

**FURTHER DETAILS REGARDING MAIN TOPICS OF
PROGRAMME NO. 04/2016 (Item No. 21)**

**OTHER RESEARCH ASSISTANT
(CHEMISTRY)**

FISHERIES

(CATEGORY No. 634/2014)

Part I: Atomic Structure, Chemical Bonding, Nuclear Chemistry and Qualitative Analysis

Atomic structure and chemical bonding: Particle and wave nature of electrons – de Broglie equation, Schrodinger wave equation and its applications, Eigen value and eigen function- probability distribution of electron around the nucleus **Periodic properties:** Long form of periodic table- classification as s, p, d and f block elements -periodicity in properties- variation of atomic and ionic radii, electron affinity, ionisation energy and electronegativity along periods and groups: Properties of ionic compounds- Born-Haber cycle- Valence bond theory – hybridization of atomic orbitals and geometry of molecules S and P-Block elements. **Nuclear chemistry:** Natural radioactivity - detection and measurement of radioactivity –Artificial radioactivity - nuclear fission and nuclear fusion – mechanisms – applications - differences – nuclear reactors - hazards of radiations -C¹⁴ dating, rock dating, - **Qualitative Analysis:** Applications of solubility product and common ion effect in the precipitation of cations –Iodometric, Iodimetric, precipitation and complexometric titrations – Indicators. Gravimetric analysis: Precipitation methods - Conditions of precipitation – co-precipitation and post precipitation - washing of precipitates.

Part II: Chemical thermodynamics and Electrochemistry

Thermodynamics: extensive and intensive properties - state functions and path functions - types of processes - Zeroth law of thermodynamics. internal energy and

enthalpy, Joule-Thomson effect –Introduction to second law of thermodynamics - spontaneous processes, Entropy- a state function - Third law of thermodynamics: Nernst heat theorem- **Chemical kinetics**; Rate of reaction-Measuring rates of reaction-expressing reaction rates- factors influencing rate-rate constant-Rate laws, Stoichiometry, order and molecularity of reactions, Effect of temperature on rate constant. The activation energy – **Ionic equilibria**: The Ostwald's dilution law-experimental verification-limitations-acids and bases-Lewis concept-dissociation of weak acids and weak bases-dissociation of water-pH scale-common ion effect- its applications- **Electro chemistry** Definitions of specific, equivalent and molar conductances – Relations between them – measurement of conductance and cell constant. Strong and weak electrolytes. Degree of dissociation of weak electrolytes – Determination of Ionic product of water Galvanic cells – Reversible and Irreversible cells – EMF and its measurement – Weston Standard cell – types of reversible single electrodes –Nernst theory for single electrode potential –standard reduction potentials – electro chemical series, electrode concentration cells- electrolyte concentration cells- concentration cells with and without transference.

Part III: Organic Reactions and Compounds, Carbohydrates and Polymers

Principles of reactions: Polar effects-inductive, resonance and steric effects, preparation, properties and structures of carbonium ions, carbanions and free radicals -type of reactions - substitution, addition, elimination and polymerisation reactions, **Hydrocarbons** Conformations of ethane and n-butane- mechanism of chlorination of methane. Addition to unsymmetrical olefins S_N1 and S_N2 mechanisms - E_1 and E_2 mechanisms- **Alcohols and ethers** Distinction between primary, secondary and tertiary alcohols, Distinction between ethers and alcohols. **Aldehydes and ketones** Structure and reactivity of carbonyl group – relative reactivities of aldehydes and ketones –**Carboxylic acids** Structure of carboxylic acid and carboxylate anion – relative strengths of monocarboxylic acids –**Heterocyclic Compounds** ; Preparation, properties and uses of furan, pyrrole & thiophene - aromatic character. Synthesis and reactions of pyridine and piperidine - **Carbohydrates**: Classification-Monosaccharides- constitution of glucose and fructose. Reactions of glucose and fructose – Osazone formation, Mutarotation and its mechanism, Disaccharides- sucrose- reactions and structure. Polysaccharides – starch

and cellulose **Phenols** Acidic character of phenols- effect of substituents on acidity of phenols Mechanisms of Kolbe's reaction and Riemer-Tiemen reaction. **Polymers**; Classification of polymers-: Natural synthetic, linear, cross linked and network- plastics, elastomers, fibres, Homopolymers and Co-polymers, Thermoplastics- Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly vinyl Chloride, nylon and polyester - Thermosetting plastics, Elastomers- Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

