

RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEM

OVERVIEW



CHAITANYA BHARATHI
INSTITUTE OF TECHNOLOGY (A)
Affiliated to Osmania University

Lecture slides by
Dr. Jnana Ranjan Khuntia

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Total Course Contents

SEMESTER – VIII									
S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week	Duration of SEE in Hours		Maximum Marks			
			L	T	P/D	CIE	SEE		
THEORY									
1		Core Elective 6	3	-	-	3	30	70	3
2		Open Elective 3	3	-	-	3	30	70	3
PRACTICALS									
3	18CE C30	Technical Seminar (On the latest trends and other than project)	-	-	2	-	50	-	1
4	18CE C31	Project Part 2	-	-	20	-	-	-	10
Total			06	-	22		110	140	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Core Elective 6:

- 18CE E23 - Earthquake Resistant Design of Structures
- 18CE E24 - Ground Improvement Techniques
- 18CE E25 - Design of Hydraulic Structures/Irrigation Engineering
- 18CE E26 - Rural Water Supply and Onsite Sanitation Systems
- 18CE E27/Applications of Block Chain Technology in Civil Engineering

Open Elective 3:

- 18ME O06 - Nano Materials and Technology
- 18IT O03 - Principles of Internet of Things
- 18EE O05 - Waste Management
- 18EC O08 - Neural Networks and Fuzzy Logic

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RWS: Course Objectives

1	Identify the problems pertaining to rural water supply and sanitation.
2	Be conversant about water treatment and sanitation system for rural community.
3	Understand wastewater treatment collection and treatment units in rural areas.
4	Get educated on Industrial hygiene, sanitation and occupational hazards.
5	Design low cost waste management systems for rural areas, plan and design an effluent disposal mechanism.

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Course Outcomes

At the end of the course, the student will be able to

CO1	solve the issues related to rural water supply and sanitation.
CO2	relate the needs for water treatment and develop different stages of water treatment and sanitation system for rural community.
CO3	plan wastewater collection system in rural areas and identify compact wastewater treatment units.
CO4	develop occupation related onsite sanitation and hygiene system and identify occupational hazards.
CO5	design an effluent disposal mechanism; develop solid waste management system in rural areas.

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All units:

Unit – I

Rural Water Supply

Issues of rural water supply, various techniques for rural water supply- merits, National rural drinking water program, rural water quality monitoring and surveillance, operation and maintenance of rural water supplies, relationships between diseases and water quality, hygiene and sanitation.

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All units:

Unit – II

Water Treatment:

Need for water treatment, point of use water treatment systems, filters, bio-sand filters, disinfection systems for rural areas, chlorination, solar disinfection systems, removal of arsenic, fluoride and iron; hygiene and sanitation, epidemiological aspects of water quality methods for low cost water treatment – specific contaminant removal systems.

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All units:

Unit – III

Rural Sanitation:

Introduction to rural sanitation, community and sanitary latrines, planning of wastewater collection system in rural areas, treatment and disposal of wastewater, compact and simple wastewater treatment units and systems in rural areas.

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All units:

Unit – IV

Onsite sanitation system:

Nexus between water quality and sanitation, importance of hydrogeology on selection of onsite sanitation systems, Industrial hygiene and sanitation, occupational hazards in schools, public buildings and hospitals; Industrial plant sanitation.

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All units:

Unit – V

Septic tanks:

Design of septic tanks, single pit and double pit toilets, small bore systems, bio digesters, reed beds, constructed wetlands, sludge/seepage management systems, stabilization ponds; Solid Waste Management: Biogas plants, rural health, other specific issues and problems encountered in rural sanitation.

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**RURAL WATER SUPPLY AND ONSITE
SANITATION SYSTEM**

UNIT-I



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Syllabus

Unit – I

Rural Water Supply

Issues of rural water supply, various techniques for rural water supply- merits, National rural drinking water program, rural water quality monitoring and surveillance, operation and maintenance of rural water supplies, relationships between diseases and water quality, hygiene and sanitation.

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Introduction

**RURAL WATER SUPPLY AND ONSITE
SANITATION SYSTEM**

- Billions of people are still striving to access the most basic human needs which are food, shelter, safe drinking water and sanitary systems.
- According to the human rights, adequate water is a right to everyone.
- Generally, governments are responsible to provide water to meet basic human needs and to improve the water supply system to meet standards of reliable, efficient, and equitable management (Gleick, 2005).

