Rs. 25/-

NORTH MAHARASHTRA UNIVERSITY
JALGAON - 425 001

SYLLABUS

FOR

B.Chem. (Chemical Engineering)

(From June 1995)

For
F.E, S.E, T.E. & B.E.

DEPARTMENT OF CHEMICAL SCIENCES

First Year Course in Chemical Engineering

Semester I

Candidates will be examined in the subject as indicated in the following tables :

Papers

Sr. No.	Subject	No.of papers	Examination Hrs	Marks	Periodic Test Marks	Total Marks
CHE 101	Electrical Engineering & Electronics	1	3	60	40	100
CHE 102	Inorganic Chemistry	1	3	60	40	100
CHE 103	Physics	1	3	60	40	100
CHE 104	Physical Chemistry-I	1	3	60	40	100
CHE 105	Mechanical Engineering-I	1	2	30	20	50
CHE 106	Engineering Graphics	1	4	60	40	100
		6		330	220	550

Practicals and Orals

Sr. No.	Subjects	Examination Hrs	Marks	Marks for Class work	Total
CHE107 -	Physics	6	60	40	100
CHE108-	Inorganic Chemistry	3	30	20	50
CHE109-	Electrical Engineering & Electronics Laboratory	3	30	20	50
		12	120	80	200
	Total Marks				750

CHE-101: Electrical Engineering and Electronics :

Three phase system of e.m.fs. and currents. Star and delta connections. Three phase power measurements.

D.C. generators : Principle of working, types of generators and their characteristics. D.C. Motors speed control. and starting methods.

Single phase transformer . Principle of working, regulation efficiency. Three phase and instrument transformers.

A.C. motors : Working principles of synchronous and induction motors, their characteristics and starting methods. Electrical h.p. meter. Choice of motors for different duties.

Alternator : Working principle and regulation.

Conversion of A.C. to D.C. - various methods used and their specific applications.

Electrical hearing methods.
Electrical Tariff and p.f.improvement.

Electronics : Use of electronic valves as rectifier, detector, amplifier and oscillator. Two and three stage amplifiers. Digital circuits. operational amplifier. Photoelectric devices and their applications. Transducers.

Characteristics of transistors and transistor amplifier.
Multistage amplifiers. Cathode Ray Oscilloscope.
Electronic timing and control devices.
Introduction to integrated circuits.

Illustrations for the above named applications to be given with the help of block diagrams only.

Reference Book

1. Electrical Technology E. Hughes (E.L.B. Publication)
2. Basic Electrical Engineering Fitzerald and Higgnbotham
3. Applied Electricity A.W. Hart (Blackie and Sons)
4. Electrical Technology H. Cotton, 7th Edition.
5. Fundamentals of Electrical Engineering Vol. I & II
   J.L.Khido M.N.Navale

CHE 102: Inorganic Chemistry:

Development of the nuclear theory of the atom. Bohr's theory of the atomic spectra of hydrogen. De Broglie's particle wave duality principle. Heisenberg s uncertainty principle. The Schrodinger equation. Qualitative account of the solution of the Schrodinger equation for the hydrogen atom. The quantum numbers, atomic orbitals. Electronic configuration of the elements.

The long form of the periodic table. types of elements. periodic trends in atomic and ionic radii. ionization potential, electronic affinities. electronegativities. oxidation states. magnetic susceptibilities of atoms and ions.

Ionic. covalent and coordinate bonds. bond properties. bond polarity. The ionic model. lattice energy. applications of lattice energetics. Bonding in metals. The covalent bond. the valence bond and molecular-orbital theories of the covalent bond. hybridization and resonance. The valence shell electron pair repulsion theory. Hydrogen bond. van der Wall's forces.

General aspects of the chemistry of the non-transition elements including the study of one representative element of each group. Study of some industrially important compounds of the non transition metals. Oxides and oxyacids of nitrogen, phosphorous, sulphur and halogens. Hydrogen and hydrides. Noble gases and their compounds.

