

ANNEXURE – III
TAMIL NADU PUBLIC SERVICE COMMISSION
(JUNIOR ANALYST) – MAIN WRITTEN EXAMINATION
PAPER – I PHARMACY (DEGREE STANDARD) OBJECTIVE TYPE

CODE NO.246

UNIT- I

- a) The physical, physico-chemical and engineering principles governing design, layout and operation of plants for the process employed in pharmaceutical industry.
- b) Unit operations: size reduction, size separation, mixing, compression, filtration, centrifugation, extraction, evaporation, drying, distillation, crystallization.
- c) Industrial Hazards and Safety Precautions: Mechanical, Chemical, Electrical, Fire and Dust hazards, Industrial dermatitis, Accident records
- d) Containers, closures and packaging materials
- e) Preformulation Studies
- f) Pharmaceutical excipients: Antioxidants, preservatives, Colouring, Flavouring and Sweetening agents, Solvents.
- g) Facts related with formulation:- Physical properties, particle size. Crystal form, flow cohesiveness. Solubility. Chemical properties, Hydrolysis. Oxidation racemization, enzymatic decompositions.
- h) pH determination, application, buffer equation, buffer capacity, buffered isotonic solutions; Micrometrics: Particle size determinations, derived properties of powders; Interfacial phenomenon : HLB values surfactants, factors influencing interfacial phenomenon, Critical micellar concentration, Electrical properties at interface; Coarse dispersions: Suspensions and emulsions, Theories of emulsification, multiple emulsions.
- i) Pharmaceutical calculations: Calculations of doses, alcohol dilutions, proof spirit, isotonic solutions.
- j) Nuclear Pharmacy- Introduction to Radiopharmaceuticals, radioactive half-life, units of radioactivity. Production of radiopharmaceuticals, methods of isotopic tagging, preparation of radioisotopes in laboratory using radiation dosimetry and radioisotope generators. Permissible radiation dose level, radiation hazards, their prevention and specifications for radioactive laboratory.
- k) Good Manufacturing Practice

- l) Quality control, of the following formulations: Semisolids, Solid dosage forms, Liquid dosage forms, Parenteral and ophthalmic preparations
- m) New Drug Delivery Systems- Aerosols, Ocusert, Transdermal Drug Delivery Systems, Osmotic Drug Delivery Systems, Targeted Drug Delivery Systems, Prolonged Drug Delivery Systems
- n) Cosmetics- Dentifrices, Lipsticks, Face powders, shampoos, depilatories and Manicure preparations

UNIT- II

- a) **Blood Products and Plasma Substitutes:** Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitutes, ideal requirements of PVP, dextran, etc. Control of blood products as per IP.
- b) Basics of pharmacokinetic studies and their importance
- c) Pharmaceutical Biotechnology- General principles of immunology, immunological techniques used in pharmacy; Sterilization of different pharmaceutical dosage forms; Sterility Testing; Methods of preparation of official sera and vaccines; Microbiological assays of antibiotics and vitamins of the pharmacopeia; Disinfectants- Classification, Mechanism and uses of disinfectants in brief. Factors affecting disinfection and methods of disinfectant evaluation.
- d) Immunologicals: Preparation and quality control of products representing various categories like

Toxoids	– Diphtheria and Tetanus,
Live Bacterial Vaccines	– BCG
Killed Bacterial Vaccines	– Cholera, DPT.
Viral Vaccines	– Polio, Rabies and small pox
Antitoxins	– Diphtheria

UNIT - III

- a) Chemistry of Alkaloids, Vitamins, Flavanoids, Glycosides, steroids, terpenes, vitamins and hormones.

- b) Catalytic hydrogenation, dehydrogenation, metal hydride reduction. Reduction with hydrazine and its derivatives, Birch reduction, Clemenson's reduction, Meerwin – Ponndrof reduction, oxidation with periodic acid, lead tetra acetate, mercuric acetate and selenium oxide. Beckmann rearrangement, Schmidt rearrangement and Darzen's reaction.

UNIT - IV

Synthesis, properties, test for purity, storage of the following categories of drugs - Analgesics and Antipyretics, Anti-inflammatory, Hypnotics and sedatives, Anti convulsants, Anti-psychotics, Anti-histamines, Sympathomimetics, Adrenergic antagonists, Cholinomimetics and anti-cholinergic, Local Anaesthetics, Anti-hypertensives, Anti-anginal, Sulphonamides, antibiotics, Anti-TB, Anti-Viral, Anti-Fungal, Antimalarials, Anti-Neoplastics,

UNIT- V

- a) Principles and Pharmacopeial Assay Procedures involving Non-aqueous Titration, Oxidation-Reduction, Diazotization, complexometric methods, electrometric titration, gravimetric analysis
- b) Polarimetry and refractometry, and gasometric analysis of oils, fats and waxes
- c) Chromatography- TLC, Column, Paper, GC, Ion exchange, HPLC, HPTLC, Gel electrophoresis,
- d) Theory, principle, instruments and applications of colorimetry, UV- Visible Spectrometry, Fluorimetry, Nephelometry, Turbidometry, IR, Mass, NMR, RIA.

