

SYLLABUS

for IRRIGATION AND DRAINAGE SYSTEMS AND PUMPING STATIONS

1. Melioration and *Irrigation and Drainage Systems* (IDS) – Definitions, Place and Connection with Other Systems. Characteristics. Historical Data. General Assessment of Necessity of Irrigation or Drainage.
2. Factors of Soil Fertility. Soil Water (Soil Moisture).
3. Soil Moisture Dynamics. Soil Water Movement – Percolation (Infiltration) and Filtration.
4. Drainage Systems – General. Protection of the Agricultural Land From Superfluous Surface Water. Contour Open Channels. Dikes. Typical Structures. Open Trench Systematic Drainage For Surface Water. Open Channel Transfer Network.
5. Drainage Systems. Filtration Area and Filtration Flow – Calculating Schemes. Filtration Area Characteristics. Types of Drainages. Protection of the Agricultural Land From External Superfluous Subsurface Water. Coastal and Intercepting Belt Drainage.
6. Drainage Systems. Protection of the Agricultural Land From Internal Superfluous Subsurface Water. Closed Tube Systematic Drainage – Main Parameters. Regulating and Transfer Networks. Construction of the Drainage. Typical Structures.
7. Irrigation Systems. Pattern of an irrigation system. Purpose and Types of Irrigation. Principles of Water Distribution. Irrigation System Efficiency.
8. Designing Parameters of an Irrigation System. Water demand for irrigation. Irrigation regime of agricultural crops.
9. Irrigation Under Water Shortage. Yield-Water relationship. Water Economic Investigations – General.
10. Runoff Regulation for Irrigation. Balance-Chronological Methods.
11. Runoff Regulation for Irrigation. Balance-Statistical Methods.
12. Main Types of Irrigation. Technologies and Techniques of Surface (Furrow) Irrigation. Typical Structures.
13. Main Types of Irrigation. Sprinkler Irrigation. Sprinklers – Main Parameters. Rainfall Uniformity. Irrigation Machines and Irrigation Equipment.
14. Main Types of Irrigation. Sprinkler Irrigation Fields – Patterns, Design Methods and Network Construction. Armatures.
15. Main Types of Irrigation. Drip (Trickle) Irrigation. Subsurface Irrigation. Basic Design Principles.
16. Pumping Stations – General. Pumping Stations Types. Basic Equipment of the Pumping Stations – Machinery, Armatures.
17. Water Flow Energy. Energy Balance. Energy Classification of the Pumps. Turbo Pumps. Centrifugal Pumps – Construction and Types of. Application Area of Different Pump Types.
18. Theory of the Centrifugal Pumps – Basic Relationships. Theoretic, Real and Catalogue Performance ($Q-H$) Curves.

19. Modeling of Pumps. Similarity – Types of (Geometric, Cinematic and Dynamic). Similarity Laws for Centrifugal Pumps. Specific Speed n_s . Hydraulic Classification of Turbo Pumps According to n_s .
20. Modification of Centrifugal Pump Performance Curves by Impeller Diameter Reducing and by Revolution Changing.
21. Pumping Stations Design Parameters – Discharge (Demand) and Total Head. Operating Conditions. Number and Type of Pump Units Determination. Hydraulic Losses in Suction and Discharge Pipelines of a Pump.
22. Cavitation, Admissible Suction Head and Net Positive Suction Head (*NPSH*). Determination of Pump Axis Elevation.
23. Combined Pump Operation Analysis. Characteristics of a Pump and a Pipeline. Operation of a Single Pump with a Single Pipeline. Operation of Centrifugal pumps in Parallel and in Series.
24. Combined Pump Operation Analysis. Typical Cases of Irrigation Pumping Stations in Open Type Supply Systems. Cases of Irrigation Pumping Stations in Semi-open Type Supply Systems.
25. Irrigation Pumping Stations in Closed Type Supply Systems. Characteristic Curve of an Pressurized Irrigation Network. Performance Analysis of the System.
26. Pump Discharge Amount Control Methods. Valve Opening Degree Control, Revolution Control, Discharge and Demand Synchronization by Balancing Reservoir. Optimization Investigations for the Irrigation and Drainage Pumping Station.
27. Water Hammer in Pumping Facilities – Reasons for Appearance, Essence and Development Stages of the Process. Equipment and Measures Against the Water Hammer.
28. Basic Layout Planning of a Pumping Station – Water Intake, Delivery Canal, Suction Sumps and PS Building.
29. Basic Layout Planning of a Pumping Station – Pipeline (Penstock), Outlet Structure and Balancing Reservoir.
30. Drainage Pumping Stations. Groundwater Pumping Stations, Pumped-storage Water Power Plants – specifics.

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