Savitribai Phule Pune University

(Formerly University of Pune)

Department of Technology

Board of Studies Civil and Environmental Technology (CE)

STRUCTURE OF ONE YEAR FULL TIME POST GRADUATE DIPLOMA IN

Water Technologies & Management (PGDWTM)

Proposed Framework of Syllabus for PGD in Water Technologies & Management

SEMESTER I

Course No.	Course Title	Credits
SEMESTER I		
WTM-01	Induction + Introduction	1
WTM -02	Unit Operations in Water Treatment	2
WTM -03	Conventional Waste water Treatment	3
WTM -04	Resource Oriented Wastewater Treatment and Sanitation	3
WTM -05	Waste-Water Treatment Processes and Plant Design	3
	Semester Credits	12

SEMESTER II

Course No.	Course Title	Credits
SEMESTER II		
WTM-06	Water Transport Distribution	3
WTM -07	Data Analytics And GIS For Water Management	3
WTM -08	Advanced Water Transport And Distribution	3

WTM -09	Drought & Flood Management And Introduction To Reservoir Operations	3
WTM -10	Assignment Based Field Work	4
WTM -11	In ternship At The Host Company	12
	Semester Credits	28

SUBJECT-WISE DETAILED SYLLABUS

SEMESTER –I

WTM-01	**Induction + Introduction**	**Lectures**
	Objectives: • Describe the various concepts in civil and environmental engineering • Understand the role and responsibilities of various key persons involved in infrastructure development • Understand the need and stages involved in formulation of infrastructure project from concept to completion • Various norms and Government clearances require for th projects • Understand the water infrastructure, Hydrological cycle, concept of water management • Impact of rapid urbanization on water sector • Understand the Government of India initiative such as SMART city mission, and other mission for the improvement of urban infrastructure and other aspects of urban development like Swachha bharat Mission etc • Understand the details of guidelines as per government of India by adopting use of CPHEEO Manual on water and sanitation	
1.	• **Components of Urban Infrastructure, SMART cities, SMART villages** – **Special emphasis on water infrastructure** • Introduction to Urban Development • Urbanization in India • Patterns of Urbanization • Growth of Cities • Causes of Urbanization	

	• The cost of Urbanization • The prospect of Urbanization • Growth Trends • Understanding Urbanization • Resources for Urbanization • Urban Planning & Management • Growth of Urban Population • The spatial pattern of Urbanization • Problems of Metropolitan cities • Water issues in India	
2.	**Current plans and future projections for SMART cities and SMART villages.** • The Smart Cities Mission is an innovative and new initiative by the Government of India to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens. This will cover the GoI guideline from the concept to implementation of mission and funding pattern for various sectors under SMART City Mission. The assessment criteria for the selection, during implementation and socio-economic-cultural impact of the development. • The Adarsha Gram yojana – SMART Village is planned by GoI for the upliftment of village environment and implementation of IEC components for self-sufficiency within village. The betterment of local infrastructure and facilities to be provided at village level	
3.	**Introduction of Regulatory Authorities (e.g – CPHEEO and other policy framework)** Government of India on water supply and sanitation and it's use for water sector This manual has been developed by the Central Public Health and Environmental Engineering Organisation (CPHEEO), a department under the Ministry of Housing and Urban Affairs (MoHUA) and serves as a standard guide in public health engineering by providing a code of day to day practice for public health engineers to follow. All the water and sanitation projects need to to follow the guidelines as stipulated by CPHEEO-GoI for every project within India. There are various manual published by CPHEEO. The introduction and understanding of the relevant manual is to be discussed in this section.	
4.	**Changes in S.E.P.T. and its impact on urban growth from the context of Water and Sanitation. (S E P T – Social-Economical-Political-Technological)-**	

