

TEACHING PLANS

CHEMISTRY GENERIC ELECTIVE COURSE

Under CBCS syllabus

Semester – I (Year 2020-21 onwards)

Core Course: CHEMISTRY-1

Paper Code: CHM-GE 1016

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	04 (Theory)	60	75 (Theory)
4	02 (Practical)	30	25 (Practical)

Course Objectives: This course aims at giving students theoretical understanding about the basic constituents of matter – atoms, ions and molecules in terms of their electronic structure and reactivity. Structure and bonding in/of these are to be dealt with basic quantum chemistry treatment. Reactivity of chemical species based on their electron transfer affinity is introduced. Further, The organic chemistry part contains fundamental of Organic Chemistry, stereochemistry and aliphatic hydrocarbon.

Course Learning Outcomes: On successful completion, students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, Students are expected to learn basic ideas used in organic Chemistry, stereochemistry functional group, Alkanes, Alkenes, Alkynes etc.

SECTION-A : INORGANIC CHEMISTRY-1

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
	1	Bohr's theory, its limitations and atomic spectrum of hydrogen atom	2	The students will be exposed to the Postulates of Bohr's model of atoms and its limitation	Lecture/ Discussion/ PPT/ Demonstration/ Practical	

Atomic Structure	2	de-Broglie wave equation, Heisenberg's Uncertainty Principle and its significance, Schrodinger wave	3	The students will understand about the wave mechanics, the importance of Heisenberg's Uncertainty Principle	Lecture/ Discussion/ PPT/ Demonstration/ Practical	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	3	Quantum numbers and their significances	3	The students get exposed to the different energy, orbitals in which electron belongs to	Lecture/ Discussion/ PPT/ Demonstration/ Practical	
	4	Hund's rule, Pauli exclusion principle, Aufbau's Principle	2	The students will get knowledge about principle for the distribution of electrons in the atom	Lecture/ Discussion/ PPT/ Demonstration/ Practical	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Chemical Bonding	1	Valence bond Theory and its limitations, hybridization	3	The students will be able to know about the bonding and hybridization of different compounds	Lecture/ discussion/ PPT	Quiz/Class test/Seminar/Assignment
	2	VSEPR Theory and shapes of different molecules	3	The students will understand the shape and bond pair and lone pair of electrons present on central atom	Lecture/ discussion/ PPT	
	3	Molecular Orbital Theory	3	The students will get the knowledge about the bonding and electronic configuration, bond order, bond length, bond strength of covalent molecules	Lecture/ discussion/ PPT	

	4	Hydrogen bonding, metallic bonding and Vander Waal's interaction	3	The students will be able to know two different types of H-bonding, metallic bonding and Vander Waal's interaction	Lecture/ discussion/ PPT	
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SECTION-B: ORGANIC CHEMISTRY-1

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment Evaluation
Fundamentals of Organic Chemistry	1	Electronic Displacement	3	The students will get able to know about the Inductive effect, Electromeric effect, Resonance and Hyper conjugation	Lecture/ discussion/ PPT	Quiz/Class test/Seminar/Assignment
	2	Reaction Intermediates	2	The students will understand the carbocation, carbanion, free radicals and their types	Lecture/ discussion/ PPT	
	3	Cleavage of covalent bond	2	The students will be able to know about the homolytic and heterolytic cleavage	Lecture/ discussion/ PPT	
	4	Nucleophiles and electrophiles	3	The students will get the knowledge of the definitions of Nucleophiles and electrophiles and their difference and reactions	Lecture/ discussion/ PPT	
Stereochemistry	1	Different projection formulae and their interconversion	2	The students will be exposed to the different Fischer, Newmann and Sawhorse model formulae	Lecture/ Discussion/ PPT/ Demonstration	
	2	Geometrical isomerism	2	The students will understand the process of different types of isomerism, their applications	Lecture/ Discussion/ PPT/ Demonstration	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Aliphatic Hydrocarbons	1	Chemistry of alkanes	3	The students will be exposed to the preparation of alkanes, reactions	Lecture/ Discussion/ PPT/ Demonstration/ Practical	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	2	Chemistry of alkene	3	The students will understand the process of preparation, reactions of alkenes and their name reactions	Lecture/ Discussion/ PPT/ Demonstration/ Practical	
	3	Alkynes	3	The students get exposed to the different reactions of alkyne ,their acidity and type	Lecture/ Discussion/ PPT/ Demonstration/ Practical	

N.B. The contact hours for tutorial classes will be 15 hours.

