TEACHING PLAN: CH-106

SCHOOL: SOBAS		ACADEMIC SESSION: 2023-2024	FOR STUDENTS' BATCH: II SEMESTER
1	Course code	CH-106	
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 basic principle of equipment and instruments used in the chemistry laboratory. Students would also acquire theoretical as well as practical information about the electrical conduction in liquid state. 3. It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation. 4. Students will be having clear idea of how the chemical reactions proceed through everyday life and how to measure the rate of such reactions. 5. Students can gain thorough knowledge about the Electrolytes and their activity.	
7	Outline syllabus:		

7.01	Paper Code	Unit	Introduction	Reference number	Teaching methods
7.02	CH-106 UNIT-I KINETICS-I	(a)	Rate of a reaction	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(b)	Integrated rate expressions	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(c)	Rate determination method	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
7.03	CH-106 UNIT-II KINETICS-II	(a)	Arrhenius Equation	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(b)	Reaction Rate Theory	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion

		(c)	Transition State Theory	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
7.04	**CH-106 UNIT-III ELECTROCHEMISTRY-I**	(a)	Electrolytic Conduction	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(b)	Conductance	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(c)	Debye-Huckel-Onsager's Theory	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
7.05	**CH-106 UNIT-IV ELECTROCHEMISTRY-II**	(a)	Kohlrausch's Law	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(b)	Conductivity	Bahl, Bahl, Tuli K. L. Kapoor Puri, Sharma, Pathania	Lecture, Blackboard, PPT,Discussion
		(c)	Degree of dissociation	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**	*Essentials of Physical Chemistry- Arun Bahl, B.S. Bahl, G.D. Tuli* *A Textbook of Physical Chemistry- K. L. Kapoor* *Principles of Physical Chemistry- Puri, Sharma, Pathania*
9.2	**References**	**Physical Chemistry- Peter Atkins, De Paula [Publisher: Oxford]**
9.3	**Video References**	https://www.youtube.com/watch?v=K6iW0OMKp2Y https://www.youtube.com/watch?v=PJRPzIcSJRI https://www.youtube.com/watch?v=n9x5ByOINqc https://www.youtube.com/watch?v=75o2kjlI3NI https://www.youtube.com/watch?v=brQWuN9vQWA https://youtu.be/ebWQC9yC2nk

Mapping of Outcomes v. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5
Paper Code.Unit I (a)	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				
Paper Code. Unit II(c)	Y		Y	Y	

Paper Code.Unit III (a)	Y	Y			Y
Paper Code. Unit III(b)	Y	Y			
Paper Code. Unit III(c)	Y				
Paper Code.Unit IV (a)	Y		Y		Y
Paper Code. Unit IV(b)	Y	Y			Y
Paper Code. Unit IV(c)	Y		Y		

QUESTION BANK

UNIT I

OJECTIVE:

1. The rate of a chemical reaction tells us about
(a) the reactants taking part in the reaction
(b) the products formed in the reaction
(c) how slow or fast the reaction is taking place
(d) none of the above

2. The average rate and instantaneous rate of a reaction are equal
(a) at the start (b) at the end (c) in the middle
(d) when two rates have a time interval equal to zero

3. When the rate of the reaction is equal to the rate constant, the order of the reaction is
(a) zero order (b) first order (c) second order (d) third order

4. In the reaction $2A + B \rightarrow A_2B$, if the concentration of A is doubled and that of B is halved, then the rate of the reaction will
(a) increase 2 times (b) increase 4 times (c) decrease 2 times (d) remain the same

5. For a second-order reaction, what is the unit of the rate of the reaction?
(a) s^{-1} (b) mol $L^{-1}s^{-1}$ **(c) mol^{-1} L s^{-1}** (d) mol^{-2} L^2 s^{-1}

SUBJECTIVE:

1. Define the following terms:
(a) Rate of reaction (b) Order of reaction (c) Molecularity of reaction
(d) Half-life of a reaction.
2. Derive mathematical expressions for (a) zero (b) first order reactions.
3. State the differences between order and molecularity of reaction.
4. Discuss one of the methods for determining the experimental rate.
5. Why the reactions of higher order are hard to occur?
6. Explain the different factors which affect the rate of a reaction.
7. Starting from the rate equations derive the units of the rate constant (k) for a zero order and first order reaction.

