

NET - ARS syllabus for Land and Water Management Engineering

Unit 1: Groundwater Development, Wells and Pumps

Water resources of India. Irrigation potential and contribution of groundwater, utilizable groundwater resources and level of groundwater development in the country, scope of groundwater development. Aquifer types and parameters. Principles of groundwater flow, interaction between surface and groundwater, natural and artificial groundwater recharge. Hydraulics of fully and partially penetrating wells. Design, construction and development of irrigation wells. Water lifts, pumps and prime movers, well and pumps characteristics, performance evaluation and selection of pumps. Energy requirement in groundwater pumping. Design of centrifugal pumps. Groundwater pollution. Salt water intrusion in inland and coastal aquifers. Application of groundwater models for groundwater development and management. Conjunctive use of surface and groundwater.

Unit 2: Open Channel Hydraulics

Hydraulics of open channel flow, energy and momentum principles, specific energy, Hydraulic jump and its classification. Design of different types of irrigation channels. Irrigation water measurement: using velocity area method, water meters, weirs, notches, flumes, orifices etc. Water conveyance and control. Conveyance losses and lining of irrigation channels. Irrigation water delivery and distribution.

Unit 3: Soil, Plant, Water and Atmosphere Relationship

Soil and water as vital resources for agricultural production. Water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, plant available water and extractable water. Soil irrigability classifications, factors affecting profile water storage. Determination of soil water content, computation of soil water depletion, soil water potential and its components, hydraulic head. Field water budget water gains and water losses from soil, deep percolation beyond root zone, capillary rise. Evapotranspiration (ET) and irrigation requirement, critical stages of crop growth in relation to irrigation. Irrigation scheduling. Plant water relations, concept of plant water potential, significance of osmotic adjustment, leaf diffusive resistance, canopy temperature, canopy temperature depression (CTD). Water movement through soil plant atmosphere system. Uptake and transport of water by roots. Development of crop water deficit, crop adaptation to water deficit, morpho physiological effect of water deficit. Drought tolerance, mechanisms of drought tolerance, potential drought tolerance traits and their measurements. Management strategies to improve crop productivity under limited water supplies. Contingent crop plans and other strategies for aberrant weather conditions. Cropping patterns, alternate land

Unit 4: Hydrology and Soil and Water Conservation

Hydrologic cycle, precipitation, infiltration and surface runoff. Measurement and analysis of

hydrologic data. Application of statistics in hydrology. Probability concepts. Distributions and application. Intensity duration frequency analysis. Hortonian and saturation overland flow theories, partial source area concept of surface runoff generation. Rainfall and runoff relationships, stream gauging and runoff measurement. Different methods of surface runoff estimation, hydrographs, S-hydrograph, IUH, unit hydrograph theory and its application, Flood routing methods and calculations. Soil erosion and types of erosion. Soil loss measurement and estimation. Universal soil loss equation and subsequent its modifications, soil and water conservation structures and their design. Gully control structures and their design. Design and construction of farm pond and reservoir. Seepage theory. Design of earthen dams and retaining walls, stability analysis of slopes. Mathematical models and simulation of hydrologic processes. Application of GIS in soil and water conservation.

Unit 5: Watershed Management

Watershed concept, Identification and characterization of watersheds. Hydrological and geomorphological characteristics of watersheds. Land capability and irrigability classification and soil maps. Principles of watershed management. Development of watershed management plans, its feasibility and economic evaluation. Land levelling and grading, machineries and equipments for land levelling.

Unit 6: Irrigation Water Management

History of irrigation in India. Management of irrigation water. Major irrigation projects in India. Crop water requirements. Soil water depletion, plant indices and climatic parameters. Crop modeling, water production function. Methods of irrigation, surface methods, overhead methods, Pressurized irrigation system such as drip and sprinkler irrigation. Merits and demerits of various methods. Hydraulics of furrow, check basin and border irrigation, Hydraulics and design of pressurized irrigation systems. Irrigation efficiency and economics of different irrigation systems. Application and distribution efficiencies. Agronomic considerations in the design and operation of irrigation projects, characteristics of irrigation and farming systems affecting irrigation management. Irrigation legislation. Irrigation strategies under different situation of water availability, optimum crop plans and cropping patterns in canal command areas. Quality of irrigation water and irrigation with poor quality water. On farm water management, socioeconomic aspects of on farm water management. Scope for economizing the use of water.

Unit 7: Management of Degraded, Waterlogged and Other Problematic Soils and Water

Problem soils and their distribution in India. Water quality criteria and use of brackish waters in agriculture. Excess salt and salt tolerant crops. Hydrological imbalances and their corrective measures. Concept of critical water table depths for crop growth. Contribution of shallow water table to crop water requirements. Management strategies for flood prone areas and crop calendar for flood affected areas. Crop production and alternate use of problematic soils and fish production. Agricultural field drainage and theory of flow in saturated soil. Flow net theory and its application. Drainage investigations. Drainage characteristics of various type of soils. Water table contour maps and isobaths maps. Drainage coefficient. Design and installation of surface and subsurface drainage system. Interceptor and relief

drains and their design. Drain pipe and accessories. Pumped drainage. Drainage requirements of crops. Drainage in relation to salinity and water table control. Reclamation of ravine, waterlogged, swampy areas and polders. Saltaffected soils and their reclamation. Command area development organizational structures and activities. River valley projects, interstate disputes. Water rights and legal aspects. Irrigation water users' association concept and responsibilities. Environmental considerations in land and water resources management.