5	**Heat Islands Cause and Effect, Water footprint, Rain Water Management, Urban Farming and Circular Economy** This is to be covered in second semester in Assignment based field work	
6	**Basics of Hydrology and Water Cycle –** • Objectives and Policies Understanding the water infrastructure comprises of various elements and it's impact on environment. • **Hydrological cycle, its processes and storages –** I. The solar system and the formation of earth II. Radioactive Heat Production through Time III. Earth's atmosphere compare to its sister IV. Earth's Atmosphere - composition and evolution V. The Hydrosphere VI. Vertical Distribution of Ground water VII. Water Shed/ Water Budget	
7	**Basics of Chemistry and Microbiology related to Water -** **Important Concepts in Chemistry related to water** This aspect to cover the water chemistry and composition which resulting water into acids, alcohols, and many salts. Water displays capillary action because of its strong adhesive and cohesive forces. Hydrogen bonding between water molecules also gives it high surface tension which need to discuss with the relevant examples. **Contaminants of water & constituents of wastes & cleansers:** Concept of contamination and its significance on various elements, human, cattle, materials, treatment process and other elements in the environment. Various constituents polluting the water source especially from domestic, industrial and manmade activities and its effect. The effect of such pollutants on the selection of suitable treatment technology • **Biochemical processes in waste recycling:** Understanding the concept of Biological, Chemical and Biochemical-combination of both biological and chemical treatment for the waste treatment. Understanding Aerobic and Anaerobic treatment. Understanding bacteria, nematodes, or other small organisms to break down organic wastes using normal cellular processes. System of treatment for the decomposition and efficient disposal of waste water.	
WTM-02	**Unit Operations in Water Treatment**	
	Objectives	

	• Describe the theoretical principles of the unit processes: coagulation, filtration, sedimentation and dissolved air flotation in conventional surface water treatment • Apply theoretical principles to practical aspects of coagulation, filtration, sedimentation, and dissolved air flotation • Determine design parameters for coagulation, filtration, sedimentation, and dissolved air flotation from laboratory experiments • Design a sedimentation tank Be able to judge the performance of the unit processes: coagulation, filtration, sedimentation, and dissolved air flotation	
1.	**Aeration –** I. Purposes of Aeration II. Aeration Process III. Requirements & Pre- requisites IV. Mathematics involved in Aeration V. Types of Aeration systems	
2.	**Coagulation –** Objective- Theory of coagulation and flocculation processes: colloidal stability and mechanisms of destabilization, rapid and slow mixing, coagulation in practice and natural coagulants. Details- • Coagulation • Factors affecting coagulation • Coagulation & Flocculation • Clariflocculation Theory • Clariflocculation – Design Criteria • Commonly used coagulant	
3.	**Sedimentation –** Objective: Hydrodynamic principles of sedimentation and flotation, Stokes Law, principles of discrete settling, flocculent settling and hindered settling. Horizontal and vertical continuous flow basins, settling tanks, shape of inlets and outlets. Design of a rectangular sedimentation tank Details- • What is sedimentation • Various zones of settling • Settling Velocities of particles • Factors affecting sedimentation • Settling in sedimentation tank – Types – Based on Flow Type, Based upon shape, • Settling Tank Efficiency	

	• Design of sedimentation tank	
4	**Dissolved Air Floatation –** Objectives: Key design parameters, Henry's law, nucleus theory, Stokes law, rate of rise theory, hydraulic loading rate, solids loading. Concept- It is a water treatment process that clarifies wastewaters or other waters by the removal of suspended matter such as oil or solids. The removal is achieved by dissolving air in the water or wastewater under pressure and then releasing the air at atmospheric pressure in a flotation tank basin.	
5	**Filtration –** Objectives: General introduction to various types of filtration systems, Mechanical filtration, Slow sand filtration, Rapid sand filtration (pilot experiments, removal mechanisms, hydraulics, filter elements, rate control, backwashing, multi- layer filtration, application) Concept- Filtration is a process that removes particles from suspension in water. Removal takes place by a number of mechanisms that include straining, flocculation, sedimentation and surface capture. Filters can be categorised by the main method of capture, i.e. exclusion of particles at the surface of the filter media i.e. straining, or deposition within the media i.e. in-depth filtration	
6	**Disinfection –** Objective: Basic principles of disinfection; chemical disinfection; disinfection by products; ozone disinfection; UV; disinfection Concept- It is a process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects The process of addition of chemicals and removal of contaminants, various types of disinfectants, chlorination-pre and post chlorination in the water supply system	
7	**Field Trip to conventional water treatment plant/ Assignment –**	
WTM-03	**Conventional Waste water Treatment**	
	Objectives: • Critically determine and analyse quality and quantity characteristics of wastewater originating from urban environments as a basis for the design, control and operation of sewage treatment facilities. • Discuss the physical, chemical, and biological processes applied for sewage purification and the complex interactions among them occurring in wastewater treatment systems • Apply the knowledge on biological treatment processes and	

