

**FURTHER DETAILS REGARDING MAIN TOPICS OF  
PROGRAMME No. 06/2019 (Item No.2)**

**ASSISTANT DRILLING ENGINEER**

**MINING AND GEOLOGY**

**(Category No.003/2018)**

**PART- I**

**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, Malayalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

## **Role Of Press In Renaissance**

*Malayalee, Swadeshbhimani, 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 Chavara, 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 Thampuran, KeralaVarma Valiyakoyi Thampuran, 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

## **PART -II**

### **STRENGTH OF MATERIALS**

Simple stress and strain, longitudinal strain, lateral strain, Poisson's ratio, Hook's law, modulus of rigidity, shear stress, shear strain, relationship between elastic constants, Friction, sliding friction, rolling friction, cone of friction, centre of gravity, moment of inertia, shear force and bending moment- types of beams and its loading conditions, shear force and bending moment diagrams and equations in different types of beams and different types of loads - point load, uniform distributed load, cantilever beam, simply supported beam, deflection of beams, torsion of circular shafts-solid and hollow shafts, power transmitted by shafts, principle stresses-Mohr's circle, Columns-critical load, equivalent length, slenderness ratio.

### **THERMODYNAMICS**

Basic concepts and definitions, microscopic and macroscopic approaches, definitions of heat and work, zeroth law of thermodynamics, temperature scales, first law of thermodynamics, properties of pure substances, ideal gas equation and other equations of state, second Law of thermodynamics, Kelvin – Planck and Clausius statements, reversible processes and cycles, entropy, inequality of Clausius, entropy changes in various thermodynamic processes, principle of increase of entropy, available and unavailable energy, availability function, availability and irreversibility open and closed systems, third Law of thermodynamics, general thermodynamic relations – combined first and second law equations, Helmholtz and Gibb's functions, Maxwell's relations, equations for internal energy, enthalpy and entropy, ideal and real gases, Clapeyron equation, throttling process, Joule Thomson coefficient, inversion curve, gas mixtures, composition of a gas mixture, mass and mole fraction, Dalton's law, Gibbs – Dalton's Law, equivalent molecular weight and gas constant, properties of gas mixtures – specific heats, internal energy, enthalpy and entropy.

## **FLUID MECHANICS AND MACHINES**

Properties of fluid - density, specific weight, viscosity, surface tension, bulk modulus, compressibility, rate of shear strain, Newton's law of viscosity, Newtonian and non-Newtonian fluids, real and ideal fluids, incompressible and compressible fluids, fluid pressure and its measurement, buoyancy and floatations, energies in flowing fluid, head - pressure, dynamic, static and total head, continuity equation, Euler's equation, Bernoulli's equation, flow rate measurements - venturi and orifice meters, notches and weirs, pitot tube, Reynolds number, laminar and turbulent flow, Hagen-Poiseuille equation, turbulent flow through pipes, head loss due to friction, Darcy-Weisbach equation, Chezy's formula, losses at entry, exit, sudden expansion and sudden contractions.

Impact of free jets - stationary and moving vanes, flat and curved vanes, series of vanes, work done and efficiency, impulse and reaction turbines - Pelton wheel, Francis turbine and Kaplan turbine, work done and efficiencies, draft tubes, cavitation, governing and specific speed of turbines, reciprocating pump - air vessels, cavitation, slip, indicator diagram, work required and efficiency, centrifugal pump - manometric head, work, efficiency and losses, priming, specific speed, performance characteristics.

## **METALLURGY AND MATERIAL SCIENCE**

Classification of engineering materials - selection of materials with reference to properties, service and economic considerations. thermal, physical, mechanical, electrical, magnetic, dielectric properties, super conductivity and super plasticity of materials, metallic bonds, crystal structure, space lattice, types of unit cells, Miller indices, co-ordination number, atomic packing factor, allotropy and polymorphism, imperfections in crystals. elastic and plastic deformation of metals, slip, twinning, dislocation, critical shear stress, Frank-Read source, Strain hardening, De-lamination theory, diffusion mechanism, Fick's Laws. theory of alloys, Gibb's phase rule, solid solutions, Hume Rothery's rule, equilibrium diagrams, equilibrium diagram of binary alloys, eutectic, eutectoid, peritectic and peritectoid reactions. iron-carbon equilibrium diagram, isothermal TTT diagrams, critical cooling rate, heat treatment processes, hardenability tests, surface treatments, case hardening, carburising, nitriding, cyaniding, induction hardening, precipitation hardening, recovery, recrystallisation and grain growth. Properties, composition and uses of various types of cast iron and steels, effect of various alloying elements. Properties, composition and uses of copper, aluminum, titanium and its alloys.