Reference Book

1. Concise inorganic chemistry : J.D. Lee, D. Van Nostrand Co., 3nd Edition

2. Introduction to valency theory : Jean Morall and J.J. Morall. Macdonald technical and scientific; London

CHE-103: Physics :

Heat: Conduction-Conductivity of Metals. insulators. liquids and gases. Electronic theory of conductivity. Radiation-Black body radiation. Kirchoff's law. Stefan-Boltzmann law. Wien's law. Planck's law.

Temperature measurement and control-Resistance thermometer, thermo e.m.f., high and low temperature measurement. thermistors. Application of thermostatic and other temperature control devices.

Light: Interference Michelson interferometer. Interference involving multiple reflections in thin films. Fabry-Perot interferometer. Measurement of refractive index and concentration of solution.

Diffraction Fresnel. Fraunhoffer diffraction. Diffraction grating. Resolving power of optical instruments.

Sound: Ultrasonic Production. detection. velocity and applications.

Electricity, Magnetism: Laws of electromagnetic induction. self and mutual induction inductive circuit. Time-varying magnetic field. Magnetization curve. Hysteresis. Magnetic circuit. leakage and reluctance. Motion of charged particles in electric and magnetic fields. Mullikan's experiment. Thomson's experiment. Capacity. energy in condenser. capacitation circuit. Sinusoidal e.m.f., R.M.S. value: graphical representation. current and power of RC and RCL circuit.

Modern Physics: Photoelectric emission, use of photocell, photomultiplier, photoconductivity, Thermionic emission, Richardson equation, Contact potential, coated cathodes, Vacuum tubes, Cathode ray tubes, thyratorons.

Lasers: Principles and applications He-Ne and Ruby lasers. Free electron theory and bond theory and their electrical properties, Semiconductors and types, diodes, transistors.

CHE 104 : Physical Chemistry :

Gaseous State: Real gases,-Deviation from ideal behaviour Reduced equation of state-Thermal properties of gases Specific heat of gases-critical phenomenon and critical constants Principle of continuity of states-liquification of gases.

Liquid State: Nature of intermolecular forces-Vapour pressure of liquid, Effect of temperature, Vapour pressure of solutions, Roult's law of lowering of vapour pressure, Boiling point elevation and freezing point depression, Ideal solutions, solubility, Nernst distribution law, Association and dissociation in solution, chemical equilibria in ideal and real solution, osmosis, Determination of molecular weight based on colligative properties.

Relationship between molecular structure and properties such as surface tension, viscosity, refractivity, optical activity and dipole moments.

Chemical Kinetics: Rate of reaction, Effect of temperature, concentration etc. on rate of reaction, order and molecularity, Methods of determination of order of reaction, Unimolecular, Zero order reaction.

Theories of reaction rates (collision, modified collision, Lindemann's hypothesis, activated complex).

Complex reactions, Side reaction, Reversible reaction, Consecutive reaction, Rate equation for complex reaction, Chain reactions, Homogeneous and heterogeneous catalytic reactions, Acid, base reactions, Enzyme reactions, Photochemical reactions, Laws of photochemistry, Chain reactions, free radical reactions, Mechanism of ($2NO + F_2 \rightarrow 2NOF$, $Cl_2 + H_2 \rightarrow 2HCl$) reactions, reactions, Mechanism of ($2NO + F_2 \rightarrow 2NOF$, $Cl_2 + H_2$ reactions.

Reference Book

1. Element of Physical Chemistry : Glasston & Lewis.
2. Textbook of Physical Chemistry : A Findaly.
3. Physical Chemistry : A.J. Mee.
4. Principales of Physical Chemistry : Prutton, Maron.

CHE 105 : Mechanical Engineering - I:

Basic principles, brief details and applications of the following:

Processes and tools Patten making, sand moulding and casting, die casting, centrifugal casting. Processing of plastics. Rolling, forging, drawing, stamping and punching processes. Metal cutting hand tools, drills, hammer, taps and dies. Lathe, drilling, planing, shaping and milling machines. Machining of plastics. Grinding machines and grinding wheels, lappig, honing and ,superfinishing. Rivetting, soldering, brazing, welding-gas and electric, and metal spraying. Welding of plastics.