	engineering on the process design and critical assessment of wastewater treatment systems and configurations for the removal of organic matter (as COD) and nutrients (nitrogen and phosphorus) • Discuss the principles, fundamentals and applicability of recently developed wastewater treatment processes such as innovative nitrogen removal processes and membrane bioreactors.	
1.	**Wastewater characterisation and sampling -** • Composition of sewage • Introduction of Sewage • Aerobic Decomposition • Anaerobic Decomposition • Characteristics of Sewage based on – Physical, Chemical, Biological • Other contents in sewage – Chloride, Fats, Oils, Greases, Toxic waste, Suplllhides, Sulphates, Hydrogen Gas, • DO, BOD, COD • Biological Characteristics	
2.	**Primary Treatment** Objective- to understand the stages involved in primary treatment along with various units needed for the treatment.	
3.	**Nitrification & Denitrification -**	
4.	**Final Settling -**	
5.	**Introduction to MBBR, SBR, MBR technologies.** • Understanding the basic concept of technology involved in MBR,MBBR and SBR • Advantages of different types of technology and technical comparison • Design philosophy of treatment plants for PST and SST • Design of BOD Removal, COD Removal of , TSS Removal of ASP • Introduction of SBR/ Major Phases or Processes – Fill, React, Settle, Decent, Idle/ Advantages of SBR/ Disadvantages of SBR Selection of suitable technology for the effective treatment	
WTM-04	**Resource Oriented Wastewater Treatment and Sanitation**	
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1.	**Introduction into resource orientation in wastewater treatment and sanitation** **Objectives:** • Describe the physical, chemical and microbiological processes occurring in anaerobic reactors and a number of natural systems	

	• Critically reflect on the current sanitation systems encountered in many urban areas and to indicate ways to improve this situation in a sustainable manner; • Evaluate the possibilities for closing cycles of energy, water and nutrients • Evaluate the feasibility of the application of the technologies studied in this module in urban settings in the developing world Carry out preliminary process design of treatment and reuse systems to assess the needs for capital, land, equipment and operation and maintenance	
2.	**Anaerobic wastewater treatment-** To understand the details of Anaerobic treatment concept of waste water treatment by way of biological treatment without use of oxygen or air. The organic pollutants are converted by anaerobic micro-organisms to biogas, which contains methane and carbon dioxide. Biogas is a renewable energy source, which can be used for electricity and heat production	
3.	**Waste stabilization ponds** To understand the concept of treatment with low cost , less skilled manpower and ample availability of land- suitable types of technology In Waste stabilization ponds (WSPs or stabilization ponds or waste stabilization lagoons) designed for waste water treatment to reduce the organic content and remove pathogens from wastewater. They are man-made depressions confined by earthen structures. Wastewater or "influent" enters on one side of the waste stabilization pond and exits on the other side as "effluent", after spending several days in the pond, during which treatment processes take place.	
4.	**DOSIWAM/ Malaprabha Digestor** Objective- To understand concept of low cost sanitation for rural area. Details- In urban areas, the sewage generation problem will not be alleviated by an increase in the number of treatment plants. To tackle this problem; a sustainable, economical and efficient onsite treatment system is an essential and DOSIWAM (Decentralized On-Site Integrated Waste Management) System which is effective for low cost sanitation.	
5.	**Urine treatment** Objective- to understand the concept of urine treatment and resource recovery Details- Urine contains 80% of the nitrogen (N) and 45% of the phosphorus (P) in wastewater. Separate collection and treatment would improve effluent quality and save energy in centralised biological nutrient removal (BNR). This part contain the possible solutions for the urine treatment in waste water	
6.	**Field Trip**	

