



**NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT**  
**SYLLABUS FOR THE WRITTEN EXAMINATION FOR THE POST OF**  
**ASSISTANT MANAGERS IN GRADE 'A'**  
**WATER RESOURCES**

**THE SYLLABUS IS ONLY ILLUSTRATIVE AND NOT EXHAUSTIVE**

The syllabus is illustrative and not exhaustive. The syllabus should not be considered as the only source of information while preparing for the examination. Keeping in view the nature of examination, all matters falling within the realm of the subject concerned will have to be studied by the candidate as questions can be asked on all relevant matters under the subject. Candidates appearing for the examination should also prepare themselves for answering questions that may be asked on the current/latest developments/Acts taking place under the subject(s) although those topics may not have been specifically included in the syllabus.

**Water Requirement of Crops :**

Crop period, duty, delta of crop, duty of water, relation between duty and delta, irrigation efficiency, consumptive use of water, soil moisture relationship, soil-moisture deficiency, estimating depth and frequency of irrigation on the basis of soil moisture regime concepts.

**Canal Irrigation System :**

Alignment of canals, watershed canals, contour canals, side shape canals, distribution system for canal irrigation, main canal, branch canal, distributaries, minors, water courses, curves in channels, gross command area, culturable command area, irrigation intensity, time factor, area factor, determination of channel capacity, channel losses, evaporation, seepage (percolation and absorption), seepage loss factors, empirical formulas for channel loss, sediment transport and load, mechanics of sediment transport, design of channels in coarse alluvium, shields entertainment method for channel with protected bank, regime channels, Kennedy's theory, critical velocity rates, design procedure, Kutter's formula, Manning's formula, negosity co-efficients, Chery's formula, Lacey's theory, Lacey's regime channels, lining of irrigation canals and economics of lining.

**Hydrology :**

Definition, hydrologic cycle, rainfall and its distribution, run-off and surface run-off, yield of drainage basis, sub-surface run-off, hydrograph, infiltration, soil moisture, field capacity, infiltration capacity curve and its equation, small and large watershed, precipitation and its measurement, frequency of storm intensity duration curve, stage discharge curve, velocity of flow in a stream, time of concentration of a catchment, valley storage, unit hydrograph theory, computation of run-off from rainfall, flood discharge and design flood.

**Ground Water, Hydrology and Construction of Wells and Tubewells :**

Drainage of ground water, ground water reservoir, occurrence of ground water, porosity yield, specific yield, specific retention of different kinds of formations, determination of specific yield, permeability, transmissibility, velocity of ground water, hydraulics of wells, aquifers and

acquicludes, non-artesian, requifers, artesian aquifers and artesian wells, specific capacity, infiltration wells, infiltration galleries, measurement of yield by theoretical and practical method, pumping test and recuperation test, Thiem's equilibrium formula for confined and unconfined aquifers, well interference, well loss and specific capacity, open wells and dug wells, different methods of recharging, various types of tubewells and its construction, methods of drilling of tubewells, well casing and screens, gravel packing, design of strainer, pumping arrangement.

### **Diversion Head Works :**

Principles and design of weir and barrage, gravity and non-gravity weirs, layout of diversion headworks, diversion weir, types of weirs, masonry weirs with vertical drops, the under sluices, the canal head regulator, silt control works, causes of failure by piping and by uplift.

### **Canal Falls, Canal Regulators :**

Types of falls and their design, design of head regulator and cross regulator.

### **Cross Drainage Works :**

Aqueducts and siphon, level crossing principles and design.

### **Dams and Reservoirs :**

Basic principles of reservoir planning, types of dams and their characteristics, selection of dam site, investigations (Engineering, Geological and Hydrological) combination of forces for design of dams, modes of failure and criteria for structural stability of gravity dams. Elementary profile of a gravity dam, construction of gravity dam, cracking of concrete in gravity dam, joints in gravity dam, keyways, water stops and foundation treatment for gravity dams.

### **Spillage, Gates and Energy Dissipators :**

Definition, location, design consideration, various types of spillways, design of crest of ogee spillway, cavitation, energy dissipators below overflow spillway and their design, use of hydraulic jump as energy dissipator, stilling basin, types of gates and their characteristics.

### **River Control :**

Scope and objective of river control, marginal embankment, spurs, cut-offs, launching apron.

### **Sanitation :**

Basic sciences for wash and sanitation, public health and hygiene, water supply, solid waste management.