UNIT- VI

- a. General Pharmacology:- Routes of administration, Absorption, distribution, Biotransformation and Excretion of drugs, Bioavailability and bio equivalence, Factors affecting bioavailability, Mechanism of action of drugs at receptor level, adverse drug reaction;
- b. Drugs acting on Central Nervous system: Analgesics, Nonsteroidal anti inflammatory drugs, Sedatives and Hypnotic, Anti convulsants and Antipsychotic drugs. Drugs used in parkinsonism.

- c. Drugs acting on Autonomic Nervous system: Drugs which influence the working of autonomic nervous system, Adrenergic drugs (or) sympathomimetic drugs, Adrenergic blocking drugs, Cholinergic drugs and cholinergic blocking drugs, Drugs acting on autonomic ganglia.
- d. Drug acting on cardiovascular system: cardiac glycosides, Anti hypertensive, anti-arrhythmic and anti anginal drugs.
- e. Diuretics & anti diuretics

UNIT- VII

- a. Drugs acting on GIT
- b. Insulin and oral anti diabetic drugs, Thyroid and anti-thyroidal drugs, oral contraceptives. Hormone replacement therapy, drugs acting on uterus.
- c. Antihistaminic drugs and Drugs used in Migraine
- d. Chemotherapy- sulphonamides penicillins, cephalosporins, quinolones, Tetracyclines, Aminoglycosides, Chemotherapy of Tuberculosis, leprosy, malaria, cancer , Ameobiasis, Helminthiasis.
- e. Toxicology- Systematic & local treatment of poisoning and their treatment.

UNIT- VIII

- a. General principles of cultivation and collection of drugs from wild & cultivated sources, their merits and demerits, factors affecting cultivation, adulterants and their detection
- b. Plant growth regulators
- c. Source, synonym, cultivation, collection, preparation for market, diagnostic characters (both macroscopical and microscopical). Constituents, substitutents, adulterants and uses of Cinnamon, Cinchona, Senna, digitalis, Clove, Saffron, Pyrethrum. Cochineal, Ergot, opium, Aloe, Acacia, Tragacanth, Benzoin, Ginseng, Brahmi, Dioscorea, Cascara, Gelatin, umbelliferous fruits, spirulina, nuxvomica, ginseng, belladonna, taxol , vinca.
- d. Principle and application plant tissue culture.
- e. Basics of fermentation technology & production of Antibiotics, Vitamins.

UNIT- IX

- a. Biosynthetic pathways of Tropane alkaloids, Cholesterol, amino acids.
- b. WHO Guidelines for herbal medicines

UNIT- X

- a. Drugs and Cosmetics Act 1940 and Rules 1945
- b. Pharmacy Act 1948

ANNEXURE – III
TAMIL NADU PUBLIC SERVICE COMMISSION
(JUNIOR ANALYST) – MAIN WRITTEN EXAMINATION
PAPER – I PHARMACEUTICAL CHEMISTRY (DEGREE STANDARD)

Code No.245

UNIT I

- 1) Atomic structure and valency, Radioactivity, Radio isotopes and Pharmaceutical applications of Radio Pharmaceuticals, hazards and precautions.
- 2) Sources of impurities in Pharmaceutical substances; Limit test as per I.P; Fundamentals of volumetric Analysis.
- 3) A systematic study of inorganic compounds for their preparation, assay and use which includes Gastrointestinal agents, Topical agents and Dental products.

UNIT II

- 1) Assay, test for purity of sodium, calcium, iron, aluminium and ammonium compounds. Major intracellular and extra cellular electrolytes.
- 2) Preparation and use of Chemical reagents and Volumetric Solutions as per Pharmacopia in Pharmaceutical Analysis.
- 3) Theory of Co-ordination Compounds with special reference to application in Pharmaceutical Analysis via EDTA, Dimercaprol, Pencillamine.

UNIT III

- 1) Physiochemical properties of gases, liquids and solids. Density, Surface tension, Viscosity and physical properties.
- 2) Osmosis, osmotic pressure, vapour pressure, Raoult's law, Ostwalds dilution law, Molecular weight determination by osmotic pressure.
- 3) Non- aqueous and complexometric titrations, analysis of fats, oils and waxes. Importance of quality control, Different types of titrations, Gasometric analysis and determination of Nitrogen.

UNIT IV

- 1) Gases in liquids, liquids in liquids, partially miscible, completely miscible and completely immiscible liquids.
- 2) Thermochemistry: Heat of reaction, heat of solution, heat of formation and heat of neutralization and Hess law.
- 3) Stereo chemistry, optical isomerism, Geometrical isomerism.
- 4) Theory of Polarimetry, Refractometry and catalyst.

