L-1 and L-2
Introduction and Important definitions

Environmental Engineering - II

T.E.(Civil Engineering) Part -II

Sr.No.	Subject	Teaching/Week					Examination scheme				
		L	Pr.	Tu.	Dr.	Total	Theory Paper	TW	POE	OE	Total
1.	Structural Mechanics-III	4	2	-	-	6	100	25	-	-	125
2.	Geotechnical Engg.II	4	2	-	-	6	100	25	-	-	125
3.	Environmental Engg.II	3	2	-	-	5	100	25	-	-	125
4.	Engineering Management-II	4	2	-	-	6	100	50	-	50	200
5.	Transportation Engg.-II	3	-	-	-	3	100	-	-	-	100
6.	Steel Structural Design & Drawing	-	-	-	4	4	-	50	-	50	100
	Total	**18**	**08**	-	**04**	**30**	**500**	**175**	-	**100**	**775**

Course Objectives

This course should result in

1. **Thorough understanding of Sources and generation of wastewater and sewer design.**
2. **Basic knowledge of domestic wastewater treatment and design of various units.**
3. **preliminary knowledge of Air pollution Prevention and solid waste management.**

Teaching Scheme and Examination Scheme

- Lectures: 3Hrs/ Week
- Practical: 2Hrs/Week (All batches will be handled by Mr. Thavare)

- Theory papers: 100 Marks
- Term Work: 25 Marks

Section-I

- **Unit -1: Collection and conveyance of Sewage**
- **Components of wastewater flows, waste water sources and flow rate. Variation in flow rates, waste water constituents, Characteristics of municipal waste water, Quantity of storm water, Ground water infiltration. Sewerage system, layout, types of sewers, collection system.**

- **Appurtenances, Design of sanitary and storm water sewers, Maintenance of sewerage systems. Sewage and sludge pumping, location, capacity and types of pumps, pumping station design.**

Unit-2: Unit Operations

- Primary treatment - **screening, comminuting, grit removal, oil and grease trap, chemical precipitation.** Secondary treatment – **Activated sludge process,** Process design and operating parameters , modification of ASP , operational problems .**Trickling filter** , classification , process design considerations . **Secondary Clarifications.**

Unit -3: Anaerobic treatment and Low cost treatment

- Fundamentals of anaerobic treatment, sludge characteristics, Treatment and disposal, Concept of different anaerobic reactors. Low cost waste water treatment methods- Principle of waste stabilization pond.

- **Design and operation of oxidation pond, aerobic and anaerobic lagoons, Aerated lagoon, Oxidation ditch, septic tank. Selection of alternative treatment process flow sheets. Concept of recycling of wastewater (gray water and brown water.)**

Section-II

Unit-4: Disposal of waste water

- Disposal of waste water stream pollution, Self purification, DO sag curve, Streeter Phelp's Equation, Stream classification, disposal on land, effluent standards for stream and land disposals. Introduction to environmental impact assessment, Assessment and Environmental legislation.

Unit -5: Solid Waste Disposal

- **Solid waste management – Solid waste definition, Types, sources, characteristics. Functional outlines- storage, collection, processing techniques, Methods of treatments of solid waste-Composting, Incineration, Pyrolysis and sanitary land filling. Concept of hazardous waste management.**

Unit -6: Air Pollution

- **Air Pollution- Definition, Sources and classification of pollutants, Effects. Introduction to meteorological aspects of control of industrial air pollution- Settling Chamber, Bag filter, Cyclone separator, Scrubbers, Electrostatic precipitators. Control of vehicular air pollution. Air quality standards.**

Term Work:-

- **Term work shall consist of the following:-**

(A)List of Experiments (Analysis of Waste Water)

1. pH Value.
2. Total Solids
3. Biochemical Oxygen Demand
4. Chemical Oxygen Demand
5. Chlorides
6. Oil & Grease
7. Sulphate Content
8. Total Nitrogen

9. Demonstration of High Volume Sampler

10. Demonstration of Auto Exhaust Analyzer.

(B) Design of sewerage system & Treatment system for a small urban area.