CHE-106 : Engineering Graphics - I

Solid Geometry Projections of solids like prism, pyramids, cylinders and cones, Sections of solids. Developments of solids, interpenetration of simple solids including cone and cylinder. Isometric scales and projections.

Machine drawing-Orthographic projections, First Angle and Third Angle methods of projections. Conventions in dimensioning and in sections. Forms and proportions of screw threads, bolts, nuts, locking devices for nuts, studs, set-screws, hangers and brackets. Free hand sketches of the above parts.

Reference Book

1. Engineering Drawings, Vol. I - N.D. Bhatt.
2. Principles of Solid Geometry - Gunda and Arvikar
3. Engineering Drawing - French.
4. Engineering Drawing - Zozora.
5. Engineering Drawing - Luzzader.

CHE-107 : Physics Laboratory :

Heat: Thermal conductivity Lee's Method. Radiation-Determination of Stefan's constant Emmissivity of Metallic surface.

Light: Interference using Bi-Prism, Newton's Rings. Cornu's Method of interference for determination of Young's Modulus. Diffraction Gratings. Spectrometer-Dispersive power of prism. Diffraction at straight edge. Particle size measurement by diffraction of light.

Electricity and Magnetism: Hysteresis B-H curve, Measurement of Magnetic susceptibility-Quincke's Method. Galvanometer - sensitivity and Reduction factor and comparison of capacities. LRC circuit. Mechanical equivalent of heat-J-Electrical Method.

Modern Physics: Characteristics of Diode, Triode, Crystal Diode and Transistors, Resistance of Thermister, Experiments on He-Ne laser.

Properties of Matter: Surface Tension-Jaeger's Methods. Ultrasonic velocity Measurement.

CHE-108 : Inorganic Chemistry Laboratory:

Volumetric analysis: Preparation and standardization of volumetric solutions. Acid base reactions, titrations of a mixture of (a) hydrochloric and acetic acid (b) sulphuric and phosphoric acid (c) Carbonate and bicarbonate. Oxidation reduction titrations involving pemanganate dichromate, ceric sulphate, iodine (triiodide) potassium bromate. Precipitation titration: Mohr's and Volhard's titrations. Complexiметric titrations involving EDTA : Determination of water hardness. Determination of Manganese in pyrolusite. Gravimetric analysis : Gravimetric determination of Fe, Ni, SO and Cl. Analysis of a

Fe Ni alloy.

Reference Book

1. A Short Course in Qualitative Analysis : Willard, Furman, Beacon.

2. Practical Inoranic Chemistry : Vogel.

CHE 109 : Electrical and Electronics Laboratory :

A. Electrical Engineering Laboratories :

Study of 3 phase circuits, lead tests on transformer, shunt motor, induction motor and D.C. shunt generator.

B. Electronics Laboratory

Characteristics of diode and triode, Triode as amplifier, Transducers, Photoelectric tubes, Rectifier circuits, Study of C.R.O. and its uses. Study of oscillators and Transistor characteristics.

Semester II

Candidates will be examined in the subjects as indicated in the following tables :

Papers

Sr. No.	Subject	No. of papers	Examination Hrs	Marks	Periodic Test Marks	Total Marks
CHE 110	Applied Mechanics	1	3	60	40	100
CHE 111	Mathematics I	1	3	60	40	100
CHE 112-	Organic Chemistry-I	1	3	60	40	100
CHE 113-	Mechanical Engineering-II.	1	3	60	40	100
CHE 114-	Computer Programming & Applications.	1	2	30	20	50
		5		270	180	450

Practicals and Orals

Sr. No.	Subjects	Examination Hrs	Marks	Marks for Class work	Total
CHE 115-	Tutorials on Computer Programming	-	-	50	50
CHE 116	Physical & Organic Chemistry Laboratory	6	60	40	100
CHE 117-	Engineering Laboratory & Workshop Practice	-	-	100	100
		6	60	190	250
	Total Marks				700

CHE-110 : Applied Mechanics

1. Coplanar forces. Equivalent system. Conditions of equilibrium. Graphic statistics.

2. Space forces. Equivalent systems. Conditions of equilibrium.

3. a) Reactions for determine beams.
   b) Forces in members of pin joined plane truses.
   c) Reactions for determine pin joined plane truses.
   d) Forces in cables and simple mechanisms.
   e) Centroid and centre of gravity.