Recommended Books:

1. J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.
2. F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley.
3. Douglas, McDaniel and Alexander: Concepts and Models in Inorganic Chemistry, John Wiley.
4. James E. Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
5. T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons.
6. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
7. E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill.
8. I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
9. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand

Course Teachers:

1. Dr. M. Phalguni Singh
2. Dr. N. Ranita Devi
3. Dr. K. Inaomacha Singh
3. N. Surjit Singh

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Semester – II (Year 2020-21 onwards)Core Course: **CHEMISTRY-2**Paper Code: **CHM-GE 2016**

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	04 (Theory)	60	75 (Theory)
4	02 (Practical)	30	25 (Practical)

Course Objectives: This course may be divided into two broad parts-inorganic and physical chemistry. Three units-main group elements and transition elements will be taught in the inorganic chemistry part. The physical chemistry part contains states of matter.

Course Learning Outcomes: After completion of this course the students will learn periodic properties in main group elements, transition metals (3d series). In physical chemistry part, the students are expected to learn kinetic theory of gases, ideal gas and real gases, surface tension, viscosity and basic solid state chemistry.

SECTION-A : INORGANIC CHEMISTRY-2

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
s- and p-block elements	1	s-block elements	3	The students will be able to know about the electronic configuration, size, I.E, electro-negativity, allotropes, oxidation states of Gr1 and Gr-2 elements	Lecture, discussion	Quiz/Class test/Seminar/Assignment
	2	p-block elements	4	The students will be able to know about the electronic configuration, size, I.E, electronegativity, allotropes, oxidation of different groups of p-block elements	Lecture, discussion	

	3	Inert pair effect and diagonal relationship	2	The students will be able to know about the similarity of elements which have diagonal relationship and oxidation state due to inert pair effect	Lecture, discussion	
	4	Anomalous behaviour of first member of each group	2	The students will be able to know the difference of first element of each group from the remaining elements	Lecture, discussion	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Transition elements	1	Electronic configuration and valency of transition elements	3	The students will get an idea about the electronic configuration of various transition elements	Lecture, discussion	Quiz/Class test/Seminar/Assignment
	2	Properties of transition elements	3	The students will be able to know about the colour formation, magnetic and catalytic properties of various transition elements	Lecture, discussion	
	3	Complex formation and stability of oxidation state of transition metals	2	The students will be able to know about the Complex formation and stability of oxidation state of transition metals	Lecture, discussion	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Co-ordination Chemistry	1	Coordination Chemistry & Drawback of VBT	4	On successful completion, students will be able to name coordination compounds according to IUPAC, explain bonding in this class of compounds, understand their various properties in terms of CFSE and predict reactivity.	Lecture, discussion and exercise	Quiz/Class test/Seminar/Assignment

SECTION B: PHYSICAL CHEMISTRY-2

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Kinetic Theory of Gases	1	Kinetic molecular model of a gas, postulates and derivation of the kinetic gas equation	4	The students will be able to understand the collision frequency; collision diameter; mean free path and viscosity of gases, relation between mean free path and coefficient of viscosity	Lecture/ Discussion/ PPT	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	2	Behaviour of real gases, Deviations from ideal gas behaviour	4	The students will have an idea of compressibility factor, causes of deviation from ideal behaviour. Van der Waals equation of state, virial equation of state.	Lecture/ Discussion/ PPT	

Liquids	1	Surface Tension & Viscosity	4	The students will get to know the physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of temperature and addition of various solutes on surface tension and viscosity.	Lecture/ Discussion/ PPT/ Practical	
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Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Solids	1	Elementary ideas of symmetry, symmetry elements and symmetry operations	2	Students will learn the elementary ideas of symmetry, symmetry elements and symmetry operations	Lecture/ Discussion/ PPT/	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	2	Forms of solids, law of constancy of interfacial angles, law of rational indices, Miller indices, Bragg's law, Analysis of powder diffraction patterns	3	Students will learn the solid state, law of constancy of interfacial angles, rational indices, Miller indices; X-ray diffraction	Lecture/ Discussion/ PPT/	
Chemical Kinetics	1	Reaction Rates, Orders of reactions, Half-life of reaction & Theories of reaction rates	5	Students will learn concept of reaction rates, Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second orders reactions. Collision theory and Activated Complex theory of bimolecular reactions.	Lecture/ Discussion/ PPT/ Practical	

N.B. The contact hours for tutorial classes will be 15 hours.

