Programme Outcomes(POs)/Programme Specific Outcomes/Course Outcomes(COs):

Course: Bachelor of Science	
Subject: Chemistry	
Semester: I-VI	
Web Link	https://design.cblu.ac.in/syllabi/
Programme Outcomes (POs)	
Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
Problem Solving	Capability of applying knowledge to solve scientific and other problems
Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, multidisciplinary settings
Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices
Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
Environment and Sustainability	Ability to design and develop modern systems which are environmentally sensitive and to understand the importance of sustainable development
Ethics	Apply ethical principles and professional responsibilities in scientific practices
Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects
Programme Specific Outcomes(POs)	
• Acquire good knowledge about the fundamentals and applications of chemical and scientific theories. • All branches of Science and Technology are related to Chemistry. • Easily assess the properties of all elements discovered. • Will become familiar with the different branches of chemistry like analytical, physical,	

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organic, inorganic, environmental and polymer.

- Will help in understanding the causes of environmental pollution and can open up new methods to control environmental pollution.
- Will develop analytical skills and problem-solving skills requiring application of chemical principles.
- Have the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques.

Course Outcomes(COs)

- States the postulates of quantum mechanics and Schrodinger equation to explain the structure of hydrogen atom.
- To study and explain the Radial and angular nodes and their significance in describing shapes of s,p and d orbitals.
- Know about Spin quantum numbers and magnetic quantum numbers and their significance.
- Have knowledge about Electronic configuration, Effective nuclear charge and slater's rule.
- To learn about Role of temperature and pressure to establish the state of gases and describe the Concept of critical temperature, pressure and volume of real gases
- To understand the Maxwell distribution law and various parameters associated with collisions ideal gas molecules
- To study the Physical properties of liquids like surface tension, viscosity and their measurements
- Have sound knowledge of the basic organic chemistry like electron displacement effects with suitable examples.
- Get information about the types of structural and stereoisomers, optical isomerism, and different nomenclature like D/L, RScis/trans, E/Z etc. of various organic compounds.
- To gain knowledge about Preparation of standard solutions used in the lab.

B.Sc. (Chemistry) 1st Sem.

Subject: Atomic structure and bonding and GOC 1 **Subject Code:** 20 UCHE-101

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Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about review of Bohrs theory.

CO2: Radial and angular nodes and their significance.

CO3: Discovery of spin quantum number.

CO4: Get introduced to review of ionic bonding and fajans rule, ionic character in covalent compounds.

CO5: Bohrn Haber cycle and its applications. Covalent bonding and valence bond approach.

CO6: Geometrical and optical isomerism, enantiomers.

B.Sc. (Chemistry) 1st Sem.

Subject: States of matter and aliphatic hydrocarbons **Subject Code:** 20UCHE-102

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Postulates of kinetic theory of gases and derivation of kinetic gas equation.

CO2: Surface tension and its determination using stalagmometer. Effect of temperature on surface tension.

CO3: Coefficient of viscosity of a liquid, Bravais lattice types and identification of lattice planes. Defects in crystals. Glasses and liquid crystals.

CO4: Functional group approach, for preparation and reactions. Catalytic hydrogenation reaction, Wurtz reaction.

CO5: Dehydration of alkenes and dehydrohalogenation of alkyl halides.

CO6: Formation of metal acetylides, addition of bromine and alkaline $KMnO_4$.

B.Sc. (Chemistry) 1st Sem.

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Subject: Practical -I **Subject Code:** 20UCHE-103

CO1: Estimation of oxalic acid by titrating it with $KMnO_4$

CO2: Estimation of water of crystallization in Mohr's salt.

CO3: Determination of viscosity.

CO4: To study the process of sublimation of camphor and phthalic acid.

CO5: Separation of mixtures by chromatography.

B.Sc. (Chemistry) 2nd Sem.

Subject: Chemistry of s&p block elements and aromatic hydrocarbons alkyl and aryl halides
Subject Code: 20UCHE-201

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Diagonal relationships, salient features of hydrides, oxides, halides and hydroxides.

CO2: Diborane, preparation, properties and structure.