(C) Visit to sewage treatment plant (MIDC kondi and Pune)

Term work submission shall consist of the following –

1. Journal containing experiments carried out in part A of the term work and visit Report on C
2. Detail design and appropriate drawings required for part B of the term work.

BOOKS

1. **Environmental Engineering by Peavey- H.S.rowe, D.R. and Thobanoglous, [McGraw –Hill Book Company] (good book for air pollution and solid waste management part)**
2. Water supply and pollution control - Viessman W. and Hammer M.J. [Harper Collins College Publishers.]
3. **Water and waste water Technology - Hammer M.J, [Prentice-Hall of India Pricvate ltd.]**
4. **Manual of Sewerage and sewage treatment- [Government of India Publication.]**
5. **Wastewater Engineering – B C Punmia (covers most of the syllabus – book bank)**

6. Air Pollution- Rao M.N. and Rao H.V.N. [Tata Mcgraw Hill, 1990]- Section-II air pollution part

7. Solid Waste Management in Developing countries - Bhide A.D. and Sundersen B.B. [Indian National Scientific Documentation Centre, New Delhi]

8. Waste Water Engineering Treatment & Disposal - Metcalf & Eddy, [Tata McGraw Hill, 1982]

9. Sewage Disposal and Air Pollution Engineering - Garg S.K., [Khanna Publishers]

10. Environmental Impact Assessment - Canter, [TMH Publication]

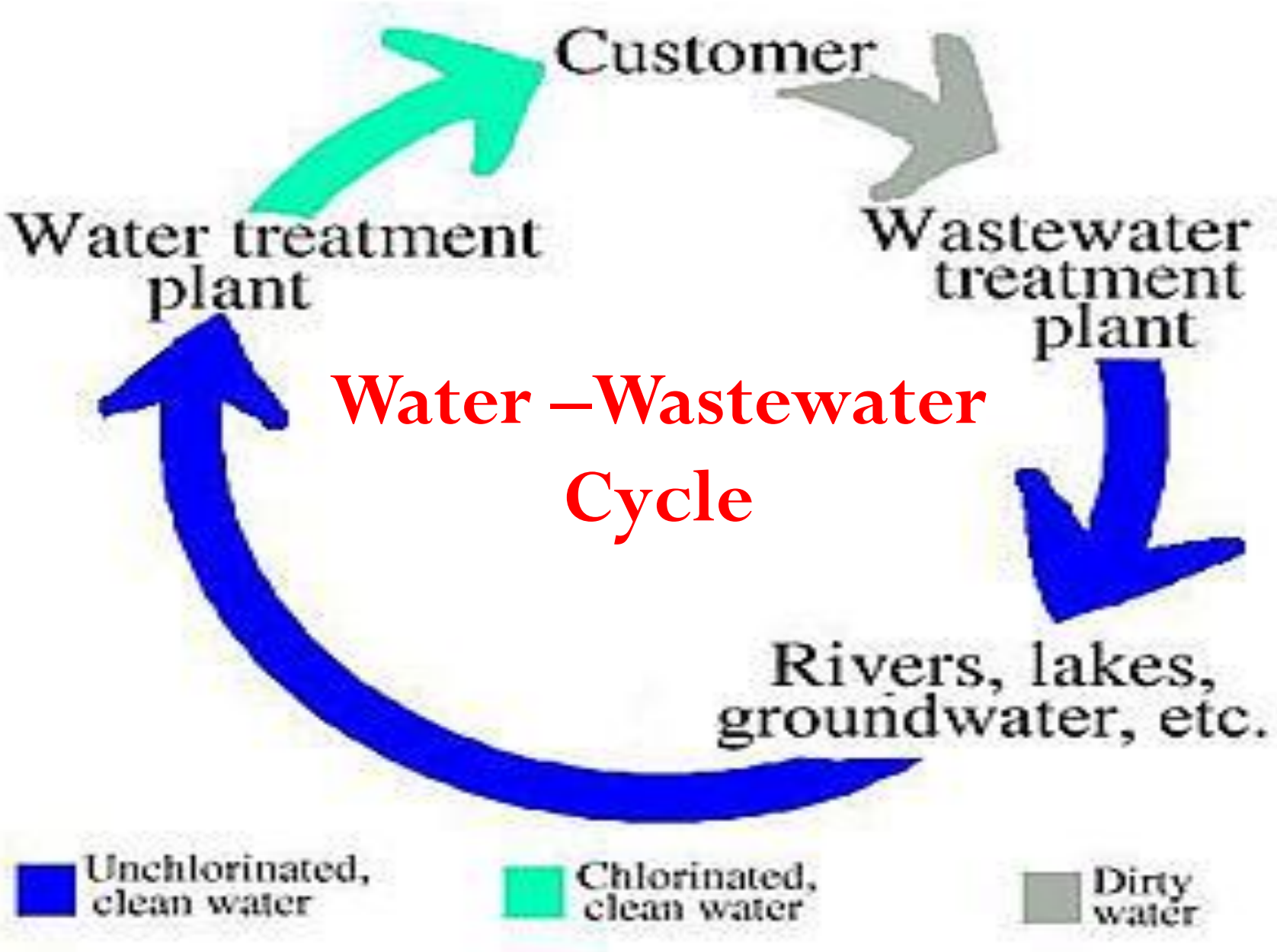
11. Manual on Municipal Solid Waste Management- Ministry of Urban Development Govt. of India.

