Name of Faculty	:	Faculty of Science
Name of Program	:	Master of Science
Course Code	:	2MSO03
Course Title	:	Physical Chemistry
Type of Course	:	Basic Science
Year of Introduction	:	2023-24

Prerequisite	:	Previous knowledge of surface tension, probability and radioactivity.
Course Objective	:	Physical Chemistry is the application of physical principles and measurements to understand the properties of matter, as well as for the development of new technologies for the environment, energy and medicine. It includes theoretical and computational tools to provide atomic-level understanding for applications.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand the behavior of real chemical systems by quantum mechanics
	CO2	Analyze an *observational*, *macroscopic* description of matter statistically
	CO3	Learn properties of radioactive elements.
	CO4	Learn about formation and use of detergents.
	CO5	Apply the knowledge of adsorption and micelle formation.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
4	0	0	4	70	30	-	-	100

Legends: ***L****-Lecture;* ***T****–Tutorial/Teacher Guided Theory Practice;* ***P*** *– Practical,* ***C*** *– Credit,* ***SEE*** *– Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping With COs
1	**A) The Basic Principles of Quantum Mechanics:** The Uncertainty Principle, Wave Mechanics, Functions and Operators, The General Formulation of Quantum Mechanics (i.e. Postulates) , Expansion Theorems, Eigen functions of Commuting Operators, Hamiltonian	15	25%	CO1

	Operator. **B) The Quantum Mechanics of Some Simple Systems:** The Free Particle, The Particle in a Box, Quantum Mechanical Tunneling, The Harmonic Oscillator and Rigid Rotor. The Hydrogen Atom, Hydrogen - like Atoms, Shape of Atomic Orbitals.			
2	**Statistical thermodynamics:** Concepts of distribution of molecules, thermodynamic probability, permutations and combinations, Boltzmann's most probable distribution, partition function-translational, vibrational, rotational, electronic nuclear partition functions, problems on types of partition functions.	15	25%	CO2
3	**Nuclear chemistry:** Nuclear properties-nuclear radius, coulombic and nuclear potential radius, nuclear spin and angular momentum, magnetic moment, nuclear binding energy, nuclear models-shell model, liquid drop model, Fermi gas model, collective model, radioactive decay, nuclear reactions, evaporation, spallation, fragmentation, fission and fusion reactions, accelerators, reaction cross section, use of radioisotopes as tracers.	15	25%	CO3
4	**Surface Chemistry:** Physical and chemical adsorption, BET and HJ equations, heat of adsorption, determination of surface area of adsorbents, surface tension, Gibb's equation, surface active agents, micellisation, factors affecting the CMC of surfactants, thermodynamics of micellization, critical micellar concentration (cmc), detergency.	15	25%	CO4 CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**40**	**20**	**20**	**20**	**-**	**-**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Learning Websites

Sr. No.	Name of Website
1	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Statistical_Thermodynamics_(Jeschke)
2	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Properties_of_Matter/States_of_Matter/Properties_of_Liquids/Surface_Tension
3	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Book%3A_Quantum_States_of_Atoms_and_Molecules_(Zielinksi_et_al)/02%3A_Foundations_of_Quantum_Mechanics

Reference Books

Sr. No.	Name of Reference Books
1	Quantum Chemistry by Ira N. Levine, Prentice Hall,
2	Introduction to Quantum Chemistry by A. K. Chandra, Tata McGraw Hill
3	Quantum Chemistry, - I . Levine, Fifth edition, Prentice Hall- 19995. Physical Chemistry – Thomas Engel, Philip Reid
4	Quantum Chemistry, By: R. K. Prasad New Age International Publishers (1985).
5	Molecular quantum mechanics, Vol. I & II, P. W. Atkins, Oxford University Press, 1970.
6	Statistical thermodynamics, by T.L.Hill, Addison Wesley, 1060 Chemical thermodynamics, by F.T. Wall, W.H.Freeman& Co. 1965
7	Physical Chemistry - P.W. Atkin, ELBS fourth edition.
8	Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995
9	Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988
10	Textbook of physical chemistry – W.J.Moore
11	Textbook of physical chemistry – Glasstone
12	Advanced physical chemistry – Surdeep Raj
13	Advanced physical chemistry – J.N.Gurtu, A.Gurtu
14	Physical chemistry – S. Castellian
15	Radiochemistry and Nuclear Chemistry 4th Edition by Gregory Choppin, Jan-Olov Liljenzin, Jan Rydberg, Christian Ekberg.
16	Principles Of Nuclear Chemistry (Essential Textbooks in Chemistry) Reprint Edition by Peter A C Mcpherson.
17	Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
18	Surface chemistry – Adamson
19	Surface chemistry – Osipov