Due to oxygen ii) Due to other gases (II) Wet or Electrochemical corrosion – Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Electrochemical Corrosion – Galvanic cell corrosion, Concentration cell corrosion (differential aeration), Pitting corrosion, Intergranular corrosion, Stress corrosion. Factors affecting the rate of corrosion – Nature of metal, position of metal in galvanic series, potential difference, overvoltage, relative area of anodic and cathodic parts, purity of metal, nature of the corrosion product, temperature, moisture, influence of pH, concentration of the electrolytes. Methods to decrease the rate of corrosion – Material selection, Proper designing, Use of inhibitors, Cathodic protection - i) Sacrificial anodic protection ii) Impressed current method, Anodic protection method, Metallic coatings – hot dipping – galvanizing and tinning, metal cladding, metal spraying, Electroplating, Cementation. Organic coatings – Paints (only constituents and their functions). | **11** |

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|---|---|---|
| **02** | **Alloys**<br>Introduction, purpose of making alloys, Ferrous alloys, plain carbon steel, heat resisting steels, stainless steels (corrosion resistant steels), effect of the alloy ingelement - Ni, Cr, Co, Mn, Mo, W and V;<br>Non-Ferrous alloys - Composition, properties and uses of – Alloys of Aluminium - i) Duralumin ii) Magnalium. Alloys of Cu - (I) Brasses -i) Commercial brass ii) German silver,<br>(II) Bronzes - i) Gun metal ii) High phosphorous bronze. Alloys of Pb - i) Wood's metal ii) Tinmann's solder. Powder Metallurgy - Introduction, (1) Methods of powder metal formation - i) Mechanical pulverization ii) Atomization iii) Chemical reduction iv) Electrolytic process v) Decomposition (2) Mixing and blending. (3) Sintering (4) Compacting - i) Cold pressing ii) Powder injection moulding (iii) Hot compaction. Applications of powder metallurgy.<br>Shape Memory Alloys - Definition, properties and Uses. | **07** |
| **03** | **Fuels**<br>Definition, classification of fuels - solid, liquid and gaseous. Calorific value - Definition, Gross or Higher calorific value & Net or lower calorific value, units of heat (no conversions), Dulong's formula & numerical for calculations of Gross and Net calorific values. Characteristics of a good fuel.<br>Solid fuels – Analysis of coal – Proximate and Ultimate Analysis with Significance and numericals.<br>Liquid fuels – Crude petroleum oil, its composition and classification and mining (in brief). Refining of crude oil - i) Separation of water ii) Separation of 'S' & iii) Fractional Distillation with diagram and composition and uses table.<br>Cracking - Definition, Types of cracking -<br>I) Thermal cracking – (i) Liquid phase thermal cracking (ii) Vapour phase thermal cracking.<br>II) Catalytic cracking - (i) Fixed- bed catalytic cracking (ii) Moving – bed catalytic cracking. Advantages of Catalytic cracking.<br>Petrol-Refining of petrol, unleaded petrol (use of MTBE), Catalytic converter, Power alcohol, Knocking, Octane number, Cetane number, Antiknocking agents.<br>Combustion - Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.<br>Biodiesel – Method to obtain Biodiesel from vegetable oils (Trans - esterification), advantage and disadvantages of biodiesel.<br>Fuel cell - Definition, types and applications. | **12** |
| **04** | **Composite Materials**<br>Introduction, Constitution - i) Matrix phase ii) Dispersed phase. Characteristic properties of composite materials. Classification - (A) Particle – reinforced composites - i) Large – particle reinforced composites ii) Dispersion – strengthened composites. (B) Fiber – reinforced composites - i) Continuous – aligned ii) Discontinuous – aligned (short) - (a) aligned (b) randomly oriented (C) Structural Composites - i) Laminates (ii) Sandwich Panels. | **04** |
| **05** | **Green Chemistry**<br>Introduction, Twelve Principles of Green chemistry, numerical on atom economy, Conventional and green synthesis of Adipic acid, Indigo, Ibuprofen and Carbaryl. Green solvents | **06** |

**Suggested Experiments: (Any five)**

1. Estimation of Zn – Complexometric titration.
2. Estimation of Ni – Complexometric titration.
3. Estimation of Al – Complexometic titration.
4. Flue gas analysis using Orsat's apparatus.
5. Estimation of Fe from plain carbon steel
6. Estimation of Ni by gravimetric method.
7. Estimation of Sn iodometrically.
8. Preparation of Biodiesel from edible oil.
9. Estimation of Cu - Iodometrically.
10. Estimation of percentage moisture in coal.
11. Estimation of percentage ash in coal.
12. To estimate the emf of Cu – Zn system by potentiometry.
13. Demonstration of Electroplating.