Introduction

- It is unhealthy for humans, pets, and wildlife to drink or come in contact with surface or ground water contaminated with wastewater.
- **Inadequate treatment of wastewater allows bacteria, viruses, and other disease-causing pathogens to enter groundwater and surface water.**

- Hepatitis, dysentery, and other water borne diseases may result from bacteria and viruses in drinking water.
- **Oil and grease** prevents entry of light into surface water
- **Disease-causing organisms** may make lakes or **streams unsafe for recreation**.
- **Flies and mosquitoes** that are attracted to and breed in wet areas where wastewater reaches the surface may also spread disease.

- Inadequate treatment of wastewater can raise the **nitrate levels in groundwater**.
- High concentrations of nitrate in drinking water are a special risk to infants. Nitrate affects the ability of an infant's blood to carry oxygen, a condition called **methemoglobinemia (blue-baby syndrome).**
- Problem of **Euthrophication**


Customer
Water treatment plant
Wastewater treatment plant
Water –Wastewater Cycle
Rivers, lakes, groundwater, etc.
Unchlorinated, clean water
Chlorinated, clean water
Dirty water

Sources of Wastewater

- You can classify wastewater as **domestic, industrial, or storm,** according to its origin.
- **Domestic sources** include water used for normal activity in **homes, businesses and institutions**.
- **Domestic wastewater is readily treatable.**

- Storm water often goes to a treatment plant, although it is usually low in pollutants.
- Great amounts of storm water can interfere with treatment efficiency in two ways: **Storm water may cause too much dilution of the wastewater.**
- **At the same time, it may cause hydraulic overloading of the plant**. In most cases, wastewater systems now call for separate storm sewers.

- **The general principle in wastewater treatment is to remove pollutants** from the water by getting them either to **settle or to float,** and then removing this material.
- Some pollutants are easily removable. Others must be **converted to a settleable form** before they can be removed.

