Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2023-24

Course Handout Part II

Date: 01.08.2023

In addition to Part – I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No.	**: BIO F216**
Course Title	**: WATER, SANITATION AND SOLID WASTE MANAGEMENT**
Instructor-in-charge	**: P. SANKAR GANESH**
Instructor	**: P. Sankar Ganesh**

1. Scope of the course:

Anthropogenic disturbances to this planet have increased tremendously in the last three decades. Some of the earth's elements, including the aquatic ecosystem, have reached saturation. Hence there is an urgent requirement to treat the existing pollutants and those that will be produced in the future. United Nations have also realized this fact through Sustainable Development Goal No. 6, which focuses on ensuring the availability and sustainable water and sanitation management for all. This course is aligned with the above environmental issues and their solutions.

2. Objective of the course:

This course aims to impart knowledge on household water treatment systems and safe storage of treated water, planning and designing sanitation systems and technologies, including an introduction to faecal sludge management and municipal solid waste management with a particular focus on developing countries.

3. Course description:

This course will consist of the following four modules:

- Module 1: Municipal Solid Waste Management in Developing Countries
- Module 2: Planning and Design of Sanitation Systems and Technologies
- Module 3: Introduction to Household Water Treatment and Safe Storage
- Module 4: Introduction to Faecal sludge management

4. Textbooks (TB):

1. Faecal Sludge Management, Systems Approach for Implementation and Operation, Linda Strande, Mariska Ronteltap, Damir Brdjanovic, IWA Publishing, 2014.

2. Solid Waste Management in Developing Countries C. Zurbrügg (2002) A primer and introduction to the main issues related to solid waste management in developing countries.

5. Course Plan:

Module 1: Municipal Solid Waste Management in Developing Countries *(To be covered in August, 2023)*
Coursera: https://www.coursera.org/learn/solid-waste-management
YouTube: https://www.youtube.com/channel/UCkXdyAGKs9dakJlgdjD5vfw

Learning goals:

A. Understand the different steps required for appropriate management of solid waste and also the principal challenges that exist in developing countries
B. Understand the governmental aspects linked to solid waste management networks
C. Understand the basis of different organic waste treatment technologies
D. Know evaluation and planning methods concerning the management of solid waste

- ***Physical Elements of Solid Waste Management (15 videos)***

  The course begins with an overview of the current waste situation in developing countries. We will introduce the Integrated Sustainable Waste Management (ISWM) framework that provides a general overview of SWM systems and will guide us through this course. The modules of this first-week deal with the physical components of a SWM.

- ***Governance aspects of SWM (11 videos)***

  In the second week, the course will elaborate on the governance aspects, also called the "soft" aspects of a SWM system. Different stakeholders and their roles, responsibilities, legislative issues, and financial mechanisms will be explained.

- ***Organic waste treatment technologies (15 videos)***

  Week three will focus on the treatment of organic waste. Students will learn the basics of two widespread organic waste treatment technologies: composting and anaerobic digestion. We then continue with less common technologies: vermicomposting, waste processing using black soldier fly larvae and thermochemical conversion. Study case examples and practical exercises will be presented to understand better the underpinning reactions and conditions needed for each treatment process.

- ***Special waste fractions (10 videos)***

  The fourth week covers special waste fractions, such as hazardous waste, healthcare waste, e-waste, plastic waste, and construction and demolition waste. We will explain the key challenges and opportunities for improved management in low- and middle-income settings.

- ***Strategic issues and planning in SWM (10 videos)***

  During the last week, the modules will focus on strategic aspects of SWM. Methods for integrating organic waste management into the municipal SWM system will be explained. A standardized method to evaluate and compare systems regarding their SWM will also be presented, and the relevance of waste on climate change. Finally, some reflections on the future of waste management will be discussed. The course will end with a wrap-up module which will also serve as preparation for the exam.

Module 2: Planning and Design of Sanitation Systems and Technologies *(To be covered in September, 2023)*
Coursera: https://www.coursera.org/learn/sanitation
YouTube: https://www.youtube.com/channel/UCgHWg270mPystle5rVFOvCA/featured

Learning goals:

A. Discern different methods of sanitation planning at the city and neighborhood levels and understand why an enabling environment is essential
B. Link the systematic approach of urban sanitation to different functional groups
C. Evaluate the pros and cons of different treatment methods
D. Discern sanitation solutions in their contexts, as well as different treatment options
E. Analyze different diagnostic and analytical tools concerning institutional and financial arrangements, behaviour changes, security planning in terms of sanitary measures and the flow of faecal matter

- ***Introduction to sanitation planning & systems approach (10 videos)***

  The course will begin with an overview of why sanitation is important for human health and environmental protection, especially in urban areas. A presentation of the importance of the Enabling Environment follows this. It will then review existing environmental sanitation planning approaches currently being used in international development.

- ***Sanitation systems & technologies-I (10 videos)***

  After presenting different sanitation planning frameworks this week, you will learn about the systems approach to environmental sanitation – the key terminology and concepts and why systems thinking is crucial for urban environmental sanitation.

- ***Sanitation systems & technologies-II (12 videos)***

  The focus of week 3 is on a detailed overview of different sanitation systems, from simple single-pit systems to more complex centralized treatment systems. The main treatment processes are then reviewed in detail, highlighting the advantages and disadvantages of each.

- ***Urban sanitation solutions - Case studies (6 videos)***

  In the fourth week, we'll present case studies from Africa and Asia showing different sanitation solutions from a neighbourhood to a national scale.

