TEACHING PLAN: CH-206

SCHOOL: SOBAS		ACADEMIC SESSION: 2023-2024	FOR STUDENTS' BATCH: IV SEMESTER
1	Course code	CH-206	
2	Course Title	PHYSICAL CHEMISTRY	
3	Credits		
4	Learning Hours	Contact Hours: 54 Practical Teaching: 27 Project, Tutorial and Assessment: 09 Total hours: 90	
5	Course Objective	The purpose of this course is to provide: 1. Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories. 2. To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems. 3. To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.	
6	Course Outcomes	1. Systematic and coherent understanding of the fundamental concepts in Physical chemistry. 2. Students will be able to understand the fundamentals of thermodynamics and electrochemistry. 3. Students will be able to understand the solve problems using the properties and relationships of thermodynamic equations. Students will have understanding of thermodynamic fundamentals for application in applied thermodynamics. 4. Students will gain the knowledge of instrumentation in electrochemistry. Students would also acquire theoretical as well as practical information about the electrical conduction in liquid state.	
7	Outline syllabus:		

7.01	Paper Code	Unit	Introduction	Reference books	Teaching methods
7.02	CH-206 UNIT-I THERMODYNAMICS-III	(a)	Second law of Law Thermodynamics	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(b)	Concept of Entropy	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(c)	Spontaneity and Equillibrium	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion

7.03	**CH-206 UNIT-II THERMODYNAMICS-IV**	(a)	Third law of Thermodynamics	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(b)	Gibbs Helmholtz Functions	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(c)	Applications of Entropy	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
7.04	**CH-206 UNIT-III ELECTROCHEMISTRY-III**	(a)	Electrolytic and Galvanic Cell	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(b)	EMF of a Cell	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(c)	Electrodes	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
7.05	**CH-206 UNIT-IV ELECTROCHEMISTRY-IV**	(a)	Concentration Cells	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(b)	Liquid Junction Potential	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion
		(c)	Potentiometric Titrations	P.C. Rakshit Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT, Discussion

8	**Course Evaluation**	
8.10	**CA: 20%**	
8.1	**Attendance**	5%
8.12	**Homework**	-
8.13	**Quizzes**	4 Quizzes, 5%
8.14	**Projects**	1 Project, 5%
8.15	**Presentation**	1 Presentation, 5%
8.16	**Any other**	--
8.2	**MTE(IA)**	20%
8.3	**End-term examination: 60%**	
9	**Text Books & References**	

9.1	**Text books**	*1.Essentials of Physical Chemistry- Arun Bahl, B.S. Bahl, G.D. Tuli* *2. A Textbook of Physical Chemistry Vol-3- K. L. Kapoor* *3. Physical Chemistry -P.C. Rakshit* *4. Principles of Physical Chemistry- Puri, Sharma, Pathania*
9.2	**References**	Physical Chemistry -Peter Atkins [OXFORD]
9.3	**Video References**	https://www.youtube.com/watch?v=WTtxlaeC9PY https://www.youtube.com/watch?v=a7CxGA6qQPE https://www.youtube.com/watch?v=XQU-9ERZdDE https://www.youtube.com/watch?v=saRdmm3VFVE https://www.youtube.com/watch?v=NfB2chtSy-I https://www.youtube.com/watch?v=j7PYqR1iGMg https://www.youtube.com/watch?v=xj8HNg_zWIw https://www.youtube.com/watch?v=UlwKBzIiIVo&list=PLF_7kfnwLFCF_VxKKAhHSLryCsJr3GW71&index=3 https://www.youtube.com/watch?v=XN60W6H0XWw&list=PLF_7kfnwLFCF_VxKKAhHSLryCsJr3GW71&index=4 https://www.youtube.com/watch?v=X3nZLd5uvjU https://www.youtube.com/watch?v=CcXZXXyPBfc https://www.youtube.com/watch?v=Fed1cgy6xEU

Mapping of Outcomes v. Topics

Outcome no. → Syllabus topic↓	1	2	3	4
Paper Code.Unit I (a)	Y	Y		Y
Paper Code. Unit I (b)	Y	Y		Y
Paper Code. Unit I (c)	Y	Y	Y	Y
Paper Code.Unit II (a)	Y		Y	
Paper Code. Unit II(b)	Y		Y	
Paper Code. Unit II(c)	Y		Y	
Paper Code.Unit III (a)	Y	Y		Y
Paper Code. Unit III(b)	Y	Y		Y
Paper Code. Unit III(c)	Y			Y
Paper Code.Unit IV (a)	Y		Y	Y
Paper Code. Unit IV(b)	Y	Y		Y
Paper Code. Unit IV(c)	Y		Y	Y