Reference Books:

1. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
5. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
7. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
8. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
9. Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008

Course Teachers:

1. Dr. M. Phalguni Singh
2. Dr N. Ranita Devi
3. M. Lokendro Singh
4. Dr K. Gayatri Sharma

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Semester – III (Year 2021-22 onwards)**Core Course: CHEMISTRY-3****Paper Code: CHM-GE-3016**

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	04 (Theory)	60	75 (Theory)
4	02 (Practical)	30	25 (Practical)

Course Objective: This course contains two broad parts- physical and and organic chemistry. In physical chemistry part the students will be taught chemical energetics, 13 chemical equilibrium and ionic equilibrium. In organic chemistry part, the students will be introduced to different classes of organic compounds.

Learning Outcome: After completion of this course the students will able to understand the chemical system from thermodynamic points of view. They will also learn two very important topics in chemistry- chemical equilibrium and ionic equilibrium. In organic chemistry part, the students are expected to learn various classes of organic molecules-alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones.

SECTION-A: PHYSICAL CHEMISTRY-3

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Chemical Energetics	1	Review of thermodynamics and laws of Thermodynamics	8	The students will be able to understand - the important principles, definitions of thermochemistry. - Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. - Calculation of bond energy, resonance energy from thermochemical data. - Kirchhoff's equation, calculation of absolute entropies of substances.	Lecture/ Discussion/ PPT/	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Chemical Equilibrium	1	Free energy change in a chemical reaction, thermodynamic derivation of law of chemical equilibrium, Le Chatelier's Principle.	4	Students will learn the concept of free energy change in a chemical reaction, Distinction between ΔG and ΔG_0 , Le Chatelier's principles and relationships between K_p , K_c , and K_x for reactions involving ideal gases.	Lecture/ Discussion/ PPT/	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	2	Ionic Equilibria	10	Students will learn the strong, moderate and weak electrolytes, degrees of ionization, its factors affecting. ionization of weak acids and bases. pH scales, Buffer solutions, solubility and solubility products	Lecture/ Discussion/ PPT/	

SECTION-B: ORGANIC CHEMISTRY-3

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Aromatic Hydrocarbon	1	Preparation of aromatic compounds	3	The students will be able to learn the preparation of aromatic compounds from phenol, acetylene, benzene sulphonic acid and by decarboxylation.	Lecture/ Discussion/ PPT/ Demonstration / Practical	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
	2	Electrophilic substitution reaction in benzene and Friedel-Craft's reaction	3	The students will understand the electrophilic reactions on benzene, Alkylation and acylation upto 4 carbons of benzene.	Lecture/ Discussion/ PPT/ Demonstration / Practical	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Alkyl and Aryl Halides	1	Alkyl halide (preparation and reactions)	3	The Students will be able to know about the preparation and reactions of alkyl halide	Lecture and discussion	Quiz/Class test/Seminar/ Assignment
	2	Aryl halide (preparation and reactions)	3	The Students will be able to know about the preparation and reactions of aryl halide	Lecture and discussion	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Alcohols, Phenols and Ethers (upto 5 carbons)	1	Alcohols (preparation and reactions)	3	The Students will be able to know about the preparation and reactions of alcohols.	Lecture and discussion	Quiz/Class test/Seminar/Assignment
	2	Phenols (preparation and reactions)	2	The Students will be able to know about the preparation, reactions and name reactions of phenols.	Lecture and discussion	
	3	Ethers (aliphatic and aromatic)	2	The Students get exposed to the preparation of ether and cleavage of ethers with HI.	Lecture and discussion	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Aldehydes and Ketones	1	Aldehydes and Ketones (preparation, name reactions and their mechanisms)	4	The Students will understand the preparation of carbonyl compound and their name reactions and mechanism	Lecture , discussion and practical	Quiz/Class test/Seminar/Assignment

N.B. The contact hours for tutorial classes will be 15 hours.

Recommended Books:

1. T. W. Graham Solomons: Organic Chemistry, John Wiley and Sons.
2. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
3. I.L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
4. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
5. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.
6. G. M. Barrow: Physical Chemistry Tata McGraw---Hill (2007). 15
7. G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004).
8. J. C. Kotz, P. M. Treichel & J. R. Townsend: General Chemistry Cengage Lening India Pvt. Ltd., New Delhi (2009).
9. B. H. Mahan: University Chemistry 3rd Ed. Narosa (1998).
10. R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).