- Treatment facilities are designed in stages. **Each stage either removes particles from the wastewater or changes dissolved and suspended material to a form that can be removed.** A modern wastewater treatment plant may include these stages:

- Primary treatment
- Secondary treatment
- Tertiary treatment, such as Disinfection and
- Effluent discharge

Aim of waste water treatment

- To enable wastewater to be disposed safely, without being danger to public health and without polluting watercourse or causing other nuisance.
- Increasingly another important aim of wastewater Treatment is to recover energy, nutrients, water and other valuable resources from wastewater.

Wastewater : Important definitions

Sullage

- Sullage is wastewater coming out from bathroom, kitchens, washing places and wash basins etc.
- It does not create bad smell as organic matter content is less or in negligible amount

Sewage

- Sewage is a liquid waste from domestic, industrial and commercial premises discharged to the wastewater network.
- It is extremely putricible and decomposition of it produces foul gases.
- Also contains pathogens
- It includes discharge from latrines, urinals, storm water, ground water infiltration.

Sanitary sewage

- Sanitary sewage or domestic sewage indicates sewage mainly derived from the residential building and industrial establishments.
- It is extremely foul in nature.
- It can be classifies as

1. Domestic sewage and
2. Industrial sewage

Domestic Wastewater (Domestic Sewage)

- Domestic Wastewater is wastewater or sewage originating from toilets, urinals, kitchen, bathrooms, showers, baths and basins such as from residential buildings.
- As it contains urine and excreta, it is extremely foul in nature.

Industrial Sewage

- It is wastewater obtained from the industrial and commercial establishments.
- It mainly contains organic compounds that may not be treated by conventional treatment processes

Greywater

- Greywater is wastewater generated from domestic activities such as laundry, dishwashing, and bathing, which can be recycled on-site for uses such as landscape irrigation and constructed wetlands, flushing of WCs.
- Greywater differs from wastewater from the toilets which is designated sewage or blackwater to indicate it contains human waste.