4. Methods of virtual work.

5. Friction (Excluding rolling pivot and journal friction).

Dynamics

1. Kinematics of particles and rigid bodies.
2. Kinetics of particles and rigid bodies : Force, mass and acceleration.
3. Kinetics of particles and rigid bodies - Work and Energy.
4. Kinetics of particles and rigid bodies - Impulse and momentum.

Reference Book

1. Applied Mechanics and Strength of Materials : I.B.Prasad.
2. A text book of Applied Mechanics : I.B.Prasad.
3. Collection of Problems in Theoretical Mechanics : Meshersky
4. Engineering Mechanics Higdon and Stiles.

CHE 111 : Mathematics - I :

(a) Algebra and Geometry.

(i) Algebra : Complex numbers. De Moivre's Theorem, hyperbolic functions, separation of a complex number into real and imaginary parts.

(ii) Geometry : Reduction of general equations of the second degree and polar equations.

(b) Calculus.

Differential Calculus : Curvature. Higher order differentiation of functions and Leibnitz's rule for the derivative. Mean value theorem. Taylor and MaClaurin's theorems. Indeterminate forms.

Integral Calculus: Simple reduction formulae for integration. Beta and Gamma functions. Determination of area and length of curves. Double and triple integrations and application to find moment of inertia and centre of gravity.

CHE-112 : Organic Chemistry :

Electronic theory : Types of bond, hybridization, bond fission, types of intermediates-formation and structure of carbonium ion, carbanion and free radicals, electrophiles and nucleophiles, types of reaction, concept of acids and bases, Alkenes : Geometrical isomerism, E-Z isomers, Addition reactions of alkenes-Markownikoff's rule, ozonolysis, types of dienes and their characteristic reactions, Diels-Alder reaction, Polymerisation.

Alkyl halides : SN^1 and SN^2 reactions-effects of temperature reactants, solvents, etc., Elimination reactions-E1 and E2 mechanism, Saytseff and Hofmann rules, Grignard reagents and their general reactions.

Stereochemistry : Absolute configuration, stereochemistry of compounds having two asymmetric carbon atoms, Walden inversion, Separation of enantiomers, diastereomers, conformations of ethane, n-butane, cyclohexane, structures of cycloalkanes, Asymmetric synthesis.

Carboxylic acids : Strength of carboxylic acids, H-bonding, Mechanism of esterification and hydrolysis, Tautomerism, Preparation of ethyl acetoacetic ester and diethyl malonate, synthesis through acetoacetic ester and diethyl malonate.

Amines : Basicity of amines.

Reactions and Rearrangements : Aldol reaction, Cannizzaro reaction, Stobbe condensation, Darzen glycidic ester synthesis, Perkin reaction, Reformatsky reaction, Michael Addition, Dieckmann condensation, Pinacol-pinacolone rearrangement, Benzil benzilic acid rearrangement, Beckmann rearrangement, (synthetic applications and mechanisms of these reactions).

Carbohydrates : Structures of glucose, fructose, starch and cellulose reactions and interconversions of glucose and fructose, Oxidation and reduction of glucose.

Oxidation and Reduction : Mechanisms and applications of oxidizing and reducing agents like, dissolving metal reductions catalytic hydrogenations, Meerwin-Ponndorf-Verley reduction, $NaBH_4$, $LiAlH_4$, Sodium dicromate, hydrogen peroxide, catalytic oxidation, OsO_4 peracids (Bacyer villager oxidation), Oppenaer oxidation.

Reference Book

1. Text book of Organic Chemistry : Morrison & Boyd
2. Organic Chemistry Vol. II : I.L.Finar

CHE-113 : Mechanical Engineering -II:

Introduction to the laws of thermodynamics, entropy concept as a consequence of the second law of thermodynamics. Study of air cycles, Otto, Diesel, semi-Diesel, and Brayton cycle. Representation of these on P.V. and T.S. diagrams. Calculations of work and power.