**Term work**

Term Work shall consist of minimum five experiments. The distribution of marks for term work shall be as follows:

1. Attendance (Practical and Theory) : 05marks
2. Laboratory Work (Experiments and journal) :10 marks
3. Assignments and Viva on practicals :10marks

## Assessment:

**Internal Assessment Test:**

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

**End Semester Theory Examination:**

1. Question paper will comprise of total 06 questions, each carrying 15 marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus where in sub – questions of 3 marks will be asked.
4. Remaining questions will be mixed in nature. (e.g. Suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

**References:**


1. Engineering Chemistry – Jain & Jain (Dhanpat Rai)
2. Engineering Chemistry – Dara & Dara (S Chand)
3. Engineering Chemistry – Wiley India (ISBN – 9788126519880)
4. A Text Book of Engineering Chemistry – Shashi Chawla (Dhanpat Rai)
5. A Text Book of Green Chemistry – V.K. Ahluwalia (Springer)

## Course Outcomes:

*Upon completion of this course students will be able to:*

***CO203.1:*** To recognize the various types of fuels.
***CO203.2:*** To relate the different types of corrosion.
***CO203.3:*** To extract metals from their alloys.
***CO203.4:*** To understand the processes that minimizes the use of hazardous substances.
**CO203.5:** To interpret the phase diagram

## Mapping of CO and PO/PSO

Relationship of course outcomes with program outcomes: Indicate 1 (low importance), 2 (Moderate Importance) or 3 (High Importance) in respective mapping cell.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FEC203.1 | 2 | | | | | | | | | | | |
| FEC203.2 | 2 | | | | | | | | | | | |
| FEC203.3 | 2 | | | | | | | | | | | |
| FEC203.4 | 2 | | | | | | | | | | | |
| FEC203.5 | 2 | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | |
| CO-PO MATRIX | | | | | | | | | | | | |

## Justification

PO1: COs are mapped to this PO1 because the students gain basic knowledge on applied chemistry related concepts required for higher semesters (chemical technology and their applications)

## CO Assessment Tools:

*FEC203*.**1:** **Direct Methods(80%):**

| Test-II | Lab-1 | Lab-2 | UE |
|---|---|---|---|
| 40% | 10% | 10% | 40% |

**InDirect Methods(20%):** Course exit survey

***CO1idm***

**FEC203.1 = 0.8*CO1dm + 0.2* CO1idm**

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FEC203.**2:** **Direct Methods(80%):**

| Test-I | UE |
|---|---|
| 60% | 40% |

**InDirect Methods(20%):** Course exit survey

***CO2idm***

**FEC203.2 = 0.8*CO2dm + 0.2* CO2idm**

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FEC203**.3:** **Direct Methods (80%):**

| Test-II | A-I | Lab-3 | Lab-4 | Lab-5 | UE |
|---|---|---|---|---|---|
| 20% | 20% | 5% | 5% | 10% | 40% |

**InDirect Methods (20%):** Course exit survey

***CO3idm***

**FEC203.3 = 0.8*CO3dm + 0.2* CO3idm**

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FEC203**.4:** **Direct Methods (80%):**

| Test-II | A-II | UE |
|---|---|---|
| 30% | 30% | 40% |

**InDirect Methods (20%):** Course exit survey

***CO4idm***

**FEC203.4 = 0.8*CO4dm + 0.2* CO4idm**

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FEC203**.5:** **Direct Methods(80%):**

| Test-II | UE |
|---|---|
| 60% | 40% |

**InDirect Methods (20%):** Course exit survey

***CO5idm***

**FEC203.5 = 0.8*CO5dm + 0.2* CO5idm**

## Course Outcomes Target:

*Upon completion of this course students will be able to:*

**FEC203.1** To recognize the various types of fuels.

TARGET RANGE: 2.0

**FEC203.2:** To relate the different types of corrosion

TARGET RANGE: 2.0

**FEC203.3** To extract metals from their alloys.

TARGET RANGE: 2.0

**FEC203.4** To understand the processes that minimizes the use of hazardous substances.

TARGET RANGE: 2.0

**FEC203.5** To interpret the phase diagram

TARGET RANGE: 2.0

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**CO203.1: To recognize the various types of fuels**
**CO203.2: To relate the different types of corrosion**
**CO203.3: To extract metals from their alloys**
**CO203.4: To understand the processes that minimizes the use of hazardous substances**
**CO203.5: To interpret the phase diagram**