QUESTION BANK

Objective type:

UNIT I:

1. A process which proceeds of its own accord, without any outside assistance, is called:

(a) non-spontaneous process (b) spontaneous process (c) reversible process (d) irreversible process

2. The tendency of a process to occur naturally is called:

(a) momentum of the reaction **(b) spontaneity of the reaction** (c) equilibrium of the reaction (d) None of the above

3. Entropy is measure of _____ of the molecules in the system.

(a) concentration (b) velocity (c) Brownian motion **(d) randomness**

4. The efficiency of a heat engine operating in between 400K to 300K is

(a) 1.0 (b) 0.75 **(c) 0.25** (d) 0.50

(5) The entropy of the system increases in the order

(a) gas< liquid< solid **(b) gas>liquid> solid** (c) liquid>solid>gas (d) None

UNIT II

1. The entropy of a pure crystal is zero at absolute zero. This is a statement of

(a) First law of thermodynamics (b) Second law of thermodynamics (c) third law of thermodynamics (d) none of these

2. The cycle of processes which occurs under reversible conditions is referred to as:

(a) Cyclic process (b) Carnot Cycle (c) Heat engine (d) Heat Machine

3. The spontaneous reaction proceeds with a decrease in

(a) Entropy (b) Enthalpy (c) Free energy (d) Internal energy

4. The work function (A) is defined as

(a) A=E-TS (b) A=E+TS (c) A=TS-E (d) None of these

UNIT III

1. An electrochemical cell can only convert electrical energy to chemical energy.

(a) True (b) False

2. When equilibrium is reached inside the two half-cells of the electrochemical cells, what is the net voltage across the electrodes?

(a) > 1 (b) < 1 (c) = 0 (d) Not defined

3. Which of the following is not a generally used electrolyte in the salt bridges used to connect the two half-cells of an electrochemical cell?

(a) NaCl (b) KNO_3 (c) KCl (d) $ZnSO_4$

4. Which of the following statements is correct regarding Electrochemical cells?

(a) Cell potential is an extensive property (b) Cell potential is an intensive property

(c) The Gibbs free energy of an electrochemical cell is an intensive property

(d) Gibbs free energy is undefined for an electrochemical cell

5. Which of the following is not a characteristic feature of a salt bridge?

(a) Salt bridge joins the two halves of an electrochemical cell (b) It completes the inner circuit

(c) It is filled with a salt solution (or gel) (d) It does not maintain electrical neutrality of the electrolytic solutions of the half-cells

UNIT IV

1. Which of the following is a not a secondary cell?

(a) Nickel-cadmium cell (b) Lead storage cell (c) Mercury cell (d) Leclanche cell

2. When a dilute solution of H_2SO_4 is electrolysed using a platinum electrode, at anode the gas evolved is

(a) SO_3 (b) SO_2 (c) H_2 (d) O_2

Subjective type

UNIT I

1. Explain the following terms: (a) Entropy (b) Gibbs free energy (c) Spontaneous Reaction
2. Explain the term thermodynamic efficiency.
3. Calculate the work done on a system if 1 mole of ideal gas is compressed isothermally and reversibly to one fifth of its original volume.
4. Derive a relation between pressure and volume for an adiabatic reversible expansion of an ideal gas.
5. Write a note on Carnot's cycle? What is the efficiency of this?
6. What is entropy? Which kind of function is it and why?
7. Prove that enthalpy remains constant when a real gas passes through a porous plug in adiabatic expansion.

UNIT II

1. Explain the relationship between entropy and enthalpy.
2. Define standard heat of formation and standard entropy change of a reaction.
3. Derive Gibbs Helmholtz Equation.
4. Write down the applications of Gibbs Helmholtz Equation.
5. What are the criteria's for thermodynamic equilibrium?

UNIT III

1. What is electrolytic and galvanic cell? What are the differences?
2. What is EMF of a cell? How is ti calculated? Describe Weston Standard cell.
3. What is the role of salt bridge?
4. Deduce the relationship between EMF of an cell and gibbs free energy.
5. Derive Nernst equation.
6. What are reversible and irreversible electrodes?
7. What is standard electrode potential?

UNIT IV

1. What are concentration cells?
2. Describe and discuss a concentration cell with transference.
3. What is liquid junction potential?
4. How to remove liquid junction potential?
5. Find out the EMF of a concentration cell without transference.
6. How to determine the pH of a solution using glass electrode?
7. Describe Quinhydrone electrode.
8. What is potentiometric titration?

PROJECTS (To be given to group of students)

1. To prepare a simple electrochemical cell using Zn and Cu rod.
2. To determine the pH of a solution using glass electrode.