Steam Engineering. Study of the properties of steam, high and low pressure boilers. Steam power plants and power calculations using steam tables and Mollier Chart. types of steam of turbines. Cogeneration of steam and electricity.

Elementry study of other types of power plants. stationary and mobile plants.

Direct energy conversion devices such as fuel cells, thermoelectric generation and MHD ; their principles and power limitations.

Solar, wind and tidal energy. Applications and allocations.

Transmissions : Types of drives, group and indivual drives, their merits and demerits. Belts, chain and gear drives.

Calculations of pulley sizes and gear trains for speed reduction.

Study of bearings : (Journal, ball and roller bearings), bearing box, keys and bolts, mechanical seals.

Bearings to withstand end thrust. Shafts and couplings.

Reference Book

1. Basic Engineering Thermodynamics : T. Roy Chaudhari
2. Thermal Engineering (J.I.Jnits) : P.L. Ballaney
3. Engineering Thermodynamics : Gupta & Prakash

CHE 114 : Computer Programming and Applications.

History and organisation of Computers problems solving on computer. Algorithms and flow charts. Introduction to numerical methods. Interpolation and extrapolation solution of differential equations partial differential equations. Elements of BASIC/FORTRAN/PASCAL.

Control and input - output statements subscripted variables, functions and Subroutines Writing simple Computer programs in BASIC, FORTRAN.

Solved examples from Chemical Engineering.

CHE 115 :Tutorials on Computer Programming:-

This will be based on programming excercises Carried out by the candidate based on the syllabus.

CHE 116 : Physical and Organic Chemistry Laboratory :

A. Physical Chemistry :

Measurements of surface tension by drop weight method and torsion balance method-Molecular weight determination of polymer by viscosity measurements-Lowering of freezing point and elevation of boiling point method-Heat of neutralization and solution-Verification of Ostwald's dilution law by conductivity measurements specific rotation of cane sugar by polarity. Percentage composition of mixture by refractive index measurements. Measurement of diffusivity in gas phase (acetone air).

Hydrolysis of methyl acetate-Relative strength of two acids Rate constant with varying conc. of ester-Order of reaction between ($K_2S_2O_8$ +KI)(KBrO$_3$ +KI) -Saponification of entyl acetate in presence of base-Adsorption of acid by charcoal-Partition coefficient of I$_2$ CCl$_4$ and Benzoic acid in Benzene Determination of energy of activation and other thermodynamic functions.

B. Organic Chemistry :

Identifications of an organic compound through elemental analysis, group detection, physical constant (m.p./b.p.) and derivatisation. Estimations of selected organic compounds like, aniline/phenol, formaldehyde/acetone, glucose, alcohol, Neutral equivalents of acids and, bases, Sap value of an oil

CHE 117 : Engineering Laboratory and Workshop Practice :

A. Engineering Laboratory :

(a) Study of petrol and Diesel engines. Trial on Diesel engine. Study of types of drives.

Test Demonstration: (i) Tension Test (ii) Hardness Test and/or Impact Test.

Power plant visit.

B. Workshop :

Practice in taper metal turning. Practice in soldering, brazing and welding. use of dies for cutting pipe-threads. Joining and fitting of pipes. Visit to workshops.

SECOND YEAR COURSE IN CHEMICAL ENGINEERING

Semester I

Candidates will be examined in the subjects as indicated in the following table.

Papers

Subject No.	Subjects	No. of papers	Examination Hrs	Examination Marks	Periodic Test Marks	Total Marks
[illegible] 201	Mathematics II	1	3	60	40	100
[illegible] 202	Organic Chemistry II	1	3	60	40	100
[illegible] 203	Physical Chemistry II	1	3	60	40	100
CHE 204	Structural Mechanics	1	3	60	40	100
		4		240	160	400

Practicals and Orals

Subject No.	Subjects	Examination Hrs	Examination Marks	Marks for Class work	Total
CHE 205	Organic Chemistry	6	60	40	100
CHE 206	Physical Chemistry	6	60	40	100
CHE 207	Structural Mechanics	3	30	20	50
		15	150	100	250
	Total Marks				650

CHE-201 : Mathematics - II :

Partial differentiation: Function of two or more variable units. Differentiation under the integral sign.

