1) **Surveying I** – Principle of surveying, object [illegible]

surveying Classification of surveying, Different types of chain and tape. The factors involved in selecting stations. The different operations in chain surveying List the errors in chaining List the obstructions in chaining

The principle of plane table surveying The functions of accessories of plane table List the operation to set up and orientation in the plane table surveying. The methods of plane table surveying

List the type of compass. Identify the parts of prismatic compass and their functions. Define bearing. The concept of meridian and types of meridian, The method of booking of field notes. Calculate reduced bearing from whole circle bearings-problem. Calculate the included angles from whole circle bearings. Understand magnetic dip and declination. List the sources in errors in compass surveying.

Define leveling. Understand the concept of level surface, datum, and horizontal surface, vertical surface and reduced level. The Bench mark and its types Understand the method of reduction of levels-rise and fall method and height of Collimation method –Classification of leveling, Contouring, **(10 Marks)**

2) Surveying II - Define the terms used in the theodolite survey

List the uses of theodolite. Explain the temporary adjustments of theodolite. List the types of traverse List the different methods of traversing using theodolite. The types of co-ordinates- consecutive and independent co-ordinates calculate the independent co-ordinates. Gales traverse tablen The methods of balancing the traverse-Bowditch's rule and transit rule. The principle of trigonometric levelling The classification of tacheometry Explain the principle of stadia tacheometry the constants

of stadia tachometry Explain the determination of stadia constant. The principle of tangential tachometry

Explain the different types of curves- simple curve, compound curve, transition curve and vertical curves Explain transition curve. The elements of simple circular curve The data required to set out circular curve.

The different parts of equipments like electronic theodolite, total station and GPS. The uses and advantages of Electronic Theodolite, Total station and GPS Remote sensing and its application in civil engineering field The fundamentals of GPS, receiving, observation and the transformation of GPS results **(10 Marks)**

3) Construction Materials- Stone – classification geological, Physical and chemical classification – characteristics of good building stone – varieties of stones – granite – trap - basalt – sand stone – Laterite. Values of, load bearing capacity of stones. Quarrying of stones – methods – wedging and blasting –explosives used. Dressing of stones.

Clay Products: Bricks: Raw materials used – Composition of brick earth, manufacturing methods (Description only), kiln and clamp burning – IS specifications of bricks – characteristics of good brick used for building purpose.

Tiles: Type of tiles-characteristics-uses-Floor, wall and roofing tiles, Porcelain, vitrified and glazed tiles. Earthenware and stoneware pipes -uses-qualities

Cement: Composition, Compounds present, manufacturing methods-characteristics of cement, Types of cement-Properties -Tests on cement-Consistency test, fineness test, Sp.gravity test, Setting time test, Soundness test, and field tests, uses of cement.

Aggregates: Sand- Sources of sand-River sand, Sea sand and pit sand-Limitations of mining of sand from rivers and sea shore, M-sand, alternatives of sand.

Coarse aggregates: Materials generally used, requirements of good coarse aggregates, commonly used sizes for different applications, grading of coarse and fine aggregate. .

Mortar: Preparation of lime and cement mortar-Proportions of mortar for various items of work, tests on cement mortar.

Cement Concrete: Proportioning, ingredients, PCC and RCC, Water cement ratio-effects on strength and workability, characteristics of Concrete and reinforcements-preparation-workability-Tests on Cement concrete-Laboratory tests and field Tests-Slump test, compaction factor test, qualities of water used for mixing. Reinforced cement concrete- Qualities of materials-Types of reinforcement used-characteristics of reinforcing material-preparation of concrete cubes and test on cubes. Chemical admixtures Plasticizers and super plasticizers

Timber and wood products: Structural classification- Soft wood and hard wood, defects in timber, seasoning of timber-preservation of timber-wood products ply wood, MDF,HDF, Veneer. Metals: Ferrous metals-Wrought iron, Cast iron, Mild steel- -Special steels-High carbon steel, High tensile steel and stainless steel (Properties and uses only)-Nonferrous metals: Aluminum, Copper, Lead, Zinc and Titanium-important alloys- properties and uses **(10 Marks)**

4) Construction Technology: Masonry: Classification of masonry walls- load bearing, non-load bearing and retaining walls. Stone masonry-Brick masonry-Laterite masonry – composite masonry. Different types of stone masonry-General principles and specifications for stone masonry as per relevant codes. Brick masonry: Different types of bonds for walls, piers and junctions of walls for equal and unequal thickness - English, Flemish (Single and Double Flemish)-Specification for brick masonry as per relevant codes. Hollow block masonry: Types of hollow blocks used in construction and methods of construction Advantages and Disadvantages with reference to other types of masonry. Solid block masonry and inter locking block masonry. Partition walls-Types- materials- requirements. Modern methods of constructions:- Framed – Prefabricated -Earthquake resistant.