CO3: Carbon family, nitrogen family, oxygen family and halogen family.

CO4: Aromatic hydrocarbons and fridel crafts reaction, sulphonation, halogenation reactions.

CO5: Alkyl halides and aryl halides.

CO6: Decarboxylation reactions.

B.Sc. (Chemistry) 2nd Sem.

Subject: Chemical energetics and functional group organic chemistry
Subject Code: 20UCHE-202

Course Outcomes (CO)

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After successful completion of the course, the student is expected to:

CO1: Zeroth law, first law of thermodynamics and heat capacities at constant volume and pressure.

CO2: Temperature dependance of enthalpy, Kirchhoff's equation.

CO3: second law of thermodynamics, Carnot's cycle and its efficiency.

CO4: Third law of thermodynamics, Nernest heat theorem.

CO5: Alcohols and phenols.
CO6: Alehydes and ketones.

B.Sc. (Chemistry) 2nd Sem.

Subject: Practical- II **Subject Code:** 20UCHE-203

CO1: Iodo/Iodimetric titrations

CO2: Inorganic preparations, cuprous chloride.

CO3: Thermochemistry, heat capacity determination by colorimeter.

CO4: To check the calibration of thermometer.

CO5: Purification of organic compounds by crystallization.

B.Sc. (Chemistry) 3rd Sem.

Subject: Chemical equilibria and Functional group organic chemistry
Subject Code: 20UCHE-301

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about equilibrium constant and free energy, chemical potential, Clapeyron equation.

CO2: Depth knowledge of Hell-Volhard reaction and its mechanism.

CO3: Will learn about physical properties and interconversion of acid chlorides.

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CO4: Learn about acid chlorides, esters, amides and acid anhydrides.

CO5: Nomenclature, structure and bonding of carboxylic acids.

CO6: Applications of distribution law, Nernst distribution law.

B.Sc. (Chemistry) 3rd Sem.

Subject: Co-ordination chemistry and chemical kinetics
Subject Code: 20UCHE-302

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Werners theory, nomenclature of co-ordination compounds.

CO2: Crystal field theory, crystal field splitting in octahedral and tetrahedral complexes.

CO3: Will learn about types of magnetic behavior, orbital contribution to magnetic moments.

CO4: Rate of reaction, rate equation, factors affecting rate of reaction.

CO5: order of reaction, rate expression for zero order, first order. Half life period or reaction, method of determination of order of reaction.

CO6: Effect of temperature on rate or reaction, theories of reaction rate.

B.Sc. (Chemistry) 3rd Sem.

Subject: Practical-III **Subject Code:**
20UCHE-303

Subject: Practical- II **Subject Code:** 20UCHE-203

CO1: Complexomteric titrations

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CO2: Gravimetric analysis.

CO3: To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed by hydrogen ions at room temperature.

CO4: To prepare arsenious sulphide sol.

CO5: Purification and purification of organic compounds by crystallization. (m-dinitrobenzene from nitrobenzene).

B.Sc. (Chemistry) 4th Sem.

Subject: Functional group organic chemistry and electrochemistry **Subject Code:** 20UCHE-401

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Structural and nomenclature of amines.

CO2: Depth knowledge of Structure of benzene diazonium salts, coupling reaction and synthetic applications.

CO3: Will learn about electrolytic conduction, factors affecting, specific conductance and Arrhenius theory of ionization.

CO4: Learn about applications of conductivity measurements, determination of degree of dissociation.

CO5: Electrolytic and galvanic cells, determination of pH, buffer solutions, Debye Huckel Onsager equation.

CO6: Types of reversible electrodes, applications of EMF measurement, Nernst equation.

B.Sc. (Chemistry) 4th Sem.

Subject: Solutions and phase equilibrium and chemistry of biomolecules **Subject Code:** 20UCHE-402

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Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about dilute solutions and colligative properties.

CO2: Depth knowledge of phase component and degrees of freedom, ideal and non-ideal solutions.

CO3: Will learn about solid-liquid equilibria, phase equilibria of one component system-water, carbon dioxide and Sulphur system.

CO4: Learn about classification and nomenclature of carbohydrates, fructose, sucrose and riboses.