Integration: Differentiation of an integral with variable units. Differentiation under the integral sign.

Vectors: Scalars and Vectors Addition of vector,s Dot and cross product of vectors. Scalar and vector triple products. Simple application of vectors to geometry of three dimensions. Matrices.

Differential Equations: Ordinary differential equations of the first order. Equations of the first order and higher degrees linear differential equations of with constant coefficients. Homogeneous linear differential equations, Simultaneous equations. Curve fitting.

CHE-202 : Organic Chemistry :

Aromaticity and aromatic Character. Properties of aromatic compounds, Huckel's rule, Resonance, resonance energy, structure of benzene and benzenoids, non-benezenoid aromatic compounds.

Orienting influence of different substituents-change distribution method and stability of the intermediate method. Mechanism of aromatic electrophilic substitution reaction. Friedel Crafts alkylation and acylation, fires rearrangement formulation reactions, Gattermann-koch, Gattermann, Vilsmeier, Reimer tiemann.

Blanks chloromethylation reaction, Kolbe reaction, Mannich reaction, Claisen rearrangement.

Halobenzenes: Nitration reaction, reagents and conditions used, uses of nitrocompounds.

Aromatic amines : Introduction of-NH_2 group in an aromatic ring, basicity correlations, Diazotisation or aromatic primary amines, Reactions of aryl diazonium salts-Sandmeyer, Gattermann, Azocoupling reaction, Ullmann reaction, reduction, deamination reaction, Azo dyes, benzidine rearrangement.

Aromatic sulphonic acids : Sulphonation reaction-mechanism and reagents used. Kinetic and thermodynamic control of a reaction. Uses SO_3H group as a blocking group, as solubilising group and its conversion to-OH group.

Phenols: Acidity of phenols, preparations of phenols, condensation polymerisation and phenol-formaldehyde resins. Heterocyclic compounds : Nomenclature, structure, aromaticity, preparation and reactions of pyricine, pyrrole, furan and thiophene. Preparations of quinoline and isoquinoline. Spectroscopy. Ultraviolet spectroscopy. Basic principles of chromophore-auxochrome concept, effect of conjugation and solvent on peak position, applications.

Infrared spectroscopy. Basic principles, selection rule, identification of functional groups, applications.

NMR spectroscopy : Basic principles, chemical shift, spin spin splitting, anisotropic affects, applications.

Reference Book

1. Basic Engineering Thermodynamics : T. Roy Chaudhari
2. Thermal Engineering (S.I.Units) : P.L. Ballaney
3. Engineering Thermodynamics : Gupta & Prakash

CHE 203 : Physical Chemistry - II :

Solid State : Crystalline state.

Laws of crystallography, X-ray diffraction by crystals, Bragg's equation, Determination of crystal structure (NaCL, KCl). Defects in crystals, space groups, Bravais Lattices. Application of group theory, Crystal structure of metals and semi-conductors.

Equilibrium in homogeneous system : Homogeneous equilibria, Law of mass action Equilibrium in gaseous system, Equilibrium in liquid system, Effect of addition one of the products on equilibrium, Effect of temperature, Effect of pressure, Le Chatelier's principle, Application to practical system.

Phase rule : Phase rule (statement and definition) application of phase rule to one component system (water and sulphur)

Two component system, solid-liquid system (Eutectic, congruent and incongruent melting solution formation), liquid-liquid system (partially and immiscible), solvent extraction, fractional distillation, distillation (azeotrope and zeotropic systems).

Derivation of Gibbs phase rule, Simple three component system, application of phase rule to solid-liquid and liquid-vapour systems.

Thermodynamics: First law of thermodynamics, application to compression and expansion of gases. Second law of thermodynamics concept of entropy. Third law of thermodynamics. Entropy change in compression expansion, chemical reactions and mixing.

Concept of free energy, Criterion for spontaneity of reaction. Gibbs Helmholtz equation, Partial molal properties, Chemical potential, concept of activity and fugacity. Criterion of phase equilibrium. Gibbs.-Duhem equation.