Sub soil water

- It is ground water that finds entry into the sewers through leaks

Storm water

- It is rainwater runoff of the locality

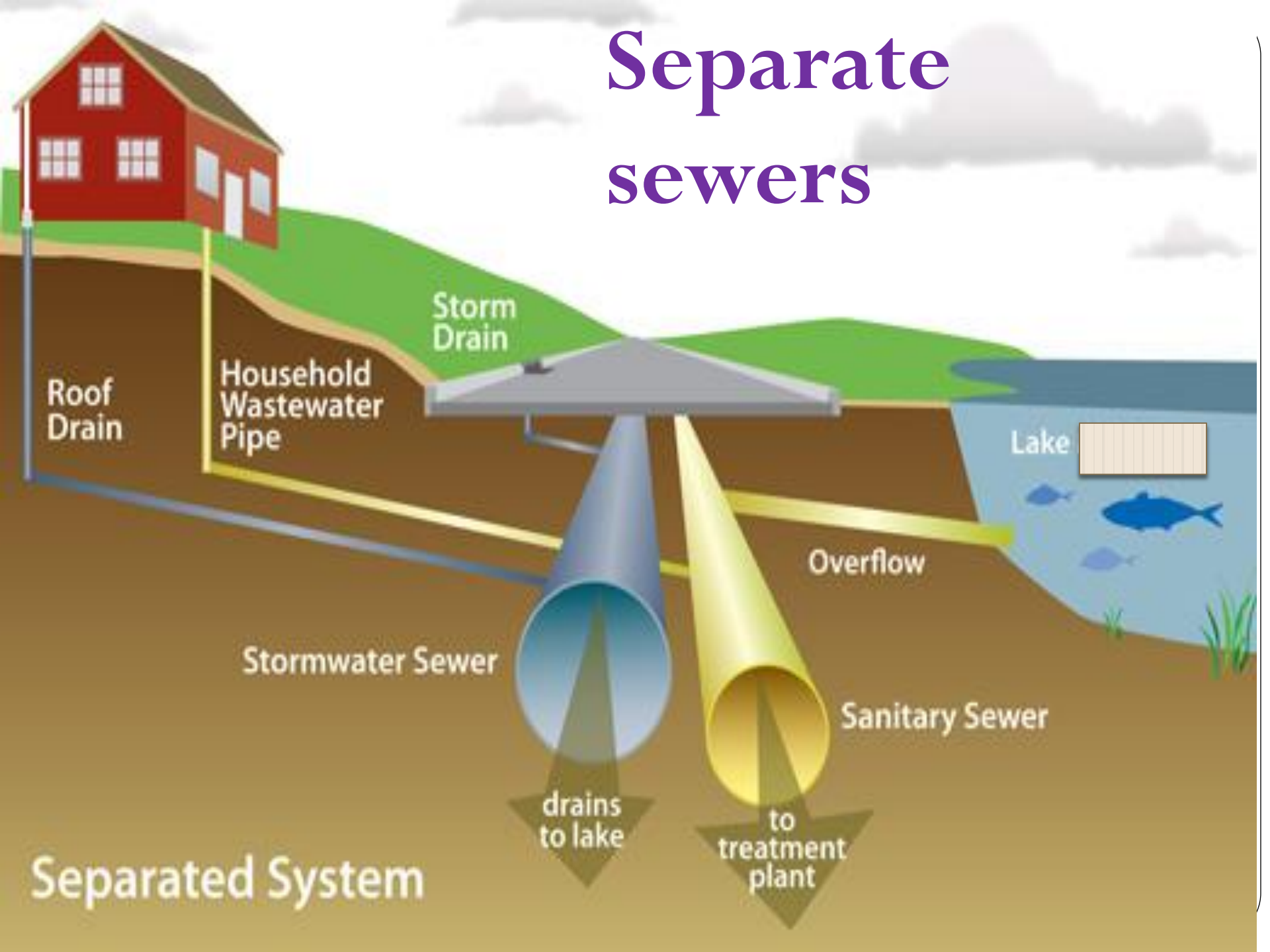
Sewer

- It is an under-ground conduit or drain through which sewage is carried to a point of treatment, discharge or disposal.

Separate sewers

- Separate sewers are those which carry the house hold i.e. domestic and industrial wastes only.

Separate sewers



Storm water drains

- are those which carry rain water from the roofs and street surfaces.