Damp proof courses: Definition of dampness – causes and effects – methods of prevention –surface treatment – internal water proofing courses. Pre stressed concrete: Principle of pre stressing- Types- Internal & External and different methods-pre

tensioning & post tensioning. Pre stressed slabs and beams Form work: Functions-materials used – Requirements of good form work – modern trends in material & technology- slip forms, pvc forms. Scaffolding, Shoring and Underpinning: Definition – purpose and function – Requirements of materials used. Plastering and Pointing: Materials and proportion – Functions – general specifications – types

Building Components: Different components of building from foundation to roof and their functions Foundations: Functions, Classification, Shallow-Deep, Types- Spread footing- raft-mat-column footing pile foundation- well foundation. Flooring: Requirements of a good floor – materials used for flooring, Floor finishes –Types Mosaic, Marble, Granite, Ceramic tiles, Vitrified tiles, Glass, Wooden, and other types of modern floor finishes. Doors and Windows: Positioning of Doors and windows with respect to lighting and ventilation. Types and Size as per relevant codes -Special types of doors-Flush, Revolving, and collapsible, Rolling and sliding Windows-Different types-Ventilator Different types-Fittings for doors and windows. Lintels and sunshades: Types of lintels- Wooden, Stone, brick, RCC and RSJ lintels-Sunshades Canopy and sun breakers. Arches- Types, terms used. Vertical Transportation: Stairs and staircases: Location – Types – Standards for stair case as per KBR – Tread, Rise, Going, Riser, Nosing – Width of stair — Head room – Flight– Landing – Hand rails. Lift and escalators- Component parts and requirements as per NBC, ramp, Lifts and Escalators - Planning and location – Component parts of staircase and lift – Types of staircase.Ceiling: Materials used for Ceiling – False ceiling.

Roof: Definition – importance of roofing with respect to climatic conditions – classification – pitched and flat – Couple, couple closed and collar roof. Different types of trusses for pitched roof – wood and steel trusses – roof covering for pitched roof – AC sheets, GI corrugated sheets, Aluminum sheets- PVC sheets – method of arranging and fixing to the battens rafters and purlins – RCC roof – slab with beams – flat and sloped slabs –Flat slab construction- weather proof course to flat roof. Requirements of good floor finish, Selection of materials. Ceiling: Types, Requirements of good ceiling, Selection of materials. **(10 Marks)**

5) Theory of Structure- De nition of force –types of forces, Moment of force – types of moments – principle of moments -Determination of Reactions of simply supported beams and overhanging beams with point loads, uniformly distributed loads, uniformly varying loads.

Centroid of plane figures –Determination of centroid of rectangle , triangle, circle, semi-circle and compound areas and reminders – Definition of center of gravity (C.G) . C.G. of combination of simple solids

Elasticity, stiffness, plasticity, toughness, brittleness, ductility, Malleability and hardness Simple stresses and strains – types of stresses – Elasticity – Hook's law – Young's modulus – stresses and strains in uniform sections of same and composite materials like steel, aluminum and copper. Tensile test on ductile material (mild steel bar) and stress strain curve – limit of Proportionality, elastic limit, yield point – ultimate stress – breaking stress – working stress and factor of safety.

Beams and bending Classification of beams – cantilever, simply supported, fixed, overhanging and continuous. Types of loading – concentrated, uniformly distributed and uniformly varying load Shear force and bending moment – definition and sign conventions. Calculation of SF and BM for Cantilever, simply supported and overhanging beams and sketching of SF and BM diagrams (for point load, uniformly distributed load, uniformly varying load and combinations of u.d.l and point loads) Relation between SF and BM. Maximum BM – point of contra flexure

Theory of pure torsion –assumptions in pure torsion- derivation of formula – problems Power transmitted by circular shafts – problems Thin cylinders Failure of thin cylindrical shell due to internal pressure – circumferential and longitudinal stresses – Changes in dimension and volume of thin cylinders due to internal pressure