UNIT V

- 1) Electronic configuration and electron displacement effects, chemical bonds and polarity.
- 2) Chemistry and medicinal uses of cardiac glycosides and vitamins.
- 3) Synthetic utility of acetoacetic ester, Grignard reagent and Diazonium compounds.

UNIT VI

- 1) Aromaticity, concept of resonance, Nucleophilic, Electrophilic substitution reaction, Elimination reactions in aliphatic and aromatic compounds.
- 2) Anti-infective agents comprising of Anti-fungal agents, synthetic antibacterial agents, anti-tubercular Agents, and Anthelmintics agents.

UNIT VII

Chemical structure, Synthesis, assay and therapeutic uses of organic synthetic drugs like, Antidepressants, General anesthetics, Sedatives and hypnotics, Narcotic analgesics, Anti-histaminics, Antimalarials., Sulphonamides, Drugs acting on CVS.

UNIT VIII

- 1) Structural elucidation of natural products - General methods.
- 2) Structure, chemistry, methods of estimation, and uses of Alkaloids, Carbohydrates, and Proteins.
- 3) Chemistry of steroids and natural hormones, currently used steroidal drugs.

UNIT IX

- 1) Study of separations and determination involving TLC, HPTLC, and column chromatography.
- 2) Colorimetry, UV and Visible Spectrophotometry, Spectrofluorimetry-Theory, Principle, Instrumentation and working.
- 3) Theory and principles of separation techniques involving Ultra centrifugation, HPLC and Gel filtration.

UNIT X

- 1) Conductometry, Potentiometry and Amperometric titrations, Basic concepts and application in pharmaceutical analysis.
- 2) Radio Immuno Assay and Electrophoresis.
- 3) Theory, Principle and application of NMR, MS, IR spectroscopy.

ANNEXURE – III
TAMIL NADU PUBLIC SERVICE COMMISSION
(JUNIOR ANALYST) – MAIN WRITTEN EXAMINATION
PAPER – I CHEMISTRY (DEGREE STANDARD) OBJECTIVE TYPE
CODE NO.243

UNIT - I**PHYSICAL CHEMISTRY:-**

- a) Gas law and Kinetic Theory:- Ideal gas equation - Deviation from ideal behaviour - vander waals equation for real gases - Molecular velocities - the Maxwell's distribution of molecular velocities –heat capacity and viscosity of gases.
- b) Solid State:- Crystal systems - Bravais lattice - Unit Cell - Miller Indices - Symmetry elements in crystals - Bragg's equation - Radius ratio's and packing in crystals – Determination of crystal structures by Bragg's method – structure of NaCl, KCl, ZnS and spinels.
- c) Thermodynamics:- Intensive and extensive variables - First law of thermodynamics – CP and CV relation - Hess's law of constant heat summation - Kirchoff's equation - Second law of thermodynamics - Carnot theorem - entropy and probability, Joule Thomson effect -Free energy and Chemical equilibrium - Temperature and pressure dependence and - Gibb's and Helmholtz functions – Heterogeneous equilibrium and Le – Chatlier principle.

UNIT - II

- d) Chemical Kinetics:- Rate laws - rate constant - order and molecularity of reactions I, II, III, and Zero order reaction Arrhenius theory - collision theory and Transition state theory - catalysis.
- e) Electro-Chemistry:- Types of reversible electrodes - Nernst equation - reference electrode and standard hydrogen electrode - computation of cell e.m.f. calculations of thermodynamic quantities of cell reactions (ΔG , ΔH , ΔS and K) - Over potential and hydrogen over voltage - Arrhenius theory - Debye-Huckel equation - Kohlrausch's law - Ostwald's dilution law - Determination of pH and pK_a of acids by potentiometric methods.

UNIT - III

- f) Chemical spectroscopy:- Elementary ideas of microwave, infrared, Raman, uv, NMR, ESR and Mass spectroscopy.

g) Pharmaceutical chemistry: Terminology pharmacology, pharmacotheraies, toxicology, chemotherapy, classification, and nomenclature of drugs, sources of drugs, assay of drugs by biological, chemical and immunological methods, physiological effects of functional groups of drugs different types of drugs like analgesics, antibiotics, antiseptics, disinfectants, anesthetics, antidepressants, antipsychotic etc.

UNIT - IV

h) Colloids and surface Chemistry:- Classification – preparation, purification - properties - Tyndall effect- Gels - Emulsions Absorption - Langmuir isotherms - Heterogeneous catalysis.

i) Physical properties and Chemical constitution:- Surface tension - parachor and its application to structural problems – Dipole moment - applications of dipole moment measurements to structural studies of simple inorganic and organic molecules - magnetic properties of matter, diamagnetism, paramagnetism, ferromagnetism and anti-ferromagnetism - Applications to structural problems.

