Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY

COURSE PLAN

Academic Year 2019-2020

Program:	B E – CIVIL Engineering
Semester :	4
Course Code:	18CV46
Course Title:	Water Supply and Treatment Engineering
Credit / L-T-P:	3/ 3-0-0
Total Contact Hours:	50
Course Plan Author:	PRIYANKASHRI K N

Academic Evaluation and Monitoring Cell

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Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	CV
Year / Semester :	2020/VI	Academic Year:	2019-20
Course Title:	Water Supply and Treatment Engineering	Course Code:	18CV46
Credit / L-T-P:	3-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	60 Marks
CIA Marks:	40	Assignment	1 / Module
Course Plan Author:	PRIYANKASHRI K N	Sign	Dt:
Checked By:	SHIVAPRASAD D G	Sign ..	Dt:
CO Targets	CIA Target : 85%	SEE Target:	80%

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting percapita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.Different methods of population forecasting -with merits and demerits. Numerical Problems.	10	Water demand Population forecasting	L3
2	Water Treatment: Objectives, Treatment flow chart – significance of each unit Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling Objectives, methods, Preservation techniques. Water quality characteristics: Physical, Chemical and Microbiological.	10	Water Sources, quality parameters analysis	L3
3	Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarri flocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system. Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pretreatment.	10	Sedimentation tank, Filtration unit	L3
4	Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nanofiltration membranes and elements, Conventional pre-treatment techniques for RO and nano filtration. Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.	10	Softening process Disinfection methods	L3
5	Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.	10	Conveyance of water	L3

	Pumps: Types of pumps with working principles. Numerical Problems. Pipes: Design of the economical diameter for the rising main; Numerical Problems. Pipe appurtenances, Valves, Fire hydrants Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material. Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination. Visit to Intake structure, Water treatment plant and report working of each unit Design of water treatment plant units and distribution system with population forecasting for the given city		Distribution of water	
-	**Total**	**50**	**-**	**-**

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2, 3, 4, 5	S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010	3, 4	In Lib / In Dept
1	Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.	2, 4	In Lib/ In dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2	B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.	1,2,3	In Lib
1, 2	Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000	1,2,3	In Lib
3, 4, 5	CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi	1,2,3,4	In lib
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
C1	https://youtu.be/zVZ9c6EXfTA	1,2	
C2	https://youtu.be/GSEiRtqBu6g	1,2	
C3	https://youtu.be/zVZ9c6EXfTA	1,2	
C4	https://youtu.be/XTkW5_I-NA0	2,3	
C5	https://youtu.be/MfkJu7J1LE4	2,3	
C6	https://youtu.be/eknrvqLtbsc	2,3	
C7	https://youtu.be/dOx1A80fxdw	2,3,4	
C8	https://youtu.be/dCimAH5IRSA	2,3,4	
C9	https://youtu.be/cvUa82Qb1Hg	2,3,4	
C10	https://youtu.be/_iz8ZkjD7z8	2,3,4	
	Lab :		
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
	https://youtu.be/6ug1L0nVUYPY		
	https://youtu.be/bZHAwF4cxjk		
	https://youtu.be/zVZ9c6EXfTA		
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1	https://youtu.be/zVZ9c6EXfTA		

2	https://youtu.be/wI7uvQThX8A		

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	18CV46	Water supply and treatment engineering	1. Knowledge on water treatment and supply	2		L3
	-	-	4. Knowledge of water Demand and water quality	-	Plan Gap Course	L3

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Water demand / Knowledge of water requirements	Higher Study	Gap A seminar on water demands for the public	Understand L2
1	Population forecasting/Knowledge different forecasting methods	Higher Study	A seminar on population forecasting methods	Understand L2
2	Sources of water/Knowledge of quantity and quality of water	Higher Study	A seminar on different surface and subsurface sources	Understand L2
3	Water quality standards/Knowledge of characteristics of water	Higher Study	A seminar on physical and chemical biological characteristics of water	Understand L2
4	Design of Treatment units/Knowledge of conventional treatment methods	Higher Study	A seminar on conventional water treatment methods	Understand L2
5	Conveyance of water/Knowledge of distribution system	Higher Study	A seminar on water distribution networks	Understand L2

