Scheme of Examination B.E. First year (All Branches of Engineering)

Second Semester

Sub Code	Subjects	Workload in hrs			Credits	Marks					Minimum Passing Marks	
		L	T/A	P		Theory		Practical		Total		
						Internal	Uni	Internal	Uni		Theory	Practical
BSE2-1T	Mathematics-II	3	1	-	4	30	70	-	-	100	45	-
BSE2-2T	Advanced Engineering Materials	2	2	-	3	30	70	-	-	100	45	-
BSE2-3T	Applied Chemistry	3	2	-	4	30	70	-	-	100	45	-
BSE2-4T	Computational Skills	2	-	-	2	15	35	-	-	50	23	-
BSE2-6T	Basics of Electrical Engineering	2	-	-	2	15	35	-	-	50	23	-
BSE2-7T	Engineering Mechanics	2	-	-	2	15	35	-		50	23	-
BSE2-8T	Indian Culture & Constitution	2	-	-	Audit	50	-	-	-	Audit	-	-
BSE1-5P	Workshop Practices	-	-	4	2	-	-	50	50	100	-	50
BSE2-2P	Advanced Engineering Materials	-	-	2	1	-	-	25	25	50	-	25
BSE2-3P	Applied Chemistry			3	1.5	-	-	25	25	50	-	25
BSE2-4P	Computational Skills			2	1	-	-	25	25	50	-	25
Three weeks Induction Program												
	Total	**16**	**5**	**11**	**22.5**	**135***	**315**	**125**	**125**	**700**		

- L- Lecture , P-Practical, T- Tutorial, A- Activity (Half Credit per Hour)

* Audit course marks are not counted in total marks

Guidelines

- Energy and Environment shall be taught by faculty of Chemistry and will come under board of Applied Science and Humanities (only by Chemistry Dept)
- Advance Engineering Materials shall be taught by faculty of Physics and will come under board of Applied Science and Humanities (only by Physics Dept)

RTMNU, Nagpur
SYLLABUS FOR FIRST YEAR (SEMESTER II) BACHELOR OF TECHNOLOGY
(For All Branches)

Course Code	**BSE2---3T**			
Course Title	**APPLIED CHEMISTRY**			
Scheme & Credits	**L**	**T/A**	**Credits**	**Semester II**
	3	**2**	**4**	

Examination Scheme	
T(U): 70 Marks T (1) 30 Marks	**Duration of University Exam. : 03 Hours**

Course Objectives.

1) To acquaint the students with the basic concepts of Chemistry, and their applications in the Engineering field.
2) To gain the knowledge on properties of materials, and protection of materials from corrosion.
3) To impart basic knowledge related to ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4) To provide an insight into Green Chemistry and its applications in engineering fields.
5) To enable the student to upgrade the existing knowledge of water technologies and to enhance the thinking capabilities in line with the modern trends in Engineering and technology.

Course Outcomes

The course will enable the students to
CO1. Rationalize the periodic properties and analyze the Microscopic Chemistry in terms of atomic and molecular orbital.
CO2. Rationalize bulk properties and processes using thermodynamic processes &understand the causes of corrosion, its consequences and methods tominimize corrosion.
CO3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
CO4. Apply the principles of green chemistry in designing alternative reaction methodologies to minimize hazards and environmental degradation.
CO5. Know about treatment of water and its applications in industry.

UNIT-1: Periodic Properties and Atomic, Molecular Structure
(8 Hours) (Marks 14)

- Periodic properties :- Effective Nuclear charge, electronegativity and polarizability
- Numerical on Slater's Rule
- Atomic, molecular structure:- Atomic and Molecular orbitals. Molecular Orbital Theory and Energy level diagrams of homo diatomic molecules (Hydrogen to Fluorine) and hetero diatomic molecules, NO, NO^+, NO^- and HF.
- Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties (tetrahedral and Octahedral complexes).

UNIT-2 Thermodynamic & Corrosion
(8 Hours) (Marks 14)

- Definition & basic equation of internal energy and enthalpy
- Numerical on internal energy, enthalpy change (Hess's Law)
- Second law of Thermodynamics, reversible and irreversible reactions
- Role or use of Gibbs free energy in a) chemical equilibrium, b) oxidation reduction
- Corrosion- Definition, Causes, theories of corrosion- dry, wet and differential aeration

- Numerical on Pilling Bedworth Rule
- Types of corrosion- pitting, inter granular, and stress corrosion
- Prevention and control of corrosion- design and material selection, cathodic protection.