7.	**Effluent reuse for agriculture-** The use of recycled water for the use of agricultural production and reduce the ground water extraction.	
8.	**Algae photo bioreactors** For effective utilization of available light source to cultivate phototrophic microorganism to generate biomass from light and carbon di-oxide. The technique used shall be discussed in detail.	
WTM-05	**Waste Water Treatment Processes & Plant Design**	
	Objectives: • Select the most suitable and cost-effective treatment process technologies, given it's composition and characteristics and taking into account the required standards. • Carryout a preliminary design of a treatment system including engineering process layout, hydraulic profile and process flow diagram • Identify and estimate the construction, operational and maintenance costs of a treatment plant, and the investments required to secure It's satisfactory operations throughout the expected life span of the system. • Describe the mean and components involved in the project planning, project management and project administration for design engineering, construction, start-up and operation of the treatment plant.	
1.	**Technology selection** Technology selection and introduction to desalination and membrane technology. Review of the most commonly applied treatment process technologies. Criteria for selection and guidelines for determination of a suitable treatment process to meet the required standards taking into account local conditions and resources availability.	
2.	**Engineering Economics** Fundamentals and principles of estimation and engineering economics (such as cash-flow, interest factors, return of investment and benefit-cost analyses, among others). Evaluation, comparison and selection of cost-effective treatment system alternatives.	
3.	**Estimates & Costing** Fundamentals and principles of costing. Identification and estimation of direct and indirect costs involved in the design, construction, operation and maintenance of treatment systems. (Project) budgeting. Details involved- • Definition of Estimation	

	• Necessities of Estimates • Role of different agencies involved – Quantity Surveyor, Estimator, Others • Components of Estimates • Specifications • Scheduled rates Preparation of Estimates – Measurements, Abstract Details involved- • Necessity of Costing • Different types of costs – Direct cost and indirect cost • Design cost, Drafting cost, Research & Development cost, Material cost, Labour cost, Cost of tools & fixtures, Electrical/ Mechanical/ Instrumentation/ Automation cost, Land cost, Finance cost, Unforeseen expenses/ Miscellaneous cost	
4.	**Engineering process layouts and process flow diagrams** Design and calculation of engineering process layouts and process flow diagrams for the design and operation of treatment plants. A detailed design exercise will be carried out on a selected treatment process lay-out.	
5.	**Hydraulic design** Calculation and design of hydraulic profiles (based on the behavior and performance of hydraulic structures and elements) for the design and operation of treatment plants.	
6.	**Design and Engineering of waste water treatment system** Preliminary design, including influent characteristics, sizing and dimensioning of a conventional treatment plant. Design and selection of equipment for monitoring, operation and control. Review of case-studies including planning, project management, and project administration of the construction and operation.	

SUBJECT-WISE DETAILED SYLLABUS

SEMESTER –II

WTM-06	Water Transport Distribution	Lectures
	Objectives: • Distinguish between different network configurations and supplying schemes; recognise various consumption categories and their growth patterns, including water leakage; define the relation between the main hydraulic parameters • Demonstrate understanding of the steady-state hydraulics by being able to select appropriate pipe diameters, indicate optimum location of reservoirs and identify pumps capable to supply the demand; • Apply the above theoretical knowledge by learning to perform computer-aided hydraulic calculations and predict the consequences of demand growth on the hydraulic performance of particular WTD system • Propose preliminary hydraulic design that will integrate economic aspects, choose adequate components, and judge technical solutions dealing with the network maintenance, rehabilitation, and expansion; • Distinguish between the main components of non-revenue water and methods of leakage assessment, survey, detection and control; • Understand the basic corrosion mechanisms and suggest the list of preventive and reactive measures	
1.	**Introduction to Water Transport and Distribution –** Main objectives and components of WTD systems; water demand categories, patterns, calculation and forecasting; steady state hydraulics of pressurized flows, single pipe calculation, branched and looped networks, pressure driven demand; hydraulics of storage and pumps; hydraulic design: choice of supply scheme, network layouts, design of pumping stations, power requirements and energy consumption; engineering design: choice of pipe materials, valves and other equipment; network construction: pipe laying, testing and disinfection; operation & maintenance: regular & irregular supply, network cleaning and rehabilitation.	
2.	**Water Loss Management and Control –** Definition of non-revenue water and IWA terminology used in the sector, components of water losses, methods of reducing and controlling real- and apparent network losses; quantification of	