UNIT - V

INORGANIC CHEMISTRY:-

j) Periodic classification:- Classification based on electronic configuration - periodic properties - atomic and ionic radii, ionisation potential, electron affinity and electronegativity- various scales - trend along periods and groups.

k) Chemical bond:- Lattice energy - VSEPR Theory and its applications - partial ionic character from electronegativity - Fajan's Rules.

l) Compounds of Boron:- Electron deficient nature of boron compounds - preparation and properties of halides and nitrates of boron - diborane – Borazine, silicones and structures of silicates

UNIT - VI

LANTHANIDES AND ACTINIDES:-

m) Occurrence Electronic configuration oxidation state, magnetic properties and complexation behaviour - comparison of lanthanides and actinides, lanthanide contraction and their position in the periodic table.

n) Fertilisers:- Ammonium nitrate, ammonium phosphate, Superphosphate and Diammonium Phosphate, NPK fertilisers.

o) Nuclear Chemistry:- Radio activity – detection and measurement – half life period - Nuclear stability, - n/p ratio - isotopes, isobars and isotones Nuclear reactions Spallation - Nuclear fission and fusion – stellar energy uses of nuclear energy - nuclear power projects in India - applications of tracers in industry, medicine, agriculture.

UNIT - VII

p) Co-ordination Chemistry:- Redo Nomenclature - theories of co-ordination compounds - Werner, valence bond, crystal field and ligand field theories - Effective atomic number - isomerism - Metal Carbonyls of iron and Nickel.

q) Analytical Chemistry:- i) Principles of volumetric analysis - different types of titrations gravimetric analysis - separation and purification techniques.

UNIT - VIII

ORGANIC CHEMISTRY:-

r) Types of reactions:- Nucleophilic, electrophilic, free radicals, addition and elimination reactions.

s) Electron displacement effects:- Inductive, inductometric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

UNIT - IX

t) Nature of Bonding:- Hybridisation (Sp , Sp^2 & Sp^3) and Geometry of molecule - cleavage of bonds - homolytic and heterolytic fission of carbon – carbon bonds - Reaction intermediates - free radicals, carbocations and carbonions - their stability.

u) Stereo Chemistry:- Optical isomerism and Geometrical isomerism - chirality - optical isomerism of lactic and tartaric acid - Racemisation - Resolution - Asymmetric synthesis - walden inversion - cis and trans isomerism of maleic and fumaric acids - R-S-Notations - conformational analysis of cyclohexane - applications of ORD and CD Techniques.

UNIT - X

- v) Dyes:- Classification and Properties of dyes – methyl orange, congo red, malachite green, fluorescein and indigo.
- w) Carbon hydrates:- Classification and reactions - Glucose, Fructose, Sucrose and lactose- structure of glucose and fructose.
- x) Aromatic Substitution:- Mechanism of nitration, Halogenation, sulphuration and Friedel Crafts reaction - Orientation effects - nucleophilic substitution - Benzyne mechanism.

ANNEXURE – III
TAMIL NADU PUBLIC SERVICE COMMISSION
(JUNIOR CHEMIST – CHEMIST – ARCHAEOLOGICAL CHEMIST) – MAIN WRITTEN EXAMINATION
PAPER – I CHEMISTRY (POST GRADUATE DEGREE) OBJECTIVE TYPE

Code No.244

UNIT- I

Reaction Kinetics:-

Rate laws - rates constant for first, second, third and zero order reaction - Half life period - Arrhenius theory - collision theory - Absolute reaction rate theory - ionic reaction - salt effect - catalysis – Laws of photo chemistry, quantum efficiency - photo physical processes of electronic excited molecules. Green Chemistry – reactions and reagents

Chemical Equilibrium:-

partial molar quantities, gibbs - Duhem equation, Equilibrium constant - temperature dependence of equilibrium constant - phase rule and its applications to two and three components systems.

UNIT- II

Solid State:-

crystal systems - designation of crystal faces, lattice structure and unit cell - law of rational indices - Bragg's law and x rays diffraction by crystals - schottky and Frenkel defects - Electrical properties - Insulators and semiconductors - band theory of solids- Superconductors – nano materials preparations and properties.

Electrochemistry:-

Types of Reversible electrodes - Nernst equation - calculation of thermo dynamic quantities of cell reactions - overpotential and hydrogen over voltage - Determination of pka of acids by potentiometric methods - Kohlrausch's law - Ostwald's dilution law - Debye - Huckel Onsager equation for Strong electrolytes - (no derivation required) - Primary and Secondary fuelcells - corrosion and prevention – drycells and storage batteries

UNIT- III**Structure and Bonding:-**

Electronic configuration of atoms, Term symbols and periodic properties of elements, Ionic radii, ionisation potential electron affinity, electronegativity, concept of Hybridization, molecular orbitals and electronic configuration of homonuclear and heteronuclear diatomic molecules, shapes of polyatomic molecules VSEPR theory, symmetry elements and point groups for simple molecules, Bond lengths, Bond angles, bond order and bond energies Types of chemical bond (weak and strong) intermolecular forces, structure of simple and covalent bonds – covalent character in ionic bond and partial ionic character – lattice energy.

