Fr. Conceicao Rodrigues College of Engineering, Bandra

First Year EngineeringSemester –First

Division-A

Syllabus

Module No	Topic	Hours Planned
01	**Atomic and Molecular Structure** Atomic orbitals (s,p,d,f) orbital shapes, Electronic Configuration, Molecular orbital theory (MOT), bonding and anti-bonding orbitals, Molecular orbital diagrams of Homonuclear and Heteronuclear diatomic molecules-Be_2, O_2, CO, NO their bond order and magnetic properties,	04
02	**Aromatic systems &their molecular structure** Define Aromaticity, Huckel's rule, Structure and bonding of benzene and pyrrole.	02
03	**Intermolecular Forces & Critical Phenomena** Ionic, dipolar and Vander Waal's interactions, Equations of state of real gases and critical phenomena	03
04	**Phase Rule-Gibb's Phase Rule** Statement of Gibbs' Phase Rule, Terms involved with examples, One Component System (Water), Reduced Phase Rule, Two Component System (Pb- Ag), Advantages and Limitations of Phase Rule. Numerical problems on Phase Rule.	05
05	**Polymers** Introduction: Definition- Polymer, polymerization, Properties of Polymers- Molecular weight (Number average and Weight average), Numerical problems on molecular weight, effect of heat on polymers (glass transition temperature), Viscoelasticity,Conducting Polymers, Classification-Thermoplastic and Thermosetting polymers; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding, Preparation, propertiesand uses of PMMA and Kevlar.	05
06	**Water** Introduction - Impurities in water, hardness of water- units (no conversions), types and numerical problems, determination of hardness of water by EDTA method and Numericalproblems.Softening of water by Ion Exchange process and numerical problems, BOD, COD- definition, significance and Numerical problems. Water purification-membrane technology- Electrodialysis, Reverse osmosis, and Ultra filtration.	05

Reference Books

Sr. No	Tile of the Book	Author	Publisher
1.	Engineering Chemistry	Jain & Jain	DhanpatRai
2.	Engineering Chemistry	Dara&Dara	S Chand
	Engineering Chemistry	Wiley India (ISBN –9788126519880)	
3.	A Text Book of Engineering Chemistry	ShashiChawla	DhanpatRai
4.	Engineering Chemistry	Payal Joshi &Shashank Deep	Oxford University Press)
5.	Concise Inorganic Chemistry	J D LEE	
6.	. Essentials of Physical Chemistry	B S Bahl&ArunBahl G D Tuli.	

Teaching and Marking Scheme

		Teaching Scheme			Credits Assigned			
Course Code	**Course Name**	**Theory**	**Pract**	**Tutorial**	**Theory**	**TW**	**Tutorial**	**Total**
FEC103	**Applied Chemistry-I**	**2**	**1**	**-------**	**3**	**0.5**		**3.5**

University Examination and Marking Scheme

		Internal Assessment			University Examination		Total
Course Code	**Course Name**	**UT-1**	**UT-2**	**Average**	**Theory**	**TW**	
FEC103	**Applied Chemistry-I**	**15M**	**15M**	**15M**	**60M**	**25M**	**100M**

Term Work:

The distribution of marks for term work is as follows:

Experiments	10 Marks
Assignments	10 Marks
Attendance	05 Marks
TOTAL	25 Marks.

Internal Assessment:

Internal Assessment consists of two tests.

Test 1: an Institution level central test is for 15 marks and is to be based on a minimum of 40% of the syllabus.

Test 2: It is of 15 marks and is to be based on the remaining 60% syllabus.

Internal Assessment Scheme

Course Code	Course Name:	Syllabus Covered	Topics Covered
FEC103	**Applied Chemistry-I**		
UT-1	**15M**	**40%**	**Water + Phase Rule**
UT-2	**15M**	**60%**	**Polymers, Chemical Bonding, Aromaticity**

Program Outcomes, Course Outcomes and Program Specific outcomes

Program Outcomes

Program Outcome Code	Program Outcomes
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes

CO	Course Outcome At the end of the course student will be able to:
CO 1	Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and relate it to diatomic molecules
CO 2	Describe the concept of aromaticity and interpret it with relation to specific aromatic systems
CO 3	Illustrate the knowledge of various types of intermolecular forces and relate it to real gases.
CO 4	Interpret various phase transformations using thermodynamics
CO 5	Illustrate the knowledge of polymers, fabrication methods, conducting polymers in various industrial fields.
CO 6	Analyze the quality of water and suggest suitable methods of treatment.