| **Subject: Applied Chemistry** | | | **Academic Year: 2018-19** | |
|---|---|---|---|---|
| **Branch: Production** | | | **Semester: II** | |
| ***Sr. No.*** | ***Name of the Topic*** | ***Planned Date*** | ***Executed Date*** | ***Remark*** |
| ***Module-I (Corrosion)(Course Outcome No.: 02)*** | | | | |
| ***1*** | Introduction | 01-01-2019 | 01-02-2019 | |
| ***2*** | Types of corrosion | 01-02-2019 | 01-04-2019 | 01/01/2019 : Mass Bunk |
| ***3*** | Galvanic or Bimetallic corrosion | 03-05-2019 | 03-05-2019 | |
| ***4*** | Concentration cell corrosion | 03-07-2019 | 03-07-2019 | 15/3/2019 : Crescendo (Friday) |
| ***5*** | Pitting corrosion | 03-08-2019 | 03-08-2019 | |
| ***6*** | Intergranular corrosion | 03-12-2019 | 03-12-2019 | |
| ***7*** | Waterline corrosion | 03-14-2019 | 03-14-2019 | |
| ***8*** | Stress corrosion | 03-15-2019 | 03-19-2019 | |
| ***9*** | Passivity | 03-19-2019 | 03-22-2019 | |
| ***10*** | Galvanic series, Factors influencing corrosion, Corrosion control | 03-22-2019 | 03-26-2019 | |
| ***Module-III (Fuels)(Course Outcome No.: 01)*** | | | | |
| ***11*** | Introduction | 01-07-2019 | 01-07-2019 | 31/1/2019 : Annual Sports Day (Thursday) |
| ***12*** | Classification of fuels | 01-08-2019 | 01-08-2019 | |
| ***13*** | Calorific value | 01-09-2019 | 01-08-2019 | |
| ***14*** | Numericals for Gross Calorific value and Net Calorific value | 01-10-2019 | 01-09-2019 | |
| ***15*** | Characteristics of a good fuel | 01-15-2019 | 01-10-2019 | |
| ***16*** | Comparison of solid, liquid and gaseous fuels | 01-17-2019 | 01-15-2019 | 5/2/2019 : Unit Test-I |
| ***17*** | Analysis of coal | 01-18-2019 | 01-17-2019 | |
| ***18*** | Numericals on proximate analysis | 01-22-2019 | 01-18-2019 | |
| ***19*** | Numericals on ultimate analysis | 01-24-2019 | 01-22-2019 | |
| ***20*** | Liquid fuels, Refining of crude oil | 01-25-2019 | 01-24-2019 | |

| | | | | |
|---|---|---|---|---|
| ***21*** | Cracking, Petrol | 01-29-2019 | 01-25-2019 | |
| ***22*** | Combustion, Numericals on combustion | 01-31-2019 | 01-29-2019 | |
| ***23*** | Bio-diesel, Fuel Cells | 01-02-2019 | 01-02-2019 | |
| | | 05-02-2019 | 08-02-2019 | |

| | | | | |
|---|---|---|---|---|
| ***Module-V (Green Chemistry)(Course Outcome No.: 04)*** | | | | |
| ***24*** | Introduction, Goals of Green Chemistry | 08-02-2019 | 21-02-2019 | 12/2/2019, 14/2/2019 & 15/2/2019 : Euphoria |
| ***25*** | Twelve principles of Green Chemistry | 12-02-2019 | 22-02-2019 | |
| ***26*** | Atom economy | 14-02-2019 | 25-02-2019 | |
| ***27*** | Synthesis of Adipic acid, Synthesis of Indigo | 15-02-2019 | 28-02-2019 | |
| ***28*** | Industrial applications of Green Chemistry | 21-02-2019 | 01-03-2019 | |
| ***Module-II (Alloys )(Course Outcome No.: 03)*** | | | | |
| ***29*** | Introduction | 22-02-2019 | 26-03-2019 | |
| ***30*** | Purpose of making alloys | 25-02-2019 | 28-03-2019 | |
| ***31*** | Types of alloys | 28-02-2019 | 29-03-2019 | |
| ***32*** | Ferrous alloys, Non- ferrous alloys | 03-01-2019 | | |
| ***35*** | Powder Metallurgy | | | |

***Signature and Date:***

***Faculty*** ***HOD*** ***Principal***