Acids and Bases:-

Bronsted and Lewis acids and bases - pH and pKa acid - base concept in non - aqueous media – HSAB concept - Buffer Solutions. Redox Reactions:- Oxidation numbers, Redox potential, Electro chemical series – application of EMF measurements - Redox indicators.

Chemistry of Non - transition elements:-

General characteristics, structure and reaction of simple compounds - boranes - silicates Oxoacids of N,P,S and halogens - xenon compounds - inter halogens, Pseudohalides and noble gas compounds – metal clusters – S,N ring and chain compounds - inorganic Polymers such as silicones, Borazines and phosphonitrilic compounds.

IUPAC Nomenclature of simple organic and Inorganic compounds.

UNIT - IV**Organic reaction mechanism:-**

General methods (Kinetic and non Kinetic) of study of reaction mechanisms Methods of determining reaction mechanism. – isotopic labelling SN1, SN2 mechanisms - addition substitution, elimination and rearrangements - free radical mechanism - aromatic substitution - and stability of reactive intermediate (Carbocations, Carbanion's free radicals, nitrates and benzyne) - Polar effects - Hammett's equation and its modification.

Chemistry of important organic reaction:-

Aldol condensation - Claisen condensation - perkin reactions - cannizzaro reaction - Fridel craft reaction - Favorski reaction - Strok enamine reaction - Michael addition - Baeyer - villigner reaction - Chichibabin reaction - Asymmetric synthesis pericyclic reactions - classification and examples - woodward and Hoffmann rules. - use of OsO₄, NBS, diborane, NaBH₄, LiAlH₄ in organic Synthesis.

UNIT- V**Quantum Chemistry:-**

Planck's quantum theory wave - particle duality, uncertainty principle, operators and commutation relations, postulates of quantum mechanics, schrodinger wave equation, particle in one dimensional box and three dimensional box - harmonic oscillator, rigid rotator and hydrogen atom, angular momentum, spin - orbit coupling.

Classical thermodynamics and elements of statistical thermodynamics:-

First law of thermodynamics:- heat capacity - isothermal adiabatic processes - Thermo chemical laws - Kircheff's equation second law of thermodynamics, entropy, in reversible and irreversible processes - Gibe's free energy and Helmholtz free energy - Third law of thermodynamics

UNIT VI**Spectroscopy:-**

Rotational spectra of diatomic molecules - Isotopic substitution and rotational constants - vibrations spectra of linear symmetric, linear asymmetric and bent triatomic molecules - electronic spectra - selection rules - nuclear magnetic resonance - chemical shifts - spin - spin coupling - electron spin resonance and hyperfine splitting theoretical principles of mass spectroscopy. Application's of UV, IR, NMR, ESR and mass spectroscopy for structural elucidation of organic compounds, inorganic complexes and free radicals.

UNIT - VII**Chemistry of Co-ordination Compounds:-**

structural aspects, isomerism - octahedral and tetrahedral, crystal - splitting of orbitals - CFSE - magnetism and colour of transition metal ions - charge transfer spectra - crystal field theory and ligand field theory – MO theory complexes of pi acceptor ligands - stereochemistry of inorganic co-ordination compounds – ORD and CD Techniques.

Chemistry of lanthanides and actinides:-

Electronic configuration - occurrence and Separation techniques -oxidation states, colour - magnetic and spectroscopic properties – lanthanide contraction , use of lanthanide compounds as shift reagents.

UNIT - VIII**Organometallic compounds and bio inorganic chemistry:-**

Metal carbonyls, Metal nitrosyls, metal alkyl, alkenes and arene compounds - organo metallic compounds in catalysis - Chemistry of porphyrins - chlorophyll hemoglobin, myoglobin, ferredoxin, rubredoxin, and cytochromes, copper proteins, enzymes, zinc enzymes, toxicity of metals and the effect of excess and deficient levels, metal complexes in therapy

UNIT- IX**Stereo chemistry:-**

Elements of symmetry - optical and geometric isomerism E. Z and R.S notation's - Conformational analysis of simple cyclic and acyclic systems - Effects of conformation on reactivity in acyclic compounds and cyclohexanes.

Carbohydrates:-

Classification - configuration and general reactions of monosaccharides - Chemistry of glucose, fructose, Sucrose and Maltose, Important compounds in chemistry - Dyes - azo, triphenylmethane, and phthalin groups - indigo - alizarin vitamins, hormones - antibiotics - proteins. Polymers: Preparation and uses of polyethylene, poly butylene PVC, Nylon - Ziegler - Natta catalysts -

UNIT - X**Instrumental methods of analysis:-**

Adsorption, partition chromatography - Gas chromatography - HPLC - Solvent extraction and ion exchange methods - atomic absorption spectroscopy - Electroanalytical techniques voltammetry, cyclic voltammetry, polarography, amperometry, Coulometry and conductometry, ion - Selective electrodes- TGA, DTA, DSC and ICP. Analysis of industrial products such as ores and Minerals, Coal, Water, Soaps & Detergents, Metals & Alloys, Manures & fertilizer, cement, Aggregate, Bricks, petroleum products, food & products, plastics.

