

## Course Information Sheet

Title	<b>Water quality indices- irrigation&amp; potable water course</b>
Duration	5 Days
Instructor	DR/ AMR ALI
Course Description	<p>the course provides a framework and knowledge of the issues, aspects and principles in water quality management. Good quality water is necessary for environmental, industrial, recreational and agricultural uses. For those working in water analysis and management, it is important to understand the rationale and be competent in the characterization of water quality in natural systems and the human activities that result in contaminant input to these systems. This includes the physical, chemical, biological and hydrological characteristics of water systems in junction to water quality management issues.</p>
Course Objective	<p><b>By End of the courses, Attendees will be able to:</b></p> <p>introduce concepts of water quality to water professionals. Build a comprehensive awareness of the physical, chemical and biological characteristics of various water systems. Learn ways to improve water quality through management and control of chemically, physically and biologically polluted waters. Learn up-to-date knowledge and skills on significant of water analysis and quality control techniques included evaluation and analysis of laboratory data results.</p>
Who should Attend	<p>this course designed for Supervisors, chemists and technicians responsible for water quality in plants. This training course is suitable to a wide range of professionals but will greatly benefit:</p> <ul style="list-style-type: none"> <li>▪ Laboratory Staff involved in water plant</li> <li>▪ Operation and maintenance staff of water plants</li> <li>▪ Personnel who is responsible for protecting the aquatic environment</li> <li>▪ Personnel responsible for operating water in different companies</li> </ul>

	<ul style="list-style-type: none"> <li>▪ In general, All workers in the field of water management</li> </ul>
Organizational Impact:_	improvement the skills of employees are not less important than improvement the efficiency of equipment within the various institutions. From this point of view, if you want to invest in your human resources welcome to your employees in training course.
Personal impact:	value in field of work increases by increasing theoretical and practical experiences, every information you gain in working life increases your value in the work environment. From this point of view, we invite you to participate in this training program to increase your skills through lecturers at the highest level of experience in the field of water treatment for various industries technologies
Course Subjects	<p><b>Day 1</b></p> <ul style="list-style-type: none"> <li>▪ Source water quality consideration</li> <li>▪ Necessity of water treatment</li> <li>▪ Basic chemistry of water</li> <li>▪ Properties and characteristics of water               <ul style="list-style-type: none"> <li>Chemical, physical and biological characteristics of water</li> <li>Characteristics of sea water</li> <li>Characteristics of industrial waste water</li> <li>Characteristics of boiler feed water</li> </ul> </li> <li>▪ Water borne impurities</li> <li>▪ Nature and sources of water pollution</li> <li>▪ Problems caused by impure water</li> <li>▪ Water sampling and samples preparation               <ul style="list-style-type: none"> <li>How to sample from different sources</li> <li>Sample points and sample plans</li> <li>Types of water sampling ( online- at line- inline- offline)</li> <li>Types of water samples ( grab, composite and integrated)</li> <li>Preservation and handling of water samples in labs</li> <li>Types of analysis methods ( qualitative and quantitative)</li> </ul> </li> </ul>

Instrumental method in analysis (spectroscopic and chromatography)

## Day 2

- Chemistry of Water
  - Water desalination
  - waste water terminologies
  - Properties of produced water
  - Characterizing oily industrial waste water
  - The general parameters in common with municipal waste water
  - Environmental regulations
  - Water specifications
  - Factors affecting the water treatment
  - Process and equipment design
  - Chemical treatment
  - Chemicals used in water treatment
  - Study of water treatment real cases
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- Evolution of Water Treatment Technology
  - Selection of Water Treatment Processes
  - Treatment Process Configurations
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- o Drinking water treatment
  - o Boiler feedwater treatment
  - o Cooling water treatment
  - o Oilfield water treatment

### **Why water Desalination?**

- Feed-water pretreatment
- Coarse intake screens, Fine screens, Raw water storage
- Algae, algal control and reservoirs, Pre-chlorination
- Aeration, Pre-settlement basins
- Coagulation
- Flocculation
- Sedimentation and Flotation
- Clarification
- Biological Treatment
- Filtration

## Water desalination process technology

- Thermal Distillation Desalination:
  - o Multi-Effect Distillation (MED)
  - o Multi-Stage Flash (MSF)
  - o Membrane Distillation
  - o Vapor Compression
- Membrane Desalination:
  - o Reverse Osmosis (RO)
  - o SWRO - Sea Water Reverse Osmosis
  - o BWRO - Brackish Water Reverse Osmosis
  - o ED - Electro Dialysis
- Ion Exchange Desalination
- Freezing Distillation Desalination
- Hybrid desalination plant: (MSF or MED) and RO plant.
- Sizing of water Desalination plant

## Day 3

### Domestic and industrial wastewater

- Effect of untreated wastewater in water bodies
- Contaminants of concern in wastewater treatment
- Characteristics of Sewage
- Variation and expression of strength of sewage

### **Waste Water Treatment**

- Septic systems
- Lagoon systems
- Wastewater garden
- Wastewater treatment methods
- Wastewater treatment plant size and cost
- Wastewater treatment plant and drainage system projects

### **Preliminary waste water treatment**

- Coarse intake screens
- Algae, algal control and reservoirs
- Fine screens
- Aeration

- Pre-settlement basins
- Odor control

### **Primary treatment**

- Coagulation
- Flocculation
- Sedimentation and Flotation
- Clarification
- Oily water separators
- Biochemical Oxidation Treatment (BOD, COD)

