DETAILED SYLLABUS FOR THE POST OF WORK SUPERINTENDENT IN AGRICULTURE DEVELOPMENT AND FARMERS WELFARE - DIRECT RECRUITMENT

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(Cat.No: 445/2022)

Module I (10)

Surveying And Levelling

Surveying – basic principles - purpose of surveying – methods of surveying - linear measurements. Chain surveying – types of ranging – direct ranging and indirect ranging – chaining – types of chains - ranging rod - offsets – types and measurement of offsets – cross staff – optical square - degree of accuracy in chaining- Triangulation, intersection, traversing, cross staff survey. Compass Surveying – Prismatic compass - Surveyor's compass – whole circle and reduced bearings - true and magnetic bearing – dip and declination – local attraction. Plane table survey - methods – radiation – intersection – traversing - Two-point problem and three-point problem. Leveling – Types of benchmarks – Rise and fall method - height of collimation method - Contouring – Profile surveying - Cross section survey. Theodolite Surveying – parts of a theodolite – measurement of angles. Tacheometric surveying- stadia system- fixed and movable hair methods – instrument constants - tangential tacheometry. Computation of area and volume – Simpson's rule - planimeter - trapezoidal and prismoidal formula. Use of Minor instruments - Hand levels - Clinometer. Total station and GPS survey – Remote Sensing, Geographical Information System.

Module II (5)

Building drawing and estimating

Building drawing- planning of building as per National Building Code and KBR - Residential and public buildings - plan, section and elevation of buildings (residential and public) for the given plinth area and requirements. Estimate of a building – estimating principle - methods of estimating - separate or individual wall method - centre line method. Main items of work - Earthwork calculations - R.C.C. work - flooring, roofing, plastering, doors, windows, wood work, iron work, aluminum work and lump sum items. Types of estimates – preliminary estimates and detailed estimates of buildings - estimate of a small building. Schedule of rates, Analysis of rate. Valuation - methods of valuation -book value, market value, scrap and salvage value

Mensuration -definition and related important terms – perimeter – area – volume - curved surface area - lateral surface area – total surface area - mensuration formulas for 2D and 3D shapes.

Module III (8)

Building Materials and Construction

Building Materials – Stones and bricks - tiles, lime, cement, concrete, sand - glass, rubber, plastics, iron, steel, Aluminium and timber – types, properties and uses of the various building materials – tests for building materials. Manufacturing of bricks and cement – Hoffman's kiln- ball mills and tube mills - Fire clay bricks - Substitute for bricks - concrete blocks, sand lime bricks and fly ash bricks. Cement concrete – properties – Reinforced Cement Concrete and Plain Cement Concrete – water cement ratio and its importance - workability of concrete -slump test, compaction test - mixing, transportation and placing of concrete – curing of concrete – Mortar - types of mortar. Building construction - stone masonry, brick masonry: technical terms and classifications – bonds in brickwork: English and Flemish bonds- Components of a building and its classifications - lintels, arches, stair cases - doors and windows, roofs – classification of roofs and types of roofing materials, different types of floors and floorings, damp proofing and water proofing, plastering, pointing, white washing, distempering and painting. Functional requirements of a building - types of agricultural buildings.

Module IV (5)

Earthwork and Road Making

Role of road in agricultural purposes. Classification of roads – factors to be considered in road alignment. Surveys and Investigations for Road Improvement Projects - topographical surveys, geotechnical and material surveys, pavement surveys and investigations. Cross section of road – various components – camber, gradient, horizontal and vertical curves, transition curves, super elevation. Cross drainage structures. Pavement - types, components and functions - Pavement materials –aggregates, bituminous binders and mixes, cement and cement concrete mixes, alternate materials. Types of equipment used in road construction - Equipment for earthwork, hauling and spreading - Dozers, excavators, loaders, hauling units, graders – application, types and different parts. Productions of aggregates and mixes - Crushers- types, factors effecting the production - Pug mill for production of wet mix macadam -Hot bituminous mix plants - concrete batching plant. Paving and Compacting Equipment - Pavers – components, types of pavers - Compactors – types and application.