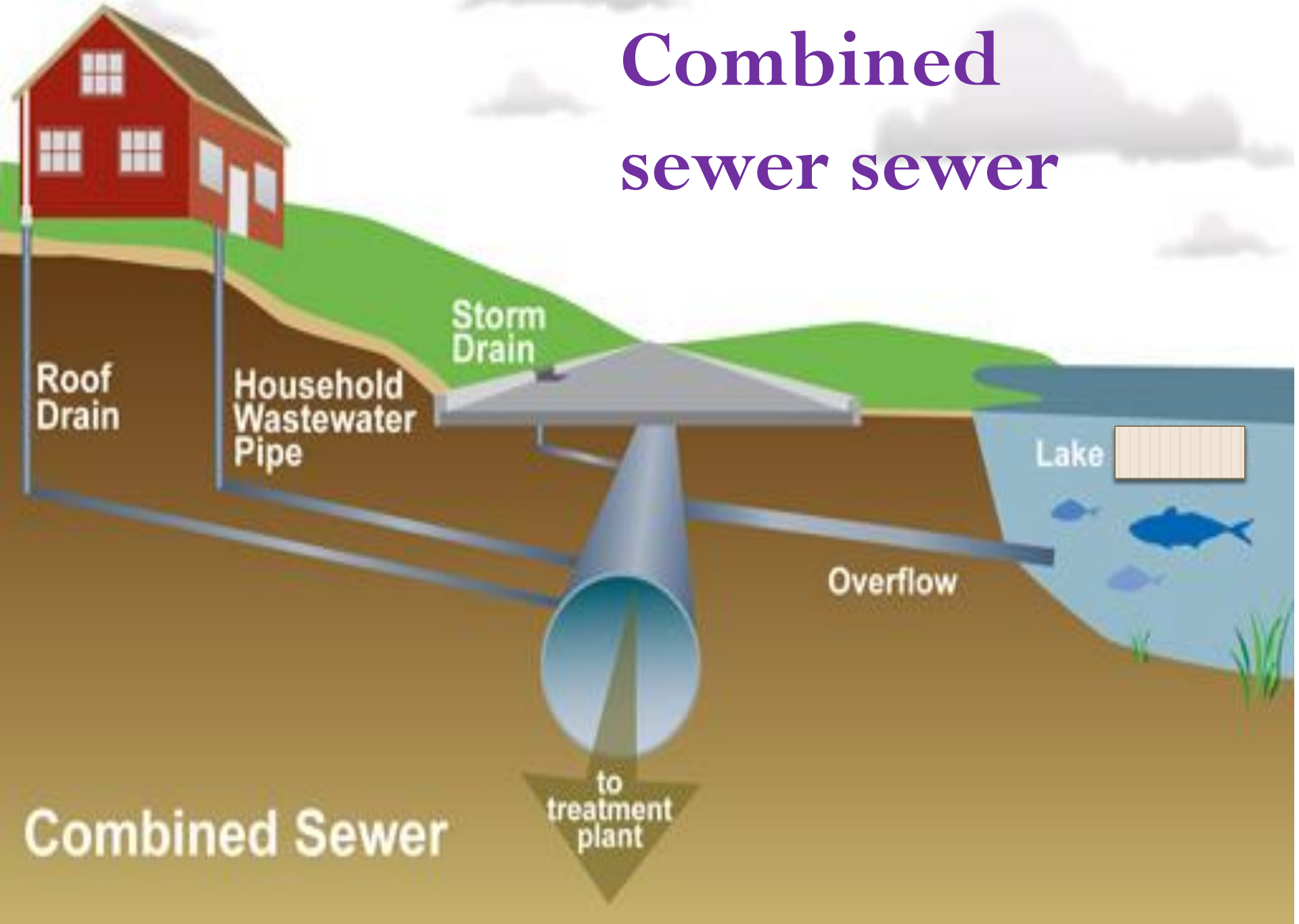
House or building sewer

- *(or drain)* is a pipe carrying away the sewage from a building to a street sewer.

Combined sewers

- are those which carry both sewage and storm water

Combined sewer sewer



Lateral sewer

- is a sewer which collects sewage directly from the houses. It indicates the first stage of sewage collection.

Branch sewer or sub main sewer

- is a sewer which receives sewage from a relatively small area, usually a few laterals, and discharge into a main sewer.