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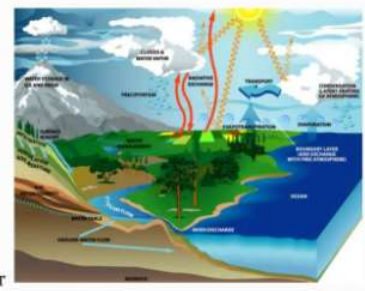
Introduction

- Water is life.
- Mismanaged source.
- 3.2 billion (320 crores) rural population.
- Rural safe water supply- priority task.
- Population growing rapidly.

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Water Sources

- Surface water
- Groundwater
- Rainwater
- Desalinized water



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Health, Water And Sanitation

- <https://youtu.be/QsiYIGWGcxw>



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India's water and sanitation crisis

- <https://youtu.be/B75sDSgMpCk>



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Continued...

Human Rights Water Normative Criteria

- Sufficient
- Safe
- Acceptable
- Accessible
- Affordable



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Countries With The Most Renewable Fresh Water Resources

Rank	Country	Freshwater (Kilometers Cubed)
1	Brazil	8,233
2	Russia	4,508
3	United States	3,069
4	Canada	2,902
5	China	2,840
6	Colombia	2,152
7	European Union	2,057
8	Indonesia	2,019
9	Peru	1,913
10	India	1,911
11	Congo, Democratic Republic of the	1,283
12	Venezuela	1,233
13	Bangladesh	1,227
14	Myanmar	1,168

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World Bank Water Statistics

- Every year insecure water and a lack of basic sanitation kills a minimum of 1.6 million children under the age of 5.
- In 2017, 71% of the global population (5.3 billion people) used a safely managed drinking-water service – that is, one located on premises, available when needed, and free from contamination. 90% of the global population (6.8 billion people) used at least a basic service
- In 2020, 6% of the world population did not have access to an improved water source.
- 5 times more rural than city dwellers lack safe water.

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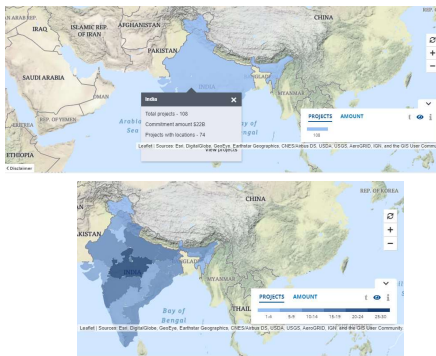
Main aim of rural water supply and sanitation project

The objectives of the project are

- to increase sustainable access to improved water services and promote improved sanitation and hygiene practices in rural areas; develop and implement a long-term support mechanism to promote the sustainability of water supply schemes in selected districts

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Project Map: RECENTLY APPROVED PROJECTS by World Bank



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Water supply and sanitation in India

- While entire population of India has access to toilets, however, many people lack access to clean water and sewage infrastructure.
- Various government programs at national, state, and community level have brought rapid improvements in sanitation and the drinking water supply. Some of these programs are ongoing.
- The water supply and sanitation in India has improved drastically since 1980s.
- In 1980 rural sanitation coverage was estimated at 1% and it reached 95% in 2018.
- The share of Indians with access to improved sources of water has increased significantly from 72% in 1990 to 88% in 2008.

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WATER SUPPLY SYSTEMS

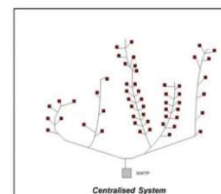
1. Centralised water supply system
2. Decentralised water supply system

CENTRALISED WATER SUPPLY SYSTEM

- Centralised water treatment plants
- Extensive pipe network
- Larger municipalities or water board

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CENTRALISED WATER SUPPLY SYSTEM



LIMITATIONS OF CENTRALISED SYSTEM

- High initial cost
- Lack of skilled and trained people
- Does not reach rural areas
- High energy consumption

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DECENTRALISED WATER SUPPLY SYSTEM

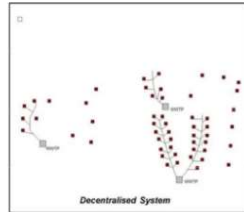
- Safe drinking water
- Small scale purification and distribution
- Treatment and reuse close to source of generation
- Small conveyance network
- Sources: lakes, rivers, groundwater, rainwater etc.

ADVANTAGES

- Maintained and designed
- Reduces pollution
- Reduces consumption of fresh water
- Reduces requirement of pipe networks.

DISADVANTAGES

- Need to control various treatments
- Time consuming daily operation.