Module V (12)

SOIL AND WATER CONSERVATION ENGINEERING

Introduction; soil erosion - causes, types and agents of soil erosion; water erosion - forms of water erosion, mechanics of erosion; Effect of slope, slope length, soil, vegetation, topographical features and rainfall on erosion. Gullies and their classification, stages of gully development; soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters. Erosion control measures agronomic measures - contour cropping, strip cropping, mulching; mechanical measures - terraces – level and graded broad base terraces and their design, bench terraces and their design. Bunds - contour bunds, graded bunds and their design; gully and ravine reclamation - principles of gully control - vegetative and temporary structures; control measures for stream bank and

coastal erosion. Landslides-factors causing it, land slips, Measures for control; Sedimentation-sedimentation in reservoirs and streams; Estimation and measurement, sediment delivery ratio, trap efficiency; Land use capability classification; Grassed waterways and their design; Introduction to water harvesting techniques. Use of Geotextiles in soil and water conservation; Wind erosion - factors affecting wind erosion, mechanics of wind erosion, wind erosion control measures- wind breaks and shelterbelts, sand dunes stabilization.

Module VI (12)

IRRIGATION ENGINEERING

Nature and Scope of Irrigation Engineering. Necessity of irrigation – advantages and disadvantages – perennial and Inundation irrigation – flow and lift irrigation – direct and storage irrigation. Water requirement of crop. Principal Crops – Kharif and Rabi Crops in India & Kerala – Dry and wet crops – Crop period. Duty and Delta– base period – relationship between base period, duty and delta. - Factors affecting duty – requirements for precise statement of duty – duty figures for principal crops – Simple problems on duty. Head works: 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. Evaporation – Evaporation losses in reservoirs (only brief description). Dams – types – selection of site – site investigations – capacity of reservoirs from contours – dead storage – live storage, rigid and non-rigid dams – main types – gravity dams – failure of gravity dams and remedial measures. 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. Tank sluices – tower head type – regulating arrangements. Distribution works: Canals – classification – typical cross section of canal in cutting, embankment, partial cutting and embankment – berms – standard dimensions – balancing depth of cutting- canal lining – types – maintenance of canals. Canal regulation. Rotational water supply. People's participation in canal management**.** Methods of irrigation – border irrigation – check- basin irrigation – furrow irrigation. Micro irrigation methods- drip irrigation- sprinkler irrigation–fertigation- design – installation- operation and maintenance

Module VII (10)

HYDRAULICS AND PUMPS FOR IRRIGATION

Scope of hydraulics in engineering. Density, specific volume, specific gravity, viscosity. Kinematics & dynamic viscosity, compressibility, vapour pressure, cohesion, adhesion, surface tension and capillarity. Units of pressure – Pascal's law–Atmospheric pressure – Gauge pressure – Absolute pressure – vacuum pressure – problems. Measurements of atmospheric pressure – simple mercury barometers – pressure measuring devices – piezometer tubes, manometers – U-tube – simple differential and inverted tubes only – Mechanical Gauge – Bourdon tube pressure gauge. Equation of continuity of flow – Problems. Types of energy need – static, pressure and velocity energy need – total energy of flowing liquid. Expressions for energy. Fluid pressure expression- height liquid column.

Bernoulli's theorem– Assumptions and limitations – application – Venturimeter, Orifice meter and Pitot tube – problems.
Flow through Orifices & Mouth pieces: Definition of orifice, types of orifices – (based size, shape flow condition) – definition of vena contracta – hydraulic coefficients – Cv, Cc, Cd – experimental determination – problems.
Head loss due to sudden enlargement and sudden contraction at the entrance of pipe from large vessel, at the exit of a pipe line, obstruction in a pipe line. Mouth piece – different types – external and internal- cylindrical – formula for discharge through them and problem. Notches: Definition, types of notches and discharge over notches – rectangular, triangular and trapezoidal notches - problems.
Flow through Pipes: Frictional loss in pipes – Chezy's and Darcy's formulae – problems Hydraulic gradient and total energy line-Water hammer and its effect (description only) Syphon- problems. Flow through Channels, Wetted perimeter Hydraulic mean depth- uniform and non-uniform flow – Chezy's formula –problems, Kutter's, Mannings and Basin's formula – Most economical section of channel – condition for rectangular and trapezoidal - problems
Pumps: Centrifugal pumps, reciprocating pumps – working principle-description of propeller pumps, jet and air lift pumps, deep well pumps, Diaphragm pumps -description and application. Drainage pumps-Axial flow – *Petti and Para*- installation-care and maintenance. Centrifugal pumps – Components- characteristic curves- Pumps in series and parallel- Pump selection- Energy requirements in pumping. Energy conservation in pumping systems. Pump installation- care and maintenance- troubleshooting. Electrical installations for pumps- starters- DOL-star delta-connection diagram- panel board.