Part IV: Analytical and Environmental Chemistry

Analytical chemistry: Errors and data analysis, deviation, mean deviation, relative mean deviation, standard deviation, coefficient of variation and variance – accuracy and precision – types of errors – random and systematic errors – student's t-test – confidence levels method of least squares. **Electroanalytical techniques**: Electrogravimetry : principle, instrumentation and applications. Coulometry : constant current coulometry – coulometric titrations – applications – Polarography : principle – advantages and disadvantages of DME: Anodic stripping voltammetry, **Spectrophotometry** – fundamental laws of photometry, UV-Visible spectrophotometry, Atomic absorption spectrophotometry, FTIR – Basic Principles and Instrumentation of FTIR Spectrophotometers, Spectra and Molecular Structure, **Chromatographic Techniques** – Classification of chromatographic techniques. applications of Ion exchange, Column, Thin Layer and Paper chromatography. HPLC and gas chromatography –Methods and applications.

Environmental Chemistry : Structure and Composition of **atmosphere**, Chemical and photochemical reactions, Oxygen and ozone chemistry, Green house effect, **Hydrosphere**: Water resources, Chemistry of sea water, eutrophication, physical examination of water, chemical characterization : pH, acidity, alkalinity, TDS, total, temporary, permanent, calcium and magnesium hardness, chloride, fluoride, BOD, COD **Water pollution**: sources of water pollution- sewage and domestic wastes, industrial effluents, agricultural discharges, pesticides, insecticides and herbicides, detergents, disease causing agents and radioactive materials. **Water purification**: Purification of water for drinking purposes: Sedimentation, filtration and disinfection- Desalination:

reverse osmosis-Purification of water for industrial purposes: water softening-permutit process and ion-exchange process. **Lithosphere:** Composition of soil, inorganic and organic components in soil, micronutrients, fertilizers, wastes and pollutants in soil, **Chemical toxicology**, biogeochemical effects of heavy metals, carbon monoxide, nitrogen oxides and pesticides.

Part V: Inland and Marine Fisheries

Inland fish production in India- Trends. Categorization of different freshwater fisheries resources. Riverine fisheries of India. Reservoir fisheries and the reasons for lesser productivity of reservoirs. Fisheries in lakes and brackish waters of Kerala. Cage and pen culture in inland waters. Estuarine fisheries: Introduction. Estuarine fishery resources of India in general and their management. Importance of wetlands in fisheries resource management. Crafts and gears in inland waters. Management and conservation of inland fishery resources. Fisheries legislation. Kerala inland fisheries bill. Government projects for enhancing Inland fish production. Introduction to marine fisheries of India. Pelagic and demersal fishery resources of India. Marine capture fishery of Kerala. Mud bank fishery- wedge bank fishery. Common pelagic fisheries of India: sardines, mackerels, anchovies, white baits, tuna, seer fish, carangids, ribbonfish, shads and other clupeids, barracudas, Bombay duck, pomfrets, mullets. Demersal fisheries of India: sharks, major perches, threadfin, breams, sciaenids, silver belly. Features and trends in production of pelagic and demersal fisheries. Impact of trawling on marine fisheries of India. Conservation of demersal fish stocks. Crustacean fishery of India: Penaeid and non-penaeid shrimp fisheries. Stock assessment and management options. Lobster fishery. Crab fishery. Marine Fisheries Regulation Act of India. Monsoon ban of trawling. Deep sea fishing policy of India. Remote sensing and fisheries. Climate change and its impact on marine fisheries.

Part VI: Aquaculture

Objectives and scope of aquaculture. Comparative efficiency of aquaculture as a means of protein. Aquaculture systems: Extensive, semi-intensive and intensive culture of fish. Status of Indian aquaculture. Aquaculture engineering. Selection of site for aquaculture. Farm engineering: Surveying- leveling-trapezoidal and Sumpson's rule, Calculation of

earthwork for the construction of pond, soil sampling. Project formulation and layout for the construction of a fish pond. Design and construction of farm and hatcheries. Equipments in farm and hatchery. Water intake system, pumping - total head, discharge head, components of a pumping system. Reservoir and distribution of water to various systems. Management of aquafarms: eradication of pests and predators, weeds and their control. Liming. Manuring. Water quality management and monitoring. Effluent treatment system. Environment impact assessment (EIA). Aquaculture of carps, freshwater prawns and shrimps. Wastewater-fed aquaculture. Integrated farming systems: Design, farming practices, constraints and economics of IFS of fish with paddy, cattle, pig, poultry, duck, rabbit, etc. Water quality management in various aquaculture practices. Seed production of freshwater prawns and marine shrimps: water quality requirements, feeding, health management, design of prawn hatchery. Freshwater prawn culture and farm management. Principles of coastal aquaculture and mariculture. Site selection, design and project preparation for the establishment of a shrimp hatchery. Culture of shrimps: stocking, water quality, feeding, health management, harvesting. Water quality management in shrimp farms and fish farms in coastal areas. Aquaculture and environmental issues. Regulation of coastal aquaculture in India. Coastal Aquaculture Authority.