UNIT II

OJECTIVE:

1. For the reaction, $A + B \rightleftharpoons X^{++}$, Ea= 20.0 KJ/mol at 300 K. The enthalpy change for the formation of the activated complex from the reactants in KJ/mol is
(a) 12 (b) 15 (c) 23 (d) 25

2. In the collision theory, the pre-exponential factor is
(a) independent of temperature
(b) proportional to temperature
(c) proportional to square of temperature
(d) **proportional to square root of temperature**

3. One of the assumptions made in the conventional activated complex theory is
(a) equilibrium is maintained between reactants and the activated complex.
(b) equilibrium is maintained between the reactants and the products.
(c) equilibrium is maintained between the products and the activated complex.
(d) equilibrium is maintained between the reactants, the activated complex and the products.

4. In the Lindemann mechanism of unimolecular reactions, the observed order at low concentration is
(a) 0.5 (b) 1 (c) 1.5 **(d) 2**

SUBJECTIVE:
1. Explain Arrhenius theory.
2. What is activation energy? How it is determined?
3. How rate of a reaction depends on the temperature?
4. Give graphical representation of activation energy diagram.
5. Explain briefly the collision theory for unimolecular reaction.
6. Discuss the transition state theory.
7. What is the role of activation energy in reaction rate?

UNIT III

OJECTIVE:
1. The units of specific conductance are:
(a) ohm cm (b) ohm cm^{-1} (c) ohm^{-1} **(d) $ohm^{-1}cm^{-1}$**

2. When a strong acid is titrated against a strong base the end point is the point of: (a) Zero conductance (b) maximum conductance **(c) Minimum conductance** (d) none of these

3. The fraction of total current carried by the cation or anion is termed as:
(a) Fractional number **(b) transport number**
(c) Speed number (d) carrier number

4. The sum of the transport number of anion and cation is equal to:
(a) 1 (b) 0 (c) 0.5 (d) ∞

SUBJECTIVE:
1. What are the factors that affect the electrolytic conduction?
2. What is conductance?
3. Define the terms: (i) Specific conductance (ii) Equivalent conductance.
4. How equivalent conductance changes with dilution?
5. Discuss Ostwald's dilution law? Write down the importance of it.

6. What is transport number? How is it measured?
7. Define and explain the following terms:
(a) Degree of dissociation (b) Arrhenius theory
8. State and explain Faraday`s law of electrolysis.
9. Discuss the determination of transport number by Hittorfs methods.

UNIT IV

OJECTIVE:

1. Find the pH of a solution containing an equal volume of 0.1 M NaOH and 0.01 M HCl.

(a) 7.0 (b) 2.0 **(c) 12.65** (d) 1.04

2. Which of the following solutions will act as a buffer?

(a) HNO_2 and $NaNO_2$ (b) HCl and KCl (c) HNO_3 and $NH4NO_3$ (d) NaOH and NaCl

3. Which is not an acidic buffer?

(a) H_2CO_3 and Na_2CO_3 (b) CH_3COOH and CH_3COONa

(c) $HClO_4$ and $NaClO_4$ (d) H_3PO_4 and Na_3PO_4

4. Buffer solutions resist any change in pH. This is because _____.

(a) acids and alkalis in these solutions are shielded from attack by other ions
(b) these give unionised acid or base on reaction with added acid or alkali
(c) fixed value of pH
(d) large excess of H^+ or OH^- ions

5. Which one of the following is equal to the pKa of a weak acid?

a) Its relative molecular mass
b) The pKb of its conjugate base
c) The pH of a solution containing equal amounts of the acid and its conjugate base
d) The equilibrium concentration of its conjugate base

SUBJECTIVE:
1. Discuss Kohlrausch's law. Write down the significance of it.
2. How viscosity, temperature and pressure affect the ionic conductance?
3. Write down the applications of conductivity.
4. What is pKa of an acid? How is it determined?
5. What is pH of a solution?
6. What is a buffer?
7. Write down the mechanism of buffer action.
8. Derive the equation for solubility product of sparingly soluble salt.