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What is Distributed Wastewater Treatment? The Benefits of Decentralization

- <https://youtu.be/MVYd0tJfouc>



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Demand-driven approaches in rural water supply

- Most rural water supply schemes in India use a **centralised, supply-driven approach**, i.e. a government institution designs a project and has it built with little community consultation and no capacity building for the community, often requiring no water fees to be paid for its subsequent operation.
- Since 2002 the Government of India has rolled out at the national level a program to change the way in which water and sanitation services are supported in rural areas.
- The program, called *Swajaldhara*, decentralises service delivery responsibility to rural local governments and user groups.
- Under the new approach communities are being consulted and trained, and users agree up-front to pay a tariff that is set at a level sufficiently high to cover operation and maintenance costs.
- It also includes measures to promote sanitation and to improve hygiene behaviour.
- The national program follows a pilot program launched in 1999.

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DEVELOPING COUNTRIES RURAL WATER SUPPLY

- Water problems are diverse and serious.
- Natural scarcity of drinking water as well as contamination of rivers and large dams.
- Contaminants present in the water
 - metals including iron
 - organic matter
 - salts
 - viruses, bacterias etc.

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RURAL WATER SUPPLY IN INDIA

- Long faced the challenge of providing safe drinking water to over 700 million people (1.5 million villages).
- 1972- GOI began to improve rural water supply.
- 1980- issue declared as national priority.
- People lacked sense of ownership and maintenance was neglected.
- Growing population lead to mounting demand of water.
- 1991-1996: shifted the responsibility of rural water supply from state govt to the local communities

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CASE STUDY MARATHWADA of MAHARASHTRA

MARATHWADA

- Homely to 30% of states below poverty line families.
- Frequent anomalies in rainfall during Monsoon season.
- Total 8535 villages- 3577 villages are effected(41%).
- Scarcity of basic resources.
- Of the 153 days of the monsoon in Marathwada last year, 94 days were dry.
- Availability of ground water is limited.

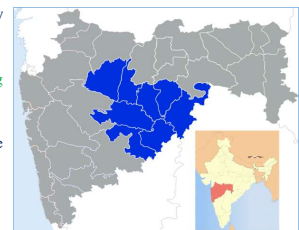


Fig : Marathwada (Source: www.wikipedia.com)

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CASE STUDY MARATHWADA of MAHARASHTRA

MAJOR ISSUES FACED

- Recurring droughts and water quality problems are major issues.
- 82% of drinking water schemes depend on groundwater.
- Over exploitation of ground water.
- Pipelines are exposed – frequently damaged



FIG: RECURRING DROUGHTS IN MARATHWADA (SOURCE: [HTTPS://WWW.DNAINDIA.COM](https://www.dnaindia.com))

*660 farmers have committed suicide in marathwada

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CASE STUDY MARATHWADA of MAHARASHTRA

RURAL WATER SUPPLY IN MARATHWADA JALSWARAJYA OBJECTIVE

- Improved and sustainable drinking water.
- Institutionalize decentralization.

FINANCES STRUCTURES

- Total project cost - Rs 1254.52 CR • World bank credit - Rs 930.93 CR • State govt share - Rs 230.45 CR • Community share - Rs 93.14 CR

MANAGEMENT OF GROUND WATER JALSWARAJYA

- Information education communication.
- Roof rain water harvesting.
- Repairs of tanks and ponds.
- Ground water monitoring.
- Reduction of water loss in domestic supply

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CASE STUDY MARATHWADA of MAHARASHTRA

According to the World Bank that partly funded the project, the development objectives of the Jalswarajya project were

(i) increasing rural households' access to improved and sustainable drinking water supply and sanitation services;

and (ii) institutionalizing decentralization of rural water supply and sanitation (RWSS) service delivery to rural local governments and communities.

BENEFITS FROM JALASWARAJYA

- 3219 (out of 3908) piped water supply schemes operational.
- 8 lakh households gained access to safe drinking water.
- 981 villages have become tanker free.
- Focus on providing 100% individual house connections -achievement till today 60%.

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CASE STUDY MARATHWADA of MAHARASHTRA

RESULT OF JALSWARAJYA PROJECT



- The project has also received the World Bank's Social Development unit's "People First Award for the year 2010", for its excellence in inclusion, innovation and results.

• "The project has shown remarkable achievements in improving the water and sanitation services in the villages of Maharashtra, by involving the community in the decision making process. We faced numerous challenges during implementation – the geographical spread across 26 districts of Maharashtra, covering a milieu of regions from hilly terrains to drought prone plains. Despite this, the Government of Maharashtra and the World Bank took on the challenges to ensure that even the last tribal person on a remote hill had access to sustainable water and sanitation services," says N.V. V. Raghava, senior infrastructure specialist and the World Bank team leader for the project.

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Concluding Remark

- Water quality has become a major issue.
- Rapid rise in extraction of ground water has led to major concerns.
- Communities abilities to plan, construct and implement water supply schemes need to be improved.
- Ability to manage ground water in a sustainable manner
- Need greater technical capacity
- Support from local governance institution is needed

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Syllabus

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