Part VII: Fish Nutrition and Diseases

Fish nutrition. Major nutrients in fish food. Proteins, Lipids, Carbohydrates, Vitamins, Minerals; Feed additives. Antimetabolites, antinutritional factors. Feed formulation in aquaculture. Common ingredients, importance of protein source, methods of feed formulation. Farm made feeds. Types of feed in aquaculture; Parts of feed mill; Water stability; Storage; Spoilage. Feeding devices, feed ration, feeding frequency, Live feeds. Evaluation of feed: FCR, PER, NPU, Chemical score, Biological value. Growth: absolute growth, relative growth, SGR, Percentage weight gain. Metabolism: Carbohydrates, lipids, proteins. Nutritional requirement. Experimental diet, reference diet, purified and semi-purified diet. Nutrient requirement in different life stages. Connections between health and diseases. Finfish diseases: Viral. Bacterial. Fungal. Protozoal. Parasitic. Non-communicable diseases (Environmental. Nutritional. Genetic). Neoplasia. Management of fish diseases. Role of water quality management in prevention of fish diseases in

aquaculture. Antibiotics and chemicals used in aquaculture. PCR technology for the management of diseases.

Part VIII: Fish Processing Technology and Quality Control

Importance of fish in human diet. Nutritional quality of fish. Proximate composition of fish. Spoilage of fish, Rigor mortis. Various methods of fish processing and preservation. Miscellaneous fishery products. Fishery by-products. Drying: Basic principles, natural drying packing and storage of dried fish. Salting: principles, quality of salt, Kench salting, brine sailing. Smoking: Principles of smoking, cold smoking, hot smoking, fuel, packing and storage of smoked fish. Chilling: Manufacture and storage of ice, quality of ice, methods of chilling. Freezing: Basic principles, methods and application of chilling, Block freezing, Individual quick freezing (IQF), storage of chilled and frozen fish. Thermal processing. Canning. Other methods of processing and preservation. Spoilage in preserved seafood. Bacteriology of fish and shellfish. Spoilage Bacteria. Bacteria of human health significance in seafood. Fundamental aspects of quality control in sea food. Inspection of sea food quality. Different aspects of sea food quality. National agencies for sea food inspection. HACCP. Hygiene in processing plants. Export of marine fish products from India. Role of MPEDA.

Part IX : General Knowledge, Current Affairs & Renaissance in Kerala

Salient Features of Indian Constitution

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

Social Welfare Legislations and Programmes

Social Service Legislations like Right to Information Act, Prevention of atrocities against Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

RENAISSANCE IN KERALA

Towards A New Society

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories, printing press etc.

Efforts To Reform The Society

(A) Socio-Religious reform Movements

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

(B) Struggles and Social Revolts

Upper cloth revolts, Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha, Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act, Malyalee Memorial, Ezhava Memorial etc.
Malabar riots, Civil Disobedience Movement, Abstention movement etc.

Role Of Press In Renaissance

Malayalee, Swadeshabhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, Al-Ameen, Prabhatham, Yukthivadi, etc

Awakening Through Literature

Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam, Nataka Prashtanam*, Library movement etc

Women And Social Change

Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu, Akkamma Cheriyan, Anna Chandi, Lalithambika Antharjanam and others

Leaders Of Renaissance

Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali, Chattampi Swamikal, Brahmananda Sivayogi, Vagbhadananda, Poikayil Yohannan (Kumara Guru) Dr Palpu,

Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chaavra, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr.Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad, Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan. Swami Ananda Theerthan , M C Joseph, Kuttippuzha Krishnapillai and others

Literary Figures

Kodungallur Kunhikkuttan Thampuram, KeralaVarma Valiyakoyi Thampuram, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

GENERAL KNOWLEDGE AND CURRENT AFFAIRS

General Knowledge and Current Affairs

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.