Theory of simple Bending Theory of simple bending, Explain the terms 'Neutral axis', 'moment of resistance' and 'section modules'. Assumptions in simple bending, derivation of the equation of simple bending Apply the theory of simple bending to simple and compound sections. Calculate stress, section modulus and

moment of resistance. Calculate the shear stress and draw the shear stress distribution diagram for rectangular and I Sections. **(10 Marks)**

6) Quantity surveying -quantity surveyor– duties of quantity surveyor-essential requirements of quantity surveyor – Estimate -types – detailed estimate , supplementary estimate, revised estimate, annual repair and Maintenance. approximate estimate-types of approximate estimate-problems-Units of measurements for different items as per standard – sundries- Lump sum- Lead and lift- contingencies unforeseen items-work charged establishment-Earth work computation – Trapezoidal – mid section-mean section (trapezoidal) - Prismoidal formula –computation of earth work from Longitudinal section and Cross section (no transverse slope)- Capacity of reservoir from contour map

Different methods of taking out quantities – Center line method – long wall short wall method Compute quantities of a compound wall – steps - doors-windows-ventilator

cost of materials at source and at site – conveyance charges – standard data book – schedule of rates – Lump sum items —extra labour – contractor's profit- conveyance statement for different materials— schedule of rates labour and materials -Analysis of rates-preparation of standard DATA of CPWD with specification as per CPWD standard- Rules of measurements – rules regarding tolerance of wastage of materials- general rules for taking measurements as per CPWD standard-abstract of estimate preparation of abstract of estimate

Detailed estimate preparation for building with gabled roof, building with hipped roof. building with valley, two storied building (residential and office) Abstract of estimate preparation for building with gabled roof, building with hipped roof building with valley, two storied building (residential and office) Detailed estimate and abstract of estimate for Septic Tank and soak pit estimate

Detailed Estimate of RCC beam, slab, Column and preparation of bar bending schedule. Detailed Estimate of Aqueduct Detailed specifications for various items of work of Earth work excavation, Foundation concrete, Masonry work, D P C, Form

work, R C C, Plastering, Pointing, Flooring, Painting and Polishing. I RC Specifications for WBM road. Preparation of Plan, Estimate and other documents for submission

Definition of Valuation:- Purpose-Factors governing valuation-Life of structure-type, location Maintenance -legal control. Scrap value-salvage value-market value-book value-sinking fund annuity and depreciation. Methods of valuation:-Rental method-direct comparison with cost-Based on profit-Development method of valuation- depreciation method. Calculation of depreciation by different methods Land valuation – Problems **(10 Marks)**

7) Irrigation Engineering

Fundamentals of Irrigation and Hydrology: Basic methods of irrigation, Nature and Scope of Irrigation Engineering: Definition of irrigation – necessity of irrigation – advantages and disadvantages – perennial and Inundation irrigation –flow and lift irrigation – direct and storage irrigation. Water requirement of crop: a) Principle Crops – Kharif and Rabi Crops in India & Kerala – Dry and wet crops – Crop period b) Duty – different methods of expressing duty – base period – relationship between duty and delta - Factors affecting duty – requirements for precise statement of duty – duty figures for principal crops– Simple problems on duty. Hydrology -Run off and maximum flood discharge of a catchment: a) Rainfall – Types of rain gauges –Factors for selecting suitable site for rain gauge station. precautions in setting and maintaining rainfall records – rainfall cycle – average annual rainfall of an area –Methods of estimating average rainfall over a catchment- Thiess's polygon method. b)Catchment basin and catchment area, Characteristics of catchment-good, average, bad – free catchment, intercepted catchment – runoff – factors affecting runoff – nature of catchment, runoff coefficient – methods of estimating runoff – empirical. Formulae .c) River gauging – importance – site selection – open gauge well – measurement of velocity by surface floats, velocity rods and current meter d) Maximum flood discharge from rainfall records Ryve's and Dicken's formulae, H.F.L marks, Gauge reading.