- ***Urban sanitation tools (9 videos)***

  Week 5 presents various urban sanitation tools, such as excreta flow diagrams (SFDs) or sanitation safety planning, followed by a series of modules from the World Bank Water & Sanitation Programme covering topics of urban sanitation.

Module 3: Introduction to Household Water Treatment and Safe Storage *(To be covered in October, 2023)*
Coursera: https://www.coursera.org/learn/water-treatment
YouTube: https://www.youtube.com/channel/UC4_goddqxeh0JZJXpsuVP9g

Learning goals:

A. Understand the basis for sludge contamination of drinking water
B. Understand the household-level treatment and safe storage of water (HWTS)
C. Discern the principal techniques and processes of water treatment
D. Understand the different approaches that comprise the successful implementation of HWTS
E. Understand the different approaches that allow for the evaluation of the implementation of HWTS

- ***Introduction to Household water treatment and safe storage (8 videos)***

  The course begins with a review of the public health impacts of unsafe drinking water. We define physical, chemical, and microbial aspects of drinking water quality and present the major classes of pathogens. An introduction to the concept of HWTS and the principal technologies follows information about pathways for faecal contamination of drinking water.

- ***HWTS treatment options-I (6 videos)***

  After identifying and discussing the problem of water contamination in the first week, we focus on potential solution methods during weeks 2 and 3. We refer first to the standards of safe drinking water and improved drinking water and discuss ways to prevent microbial contamination through water source protection and household hygiene. Week 2 focuses on sedimentation and different kinds of filtration.

- ***HWTS treatment options-II (6 videos)***

  In week three, we continue with potential solution methods by focusing on heat, ultraviolet radiation, and chemical disinfection. Specific modules cover safe storage and the combination of solution methods.

- ***Implementation strategies for HWTS (5 videos)***

  There is no single standard strategy for successful HWTS implementation. During week four, we analyze different approaches that have been successfully applied. We highlight key components which make programs more likely to succeed. We ask what is required for the most vulnerable populations to use HWTS correctly and consistently over the long term. In separate modules, we consider the special case of HWTS in emergency response and provide information about the role of government bodies.

- ***Assessing the impact of HWTS (9 videos)***

  During the fifth week, we present different approaches to assess the impact of HWTS and highlight the challenges of measuring HWTS impact. The course ends with a wrap-up module, which serves as preparation for the final exam.

Module 4: Introduction to Faecal Sludge Management *(To be covered in November 2023)*

Coursera: https://www.coursera.org/learn/faecalsludge
YouTube: https://www.youtube.com/channel/UCA6g0XkRVlRpjD8_Sv0QK9w

Learning goals:

A. Understand the importance of faecal sludge management and the lacks and weaknesses of faecal sludge service chain
B. Understand the fundamentals of faecal sludge management
C. Integrate the information necessary to analyze and select among technologies of faecal sludge treatment
D. Know how to design well-functioning treatment technologies
E. Analyze the management and planning approaches that lead to sustainable solutions
F. Know research and innovations in terms of technology

- ***An introduction to FSM (7 videos)***

  This first week of this course includes an overview of fecal sludge and the importance of an integrated approach to faecal sludge management. It provides an introduction to what is currently lacking and weak links in the service chain, and also presents positive examples of what is working.

- ***Overview of fundamentals for design and selection of treatment technologies (9 videos)***

  The second week of this course is based on an integrated engineering design approach and will introduce fundamentals and required information for the design and selection of technologies, including objectives, mechanisms, quantification, and characterization. It also includes the collection and transport of faecal sludge to treatment.

- ***Treatment technologies for faecal sludge (9 videos)***

  The third week of this course focuses on engineering aspects of how to size and properly operate faecal sludge treatment technologies.

- ***An integrated approach to FSM (8 videos)***

  Sanitation solutions do not rely on technology alone and are prone to failure if an integrated planning approach that includes stakeholder involvement and the development of appropriate institutional, management, and financial arrangements are not implemented. Presented in week four is the full picture, in addition to technology, that needs to be considered for sustainable solutions

- ***Innovations in FSM (9 videos)***

  Faecal sludge management is a relatively new and rapidly growing field. As a result, many solutions are not yet fully developed, which has to be carefully considered in technology implementation. Week 5 will focus on current research and technological innovations to provide an understanding of the most up-to-date options and what needs to be considered for further development and implementation.

6. Evaluation scheme:

Evaluation component	*Duration*	*Weightage %*	*Date and time*	*Nature of the Component**
Mid Semester Examination	1.5 Hrs	30	07/10/2023 4:00-5:30 PM	CB
Quiz	Diverse	15	Continuous Evaluation	OB
Presentation	Diverse	15	Continuous Evaluation	OB
Comprehensive examination	2 Hrs	40	05/12/2023 AN	CB

*CB: Closed book and OB: Open book

7. Chamber consultation hour:
To be announced.

8. Grading policy:
Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, student's regularity in attending classes, and the section instructor's assessment of the student.

9. Make-up policy:
Make-up for Mid semester examination will be given only in genuine (medical emergency) cases of absence. If the absence is anticipated, before the examination, prior permission of the Instructor-in-charge is necessary. Request for make-up should reach the Instructor-in-charge at the earliest. Make-up for class tests/ quizzes and assignments are not given. Also refer to Clause 4.07 of BITS *Academic Regulations* for more details.

10. Notices:
All notices/ announcements regarding this course shall be displayed in Course Management System (CMS).

11. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Prof. P. Sankar Ganesh
Instructor In-charge
BIO F216