Main sewer or *trunk sewer*

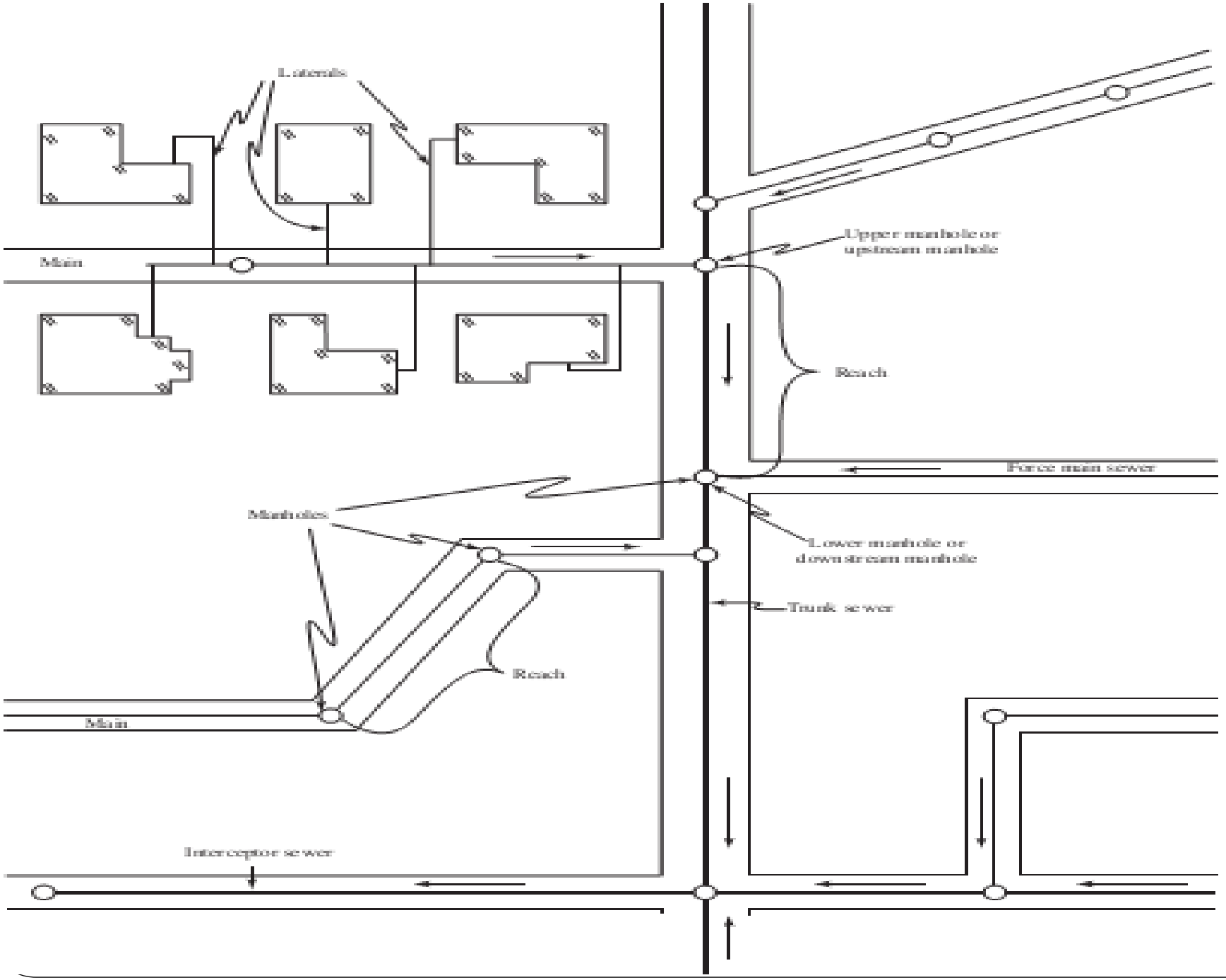
- is a sewer that receives sewage from many tributary branches and sewers, serving as an outlet for a large territory.

Out fall sewer

- is a sewer, that receives the sewage from the collecting system and conducts it to a point of final discharge or to a disposal plant.