Diversion Head works: a) Classification of head works – storage and diversion head works – their suitability under different conditions.– suitable site for diversion works –

general layout of diversion works- brief description of component parts of a weir. b) Barrage and weirs. c) Head Regulator – scouring sluice – flood banks and other protective works (only description).d) Percolation – percolation gradient – up lift pressure, effect of percolation on irrigation works, up lift pressure and exit velocity – scour – protective works – solid and loose aprons

Storage head works: a. Dams – types – selection of site-types of survey for site selection – Factors influencing in site selection- site investigations – Describe the terms – full reservoir level, maximum water level, top bund level, dead storage, live storage, free board. b. Evaporation – Evaporation losses in reservoirs (only brief description) c. Dams – rigid and non-rigid dams – main types – gravity dams-forces acting on a gravity dam – failure of gravity dams and remedial measures – elementary profile – limiting height of dam – low dam and high dam – free board and top width – sketch practical profiles of low dam — drainage gallery – construction joints and their functions - spill ways (only brief description). d). Earth dams – situations suitable for earth dams – types of earth dams – causes of failure of earth dams and precautions - saturation gradient and (phreatic) line– drainage arrangements of an earth dam. e). Tank sluices – head wall, tower head type – regulating arrangements. (Brief explanation and diagram only. Tank surplus works – necessity – suitable site – flush escapes – surplus weirs .

Irrigation canals and soil erosion: Distribution works. a) Canals – classification – typical cross section of canal in cutting, embankment, partial cutting and embankment – berms – standard dimensions – balancing depth of cutting- regime channel, necessity and types of canal lining – maintenance of canals.(Only in brief). b) Canal regulation – sluice – drops – escapes and their functions, c) Cross drainage works – necessity – general description of aqueducts – super passage, under tunnel – siphon – level crossing – inlet and outlet. (Brief explanation and diagram only) d) Soil erosion – causes and effects of soil erosion, methods of prevention of soil erosion **(10 Marks)**

8)Geotechnical Engineering

Introduction of Soil mechanics: – soil Engineering – Scope of soil Engineering – History of development of soil mechanics –Soil types – residual and transported – Soil

as a three phase system – water content. Unit weight of soil – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weights – specific gravity –void ratio – porosity – degree of saturation – percentage air voids –Air content -density index - functional relationships –Estimation and relationship between properties. Determination of index properties: - water content by oven drying method – specific gravity using Pycnometer and specific gravity bottle – particle size distribution – sieve analysis, hydrometer method – particle size distribution curve – consistency of soils - liquid limit, plastic limit, shrinkage limit, plasticity index, consistency index – determination of liquid limits, plastic limit & shrinkage limit - shrinkage ratio. Field density by sand replacement method and the core cutter method Classification of soils, Engineering properties of soil-Shear strength-permeability- compressibility. Necessity – I.S. classification.

Soil water – classification – absorbed water – capillary water - stress condition in soil Effective and neutral pressures - Permeability of soil – Darcy's law – discharge velocity and seepage velocity – factors affecting permeability - Determination of coefficient of permeability – constant head permeability test – falling head permeability test-coefficient of permeability estimation problems. Compaction of soil- Definition and objectives of compaction – Standard Proctor test and modified proctor test – concept of O.M.C and maximum dry density – Zero air voids line – field compaction methods – factors affecting compaction.

Site Investigation and sub-soil exploration – Objectives – site reconnaissance – site exploration – depth of exploration – number and disposition of pits and boring – general exploration – detailed exploration - methods of site exploration – open excavations – boring methods - auger boring – auger and shell boring - wash boring – percussion boring – rotary boring – soil samples and samplers – disturbed sampling – undisturbed sampling–Standard Penetration Test – Geophysical methods (Seismic refraction and Electrical resistivity method.) Bearing capacity: – ultimate bearing capacity, safe bearing capacity and allowable bearing pressure – general and local shear failure – Terzaghi's theory of bearing capacity-effect of water table-plate load test and limitation.

Foundation engineering–different types of foundations – proportioning of foundations – rectangular footing Design of strip footing using Rankine's equation .Deep foundations: - Pile foundation – necessity of pile foundation – classification of piles according to materials, mode of transfer of loads, method of installation, use and displacement of soil. Well foundations/caissons – shapes of wells and component parts – well sinking – tilts and shifts – measures for rectification of tilts and shifts. **(10 Marks)**

9) Transportation Engineering

Highway Engineering:- History of road development in India –Importance of roads and intermodal mix of traffic - Recommendations of Jayakar committee report & its implementation – Road plans in India – Salient feature of current road plan (Brief Description only).IRC – IRC classification of road – Urban road classification – Major SH and NH in Kerala. Investigation and Planning of Highways: - Detailed project report for road project - Different types of surveys – Engineering surveys and Traffic surveys – The Es in traffic management. Engineering Surveys :– Map study – Reconnaissance survey – Preliminary survey – Final location survey – Road alignment – Factors to be considered in road alignment – socio- economic studies – Environmental impact assessment -Drawings to be included in road project. Traffic Engineering: – Traffic volume study – Traffic intensity studies - OD studies – Road intersection studies – Sight distance - stopping and overtaking sight distances - Road structures – Kerb – Medians/Dividers – Channelizing islands – pedestrian loading islands – Rotary islands – Intersections – types of at grade intersection – Grade separated intersections – Clover leaf junction – Trumpet junction – Road markings – Traffic signals – purpose of signals Types of signals – Mandatory, cautionary and informatory signals.