Mapping COs to POs

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

CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
FEC101.1	2											
FEC101.2	2											
FEC101.3	2											
FEC101.4	3											
FEC101.5	3											
FEC101.6	3											
TOTAL												
CO-PO MATRIX												

COs Attainment Tools

	Direct Methods								Indirect Methods
	T-1	T-2	L-1	L-2	L-3	L-4	L-5	Uni. Exam	Course Exit Survey
CO1	10		10	10	10	10	10	40	100%
CO2		50						50	100%
CO3		50						50	100%
CO4		50						50	100%
CO5		50						50	100%

T = Tutorials L= Lab session A = Assignments

COs Attainment Target

CO	CO Statement	CO Target	Target Range
CO 1	Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and relate it to diatomic molecules	60% Students Scoring 60% of Marks	2.5
CO2	Describe the concept of aromaticity and interpret it with relation to specific aromatic systems	60% Students Scoring 60% of Marks	2.5
CO3	Illustrate the knowledge of various types of intermolecular forces and relate it to real gases.		
CO4	Interpret various phase transformations using thermodynamics.		
CO5	Illustrate the knowledge of polymers, fabrication methods, conducting polymers in various Industrial fields.		
CO6	Analyze the quality of water and suggest suitable methods of treatment		

Lesson Plan- Division-A

Lect No	Topic Planned [Mapped to CO6]	Planned Date	Actual Date	Content Delivery Method
1	**Water**			Chalk and Board
2	Introduction - Impurities in water, hardness of water- units (no conversions)	16/08/19	16/08/19	Chalk and Board
3	numerical problems	19/08/19	19/08/19	Chalk and Board
4	determination of hardness of water by EDTA method and numerical problems	21/08/19	22/08/19	Chalk and Board
5	hardness of water by EDTA method and numerical problems	26/08/19	23/08/19	Chalk and Board
6	Softening of water by Ion Exchange process and numerical	28/08/19	26/08/19	Chalk and Board
7	Ion Exchange process and numerical	09/09/19	09/09/19	Chalk and Board
8	BOD, COD- definition, significance and Numerical problems.	11/09/19	11/09/19	Chalk and Board
9	Water purification-membrane technology- Electrodialysis, Reverse osmosis, Ultrafiltration	14/09/19	14/09/19	Chalk and Board
2.	**Polymers[Mapped to CO5]**			
	Introduction: Definition- Polymer, polymerization, Properties of Polymers	14/09/19	14/09/19	Chalk and Board
	Molecular weight (Number average and Weight average), Numerical problems on molecular weight, effect of heat on polymers	16/09/19	18/09/19	Chalk and Board
	(glass transition temperature), Viscoelasticity	18/09/19	18/09/19	Chalk and Board
	Conducting Polymers, Classification-Thermoplastic and Thermosetting polymers;	23/09/19/	23/09/19/	Chalk and Board
	Compounding of plastic, Fabrication of plastic by Compression, Injection,	25/09/19	25/09/19	Chalk and Board
	Compounding of plastic- Transfer and Extrusion moulding	28/09/19	28/09/19	Chalk and Board
	Preparation, properties and uses of PMMA and Kevlar.	30/09/19	30/09/19	Chalk and Board
3.	**Phase Rule-Gibb's Phase Rule[Mapped to CO4]**			
	with examples, System (Water), Reduced Phase Rule,	01/10/19	01/10/19	
	Statement of Gibbs' Phase Rule, Terms involved Advantages and Limitations of Phase Rule.	07/10/19	03/10/19	Chalk and Board

	One Component system- Water	09/10/19	09/10/19	Chalk and Board
	Two Component System - (Pb- Ag), Numerical problems on Phase Rule.	11/10/19	14/10/19	Chalk and Board
4.	**Intermolecular Forces & Critical Phenomena [Mapped to CO 3]**			
	Ionic, dipolar interactions	15/10/19	15/10/19	Chalk and Board
	Vander Waal's interactions	16/10/19	16/10/19	Chalk and Board
	Equations of state. real gases and critical phenomena	18/10/19	18/10/19	Chalk and Board
5.	**Aromatic systems &their molecular structure [Mapped to CO2]**			Chalk and Board
	Define Aromaticity, Huckel's rule	19/10/19	19/10/19	Chalk and Board
	Structure and bonding of benzene and pyrrole.	22/10/19	22/10/19	Chalk and Board
	Atomic and Molecular Structure[Mapped to CO1]			Chalk and Board
	Atomic orbitals (s,p,d,f) orbital shapes, Electronic Configuration,	30/10/19	30/10/19	Chalk and Board
	Molecular orbital theory (MOT), bonding and anti-bonding orbitals, Molecular orbital diagrams of Homonuclear	04/11/19	04/11/19	Chalk and Board
	Heteronuclear diatomic molecules-Be_2, O_2,CO, NO their bond order and magnetic properties,	05/11/19	05/11/19	Chalk and Board