CO5: classification of amino acids, isoelectric point, electrophoresis. Preparation of amino acids.

CO6: Structure and nomenclature of peptides and proteins.

B.Sc. (Chemistry) 4th Sem.

Subject: Practical IV **Subject Code:** 20UCHE-403

CO1: Paper chromatography, colometry.

CO2: To determine the specific reactivity.

CO3: To study the distribution of iodine between water and CCl_4.

CO4: Steam distillation of Naphthalene from its suspension in water.

CO5: Column Chromatography.

B.Sc. (Chemistry) 4th Sem.

Subject: Green chemistry **Subject Code:** 20UCHE-404

Course Outcomes (CO)

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After successful completion of the course, the student is expected to:

CO1: Learn about green chemistry, principles of green chemistry and their explanation with examples.

CO2: green reagents, microwave assisted reactions in Hofmann elimination.

CO3: Will learn about ultrasound assisted reactions, ozone depletion, biomimetic, multifunctional reagents.

CO4: Learn about solvent free synthesis of inorganic complexes.

CO5: Green chemistry for sustainable development, oxidation regents.

CO6: Sono chemical reactions, non- phosgene isocyanate synthesis.

B.Sc. (Chemistry) 5th Sem.

Subject: Chemistry of Heterocyclic compounds **Subject Code:** 20UCHE-501

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Nomenclature of heterocyclic compounds, three and four membered rings.

CO2: Five- membered heterocyclic compounds, methods of synthesis and chemical reactions.

CO3: Six- membered heterocyclic compounds, methods of synthesis and chemical reactions.

CO4: Comparison of basicity of pyridine, pyrrole and piperidine.

CO5: Fused heterocyclic compounds, preparation and reactions of quinoline and isoquinilone.

CO6: Mechanism of electrophilic reactions.

B.Sc. (Chemistry) 5th Sem.

Subject: Organic spectroscopy I **Subject Code:** 20UCHE-502

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

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CO1: UV spectroscopy.

CO2: IR spectroscopy.

CO3: NMR- spectroscopy-I.

CO4: NMR- spectroscopy-II

B.Sc. (Chemistry) 5th Sem.

Subject: Practical V **Subject Code:** 20UCHE-503

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Preparation of tetraamine copper II sulphate.

CO2: Conductance measurement and cell constant

CO3: Conductometric titrations.

CO4: Detection of extra elements.

B.Sc. (Chemistry) 5th Sem.

Subject: Environmental Chemistry **Subject Code:** 20UCHE-504

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about Air pollution, major regions of atmosphere.

CO2: Hydrological cycle, water resources, sources and nature of water pollutants.

CO3: Industrial waste management, water purification methods.

CO4: Coal, petrol and natural gas, nuclear fusion and fission, solar energy and tidal energy.

CO5: Biocatalysts.

CO6: water quality parameters, chloroflurocarbons.

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B.Sc. (Chemistry) 6th Sem.

Subject: Inorganic materials of Industrial importance **Subject Code:** 20UCHE-601

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Learn about recapitulation of s and p block elements.

CO2: Silicates industries, glass, ceramics and cements.

CO3: Different types of fertilizers, manufacture of urea. Coating surfaces, paints and pigments.

CO4: Objectives of surface coating, special paints, dyes, wax, plastic paints.

CO5: water and oil paints, metallic coatings.

CO6: primary and secondary batteries, components and their role, fuel cells, solar cell and polymer cell.

B.Sc. (Chemistry) 6th Sem.

Subject: Quantum mechanics and molecular spectroscopy **Subject Code:** 20UCHE-602

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Black body radiations, planks radiation law, photoelectric effect, Compton effect, Heisenberg uncertainty principle.

CO2: Rigid rotator model of rotation of diatomic molecule, Schrodinger equation, zero-point energy.

CO3: Interaction of electromagnetic radiation with molecules and various types of spectra, born Oppenheimer reaction.

CO4: Rotational spectroscopy, vibrational spectroscopy.

CO5: Raman spectroscopy, qualitative treatment of rotational Raman spectra, effect of nuclear spin, vibrational Raman spectra.