UNIT-3 Applications of Spectroscopic Techniques
(8 Hours) (Marks 14)

- Principles of spectroscopy and selection rules (Electronic Spectra of Transition Metal Complexes)
- Electronic spectroscopy- basic principles, Lambert-Beer's law, Woodward Fisher Rule for conjugated dienes.
- Numerical on Lambert-Beer's Law
- Numerical on Woodward Fischer Rule
- Fluorescence, Phosphorescence, Jablonski Diagram and its applications.
- Nuclear magnetic resonance - basic principle, chemical shift, spectral interpretation of some simple compounds and magnetic resonance imaging.

UNIT-4 Basic Green Chemistry
(7 Hours) (Marks 14)

- Green Chemistry:- Introduction, twelve principles of Green chemistry with examples,
- Numerical based on atom economy
- Carbon sequestration & Carbon Credits,
- Green reagents, Dimethyl carbonate and its applications,
- Supercritical CO_2 properties and applications, uses and applications of biopolymers – polyadipic acid and polycaprolactum.

UNIT-5 Water Technology
(9 Hours) (Marks 14)

- Importance of Hardness and Alkalinity of water.
- Industrial Water Treatment: Softening of water-principle, reactions, advantages, limitations and comparison of Zeolite process and De mineralization process.
- Numerical based on Zeolite process.
- Boiler Troubles - (causes, effect on boiler operation and methods of prevention) -Scales and sludges, Caustic embrittlement.
- Desalination of sea water- Principle methods and advantages of electro dialysis and reverse osmosis processes
- Waste Water Treatment (introduction and importance) - Water treatment from biological waste water to clean water production, Membrane bio reactors.

Books Recommended:

1. Applied Chemistry: Dr. Avinash V. Bharati, Dr. (Mrs.) Seema A. Shrivastava, Dr. (Mrs.) Seema G. Rawat, Dr. Indrani B. Das Sarma, Dr. (Mrs.) Jyoti N. Thakre, Dr. Kiran M. Khandalkar. Published by Das GanuPrakashan, Nagpur (India)
2. Text Book of Engineering Chemistry: S.S. Dara, S. S. Umare, Published by S. Chand and Company Ltd. New Delhi
3. Textbook of Engineering Chemistry P.C. Jain and Monica Jain, Published by DhanpatRai and Sons, New Delhi.

Reference Books:

1. A textbook of Engineering Chemistry by RajashreeKhare, Published by S. K. Katariya and sons
2. University Chemistry, by B. H. Mahan.
3. Organic Chemistry by Paula Y. Bruice, Published by Pearson
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
5. Fundamentals of Molecular Spectroscopy, by C. N. BanwellIndia.

6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M.S. Krishnan
7. Physical Chemistry, by P. W. Atkins
8. A Text book of Engineering Chemistry: Shashi Chawla; DhanpatRai& Sons, New Delhi.
9. Engineering Chemistry: A.V. Bharati and Walekar, Tech Max Publications, Pune.
10. Selected Topics in Inorganic Chemistry: Madan, Malik, Tuli.
11. Elementry Organic Spectroscopy by Y. R. Sharma, Published by S. Chand and Company Ltd. New Delhi

Course Code	BSE2-3P				
Course Title	APPLIED CHEMISTRY LABORATORY				
Scheme & Credits	L	T	P	Credits	Semester
	0	0	3	1.5	II

Examination Scheme	
P (U): 25 Marks P (I): 25 Marks	Duration of University Exam. : 03 Hours

Course Outcomes

After completion of course students will learn to:

1) Measure molecular/system properties like, concentrations, surface tension, conductance of solutions etc.
2) Estimate the soluble impurities present in the given water sample.
3) Handle the different instruments used in chemistry laboratory.

Students should

- Perform any eight experiments.
- Study of any one experiment in virtual lab topics based on the syllabus.
- Study of any one demonstration experiment.

1) Preparation of different solutions molar solution, Normal solution.
2) Determination of surface tension of a given liquid solution, percent
3) Determination Hardness of water sample by complexometric method.
4) Determination of types and extent of alkalinity of water sample
5) Determination of free chlorine in water sample by lodometry
6) Determination of cell constant and conductance of a given solution.
7) Synthesis of a polymer/drug
8) Estimation of Fe/Fe by redox titrimetry
9) Determination of capacity of cation exchange resin.
10) Determination of Dissolve Oxygen.
11) Demonstration of study of Adsorption of Acetic acid by Charcoal.
12) Demonstration of Thin layer Chromatography
13) Demonstration of Potentiometric titration of an unknown weak Monoprotic Acid
14) Virtual Demonstration of UV-Visible spectrophotometer and FTIR (Fourier transformation infrared spectroscopy)
15) Virtual Demonstration of Lambert-Beer's Law

ACTIVITY

Students should perform any one activity

1) Drinking water quality analysisHardness,Alkalinity, pH, TDS
2) Titration of Aspirin tablets
3) Study of commonly used antacid tablets
4) Interpretation of NMR spectra of 10 compounds
5) Corrosion of surrounding materials
6) Application of chromatography in industry