ANNEXURE – III
TAMIL NADU PUBLIC SERVICE COMMISSION
(CHEMIST) – MAIN WRITTEN EXAMINATION
PAPER – I CHEMICAL TECHNOLOGY (PG DEGREE STANDARD)

CODE NO: 290

UNIT- I PROCESS CALCULATIONS AND THERMODYNAMICS

Properties of liquids, solids and gases - Gas laws - Material and Energy balance, Material balance involving recycle by-pass and purge

Thermodynamics functions - Chemical and Phase Equilibrium - Laws of Thermodynamics - Ideal and non-ideal gases and solutions, fugacity, correlation of activity coefficient, partial molal properties.

UNIT- II FLUID MECHANICS AND MECHANICAL OPERATIONS

Newtonian and non-Newtonian fluids, compressible and non - compressible fluids, flow through pipeline systems, flow in closed ducts, packed beds and fluidized bed. Continuity and conservation equations. Macroscopic energy balance, Bernoulli equation and its applications, Dimensional analysis, flow meters, pumps and compressors.

Size reduction and size separation; laws of size reduction, Gravity settling, hindered settling sedimentation; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; thickening, elutriation, conveying of solids.

UNIT - III REACTION ENGINEERING, HEAT AND MASS TRANSFER

Rate equation, elementary and non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors.

Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, The residence time distribution, basic models for non-ideal flow; conversion in non-ideal reactors.

Fourier's law of heat conduction, convection and radiation, Heat transfer with phase change, heat exchangers, evaporation, Heat transfer in extended surfaces, Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds. Radiative heat transfer – Black body radiation, Emissivity, Stefan - Boltzman law, Plank's law, radiation between surfaces.

Diffusion, Theories of mass transfer, Analogy, inter-phase mass transfer. Distillation, absorption, leaching, liquid-liquid extraction, crystallization, adsorption, drying, humidification, de-humidification.

UNIT - IV PROCESS CONTROL AND INSTRUMENTAL METHODS OF ANALYSIS

Laplace transformation, application to solve ODEs. Dynamics of process elements, open loop and closed loop systems, principles of pneumatic and electronic controllers, Instrumentation: Sensors for Pressure, Flow, Temperature, Control valves, Computer Control of Processes, Analysis of control systems. Micro processor –based control.

Spectroscopic analysis: Absorption spectroscopy, emission spectroscopy, mass spectroscopy, x-ray diffraction, color measurement by spectrometers, Gas analysis by thermal conductivity Moisture (humidity analysis) p^H measurements, Chromatography - H.P.L.C.

UNIT – V CHEMICAL PROCESSES

Nitration, Sulphonation and Sulfation, Hydrogenation, Halogenation & Oxidation, Kinetics and mechanism, the derivative reactions, Industrial applications, Raw material and manufacture of Soda ash, Sodium bicarbonate, Chlorine and Causticsoda, Bleaching powder, Calcium Hypochlorite; Sodium Hypochlorite; Sodium chloride or common salt, sodium sulfate, sodium bisulfate, or Nitercake, Sodium Bisulfite; Sodium Sulfite, Sodium Hydrosulfite; Sodium sulfide, Sodium Hydrosulfide, Sodium Thiosulfate; Sodium Nitrite; Sodium Silicates; Sodium peroxide, Sodium perborate; Sodium amide; Sodium cyanide and Ferri cyanide.

Industrial alcohols, Beer, Wine, Butyl alcohol. Raw Materials, Manufacture of phosphoric acid, nitric acid, Sulfuric acid and HCL & the occurrence, Purification of all acids.

Occurrences of oils, fats and waxes, classification, chemical composition, Extraction and refining oils and fats. Manufacture of edible oil.

Surfactant : Concept of surface activity, Hydrophilic-lypophilic balance; Mechanism of detergency. Classification of surfactants; Biodegradation of surfactant; application of surfactants.

Soap and Detergent: Soap, detergent, Glycerine: spentlye, synthetic glycerine manufacture and their applications

Origin, Occurrence, exploration and classification of crude oils, Hydrocarbon, composition of petroleum and petroleum products (liquid and gas); Refining of crude oil, Catalytic cracking, thermal cracking; reforming. Chemical conversions, Extraction of Aromatics.

UNIT - VI PULP AND PAPER, AGROCHEMICALS AND FERTILIZERS

Classification and manufacture of Insecticides and pesticides, Plant derivatives, Pyrethrin, Nicotine, Rotenone, attractants and repellents, Fumigants, Nematocides, Acaricides, Fungicides, Industrial Biocides, Plant growth regulators, Herbicides.