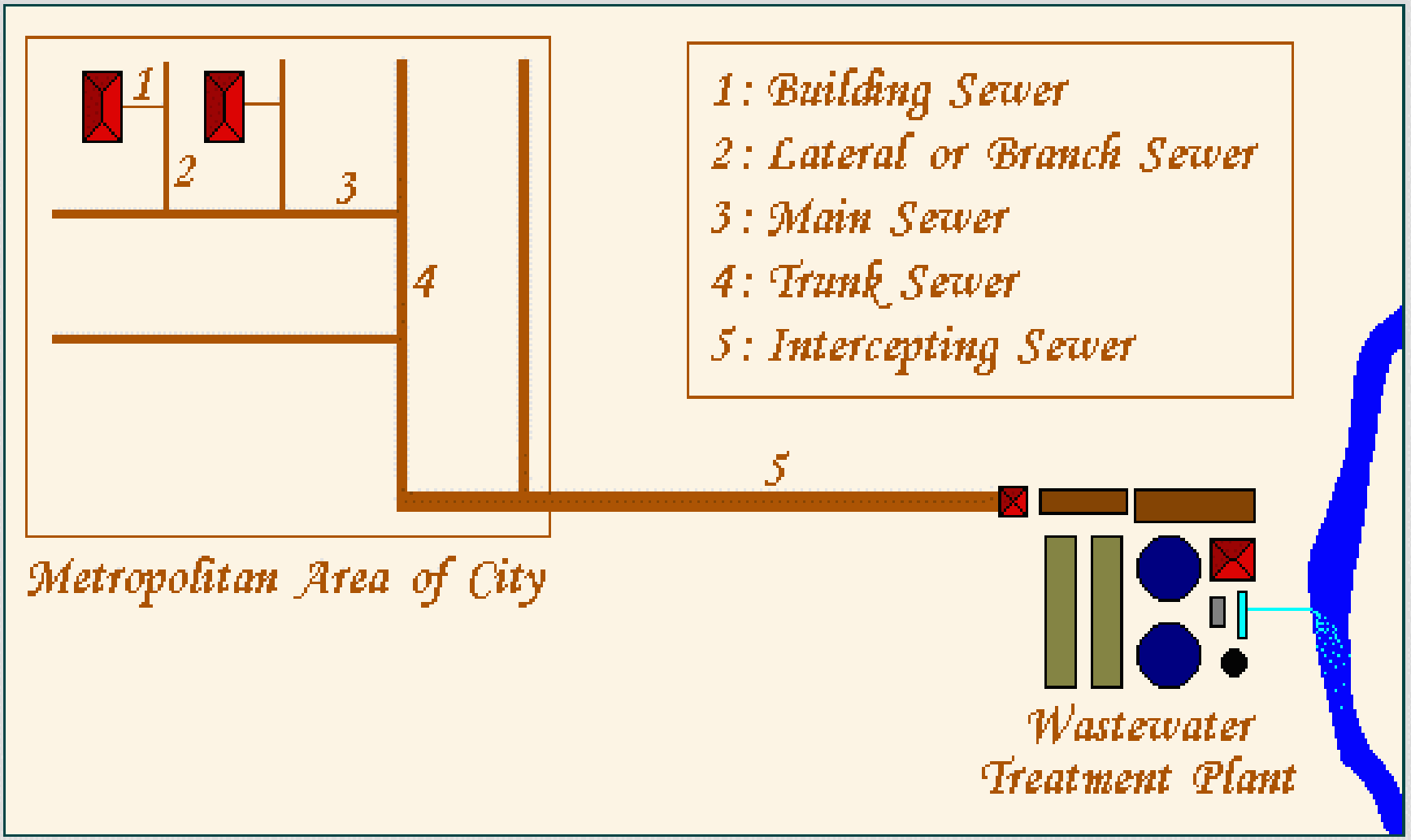
An intercepting sewer

- is usually a large sewer, flowing parallel to a natural drainage channel, into which a number of main or out fall sewers discharge.


Laterals
Main
Upper manhole or upstream manhole
Reach
Force main sewer
Manholes
Lower manhole or downstream manhole
Trunk sewer
Reach
Main
Interceptor sewer

Definition Sketch for Types of Sewers

Plan



Objective Questions

1. _____ is wastewater coming out from bathroom, kitchens, washing places and wash basins etc.
2. _____ is a sewer which collects sewage directly from the houses.
3. _____ is rainwater runoff of the locality.
4. _____allows bacteria, viruses, and other disease-causing pathogens to enter groundwater and surface water.

5. Separate sewers are those which carry the _____ _____.

6. _____ are those which carry both sewage and storm water.

Theory questions

Q1. Discuss importance of wastewater treatment.

Q2. Define the following:

i. Sullage
ii. Sewage
iii. Lateral sewer
iv. Submain sewer
v. Trunk sewer