Laboratory Plan

List of Experiments

Outcomes: Learners will be able to…
1. Determine Chloride content and hardness of water sample
2. Determine free acid pH of different solutions
3. Determine metal ion concentration
4. Synthesize polymers, biodegradable plastics.
5. Determine Viscosity of oil

	Applied Chemistry-I
	List of Experiments
Sr. No	(Prescribed by University of Mumbai in its R-2019 revision of the syllabus)
1.	To determine Chloride content of water by Mohr's Method.
2.	To determine total, temporary and permanent hardness of water sample by EDTA method.
3.	To determine free acid pH of different solutions using pH meter
4.	To determine metal ion concentration using colorimeter.
5.	Removal of hardness using ion exchange column.
6.	Molecular weight determination of polymers by Oswald Viscometer.
7.	Synthesis of UF, PF, Nylon 66.
8.	Determination of COD
9.	Synthesis of biodegradable polymer using corn starch or potato starch
10.	Determination of Viscosity of oil by Redwood Viscometer

Rubrics for Practical Evaluation

Rubrics for evaluation	Out Of	Expectation (EE)	Meeting Expectation (ME)	Below Expectation (BE)
Knowledge	02	02	1.5	01
Writing	02	02	1.5	01
Completeness	02	02	1.5	01
Presentation	02	02	02	01
Timeline	02	02	02	01
TOTAL	10			

Laboratory Plan

	DIVISION -A		
	SEMESTER- I		
Exp. No	**Topic Planned**	**Planned Date**	**Actual Date**
	BATCH-A		
1	To determine total, temporary and permanent hardness of water sample by EDTA.	26/08/19	26/08/19
2	To determine free acid pH of different solutions using pH meter	26/08/19	26/08/19
3	To determine metal ion concentration using colorimeter.	20/09/19	20/09/19
4	Determination of COD	11/10/19	11/10/19
5	Removal of hardness using ion exchange column.	11/10/19	11/09/19
	BATCH-B		
1	To determine total, temporary and permanent hardness of water sample by EDTA.	06/09/19	06/09/19
2	To determine free acid pH of different solutions using pH meter	06/09/19	06/09/19
3	To determine metal ion concentration using	27/09/19	27/09/19

	colorimeter.		
4	Determination of COD	18/10/19	18/10/19
5	Removal of hardness using ion exchange column.	01/11/19	01/11/19
	BATCH-C		
1	To determine total, temporary and permanent hardness of water sample by EDTA.	13/09/19	13/09/19
2	To determine free acid pH of different solutions using pH meter	13/09/19	13/09/19
3	To determine metal ion concentration using colorimeter.	04/10/19	04/10/19
4	Determination of COD	04/10/19	04/10/19
5	Removal of hardness using ion exchange column.	02/11/19	02/11/19

Rubrics for Tutorial Evaluation

Rubrics for evaluation	Out Of	Expectation (EE)	Meeting Expectation (ME)	Below Expectation (BE)
Knowledge	02	02	1.5	01
Writing	02	02	1.5	01
Completeness	02	02	1.5	01
Presentation	02	02	02	01
Timeline	02	02	02	01
TOTAL	10			

	DIVISION -A		
	SEMESTER- I		
Exp. No	Topic Planned	Planned Date	Actual Date
	BATCH-A		
1	Water-1	27/08/19	26/08/19
2	Water-2	17/09/19	17/08/19
3	Polymers	24/09/19	24/09/19
	BATCH-B		
1	Water-1	30/09/19	30/09/19
2	Water-2	13/10/19	13/10/19
3	Polymers	20/10/19	20/10/19
	BATCH-C		
1	Water-1	27/08/19	27/08/19
2	Water-2	17/08/19	17/08/19
3	Polymers	24/09/19	24/09/19