Highway Geometrics:– Road structure – sub-grade, sub-base course, base course and wearing course/pavement – Highway width - Carriage way, shoulders, formation width, right of way – Arboriculture - Cross-section of road on level ground, embankment, cutting, partially cutting & filling Road slopes – camber, gradient-types of gradient – ruling, limiting and exceptional gradients – Supper elevation – widening of road on

curves – Curves – Horizontal & vertical curves and their types – Road drainage – surface & sub surface drainage, catchment/intercepting drains. Road Construction: – Earth work for road – forming the formation width – spoil bank and borrow pit – balancing of earth work – Compaction of sub grade – Construction of earthen road - Water bound Macadam road – Materials used – Construction of WBM road – Construction of bituminous road – prime coat & tack coat – premix Macadam & penetration Macadam – Seal coat - Bituminous Macadam road maintenance using cutback/emulsion and hot pre-mix Macadam – Flexible pavement & Rigid pavement

Introduction: – Importance of railways – Classification of railway based on gauge Permanent way - Component of permanent way – Formation – Ballast – functions & materials used - Rails – Types - Rail joints – types - requirements of good joint - fixtures and fasteners – fish plates & bolts, pandrol clip - sleepers – materials used - coning of wheel, adzing of sleepers - Cross section of a BG single and double line in cutting and embankment. Laying and Maintenance: - Plate laying – definition, methods. Points and Crossings - Points, crossings, turn out, diamond crossing. (General description and sketches only) Station yards:- Station yard – marshalling yard – goods yard – shunting yard – loco yard. (Brief description only) Signaling and Interlocking: - Objectives of signaling – Types of signal - modern signaling methods – principles of interlocking.

Bridge and Culvert: – Types of bridges and culvert based on materials used, HFL, position of deck slab, alignment and IRC classification. Foundation – Types of foundations used for bridge – well and pile foundation Sub Structure – Abutment, pier and wing wall – different types Super Structure – Bridge bearing - girder beams – Deck slab – RCC beam bridge – Plate Girder Bridge - steel trussed bridge – arch bridge and bow string girder - Parapet/Hand rail. Approach road – function - different types of approach road alignment Alignment of bridge – types - economical span – linear water way - afflux and vertical clearance – permissible velocities – scour depth – prevention of scour Bridge project - Surveys, plans and documents – Selection of site for bridge Tunnel Engineering: - Necessity of tunnels and its uses – Parts of a tunnel – Audit tunnel – Vertical shaft – Common shapes – Tunnel lining - Typical section of a tunnel. Air port Engineering:-Classification of airport – layout of an airport and location

requirements – airport components –Runway, Apron, taxi way, terminal building, hangers, cargo, Fueling facility, Fire fighting, parking and circulation area – Run way alignment - pattern and layout of Bridge and Culvert: – Types of bridges and culvert based on materials used, HFL, position of deck slab, alignment and IRC classification. Foundation – Types of foundations used for bridge – well and pile foundation Sub Structure – Abutment, pier and wing wall – different types Super Structure – Bridge bearing - girder beams – Deck slab – RCC beam bridge – Plate Girder Bridge - steel trussed bridge – arch bridge and bow string girder - Parapet/Hand rail. Approach road – function - different types of approach road alignment Alignment of bridge – types - economical span – linear water way - afflux and vertical clearance – permissible velocities – scour depth – prevention of scour Bridge project - Surveys, plans and documents – Selection of site for bridge Tunnel Engineering: - Necessity of tunnels and its uses – Parts of a tunnel – Audit tunnel – Vertical shaft – Common shapes – Tunnel lining - Typical section of a tunnel. Air port Engineering:-Classification of airport – layout of an airport and location requirements – airport components –Runway, Apron, taxi way, terminal building, hangers, cargo, Fueling facility, Fire fighting, parking and circulation area – Run way alignment - pattern and layout of runway length - selection of site for airport. **(10 Marks)**