	leakage in distribution systems, leak location and repair techniques, pressure management.	
3.	**Corrosion in Water Distribution Networks (removed from IHE Syllabus – but essential for India) –** Corrosion of pipe materials, indices of measure, corrosion assessment, prevention and control, optial water composition, principles of water quality modelling of distribution networks, modelling of chlorine residuals.	
WTM-07	**Data Analytics And GIS For Water Management**	
	Objectives: • The students will be able to explain RS theory and GIS application, technology, typical applications, and be able to identify and download relevant data and products • The students will be able to pre-process, extract and analysed common indices, design and collect ground-truth points, and conduct land cover classification • The students will be able to extract biophysical, infrastructure and management features of the region • The students will be able to assess the various performance indexes using GIS and remote sensing, interpret them to identify gaps, diagnose water management problems, and attribute to relevant factors for improvements • The students will be able to produce water accounts for a hydrological system for a given region using GIS and remote sensing information and evaluate the performance of the system. • Setting the context of generating data from various sources through the cycle of water management • Analysing historical data, understand the changes happening through the years and develop adaptive solutions for future • Develop the ability to provide meaningful information and generate the possibility to take informed decisions based on big data generation in water sector. • Scoping of operationalising neural networks in water management • Develop a smart integrated infrastructure through the tools for data analysis	
1.	**Introduction to GIS and Remote sensing** Basics of GIS & RS, introduction to common data portal, satellites, typical application of GIS & RS and existing products, Hands-on exercises on need analysis and acquiring of relevant data.	
2.	**Data analysis for land cover classification** Overview of the data processing flow, common indices, and classification theory; Ground Truthing methods; Hands-on exercises (1) GT collection, (2) Landsat data pre- processing, extracting common indices, categorize them,	

	and (3) Land cover classification and accuracy assessment. A case study is introduced to which these skills will be applied by the students.	
3.	**Mapping existing infrastructure systems** Hands-on exercise on mapping infrastructure, land use patterns, water resources, water networks, ground water data for the catchment, integrating the primary data and secondary data	
4.	**Data Analytics in GIS and RS for infrastructure development** Acquire historical data for catchments, generate data points and source data, generate adaptive tools based on the data being generated through the data points. Develop strategies based on micro data for water management – interlinks for water for irrigation and agriculture and urban / rural development	
5.	**GIS & Remote sensing for enhancing performance of water management systems** Assessment of the system performance using GIS and remote sensing tools, interpret various performance indicator results to identify gaps, diagnose water management problems, and attribute to relevant factors for improvements	
6.	**GIS & Remote Sensing for Water Accounting** Theory of producing water accounts for a water management system using remote sensing information is discussed. The knowledge will be applied to the hands-on and form the concluding section of the assignment.	
WTM-08	**Advanced Water Transport And Distribution**	
	Objectives: • Understand the theory of advanced hydraulic and water quality modelling; apply state-of-the-art network software for assessment of irregular operational scenarios and develop a reliability-based and cost-effective design using computer model. • Select modern tools for monitoring of operation, and planning of maintenance of WTD systems. • Recognise the GIS and remote sensing technologies, and familiarise with the GIS-based techniques for sustainable planning and management of WTD systems; • Understand the theory of transient flows, and plan the measures to prevent/control water hammer; • Distinguish between various sources of water quality problems in distribution networks; understand the basic mechanisms of biological stability and suggest the list of preventive and reactive measures	

	• Setting the context of generating data from various sources through the cycle of water management • Analysing historical data, understand the changes happening through the years and develop adaptive solutions for future • Develop the ability to provide meaningful information and generate the possibility to take informed decisions based on big data generation in water sector. • Scoping of operationalising neural networks in water management • Develop a smart integrated infrastructure through the tools for data analysis	
1.	**Advanced Water Distribution Modelling and Data analytics** Principles of genetic algorithm; pressure-driven demand calculations; network calibration; failure analysis and calculation of demand losses; economic aspects of capital investments and network operation. Optimization of networks and scoping of introducing neural networks for water management, asset management	
2.	**Advanced O&M Practices in Water Distribution** Monitoring of network condition and operation; data collection and management; organisation of maintenance, emergency water supply, asset management plans, water company organisation	
3.	**GIS in Water Distribution** The aim of this course is to provide both a solid theoretical understanding and a comprehensive practical introduction of how to use geographic information systems and remote sensing technologies for the analysis and solution of water distribution related problems. The course focuses on the analysis of digital spatial data, preparation for numerical modelling, presentation of modelling results and support to the decision- making process. The topics covered in the course include the following: introduction to geographic information systems and remote sensing technologies, active and passive remote sensing, data structures, map projections and coordinate systems, processing of digital geographic information, creation of digital elevation models, visualisation, mapping of water related features, delineation of pressure zone areas, digitisation, soil and land use mapping, map algebra, export of GIS layers into a modelling package, incorporation of modelling results in GIS.	
4.	**Introduction to Water Hammer** Basic equations and applications; computer modelling: model building, simulations of simple cases (full pump trip, emergency shut down; protection devices: practical methods of surge suppression, direct action, diversionary tactics, choice of protection strategy	
5.	**Water Quality in Distribution Networks** Bacterial growth in drinking water, influence of water treatment and distribution on biological stability of drinking water, optimal water composition, principles of water quality modelling of distribution networks,	