CO6: Electronic spectroscopy, Franck Condon principle, singlet and triplet states,

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fluorescence and phosphorescence spectroscopy.

B.Sc. (Chemistry) 6th Sem.

Subject: Practical VI **Subject Code:** 20UCHE-603

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Potentiometric titration of strong acid and strong base.

CO2: To prepare o-chlorobenzoic acid from anthralinic acid.

CO3: Determine the concentration of $KMnO_4$ and $K_2Cr_2O_7$.

CO4: Verify Lamberts-Beer law.

B.Sc. (Chemistry) 6th Sem.

Subject: Analytical chemistry **Subject Code:** 20UCHE-604

Course Outcomes (CO)

After successful completion of the course, the student is expected to:

CO1: Methods of sampling and associated errors, classification of errors, propagation of errors, treatment of errors, normal distribution.

CO2: Flame atomic absorption and emission spectroscopy.

CO3: Diffraction methods.

CO4: Electroanalytical methods.

CO5: Chromatographic techniques.

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Department of Physics

Course Outcomes and Programme Specific Outcomes

B.Sc. Physics

B. Sc. PHYSICS PROGRAMME SPECIFIC OUTCOMES (PSO)

- This undergraduate course in Physics would provide the opportunity to the students: T

  o understand the basic laws and explore the fundamental concepts of physics.
- To understand the concepts and significance of the various physical phenomena.
- To carry out experiments to understand the laws and concepts of Physics.
- To apply the theories learnt and the skills acquired to solve real time problems.
- To acquire a wide range of problem-solving skills, both analytical and technical and to apply them.
- To enhance the student's academic abilities, personal qualities and transferable skills, this will give them an opportunity to develop as responsible citizens.
- To produce graduates who excel in the competencies and values required for leadership.
- To serve a rapidly evolving global community.
- This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques specially the importance of accuracy of measurements.
- Providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity and electronics.

Course Outcome (CO)

Semester 1st

Paper I

PHY-101

Mechanics

The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion & gravitation.

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Paper II

PHY-102

Electricity and Magnetism

It gives an opportunity for the students to learn about one of the fundamental interactions of electricity and magnetism, both as separate phenomena and as a singular electromagnetic force. The course contains vector analysis, electrostatics, magnetism, electromagnetic induction and Maxwell's equations. The course is very useful for the students in almost every branch of science and engineering.

Paper III

PHY-103

Practical

Students would perform basic experiments related to mechanics, electricity and magnetism and measurements such as: Resistance, Voltage, current etc. would learn the importance of accuracy of measurements.

Semester 2nd

Paper I

PHY-201

Properties of Matters, Kinetic Theory and Relativity

After successful completion of the course, the student is expected to learn the basics of properties of matter, how Young's modulus and rigidity modulus are defines and how they are evaluated for different shapes of practical relevance.

Paper II

PHY-202

Electro-magnetic Induction and Electronic Devices

After successful completion of the course, the student is expected to have a basic knowledge of semiconductor physics. Acquire knowledge about how a semiconductor diode rectifies an input ac signal. Learn how to construct a transistor amplifier and how its gain varies with frequency.

Paper III

PHY-203

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Practical

Student will learn practical's of above said theory course and learn the usages of scientific instruments in daily life.

Semester 3rd

Paper I

PHY-301

Computer Programming Thermodynamics

The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, and kinetic theory of gases.

Paper II

PHY-302

Optics- I

The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization. The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.

Paper III

PHY-303

Practical

They would learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers.

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Semester 4th

Paper I

PHY-401

Statistical Mechanics

Familiarize in depth about statistical distribution and have basic Ideas about Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac Statistics and their applications.

Paper II

PHY-402

Optics- II

The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization. The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.

Paper III

PHY-403

Practical

They would learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers.

Semester 5th

Paper I

PHY-501

Solid State Physics

The course Provides practical knowledge of various physical phenomena such as: magnetism, dielectrics, ferroelectrics and semiconductors. Students would gain a hands-on learning experience by performing experiments on these properties of materials.