Introduction to statistical thermodynamics, Maxwell Boltzman distribution, partition functions-Entropy and free energy function, Sackur Tetrode equation.

Thermochemsitry. standard heat of formation. Standard free energy of formation, variation heat of reaction and free energy change of a reaction with temperature and pressure.

Electrochemistry : Laws of electrolysis, electrolytic conduction. measurement and application of transport number, ionic mobility, strong and weak electrolytes. Interionic attraction theory. Debye-Huckel theory. Concept of pH, buffer solutions. Concept of acidity and basicity.

Electromotive force, electrolytic and galvanic cells, types of electrodes and electrode reactions. determination of standard E.M.F., electrodic oxidation potential, reversible electrode and half cell reaction. Nernst equation, potentiometric titrations, thermodynamics of cell reactions.

Reference Book

1. Element of Physical Chemistry : Glasston & Lewis.
2. Textbook of Physical Chemistry : A Findaly.
3. Physical Chemistry : A.J. Mee.
4. Principales of Physical Chemistry : Prutton, Maron.

CHE-204 : Structural Mechanics :

Concept of loads, supports and free body diagram. Equilibrium of rigid bodies such as beams, frames and trusses. Problems on analysis of beams and trusses.

Friction-sliding friction between dry solids. Laws of friction. Problem on block friction, wadge friction, belt friction and other rigid bodies under friction.

Concept and simple problems on centroid and second moment of area (M.I.)

Various types of stress and strains. Relation between elastic constants Introduction to temperature stress. Problems on simple and composite sections Concept of shear stress distribution.

Shear force and Bending moment diagrams for cantilever and simply supported beams (with or without overhang). Theory of bending: Concept and problems.

Torsion of a circular shaft. Transmission of Power-Close coiled Helical spring. Concept and derivation only. Simple problems.

Concept of slope and deflection of beam. Standard cases of slope and deflection by Moment-area Method and mathematical method. Simple problems.

Short and long columns and struts. Standard cases with axial load. Euler's and Rankine's formulae. (without Derivations). Behaviour of thin and thick cylinders. Problems on thin cylinders and spheres.

Reference Book

1. Strength of Material : L.B.Prasad
2. Advanced Strength of Materials : K.T.Krishna Swamy
3. Strength of Materials : Junnarkar

CHE 205 : Organic Chemistry Laboratory :

Separation and purification of binary mixtures of the type: water soluble, water insoluble, both water soluble, liquid-solid and liquid-liquid.

Estimation of functional groups like, hydroxyl, carboxyl, ester, amide, unsaturation, nitro, aromatic primary amino group, etc.

Preparations of simple organic compounds like acetanilide, m-dinitrobenzene, methyl salicylate, benzamide, o-chlorobenzoic acid, tribromophenol, p-nitrobenzoic acid and an azo dye.

CHE 206 : Physical Chemistry Laboratory :

Determination of equivalent conductivity of strong electrolyte at infinite dilution, Solubility of sparingly soluble salt by conductometric and potentiometric measurement, Conductometric titration, Determination of standard redox potential of Fe^{++}/Fe^{+++} system, Saponification of ehtyl acetate by conductivity method, Potentiometric titrations, Evaluation of ΔH, ΔS and ΔG for electrochemcial reactions by E.M.F. measurements, Verification of Lamber-Beer's law, Adsorption of a dye on solid surface by colourimetry.

Determination of transport number by Hittorff method and by the moving boundary method, Dissociation constant of acid by using pH meter, Determination of pKa of an acid, Determination of rate constant for inversion of cane sugar by polarimetry.

Study of rate of decomposition of H_2O_2 or Na_2O_2 study of complex formation by distribution method, Determination of surface area by dynamic adsorption of N_2, Decomposition of benzoyl by ion exchange resin catalysts, Determination of solubility of a gas in liquid, Determination of vapour-liquid equilibrium and activity coefficient.

CHE 207 : Structural Mechanics Laboratory :

Universal force table, roof truss apparatus, fractional [illegible] Reactions in beam, both simply supported and overhanging, Truss Polygon, B.M. apparatus, Simple machine like Screw Jack or [illegible] and others.