Raw material for fertilizers; Synthesis of ammonia, Ammonium nitrate, ammonium sulfate, Ammonium Phosphates; Urea, Super phosphates, Mixed fertilizers, organic fertilizers.

Raw material for pulp, manufacture of pulp and paper. Hydrolysis of wood, Wood extractives. Cellulose; Hemi cellulose, lignin and associated materials. composition of cell walls. Physical and Chemical properties of cellulose and derivatives.

UNIT- VII PHARMACEUTICALS, POLYMERS, PLASTICS AND RUBBERS

Types of polymers, Thermoplastics and thermosetting plastics, Polymerization Types. Degradation of polymers through thermal, mechanical and chemical methods. Raw materials for polymers and resins. Chemistry of Natural resins and polymers such as lac, rosin, cellulose, rubber, proteins, fossil resins, etc. Preparation and applications of phenolics, amino resins, polyesters, polyamides, epoxides, polyurethanes, vinyls. Raw materials, manufacturing processes of plastics.

Composites: Raw materials, Comparison of different materials with composite; advantages and disadvantages of Natural rubber, synthetic rubber, rubber compounding, rubber fabrication; latex compound, rubber derivatives.

Alkylations, Carboxylation and Acetylation; Condensation and Cyclization; Dehydration; Halogenation; Oxidation; Sulfonation; Amination; Complex Chemical Conversions. Fermentation and Life processing for antibiotics, Biologicals, Hormones and Vitamins, Biologicals, Steroids Hormones; Isolates from Plants and Animals.

UNIT - VIII COAL CHEMICALS AND INDUSTRIAL CARBON AND EXPLOSIVES

The destructive distillation of coal; Coking of coal; Distillation of coal tar; coal to Chemicals. Methods of manufacture and applications of Lampblack; carbon black; activated carbon; Natural graphite; Manufactured graphite and carbon; Industrial diamonds.

Nuclear reactions: uranium and Thorium fission; Uranium as an energy source; nuclear fuels and processing. Types, Characteristics & Uses of explosive, Industrial Explosives.

UNIT - IX CERAMIC, GLASS, CEMENT AND LIME

Basic raw Materials; Chemical conversions, Including Basic Ceramic Chemistry; White wares: Structural Clay products; Refractories; Specialized Ceramic products: Vitreous Enamel; Kiln, Composition, manufacture of specialty glasses.

Portland cement: Raw materials & Manufacture of Portland cements; Setting and Hardening of cement; Manufacture and use of Lime and Gypsum.

UNIT - X FOOD AND FOOD BY- PRODUCTS

Classification and structure of carbohydrates, Physical and chemical properties of sugar, starch, pectin substances, gum and other polysaccharide, Functional properties of carbohydrates in foods, Definition and classification of lipids, chemistry of fatty acids and glycerides.

Functional properties of lipids in foods, structure and chemistry of amino acids, peptides and proteins, Source and distribution of proteins, Isolation, identification and purity of proteins.

Texture of fruits and vegetables, Plant pigments, Effects of cooking on texture and composition of fruits and vegetables Animal proteins, Structure and chemical composition of muscles .Composition of milk, Physical and chemical properties of milk proteins and effects, chemistry of milk products like cheese, cream, butter, ghee, etc.

ANNEXURE - III
TAMIL NADU PUBLIC SERVICE COMMISSION
(MAIN WRITTEN EXAMINATION)
PAPER - II GENERAL STUDIES (DEGREE / PG DEGREE STANDARD)
OBJECTIVE TYPE

UNIT – I GENERAL SCIENCE

Physics - Universe - General Scientific laws - Scientific instruments - Inventions and discoveries - National scientific laboratories - Science glossary - Mechanics and properties of matter - Physical quantities, standards and units - Force, motion and energy - electricity and Magnetism - Electronics & communications - Heat, light and sound - Atomic and nuclear physics - Solid State Physics-Spectroscopy – Geophysics - Astronomy and space science.

Chemistry - Elements and Compounds - Acids, bases and salts - Oxidation and reduction – Chemistry of ores and metals - Carbon, nitrogen and their compounds -Fertilizers, pesticides, insecticides - Biochemistry and biotechnology –Electrochemistry - Polymers and plastics

Botany - Main Concepts of life science-The cell-basic unit of life-Classification of living organism - Nutrition and dietetics-Respiration - Excretion of metabolic waste-Bio-communication

Zoology - Blood and blood circulation-Endocrine system-Reproductive system-Genetics the science of heredity-Environment, ecology, health and hygiene, Bio- diversity and its conservation-Human diseases, prevention and remedies-Communicable diseases and non- communicable diseases-Alcoholism and drug abuse-Animals, plants and human life-

UNIT – II CURRENT EVENTS

History - Latest diary of events – National - National symbols -Profile of States-Defence, national security and terrorism - World organizations-pacts and summits-Eminent persons & places in news-Sports & games - Books & authors - Awards & honours - Cultural panorama - Latest historical events - India and its neighbours - Latest terminology-Appointments - who is who?