10) Environmental Engineering

WATER SUPPLY ENGINEERING:- General importance of water supply- Development of water supply Different systems of water supply-Need for protect water supply-Estimating water requirement:- Total quantity of water for a town, per capita demand and factors affecting demand- Water requirements for domestic purposes, industrial use, fire fighting, commercial and industrial needs, public use- Variation in demand – Peak demand during day, month and year-Fore casting population by arithmetical, geometrical and incremental increase method (problems)

Sources of Water:-Surface source – lakes, streams, rivers and impounded reservoirs, Yield from surface source-Underground sources – springs, wells, infiltration wells and galleries- Yield from wells – test for yield. Conveyance of water:-Types of Intakes-

Reservoir intake-River intake-Canal intake- open channels, aqueduct pipes- List of pipe materials – C.I. pipes, steel pipes, concrete pipes, A.C. pipes, G.I. pipes, plastic and P.V.C. pipes, high density polythene pipes, merits and demerits of each type (brief description only). Pipe joints – spigot and socket joint, flange joint, expansion joint for C.I. pipe, joints for concrete and asbestos cement pipe- methods of leak detection – prevention –rectification- Pipe corrosion – causes and prevention

PURIFICATION OF WATER:- Quality of Water: - Impurities of water – need for laboratory test. Sampling and Testing of water – physical, chemical, and bacteriological tests (brief description only) –Various standards of water such as pH value, color, taste, hardness, odour - for potable water- Flow diagram of different treatment units for both surface and ground sources – reservoir / pond and well Aeration – methods of aeration- Sedimentation – plain sedimentation and sedimentation by coagulation-Filtration – construction and operation of slow sand, rapid sand and pressure filters Disinfections of water – necessity and method, chlorination, pre-chlorination, break point chlorination, super chlorination. Removal of Taste, colour, odour and hardness Note: (No design for treatment units) Distribution system:- General requirements, system of distribution, gravity system, combined system, direct pumping- Methods of supply – intermitted and continuous – advantages & disadvantages Layout of distribution system -Types – dead end, grid, radial and ring system their merits and demerits and their suitability. Appurtenances in Distribution system: - Uses of Sluice valves, Check valves or reflux valves, Air valves, Drain valves or blow-off valves, Scour valves, Fire hydrants and Water meters- (brief description only). Water supply arrangements in Building, Definition of terms- water main, service pipe, communication pipe, supply pipe, distribution pipe, air gap- General layout of water supply arrangements for single and multistoried building as per I.S. Code of practice general principles and precautions in laying pipe line within the premises of a building- Connection from water main to building- (Brief description only)

SANITARY ENGINEERING:- Objects of providing sewerage works - Definition of terms – sewage, sewerage, sewer, refuse, garbage, sullage etc- Systems of sewage disposal – conservancy and water carriage systems- Types of sewerage systems and their suitability – separate, combined and partially separate- Quantity of Sewage-

Quantity of discharge in sewers, dry weather flow, variability of flow, limiting velocities of sewers- Surface drainages – requirements, shapes=Different shapes of cross section for sewers – rectangular, circular, egg shaped – merits and demerits of each. Brief description and choice of types of sewers – stone ware, cast iron, cement concrete, pre cast sewers, AC pipe. Sewer appurtenances:- location, function and construction of Man holes, Drop man holes, Catch basins , Flush tanks and Inverted siphon -(Brief description only).Necessity of pumping sewage – location and component parts of pumping station Sewage characteristics:- Strength of sewage, sampling of sewage, characteristics of sewage – physical, chemical and biological – significance of the following tests for –Solids, Oxygen demand, BOD, COD,Phvalue, Chlorides

SEWAGE TREATMENT AND DISPOSAL:- Preliminary treatment – brief description and functions of Screens, Skimming tanks and Grit chambers. Primary treatment – brief description and functions of plain sedimentation Secondary treatment – brief description of Trickling filters, Activated sludge process, Secondary clarifier and Sludge digestion, drying, disposal. Miscellaneous treatment: – septic tank – imhoff tank - Calculation of dimension of a septic tank from a given data. Sewage disposal – dilution, disposal on lands, oxidation ponds, oxidation ditch, aerated lagoons, an aerobic lagoons. (brief description only) Drainage and Sanitation in Buildings (brief description):- Sanitary fittings – traps, water closets,

flushing cisterns, urinals, inspection chambers, anti syphonage pipe. Rural sanitation and sanitary latrines, brief description of operational details of bio-gas plants using cow dung, night soil and agricultural wastes Pollution Control Board: - The functions with respect to monitoring and control of air and water pollution. **(10 Marks)**