## **THERMAL ENGINEERING**

Steam engineering - Rankine cycle, boilers, boiler mountings, boiler accessories, steam engine, steam nozzles. steam turbines, multistage turbines. IC engines - classification, air supply system, fuel supply system, ignition system, performance

testing, combustion in SI and CI engines, auto ignition, preignition, detonation, octane and cetane numbers, anti knocking agents. Gas turbines-classification, regeneration, intercooling, reheating, efficiency and work output. Compressors - classification of compressors, uses of compressors, reciprocating compressor-single stage compressor, equations for work, efficiencies, multistage compressor, intercooler, rotary compressors, fans and blowers. Refrigeration- concept of COP, heat pump, unit of refrigeration, reversed Carnot cycle, refrigeration systems, refrigeration equipments and refrigerants. Psychrometry- dry air, moist air, saturated, unsaturated and super saturated air, degree of saturation, dry bulb temperature, wet bulb temperature, dew point temperature, psychrometric processes, air conditioning, air conditioning systems. Heat transfer – conduction, convection and radiation, Fourier's law, thermal conductivity, conduction through plane wall and composite wall, black body concept, Stefan-Boltzman law, gray body concept, Newton Rikhman equation free and forced convection. Heat exchangers– classification, recuperator type and regenerative type, parallel flow, counter flow type & cross flow, concept of overall heat transfer coefficient, LMTD. Power plants-hydro electric, thermal, diesel and nuclear power plants.

## **THEORY OF MACHINES AND DESIGN OF MACHINE ELEMENTS**

Defintions and basic concepts, kinematic and dynamic analysis of planer mechanisms. Belt –Rope –Chain Drives, open and cross belt drive, length of belt , ratio of belt tensions, centrifugal tensions, initial tensions, V belt drive, rope drive, chain drive, power transmitted. Friction clutches-plate clutches, conical clutches. Brakes and Dynamometers- types of brakes, absorption and transmission type dynamometers. Gears-types of gears, terminology, law of gearing , gear tooth profiles, interference and under cutting, calculation of minimum number of teeth, contact ratio, path of contact, arc of contact. Gear trains, Flywheels, Governors. Balancing of rigid rotors and field balancing, balancing of single and multi cylinder engines, free and forced vibrations of single degree of freedom systems, effect of damping, vibration isolation and transmissibility, resonance, critical speeds and whirling of shafts.

Design for static and dynamic loading, failure theories, fatigue strength and S-N diagram, principles of design of machine elements such as bolted, riveted and welded joints. design of shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

## **PRODUCTION TECHNOLOGY**

Foundry –patterns, moulding sand, cores, gating and risering, chills, chaplets, gating systems, gravity die casting, pressure die casting, centrifugal casting, semi centrifugal casting, centrifuging, continuous casting, casting defects. Welding-weldability,. types of flames, types of welding, weld defects. Forming - cold

rolling, hot rolling. Forging-types of forging , defects in forging. Extrusion-hot and cold extrusion, Wire drawing ,Rotary piercing, Rotary swaging, Metal spinning. Metal cutting-types of chips, tool signature, tool geometry, machinability, tool wear,cutting forces in orthogonal cutting, Merchants theory, economic of machining. Lathe–work holding parts, main operations, attachments. Shaper-cutting speed, shaper operation and tools used. Milling Machine –milling cutters, up milling, down milling and face milling operations, indexing. Drilling machines-classification, cutting speeds and feeds, types of drill, reamers. Boring machines-classification, machining time, boring tools. Grinding Machines - surface, cylindrical and centreless grinding.Turret and Capstan lathes, transfer machines. Unconventional machining processes – EDM, ECG, ECM,LBM,USM, AJM, EBM and Chemical Machining. Powder metallurgy. Metrology and instrumentation–line standard and end standard, limits, fits and tolerances, allowance, accuracy, precision, repeatability, sine bar, comparators, gauges, interferometry, surface roughness, measurement of displacement, velocity, acceleration, temperature, Transducers.

## **INDUSTRIAL ENGINEERING AND MANAGEMENT**

Meaning of management, Taylor’s scientific management, functions of management, organisational structure, authority, responsibility and span of control, line, line and staff, functional, project and matrix organization. Formation of companies- proprietary, partnership and joint stock companies, private limited, public limited companies, cooperative organizations and government organizations.

Facilities planning-selection of site, factors to be considered,plant layout-process, product, fixed group technology layout, principles of material handling, types of material handling equipments, preventive and break- down maintenance, replacement of equipments.

Work study- analysis of work methods using different types of process chart and flow diagrams, critical examination, micromotion study and therbligs, SIMO chart, principles of motion economy, determination of allowances and standard time, job evaluation and merit rating, wage payment plans.

Production planning and control- importance of planning, forecasting techniques, job, batch and mass production, determination of economic lot size in batch production, functions of production control, routing, scheduling, dispatching and follow up, Gantt charts, inventory models, determination of EOQ and reorder level, selective inventory control techniques, breakeven analysis.

Quality control and inspection- process capability, statistical quality control, control charts for variables and attributes, acceptance sampling and operation characteristic curves, system reliability, life testing, bath tub curve.

Personal management- objectives and function, recruitment, selection ,orientation and training of workers, industrial safety and health, labour welfare, Industrial psychology, labour legislation.

linear programming – graphical and simplex solution methods, transportation and assignment problems, game theory, single server queuing models, network theory, CPM and PERT.

***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***