Political Science - India's foreign policy - Latest court verdicts – public opinion - Problems in conduct of public elections- Political parties and political system in India- Public awareness & General administration- Role of Voluntary organizations & Govt.,- Welfare oriented govt. schemes, their utility.

Geography - Geographical landmarks-Policy on environment and ecology.

Economics - Current socio-economic problems-New economic policy & govt. sector.

Science - Latest inventions on science & technology - Latest discoveries in Health Science - Mass media & communication.

UNIT – III GEOGRAPHY

Earth and Universe - Solar system - Atmosphere hydrosphere, lithosphere -Monsoon, rainfall, weather and climate - Water resources - rivers in India - Soil, minerals & natural resources-Natural vegetation - Forest & wildlife-Agricultural pattern, livestock & fisheries - Transport & communication - Social geography – population-density and distribution-Natural calamities – disaster management-Climate change - impact and consequences - Mitigation measures - Pollution Control.

UNIT – IV HISTORY AND CULTURE OF INDIA

Pre-historic events - Indus valley civilization-Vedic, Aryan and Sangam age - Maurya dynasty - Buddhism and Jainism - Guptas, Delhi Sultans, Mughals and Marathas - Age of Vijayanagaram and the bahmanis - South Indian history - Culture and Heritage of Tamil people - Advent of European invasion - Expansion and consolidation of British rule-Effect of British rule on socio-economic factors - Social reforms and religious movements - India since independence - Characteristics of Indian culture - Unity in diversity – race, colour, language, custom - India-as secular state - Organizations for fine arts, dance, drama, music-Growth of rationalist, Dravidian movement in TN-Political parties and populist schemes – Prominent personalities in the various spheres – Arts, Science, literature and Philosophy – Mother Teresa, Swami Vivekananda, Pandit Ravishankar , M.S.Subbulakshmi, Rukmani Arundel and J.Krishnamoorthy etc.

UNIT – V INDIAN POLITY

Constitution of India - Preamble to the constitution - Salient features of constitution - Union, State and territory - Citizenship-rights amend duties - Fundamental rights - Fundamental duties - Human rights charter - Union legislature – Parliament - State executive - State Legislature – assembly - Status of Jammu & Kashmir - Local government – panchayat raj – Tamil Nadu - Judiciary in India – Rule of law/Due process of law - Indian federalism – center – state relations - Emergency provisions - Civil services in India - Administrative challenges in a welfare state - Complexities of district administration - Elections - Election Commission Union and State - Official language and Schedule-VIII -

Amendments to constitution - Schedules to constitution-Administrative reforms & tribunals- Corruption in public life - Anti-corruption measures – Central Vigilance Commission, lok-adalats, Ombudsman, Comptroller and Auditor General of India. - Right to information - Central and State Commission - Empowerment of women- Voluntary organizations and public grievances redressal - Consumer protection forms.

UNIT – VI INDIAN ECONOMY

Nature of Indian economy - Five-year plan models-an assessment - Land reforms & agriculture - Application of science in agriculture -Industrial growth - Capital formation and investment - Role of public sector & disinvestment - Development of infrastructure- National income - Public finance & fiscal policy - Price policy & public distribution - Banking, money & monetary policy - Role of Foreign Direct Investment (FDI) – WTO - globalization & privatization - Rural welfare oriented programmes - Social sector problems – population, education, health, employment, poverty - HRD – sustainable economic growth- Economic trends in Tamil Nadu - Energy Different sources and development - Finance Commission - Planning Commission - National Development Council.

UNIT – VII INDIAN NATIONAL MOVEMENT

National renaissance- Early uprising against British rule-1857 Revolt- Indian National Congress - Emergence of national leaders- Gandhi, Nehru, Tagore, Netaji -Growth of militant movements -Different modes of agitations-Era of different Acts & Pacts-World war & final phase struggle - Communalism led to partition- Role of Tamil Nadu in freedom struggle - Rajaji, VOC, Periyar, Bharathiar & Others - Birth of political parties /political system in India since independence.

UNIT – VIII APTITUDE & MENTAL ABILITY TESTS

Conversion of information to data - Collection, compilation and presentation of data - Tables, graphs, diagrams - Parametric representation of data-Analytical interpretation of data - Simplification – Percentage - Highest Common Factor (HCF) - Lowest Common Multiple (LCM) - Ratio and Proportion - Simple interest - Compound interest - Area- Volume - Time and Work - Behavioral ability - Basic terms, Communications in information technology - Application of Information and Communication Technology (ICT) - Decision making and problem solving.

Logical Reasoning - Puzzles – Dice - Visual Reasoning - Alpha numeric Reasoning- Number Series - Logical Number/Alphabetical/Diagrammatic Sequences.