Module VIII (15)
FARM POWER AND MACHINERY

Agricultural mechanization – scope, objectives, limitations. Status indicators, status of mechanization in Kerala. Agricultural implements- simple machines- hand tools and manual soil working implements. Field capacities and efficiencies: Calculations. Concept of work, power and energy- Energy efficiency- Energy use in agriculture – Sources of farm power. Measurement of power-Force-work -indicated Horse power-Brake horse power-Drawbar horse power-Mechanical efficiency. Internal combustion engine- CI & SI engines - types, classification, parts and principles - Principles of two & four stroke cycle engines - Firing orders - valve timing. Prime movers in agricultural farms- Tractors & power tillers- Types - Selection of tractors and tillers. Tractors and their power units - Fuel supply and carburetion system - Ignition, Cooling, lubrication and governing system. power transmission- clutch-gear box- differential- final drive. Brake system. Tyres, cage wheels. Power tillers – Power transmission system. Tractor - hydraulic system - three-point linkage – position and draft control. Cost of operation of farm machinery. Field capacities and efficiencies: Calculations. Tillage- implements and machinery for primary, secondary tillage operations – puddling implements - rotary tillers – rotavators. Ridgers, bund formers. Implements and machinery for seeding and planting – Seed drills, transplanting equipment. Tools and implements for intercultivation operations – manual weeders, power weeders – brush cutter. Equipment for

plant protection- calibration. Harvesting, threshing and winnowing machinery- reapers and combine harvesters. Paddy cultivation equipment.

Module IX (15)

POST HARVEST ENGINEERING

Post harvest technology of Cereals, Pulses and Oil seeds, post-harvest losses, importance, basic engineering properties of food materials. Basic psychrometric properties of air-water-vapour mixture. Processing of cereals - rice processing, cleaning and grading, parboiling of paddy, drying, shelling, polishing, by-product utilisation, modern rice mills. Oil seed processing - processing of Coconut- de husking, drying, oil milling - pre-treatments, screw press, oil filtration, wet processing of coconut, value added products, coconut-based beverages- process and equipment, by-product utilisation. Processing of pulses - basic operations and flow charts of pulse processing, pre-treatments, pulse milling-process and equipment. Dairy engineering –principles and equipment for receiving, cleaning, cream separation, pasteurization, sterilization, homogenization, drying filling and packaging of milk. Common plantation crops in India. Processing of plantation crops: Tea, coffee, cocoa, arecanut, rubber, cashew nut and oil palm- processes and equipment and by-product utilization. Processing of spices and condiments: Pepper, cardamom, ginger, vanilla, and turmeric and chilies- value added products. Major Horticultural crops in India. Recommended storage conditions of fruits, vegetables and flowers. Harvesting- pre-cooling - cleaning- washing and grading. Handling-storage-refrigerated-Modified and Controlled atmosphere storage-Refrigeration: - drying and dehydration– importance –Types of dryers. Processing of important fruits and vegetables-banana, mango, pineapple, tomato and mushrooms. Packing and transportation of fruits, vegetables and flowers. Packaging: Principles- selection and requirements. Refrigeration - Definitions – principles of refrigeration, common refrigerants. Units of Refrigeration – Enthalpy, Entropy – Applications of Refrigeration – Gas laws, thermodynamic laws. Reversible cycles, Carnot theorem, Vapour compression system and Vapour Absorption system – Condensers, Evaporators, Compressors and Expansion valves. Freezing – Factors affecting freezing – Design and construction of cold storage. Food cold storages. Air conditioning – Psychrometry-Psychrometric charts – Classification of air conditioners – Central air conditioning – Equipment.

Module X (8)

FARM BUILDINGS AND STRUCTURES

Planning and layout of farmstead. – Dairy and poultry housing and design requirements. Design, construction and cost estimation of farm structures; such as, compost pit, fodder silo, fencing and implement sheds etc. Site and orientation of building in regard to sanitation, community sanitation system; sewage system its design, cost and maintenance, design of septic tank for small family. Design of bio gas plant. Storage of grains -Introduction, need and importance, general principles of storage, temperature and moisture changes during storage. Influence of moisture content, relative humidity, temperature, fungi etc. on stored product. Familiarization with the various types of storage structures. Deep and shallow bins.

Design and construction of rural grain storage system. Study of modem storage structures. Green house technology-Basic approach and scope in India-attributes of greenhouse technology-types of greenhouses-green house environment control.

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