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	18CV46.1	Analyze the variation of water demand and to estimate water requirement for a community.	5	Water demand	Lecture	CIA	L3 Apply
2	18CV46.2	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system	5	Water Quality analysis	Lecture	CIA	L3 Apply
3	18CV46.3	To design disinfection treatment units in the treatment plant in the water supply system	5	Disinfection methods	Lecture	CIA	L3 Apply
4	18CV46.4	Evaluate the sources and conveyance systems for raw and	5	Conveyance of water	Lecture	CIA	L3 Apply

		treated water					
5	18CV46.5	Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.	5	Distribution of water	Lecture	CIA	L3 Apply
-	**-**	**Total**	**50**	**-**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	variation of water demand and to estimate water requirement for a community.	CO1	L3
1	Forecast the population by using different methods	CO2	L3
2	Identify sources of water, quantitatively and qualitatively and make appropriate choice for a community	CO3	L3
2	Analysis of physical chemical biological characteristics of water	CO4	L4
3	water quality and environmental significance of various parameters and plan suitable treatment system	CO5	L3
3	To design various treatment units in the treatment plant in the water supply system	CO6	L4
4	To design various treatment units in the treatment plant in the water supply system	CO7	L4
4	Design various treatment units in the treatment plant	CO8	L4
5	Sources and conveyance of raw and treatment water	CO9	L2
5	To supply portable water the public	CO10	L2

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	**CO**	**PO**	**-**	**'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'**	**-**
1	CO1	PO1	3	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to find the solution for water independence for an entire city	L3
1	CO1	PO2	2	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve the total amount of water needed for a city by population forecasting	L3
1	CO1	PO3	1	The students will be able to design the water demand of a city in such a way that it will cater all the environmental/ public health needs	L3
1	CO2	PO1	1	The students will be able to analyse the water quality of a surface or ground water body and develop strategies for improving them in concern with the public health/ environmental concern	L4
1	CO2	PO2	2	The students will be able to analyse the water quality of a surface or ground water body and develop strategies for improving them in con	L3
2	CO3	PO1	1	The students will be able to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid treatment methods to complex pollution scenarios	L4
2	CO3	PO2	2	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to analyze the characteristics of water	L4
2	CO4	PO3	3	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to analyze the characteristics of water and suggest suitable treatment methods	L4
2	CO4	PO1	2	The students will be able to identify different types of pollutants and	L2

				provide a solution by their environmental application to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations	
3	CO5	PO3	3	The students will be able to apply the knowledge of physical chemical and biological characteristics of water to know strength of water	L2
3	CO5	PO4	2	The students will be able to design individual treatment units in concern with the environment	L3
3	CO6	PO3	3	The students will be able to initiate the design solutions for rapid and slow sand filters in such a way that it will be cost effective and efficient	L3
3	CO6	PO4	2	The students will be able to design individual treatment units in concern with the environment	L3
4	CO7	PO3	3	The students will be able to initiate the design solutions for softening units in such a way that it will be cost effective and efficient	L4
4	CO7	PO4	2	The students will be able to design individual treatment units in concern with the environment	L4
4	CO8	PO1	1	The students will be able to use research-based knowledge and research methods including design of units, analysis and interpretation of data, and synthesis of the information to provide valid disinfection treatment methods to complex pollution scenarios	L4
4	CO8	PO2	2	The students will be able to apply the knowledge of biological characteristics of water to know strength of water in the disinfection unit	L4
5	CO9	PO1	1	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to analyse and solve the complex water network system for a community/city	L3
5	CO9	PO2	2	The students will be able to design water network system by analyzing the layout of the city and available water sources	L3
5	CO10	PO1	1	The students will be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to analyse and solve the complex water distribution system for a city	L3
5	CO10	PO2	2	The students will be able to design water distribution network system by analyzing the layout of the city and available water sources	L3

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	18CV46.1	Analyze the variation of water demand and to estimate water requirement for a community.	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	L3
1	18CV46.2	To understand the methods of population forecasting to meet water demands for a community	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L3
2	18CV46.3	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L3
2	18CV46.4	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L4
3	18CV46.5	Design settling tank and coagulation tank to remove particles to get safe and potable water Supply.	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	L3
3	18CV46.6	Design Different types of filters to	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	L4