Course Teachers:

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3. Dr.Th. Brojendro Singh
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Semester – IV (Year 2021-22 onwards)

Core Course: CHEMISTRY-4

Paper Code: CHM-GE-4016

No. of Hours per Week	Credits	Total No. of Hours	Marks
6	04 (Theory)	60	75 (Theory)
4	02 (Practical)	30	25 (Practical)

Course Objective:

This course may be divided into two broad parts-physical and organic chemistry. In 1st part of this course students will be introduced to solutions, phase equilibrium and electrochemistry. The 2nd part contains carboxylic acid and derivatives, amines and diazonium salt and biochemistry.

Learning Outcome:

After completion of this course the students learn solutions, phase rule and its application in specific cases, basics of conductance and electrochemistry. Students will also learn some important topics of organic and biochemistry- carboxylic acids, amines, amino acids, peptides, proteins and carbohydrates.

SECTION-A: PHYSICAL CHEMISTRY-4

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Solutions	1	Thermodynamics of ideal solutions	6	The students will be able to understand and learn - Ideal solutions and Raoult's law, deviations from Raoult's law– non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids-Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.	Lecture/ Discussion/ PPT/	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Phase Equilibrium	1	Criteria of Phase equilibrium, Phase Rules and its thermodynamic derivations, phase diagrams of one-component and two-component systems	5	Students will learn the concept of Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems and two component systems	Lecture/ Discussion/ PPT/	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment

Unit	Section	Topic	Lecture hours	Learning outcomes	Pedagogy	Assessment/Evaluation
Conductance	1	Conductivity, Kohlrausch law of independent migration of ions. transference number, applications of conductance measurements.	5	Students can understand the concept of conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes, Kohlrausch law of independent migration of ions. Application of conductivity measurements, determination of degrees of ionization of weak electrolytes, conductivity titrations.	Lecture/ Discussion/ PPT/ Demonstration/ Practical	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment

Electrochemistry	1	Reversible and irreversible cells, Concept of EMF of cells, Nernst equation, Potentiometric titrations - qualitative treatment.	6	The students will have the concepts of EMF of a cell, Types of electrodes, thermodynamics of reversible cell and also learn to calculate the thermodynamic properties: ΔG , ΔH and ΔS from EMF data. Liquid junction potential and salt bridge, pH determination, potentiometric titrations	Lecture/ Discussion/ PPT/ Demonstration/ Practical	Quiz/Class test / Seminar/ Group Discussion/ Q & A Session/ Assignment
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SECTION-B: ORGANIC CHEMISTRY-4

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Carboxylic acids and their derivatives	1	Preparation, physical properties and reactions of monocarboxylic acids	4	The Students will understand the preparation of carboxylic acid and their name reactions and mechanism	Lecture , discussion and practical	Quiz/Class test/Seminar/Assignment
	2	Dicarboxylic acids, hydroxy acids and unsaturated acids	3	The Students will be able to know about the preparation and reaction of unsaturated, hydroxy and di carboxylic acid	Lecture and discussion	
	3	Specific Name reactions of carboxylic acid	3	The Students get exposed to different name reactions of carboxylic acids	Lecture and discussion	
Amines and Diazonium salts	1	Amines (aliphatic and aromatic) preparation and reactions	3	The Students will be able to know about the preparation amines from alkyl halides, Gabriel's Phthalimide synthesis and and Hofmann Bromamide reaction.	Lecture, discussion and practical	Quiz/Class test/Seminar/ Assignment
	2	Diazonium salts (preparation and reactions)	2	The Students will be able to know about the preparation of Diazonium salts from aromatic amines and conversion to benzene, phenol, dyes.	Lecture and discussion	

Unit	Section	Topic	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Amino Acids, Peptides and Proteins	1	Amino acids	3	The Students will understand different types of amino acids and their synthesis and characteristics	Lecture , discussion and practical	Quiz/Class test/Seminar/Assignment
	2	Peptides	3	The Students will be able to know about the synthesis of peptides	Lecture and discussion	
	3	Proteins	2	The Students get exposed to the preparation and application and types of protein	Lecture, discussion and practical	

N.B. The contact hours for tutorial classes will be 15 hours.

Recommended Books:

1. G. M. Barrow: Physical Chemistry Tata McGraw---Hill (2007).
2. G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).
3. J. C. Kotz, P. M. Treichel, J. R. Townsend, General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
4. B. H. Mahan: University Chemistry, 3rd Edn. Narosa (1998).
5. R. H. Petrucci, General Chemistry, 5th Edn., Macmillan Publishing Co.: New York (1985).
6. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.
10. Berg, J. M., Tymoczko, J. L. & Stryer, L. Biochemistry 7th Ed., W. H.

Course Teachers:

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