Course Code	Course Title	C	H	I	E	T
17P4CME3	CSIR-NET-GATE-SET EXAMINATIONS PREPARATIONS	4	4	25	75	100

UNIT I INORGANIC CHEMSITRY - I 12 Hrs

a. Structure and bonding in homo and hetero nuclearmolecules, including shapes of Molecules (VSEPRTheory).
b. Transition elements and coordination compounds: structure, bondingtheories, spectral and magnetic properties, reaction mechanisms.
c. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
d. Organometallic compounds: synthesis, bonding and structure, and reactivity, Organometallics in homogeneous catalysis.

UNIT II INORGANIC CHEMSITRY – II 12 Hrs

a. Cagesand metal clusters.
b. Analyticalchemistry- separation, spectroscopic, electro- and thermo- analytical methods.
c. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogenfixation, metalcomplexesin medicine.
d. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.
e. Atomicstructure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.

UNIT III PHYSICAL CHEMISTRY 12 Hrs

a. Basic Principles of quantum mechanics: Postulates, particle-in-a box, harmonic oscillator and the hydrogen atom including shapes of atomic orbitals; orbital and spin angular momentum tunneling.
b. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
c. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.
d. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems.
e. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
f. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
g. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations;

spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

h. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.
i. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
j. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
k. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
l. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

UNIT IV ORGANIC CHEMISTRY-I 12 Hrs

a. IUPAC nomenclature of organic molecules including regio- and stereoisomers.
b. Principles of stereochemistry: Configurational and conformational isomerism in acyclicand cycliccompounds; stereogenicity, stereoselectivity, enantioselectivity, diastereo selectivity and asymmetric induction.
c. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbocations, carbanions, free radicals, carbenes, benzynes andnitrenes.
d. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilicor radicalspecies. Determination of reaction pathways.
e. Common named reactions and rearrangements– applications in organic synthesis.

UNIT V ORGANIC CHEMISTRY-II 12 Hrs

a. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic andenzymatic). Chemo, regio and stereo-selective transformations.
b. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.
c. Pericyclicreactions– electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
d. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
e. Structure determination of organic compounds by IR, UV-Vis, ^{1}H &^{13}C NMR and Mass spectroscopic techniques.

Reference Books:

1. UGC-CSIR NET/SET (JRF&LS) Chemical Sciences Arihant publications.
2. UGC-CSIR NET/SET (JRF&LS) Chemical Sciences Upkars.
3. Adi Chemistry Online materials
4. E.S.Gilreeth-Fundamental concepts of Inorganic Chemistry Mcgraw Hill
5. Modern Inorganic Chemistry-William Jolly.
6. Concise Inorganic chemistry J.D.Lee ELBS IV edition.
7. Advanced Inorganic Chemistry Cotton & Wilkinson wiley.
8. Coulson. Valence Oxford Clarendon.
9. Inorganic chemistry Keilts Purcell & J.C. Kotz W.B.Saunders.
10. Modern Aspects of Inorganic chemistry Emeleus and Sharpe
11. C.Day and J.Selbin-Theoretical Inorganic Chemistry-II Edition.
12. James Huheey Inorganic Chemistry IV edn. Harper - Collins
13. Atkins, P. and de Paula, J., "Physical Chemistry", Ninth Edition, Oxford University Press, New Delhi, 2011.
14. Ball, D. W., "Physical Chemistry", First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
15. Mortimer, R.G., "Physical Chemistry", Third Edition, Academic Press – An imprint of Elsevier, London, 2009.
16. Engel T. and Reid, P. "Physical Chemistry", Second South Asian Edition, Pearson Publication, New Delhi, 2011.
17. Berry, R.S., Rice, S.A and Ross. J, "Physical Chemistry", Second Edition, Oxford University Press, New York, 2007.
18. Puri, B.R., Sharma, L.R. and Pathania, M.S., "Principles of Physical Chemistry", Forty Sixth Edition, Vishal Publishing Co., Jalandhar, 2013.
19. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", First Edition, Oxford University Press, New York, 2006.
20. March, J., "Advanced Organic Chemistry", Sixth Edition, John Wiley & Sons, New York, 2007.
21. Smith, M. B., "Organic Synthesis", Second Edition, McGraw-Hill International Edition, New Delhi, 1994.
22. Skyes, P., "A Guide Book to Mechanism in Organic Chemistry", Sixth Edition, Pearson Education Ltd., New Delhi, 2011.
23. Ahluvalia, V.K., "Chemistry of Natural Products", First Edition, Vishal Publishing Co, Jalandhar, 2008.
24. Finar, I.L., "Organic Chemistry", Vol. II, Sixth Edition, Pearson Education Pvt. Ltd., Singapore, 2006.
25. Carrutherus, W., "Some Modern Methods in Organic Synthesis", Third Edition, Cambridge University Press, New York, 1997.

26. Ireland, R.E., "Foundation of Modern Organic Chemistry Series- Organic Synthesis", First Edition, Prentice – Hall of India Pvt. Ltd., New Delhi, 1975.
27. Mackie, R.K., Smith, M.M., and Aitken, R.A., "Guide Book to Organic Synthesis" Second Edition, Longman Scientific and Technical, Singapore, 1990.
28. Bruckner, R., "Advanced Organic Chemistry – Reaction Mechanism", First Edition, Elsevier India Pvt. Ltd., New Delhi, 2005.
29. Principles of Organic Synthesis, R. Norman and J. M. Coxon, Blackie Academic &Professional, 1988.
30. Mukherji, S.M., and Singh, S. P., Organic Reaction Mechanism by MacMillan India Ltd.