Paper II

PHY-502

Quantum Mechanics

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Quantum mechanics provides a platform for the physicists to describe the behavior of matter and energy at atomic and subatomic level. The course plays a fundamental role in explaining how things happen beyond our normal observations. The course includes the study of Schrodinger equations, particle in one dimension potential.

Paper III

PHY-503

Practical

Various practical problems solving methods related to Quantum Mechanics would be learned by students.

Semester 6th

Paper I

PHY-601

Atomic, Molecular and Laser Physics

Describe the atomic spectra of one and two valance electron atoms. Explain the change in behavior of atoms in external applied electric and magnetic field. Explain rotational, vibration, electronic and Raman spectra of molecules. Describe electron spin and nuclear magnetic resonance spectroscopy and their applications. Basic Laser principles, Laser behavior, Properties of laser radiations, Different types of Lasers and Laser applications.

Paper II

PHY-602

Nuclear Physics

After taking this course, students are able to determine the charge, mass of any nucleus by using various spectrographs. They are able to understand the size of nucleus and all its properties. This course has led the students to understand interaction of various types of radiation with matter which they observe in their daily life. It's easy for them now to relate the theory to practical. Students now know various methods of accelerating various types of particles to perform scattering experiments. Students are able to understand the detecting methods and instruments for different types of charged and neutral particles.

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Mathematics

Programme Outcomes :-

i) Student acquire good knowledge and ability to understand in advanced areas of mathematics & its application.

ii) Students becomes able in advanced studies and research in research pure and applied mathematical science.

iii) Student acquire the ability to analyses a problem, identify & appropriate it's solution.

iv) Students develop a positive attitude towards mathematics.

Programme specific outcomes :-

i) Students will be able to apply critical thinking skills to solve problems that can be modelled mathematically to use numerical & graphical data, Read and Construct Mathematical argument & proof. To use computer technology appropriately to solve problems.

ii) Think in a critical manner.

iii) Formulate & develop mathematical arguments in a logical manner.

iv) Acquire good knowledge and understanding in advanced areas of mathematics.

Learning outcomes :-

Students will be well equipped to critically analyses a given problem, understand and build a mathematical model to represent the problem. Students are well prepared for higher studies in their chosen field.

Course outcomes :-

1. Calculus & Analytical Geometry :-

   After the completion of this course students understand the basic concept about calculus & 2D, 3D Geometry.

   a. Hyperbolic function & its derivatives.
   b. Pedal equation
   c. Curve tracing
   d. L' Hospital Rule.

2. Algebra :-

   This course aware the student's knowledge of Classical Algebra which will be useful in solving real life problems. After Completion of this course students will be able to understand:

   a. Permutation, Cycle notation
   b. Definition & Elementary property of group.
   c. Function, composite function.
   d. Matrix, order of a group, order of an element.
   e. Group, Subgroup etc.

3. Real Analysis :-

   After completion of this course students becomes able to think about the basic proof & concept of real number system. Students become conversant with many of the important theorem for ex :-

   a. Monotone, sequence, Monotone convergence theorem.
   b. Bolzano weirestrass theorem.

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c. Peano's axiom.
d. Limit theorem sandwich theorem.

4. Differential equation :

After completion of this course student become able to identify the different type of differential equation and learn to use a proper technique to solve the problem. They learn to this course :-

a. Differential equation & sperable equation.
b. Lipschitz condition & Picard's Theoram.
c. Implict , Explict differential equation

5. Theory of Real & Vector function :-

In this Course students will learn the fundamental concept of real analysis and vector function and it's application. Student's learn about the :-

a. Limit of function
b. Continuity, uniform continuity
c. Rolle's theorem, Darboux theorem, Taylor's theorem
d. Lagrange theorem application of Taylor's theorem
e. Gradient, Divergence, Curl of vector function.

6. Programming in 'C' :

For any of the CAS (Computer Aided Software) students are introduced to Date types, simple date types, operator procedure and different type of numerical problem using the computer programming techniques of C. After this course students learn about :

a. Brief historical development of computer generation.
b. Basic structure of computer system.
c. BIT, BYTE, WORD
d. Coding of data
e. Algorithm & Flow chart.

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