# Imperial TC

## JEE Advanced 2024 Detailed Syllabus, Pattern, and Marks Scheme

**1. JEE Advanced Exam Pattern:**

- **Mode of Exam: Online (Computer-Based Test)**

- **Duration: 3 hours per paper (2 papers, Paper 1 and Paper 2)**

- **Sections: Three sections in each paper - Physics, Chemistry, Mathematics**

- **Question Types: Multiple Choice Questions (MCQs), Numerical Value-based Questions, and Match the Following**

- **Total Questions: Varies each year; typically around 54 questions per paper**

- **Marks Scheme:**

    o **Varies each year, with a mix of full, partial, and zero marks.**

    o **No uniform negative marking scheme; it depends on the question type.**

- **Total Marks: Varies, usually around 360 marks (180 marks per paper)**

**2. Detailed Syllabus:**

**Physics:**

1. **General:**

    o **Dimensional analysis, experimental skills, units, and measurements.**

2. **Mechanics:**

    o **Kinematics: Motion in one and two dimensions, relative velocity, projectiles.**

    o **Newton's Laws: Applications to simple systems, friction, tension.**

    o **Work, Energy, and Power: Conservation laws, work-energy theorem, potential energy.**

    o **Systems of Particles: Center of mass, momentum conservation, collisions.**

    o **Gravitation: Newton's law, potential energy, orbits, escape velocity.**

    o **Rigid Body Dynamics: Rotational motion, moment of inertia, torque, angular momentum.**

    o **Fluid Mechanics: Pressure, Bernoulli's theorem, viscosity, surface tension.**

    o **Thermal Physics: Kinetic theory, thermodynamics, laws of thermodynamics, Carnot engine.**

3. **Electricity and Magnetism:**

- Electrostatics: Coulomb's law, electric field, Gauss's law, potential, capacitors.

- Current Electricity: Ohm's law, series and parallel circuits, Kirchoff's laws.

- Magnetism: Biot-Savart law, Ampere's law, Lorentz force, magnetic properties of materials.

- Electromagnetic Induction: Faraday's laws, Lenz's law, inductance, AC circuits.

4. **Optics:**

- Geometrical Optics: Reflection, refraction, lenses, mirrors, optical instruments.

- Physical Optics: Interference, diffraction, polarization, wavefronts.

5. **Modern Physics:**

- Dual Nature of Matter and Radiation: Photoelectric effect, de Broglie waves.

- Atoms and Nuclei: Models of atoms, radioactivity, nuclear fission and fusion.

- Electronics: Semiconductors, diodes, transistors, logic gates, digital electronics.

## Chemistry:

- **Physical Chemistry:**

  1. **Basic Concepts in Chemistry:** Atomic and molecular masses, mole concept, stoichiometry.

  2. **States of Matter:** Gaseous state, ideal gas law, real gases, liquid state.

  3. **Atomic Structure:** Bohr model, quantum mechanics, electronic configuration.

  4. **Chemical Bonding:** Molecular orbital theory, VSEPR theory, hybridization, ionic and covalent bonds.

  5. **Chemical Thermodynamics:** Enthalpy, entropy, free energy, Hess's law, spontaneity.

  6. **Solutions:** Colligative properties, Raoult's law, ideal and non-ideal solutions.

  7. **Chemical Kinetics:** Rate laws, reaction order, Arrhenius equation, collision theory.

  8. **Surface Chemistry:** Adsorption, colloids, catalysis, emulsions.

  9. **Electrochemistry:** Electrolytic cells, Nernst equation, electrochemical series, batteries.

  10. **Nuclear Chemistry:** Radioactivity, decay processes, nuclear reactions.

- **Inorganic Chemistry:**

  1. **Periodic Table:** Trends in atomic and ionic sizes, ionization energy, electronegativity.

2. **Chemical Bonding:** Lewis structures, valence bond theory, crystal field theory.

3. **Metallurgy:** Extraction of metals, refining, and purification.

4. **s-Block Elements:** Properties of alkali and alkaline earth metals, important compounds.

5. **p-Block Elements:** Properties, trends, and compounds of groups 13-18.