		remove particles to get safe and potable water Supply.																
4	18CV46.7	To design Hardness removal units in the treatment plant in the water supply system	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	L4
4	18CV46.8	To design disinfection treatment units in the treatment plant in the water supply system	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L4
5	18CV46.9	Evaluate the sources and conveyance systems for raw and treated water	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
5	18CV46.10	Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
-	**CS501PC**	**Average attainment (1, 2, or 3)**	**2.5**	**2.5**	**1.5**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**L2-L4**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction: Need for protected water supply	10	2	-	-	1	1	2	CO1, CO2	L1, L2
2	Water Treatment	10	2	-	-	1	1	2	CO3, CO4	L2, L3
3	Coagulation aided sedimentation	10	-	2	-	1	1	2	CO5, CO6	L3, L4
4	Softening	10	-	2	-	1	1	2	CO7, C08	L2, L3
5	Collection and Conveyance of water:	10	-	-	4	1	1	2	CO9, CO10	L4, L5
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1,2	CIA Exam – 1	15	CO1, CO2, CO3, CO4	L1, L2, L3,
3,4	CIA Exam – 2	15	CO5, CO6, CO7, C08	L1, L2, L3,
5	CIA Exam – 3	15	CO9, CO10	L1, L2, L3,
1,2	Assignment - 1	05	CO1, CO2, CO3, CO4	L1, L2, L3,
3,4	Assignment - 2	05	CO5, CO6, CO7, CO8	L1, L2, L3,
5	Assignment - 3	05	CO9, CO10	L1, L2, L3,
1,2	Seminar - 1	05	CO1, CO2, CO3, CO4	L1, L2, L3,
3,4	Seminar - 2	05	CO5, CO6,CO7,CO8	L1, L2, L3,
5	Seminar - 3	05	CO9, CO10	L1, L2, L3,
	Other Activities – define – Slip test		CO1 to Co9	L1, L2, L3,
	Final CIA Marks	**20**	**-**	

D1. TEACHING PLAN - 1

Module - 1

Title:	Divide and Conquer	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze the variation of water demand and to estimate water requirement for a community.	CO1	L3
2	To understand the methods of population forecasting to meet water demands for a community	CO2	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction: Need for protected water supply	C01	L3
2	Demand of Water: Types of water demands -domestic demand,	C01	L3
3	industrial, institutional and commercial, public use,	C01	L3
4	fire demand,	C01	L3
5	Factors affecting percapita demand,	C01	L3
6	Variations in demand of water	CO2	L3
7	Peak factor,	CO2	L3
8	Design period and factors governing design period	CO2	L3
9	Different methods of population forecasting with merits and demerits	CO2	L3
10	Numerical Problems.	CO2	L3
c	**Application Areas**	**CO**	**Level**
1	Demand of water in water supply scheme	CO1	L3
2	Forecasting population to meet public demands	CO2	L3
d	**Review Questions**	-	-
1	Explain necessity of water supply scheme	CO1	L1
2	Explain the various types of water demand.	CO1	L3
3	What is meant by per capita demand?	CO2	L2
4	Mention the factors that affect per capita demand	CO2	L4
5	What is meant by design period? Discuss the factors affecting design period.	CO2	L2
6	Define population forecasting	CO2	L3
7	Explain methods of population Forecasting	CO2	L2
8	Describe the incremental method of estimating the population of a locality.	CO2	L3
9	Describe the incremental method of estimating the population of a locality.	CO2	L3
10	Describe the incremental method of estimating the population of a locality.	CO1	L1
11	Explain briefly about Peak factor	CO1	L3
12	Discuss the environmental pollution due to human activities.	CO2	L2
13	What is meant by per capita demand? List and discuss the factors that affect the per capita demand.	CO2	L3
14	The following is the population data of a city available from past census records. Determine the future population of the city in 2030 by i) Arithmetical increase method and ii) Geometrical increase method.	CO2	L2

Year	Population
1960	25,000
1970	28,000
1980	34,000
1990	42,000

	2000 | 47,000		
15	The population of a town is as below Year | population 1980 | 30000 1990 | 36000 2000 | 45000 2010 | 53000	CO2	L3
16	Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.	CO2	L3
e	**Experiences**	-	-
1			
2			
3			
4			
5			