### **Secondary treatment**

- **Filtration**
- **Softening and Ion Exchange**

#### **Precipitation Softening**

- Soda Lime Softening
- Types of Ion Exchange Reactions
- Ion Exchanger Operation
- Selection of an Ion Exchange Process

### **Tertiary treatment**

- **Biological Treatment**
- **Algaecides & Biocide**
  - **Biochemical Oxidation or Biological Treatment**
- **Aerobic biological treatment (presence of DO)**
  - Biofilters
  - Activated-Sludge Process
    - Conventional Activated Sludge
    - Membrane Bio-Reactor - MBR
    - Sequential Batch Reactor “SBR” Process
    - Trickling Filter “ Biological Air Filters”
  - Aerated pond - Lagoon
  - Waste Stabilization Pond

- **Anaerobic biological treatment (absence of DO)**
  - Anaerobic Contact Reactor (ACR) - Biogas reactor
  - Denitrification (tertiary)
  - Septic tanks
  - Anaerobic Ponds
  - Bioremediation
- **Disinfection**
  - Chemical Disinfection
    - Chlorination
    - Ozonation
  - Physical Disinfection
    - UV Disinfection
  - Disinfection By-Products
  - Control of Oxidation/Disinfection By-Products

## Day 4

### Water lab analysis

- Produced Water & Drinking Water Technical Index Testing and Practice
- pH (ASTM-D-1293)
- alkalinity and acidity
- Iron Content (ASTM-D-1068)
- Total dissolved solids (TDS) (ASTM-D-5907)
- TS and TSS
- Oxygen demand DO, COD and BOD
- Conductivity (ASTM-D-1125)
- Chlorine content (ASTM-D-1253)
- Turbidity (ASTM-D-1889)
- Hardness (ASTM-D-1126)
- Chloride (ASTM-D-512)
- Sp. Gravity (ASTM-D-1429)

- Sulfate (ASTM-D-516)
- Calcium and Magnesium (ASTM-D-511)
- Total Coliforms and Escherichia Coli in Water ( EPA - 1604 )
- nutrients analysis Nitrite, nitrates, Ammonia and Kheldal no.
- Sulphides, sulphate, phosphates
- Silica
- Cyanides
- Organic contaminants & Toxic Organic Compounds
- Oil and grease analysis
- Radioactive contaminants
- Metals analysis (Si, Fe, Cu...etc)
- TOC
- Pathogenic microorganisms

Analysis for Chemicals used in water treatment Disinfection

- o Chemical Disinfection (Chlorination, Ozonation, ....)
- o Physical Disinfection (Heat, UV, ....)
- o Disinfection By-Products
- o Control of Oxidation/Disinfection By-Products

- Chemicals used in water treatment :
- Water clarifier & Coagulation chemicals
- Oil/ water Emulsion breakers, Oil dispersion
- Polymers - Water Treatment
- Water Disinfection Chemicals
- pH Adjusters
- Corrosion inhibitors
- Scale inhibitors
- Antifoams & Defoamers
- Oxygen Scavengers
- Membrane Reverse Osmosis (RO) chemicals
- Chemical biocides
- Microbiological control
- Odor Control
- Water Softening Chemicals

### **USE OF WATER IN IRRIGATION**

- Definition of irrigation
- Introduction to irrigation principles

- Irrigation water quality
- Salinity types, problems and their management in irrigated agriculture
- Groundwater contribution through capillary rise to the root zone
- Irrigation requirements
- Irrigation efficiencies

## Day 5

- Lab accreditation
- Accreditation authorities
- Results assessment
- ISO 17025
- Administrative needs for iso 17025
- Technical needs for iso 17025
- Quality evidence
- Mean
- Variation
- Standard deviation
- Coefficient of variation
- Probability distribution
- Z-score
- Bias
- Repeatability
- Reproducibility
- Uncertainty definition
- Measurement and reporting of uncertainty
- Benefits of uncertainty estimation.
- Quality system
- Quality control samples
- Quality of test results
- Internal and external quality control
- Control charts
- Handling and safety aspects of dealing with chemicals :
- HAZARD.
- Exposure
- Health Risk
- Hazard Identification
- Risk
- Hazard And Risk
- Risk Assessment
- Accident
- Workplace Hazards



	<ul style="list-style-type: none"> <li>▪ Occupational Hazards</li> <li>▪ Chemical Hazards</li> <li>▪ Measures of concentration of toxic substances</li> <li>▪ Maximal Allowable Concentration (MAC)</li> <li>▪ Threshold</li> <li>▪ Classification of Toxic Effects</li> <li>▪ Acute Toxicity Levels</li> <li>▪ Health Hazards</li> <li>▪ Health Effects</li> <li>▪ Chemical Categories</li> <li>▪ Chemical Storage -Hazard Class</li> <li>▪ Some of Warning Labels</li> <li>▪ Right To Know (RTK) LABELS</li> <li>▪ Supplier's Label</li> <li>▪ Chemical Hygiene Plan</li> <li>▪ MSDS.</li> <li>▪ Laboratory Safety Equipment</li> <li>▪ Fire Safety Equipment.</li> <li>▪ Waste Disposal</li> </ul>
Course Related Standards	ASTM- IP-IRCA
TRAINING METHODOLOGY	<p>This course Methodology includes detail Explanation of the subject. All course material is PowerPoint equipped with necessary animation, learning video and general discussion to provide participant with full understanding concerning the subject course this not limited but will extended to the following:</p> <ul style="list-style-type: none"> <li>• General discussion</li> <li>• Practical session</li> <li>• Learning Examples</li> <li>• Working in teams</li> <li>• Playing Roles</li> <li>• Workshop &amp; Case Study</li> </ul>
COURSE ASSESSMENT	