

antiaromaticity; homoaromaticity. Physical properties: bond distance, bond angles, mp/bp & dipole moment in terms of structure and bonding. Heat of hydrogenation and heat of combustion.

Aldol and related reactions:

Keto-enol tautomerism, mechanism and synthetic applications of aldol condensations, Claisen reaction, Schmidt reaction, Perkin reaction, Knoevenagel, benzoin, Cannizzaro reaction, Michael addition. Aromatic substitution reactions - electrophilic, nucleophilic and through benzyne - radical substitution of arenes - orientation of nucleophilic substitution at a saturated carbon, SN1, SN2, SNi reactions - effect of structure, nucleophile, leaving group, solvent. Additions involving electrophiles, nucleophiles and free radicals.

Mechanism of some name reactions:

Aldol, Perkin, Benzoin, Cannizzaro, Wittig, Grignard, Reformatsky, Hoffmann, Claisen and Favorsky rearrangements. Oppenauer oxidation, Clemmensen reduction, Meerwein - Ponndorf and Verley and Birch reductions. Stork enamine reactions, Michael addition, Mannich Reaction, Diels - Alder reaction.

Electrocyclic Reactions:

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions. Conrotatory and disrotatory motions ($4n$) and ($4n+2$).

Organic Reaction Mechanisms:

Addition Elimination Mechanisms: (a) Addition to carbon multiple bonds- hydrogenation of double and triple bonds, hydroboration, Birch reduction, Michael reaction, addition of oxygen and N, (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction, Reductions of Carbonyl compounds, acids, esters, nitrites, addition of Grignard reagents, Reformatsky reaction, Tollen's reaction, Wittig reaction: (c) Elimination reactions: Stereochemistry of eliminations in acyclic and cyclic systems, orientation in eliminations - Saytzeff and Hoffman elimination.

Organic Spectroscopy:

Infrared spectroscopy: Units of frequency wave length and wave number, molecular vibrations, factors influencing vibrational frequencies, the IR spectrometer, characteristic frequencies of organic molecules and interpretation of spectra. Ultraviolet spectroscopy: Introduction, absorption laws, measurement of the spectrum, chromophores, definitions, applications of UV spectroscopy to Conjugated dienes, trienes, unsaturated carbonyl compounds and aromatic compounds. Nuclear Magnetic Resonance Spectroscopy: (Proton and Carbon -13 NMR) The measurement of spectra, the chemical shift: the intensity of NMR signals and integration factors affecting the chemical shifts: spin-spin coupling to ^{13}C IH-IH first order coupling: some simple IH-IH splitting patterns: the magnitude of IH-IH coupling constants.

Mass spectroscopy: Basic Principles: instrumentation: the mass spectrometer, isotope abundances; the molecular ion, meta stable ions.

HYDROGEOLOGY 200 Marks

Section A: Origin, occurrence and distribution of water.

Water on earth; Types of water — meteoric, juvenile, magmatic and sea water; Hydrological Cycle and its components; Water balance; Water-bearing properties of rocks — porosity, permeability, specific yield and specific retention; Vertical distribution of water; Zone of aeration and zone of saturation; Classification of rocks according to their water-bearing properties; Aquifers; Classification of aquifers; Concepts of drainage basins and groundwater basins; Aquifer parameters- transmissivity and storage coefficient; Water table and piezometric surface; Fluctuations of water table and piezometric surface; Barometric and tidal efficiencies; Water table contour maps; Hydrographs; Springs; Geologic and geomorphic controls on groundwater; Hydrostratigraphic units; Groundwater provinces of India. Hydrogeology of arid zones of India; Hydrogeology of wet lands.

Section B: Groundwater Hydraulics

Theory of groundwater flow; Darcy's law and its applications; Determination of permeability in laboratory and in field; Flow through aquifers; steady, unsteady and radial flow conditions; Evaluation of aquifer parameters of confined, semi-confined and unconfined aquifers - Thieme, Thies, Jacob and Walton's methods; Groundwater modelling.

Section C: Groundwater Exploration and Water Well Construction

Geologic and hydrogeologic methods of exploration; Role of remote sensing in groundwater exploration; Hydrogeomorphic and lineament 'mapping; Surface geophysical methods — seismic, gravity, geo-electrical and magnetic methods; Types of water wells and methods of construction; Design, development, maintenance and revitalization of wells; Sub-surface geophysical methods; Yield characteristics of wells; Pumping tests- methods, data analysis

and interpretation;

Section D: Groundwater Quality

Physical and chemical properties of water; Quality criteria for different uses; Graphical presentation of groundwater quality data; Groundwater quality in different provinces in India; Groundwater contamination; natural (geogenic) and anthropogenic contaminants; Saline water intrusion; Radio-isotopes in hydrogeological studies.

Section E: Groundwater Management

Groundwater problems related to foundation work, mining, canals and tunnels; Over-exploitation of groundwater and groundwater mining; Groundwater problems in urban areas; Ground water management in arid and semi arid areas; Climate change impact on groundwater resources; Concept of sustainable development of groundwater resources; Groundwater management —supply side and demand side management; Rainwater harvesting and managed aquifer recharge; Conjunctive use of surface and groundwater; Groundwater legislation.

APPENDIX-II-

INSTRUCTIONS TO THE CANDIDATES FOR FILLING ONLINE APPLICATIONS

- Candidates are required to apply Online using the website <http://www.upsconline.nic.in>.
- Salient features of the system of Online Application Form are given hereunder:
- Detailed instructions for filling up online applications are available on the above mentioned website.
- Candidates will be required to complete the Online Application Form containing two stages viz. Part-I and Part-II as per the instructions available in the above mentioned site through drop down menus.
- The candidates are required to pay a fee of Rs.200/- Rupees Two Hundred only) [excepting SC/ST/ Female/Persons with Benchmark Disability candidates who are exempted from payment of fee] either by depositing the money in any branch of State Bank of India by cash, or by using net banking facility of State Bank of India or by using any Visa/Master/RuPay Credit/ Debit Card.
- Before start filling up Online Application, a candidate must have his photograph and signature duly scanned in the .jpg format in such a manner that each file should not exceed 300 KB each and must not be less than 20 KB in size for the photograph and signature.
- The candidate should have details of one Photo ID viz. Aadhar Card/ Voter Card / PAN Card / Passport/ Driving License / Any other photo ID Card issued by the State / Central Government. The details of this photo ID will have to be provided by the candidate while filling up the online application form. This photo ID will be used for all future references and the candidate is advised to carry this ID while appearing for the examination.
- The Online applications (Part I and II) can be filled from 20th March, 2019 to 16th April, 2019 till 18:00 Hrs.
- Applicants should avoid submitting multiple applications. However, if due to any unavoidable circumstances, any applicant submits multiple applications then he/she must ensure that the applications with higher RID is complete in all respects.
- In case of multiple applications, the applications with higher RID shall be entertained by the Commission and fee paid against one RID shall not be adjusted against any other RID.