	modelling of chlorine residuals.	
WTM-09	**Drought & Flood Management And Introduction To Reservoir Operations**	
	Objectives: • Be able to identify and describe the concept of drought, and describe the different types of drought, the influence of society on drought, and the relationship between drought and water scarcity • Develop understanding of structural and non-structural flood resilience measures such as, conventional and innovative structures, early warning systems, etc. • Be familiar with concepts of drought monitoring and forecasting, and data and modelling systems used. • Be able to describe the principles of reservoir operations and optimisation, and develop operational rules for (multi-purpose) reservoir systems.	
1.	**Drought and Drought Management –** Introduction to the concept of drought and the different types of drought. How these are related in time. Drought as a natural phenomenon and the influence of society on drought. Concepts of drought risk, and the constituent components of drought hazard and drought vulnerability. Drought Management and the development of drought management planning.	
2.	**Drought Monitoring and Forecasting –** Concepts of drought indicators and the use of drought indicators in monitoring different types of drought. Drought Monitoring systems. Drought Forecasting and drought Forecasting systems. Data requirements. Exercise in using global data to characterise drought in different parts of the world.	
3.	**Flood and Flood Management & Ethics of risk –** Introduction to floods and flooding. Introduction to urban floods and urban water systems. Introduction to environmental systems. Introduction to the effects of climate variability on the hydrology that affects urban areas, urban hydrology as a very fast rainfall-runoff process, selection of appropriate time steps in urban runoff modelling, global, regional and local climate models, development of climate change scenarios. Introduction to the basic theory of ethics and its application to the flood risk management.	
4.	**Structural and Non-structural Urban Flood Management Measures –** Sustainable structural and non-structural urban flood management measures such as: amplification of pipe networks, open channels, detention/retention basins, on-site- detention, on-site-infiltration, on-site-retention, SUDS, stormwater sensitive urban design, asset management and multi-objective optimization of rehabilitation measures (use of computational intelligence), design and employment of early warning systems.	

5.	**Introduction to Reservoir Operations –** Principles of reservoir operation rules, including standard operation policy, hedging and flood control rules. Long term versus short term reservoir operation. Establishing objective functions for multiple- purpose reservoirs. Planning and implementation of environmental flows.	
WTM-10	**Assignments Based Field Work**	
WTM-11	**Internship At The Host Company**	

Reference Books:

1. Water Supply Engineering V-1 - P.N. Modi
2. Water Supply Engineering: Environmental Engineering (volume 1) - Santhosh Kumar Garg
3. Wastewater Engineering: Treatment and Reuse - George Tchobanoglous, Franklin Burton, H. David Stensel - Metcalf & Eddy.
4. Water Supply Engineering: Environmental Engineering – I - (Paperback, Dr. B.C. Punmia, Er. Ashok Kumar
5. Sewage Disposal and Air Pollution Engineering - S.K. Garg
6. Waste Water Treatment 3Ed - M. N. Dutta and A. K. Rao
7. Faecal Sludge Management in Marathi - Linda Strande, Mariska Ronteltap, Damir Brdjanovic & Unity Publication
8. Faecal Sludge Management in Hindi - Linda Strande, Mariska Ronteltap, Damir Brdjanovic & Unity Publication
9. Experimental Methods in Wastewater Treatment in Marathi - Editor(s):Mark C.M. van Loosdrecht, P.H. Nielsen, C.M. Lopez-Vazquez, Damir Brdjanovic & Unity Publication
10. Experimental Methods in Wastewater Treatment in Hindi - Editor(s):Mark C.M. van Loosdrecht, P.H. Nielsen, C.M. Lopez-Vazquez, Damir Brdjanovic & Unity Publication
11. CPHEEO Manual, Govt of India