6. **d- and f-Block Elements:** Properties of transition metals, lanthanides, and actinides.

7. **Coordination Compounds:** Nomenclature, bonding theories, isomerism, color, and magnetic properties.

8. **Environmental Chemistry:** Atmospheric pollution, ozone layer depletion, water and soil pollution.

- **Organic Chemistry:**

    1. **General Organic Chemistry:** Inductive, mesomeric, hyperconjugation effects, resonance, acidity, and basicity.

    2. **Hydrocarbons:** Alkanes, alkenes, alkynes, aromatic hydrocarbons, reactions and mechanisms.

    3. **Haloalkanes and Haloarenes:** Nucleophilic substitution reactions, SN1, SN2 mechanisms.

    4. **Alcohols, Phenols, and Ethers:** Properties, acidity, reactions, and preparation methods.

    5. **Aldehydes, Ketones, and Carboxylic Acids:** Reactivity, mechanisms, nucleophilic addition, oxidation-reduction reactions.

    6. **Amines:** Structure, basicity, preparation, and reactions, diazotization.

    7. **Biomolecules:** Carbohydrates, proteins, lipids, nucleic acids, their structure, and function.

    8. **Polymers:** Classification, types, mechanisms, and uses.

    9. **Chemistry in Everyday Life:** Drugs, food preservatives, detergents, and polymers.

**Mathematics:**

1. **Algebra:**

    o **Quadratic Equations:** Roots, nature of roots, relationship between roots and coefficients.

- o **Sequences and Series:** Arithmetic and geometric progressions, harmonic progression.

- o **Matrices and Determinants:** Inverse, rank, properties, eigenvalues, and eigenvectors.

- o **Complex Numbers:** Argand plane, De Moivre's theorem, roots of complex numbers.

- o **Probability:** Bayes' theorem, probability distributions, random variables.

- o **Permutation and Combination:** Factorials, binomial theorem, combinatorial identities.

- o **Binomial Theorem:** General term, expansion, application in probability.

2. **Trigonometry:**

   - o **Trigonometric Functions:** Identities, inverse trigonometric functions, graphs.

   - o **Solution of Triangles:** Laws of sines and cosines, area, and solutions.

3. **Coordinate Geometry:**

   - o **Straight Lines:** Equations, distance of a point, angle between lines.

   - o **Circles:** Tangents, chord properties, equations.

   - o **Conic Sections:** Parabolas, ellipses, hyperbolas, their properties and equations.

4. **Calculus:**

   - o **Limits and Continuity:** L'Hopital's rule, continuity, and differentiability.

   - o **Differentiation:** Derivatives, higher-order derivatives, applications in finding tangents, normals, maxima, and minima.

   - o **Integration:** Indefinite and definite integrals, properties, applications in area, and volume.

   - o **Differential Equations:** First-order differential equations, linear differential equations.

5. **Vectors and 3D Geometry:**

   - o **Vectors:** Operations, dot and cross product, applications in geometry.

   - o **Three-Dimensional Geometry:** Equations of planes and lines, distances, and angles.

6. **Mathematical Reasoning:**

   - o **Logic:** Statements, truth tables, implications, and equivalences.

7. **Statistics:**

   o **Measures of Central Tendency: Mean, median, mode, variance, standard deviation.**

## 3. Marks Distribution:

- **Physics:**

   o **Paper 1 & Paper 2: Combined weightage with 18-20 questions, approximately 120 marks**

- **Chemistry:**

   o **Paper 1 & Paper 2: Combined weightage with 18-20 questions, approximately 120 marks**

- **Mathematics:**

   o **Paper 1 & Paper 2: Combined weightage with 18-20 questions, approximately 120 marks**

## Marking Scheme (Varies Year to Year):

- **MCQs:**

   o **Full marks for correct answers.**

   o **Partial marks for partially correct responses.**

   o **Negative marks for incorrect answers.**

- **Numerical Value Questions:**

   o **Full marks for correct answers.**

   o **No negative marking.**

- **Match the Following:**

   o **Full and partial marks depending on correctness.**

P.S Please cross-check the syllabus on the official JEE website to ensure accuracy and stay updated with any changes.