Module – 2

Title:	Divide and Conquer	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.	CO1	L3
2	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system	CO2	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
17	Water Treatment: Objectives	CO1	L3
18	Water quality characteristics: Physical	CO1	L3
19	Water quality characteristics: Chemical	CO2	L3
20	Water quality characteristics: Microbiological	CO2	L3
21	Treatment flow chart significance of each unit	CO2	L3
22	Sources and Characteristics: surface and subsurface sources suitability with regard to quality and quantity.	CO2	L3
23	Sampling techniques.	CO2	L3
24	Sampling Objectives,	CO2	L3
25	Sampling methods, Preservation	CO2	L3
c	**Application Areas**	**CO**	**Level**
1	To find suitable water sources qualitatively and quantitatively	CO1	L3
2	To supply portable water to water supply scheme	CO2	L3
		CO2	
d	**Review Questions**	CO2	-
12	Write the desirable limits for the following parameters as per BIS : 10500 — 1991 : i) Color ii) pH iii) Total hardness iv) Nitrate v) Total dissolved solids vi) Iron vii) Fluoride viii) Chloride ix) Alkalinity x) Turbidity.	CO1	L1
13	Explain in brief grab sampling and composite sampling.	CO1	L3
14	In a water treatment plant the pH values of incoming and outgoing water are 7.2 and 8.4 respectively. Find average value of pH, assuming linear variation of pH with time.	CO2	L2

15	What is aeration? with neat sketches, explain slat tray aerator and trickling bed aerator	CO1	L4
16	Mention the permissible limits for the following parameters and explain the environmental significance of each : Hardness, Nitrate, Fluorides and Iron.	CO1	L2
17	Write a note on properties of whole some water.	CO2	L3
18	Briefly explain the water borne diseases and their control.	CO2	L2
19	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	CO2	L3
20	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	CO2	L3
21	Explain with chemical equations, what happens when alum is added to water?	CO2	L3
22	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min.	CO2	L2
23	Explain the significance of the following impurities with respect to quality of water: i) Turbidity ii) Hardness iii) Fluoride iv) Nitrate	CO2	L3
24	Explain the multiple fermentation tube test.	CO1	L2
25	Write a note on water borne diseases and their control.	CO1	L3
26	Enumerate the various physical and chemical characteristics of testing of raw water supplies	CO2	L2

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	18CV46	Sem:6	I	Marks:	30	Time:	75 minutes		
Course:	Water supply and treatment engineering								
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 1, 2**					**Marks**	**CO**	**Level**
1	a	Explain necessity of water supply scheme					8	CO1	L1
	b	Explain the various types of water demand.					7	CO1	L2
		OR						CO2	
2	a	Mention the factors that affect per capita demand					8	CO2	L2
	b	What is meant by design period? Discuss the factors affecting design period.					7	CO2	L3
								CO2	
3	a	Write the desirable limits for the following parameters as per BIS : 10500 — 1991 : i) Color ii) pH iii) Total hardness iv) Nitrate v) Total dissolved solids vi) Iron vii) Fluoride viii) Chloride ix) Alkalinity x) Turbidity.					8	CO2	L2
	b	Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.					7	CO2	L2
		OR							
4	a	Explain with chemical equations, what happens when alum is added to water?					7	CO3	L2
	b	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min.					8	CO4	L2

Model Assignment Questions							
Course Code:	18CV46	Sem:	4	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Water supply and treatment engineering						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	Assignment Description	Marks	CO	Level
1	Explain necessity of water supply scheme	5	CO2	L3
2	Explain the various types of water demand.	5	CO1	L3

<table>
<tr><td>3</td><td>What is meant by percapita demand?</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>4</td><td>Mention the factors that affect per capita demand</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>5</td><td>What is meant by design period? Discuss the factors affecting design period.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>6</td><td>Define population forecasting</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>7</td><td>Explain methods of population Forecasting</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>8</td><td>Describe the incremental method of estimating the population of a locality.</td><td>5</td><td>CO2</td><td>L3</td></tr>
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<tr><td>10</td><td>Describe the incremental method of estimating the population of a locality.</td><td>5</td><td>CO1</td><td>L3</td></tr>
<tr><td>11</td><td>Explain briefly about Peak factor</td><td>5</td><td>CO1</td><td>L3</td></tr>
<tr><td>12</td><td>Discuss the environmental pollution due to human activities.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>13</td><td>What is meant by per capita demand? List and discuss the factors that affect the per capita
demand.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>9</td><td>The following is the population data of a city available from past census records. Determine
the future population of the city in 2030 by i) Arithmetical increase method and ii) Geometrical increase method.
<table>
<tr><td>Year</td><td>Population</td></tr>
<tr><td>1960</td><td>25,000</td></tr>
<tr><td>1970</td><td>28,000</td></tr>
<tr><td>1980</td><td>34,000</td></tr>
<tr><td>1990</td><td>42,000</td></tr>
<tr><td>2000</td><td>47,000</td></tr>
</table></td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>10</td><td>The population of a town is as below
<table>
<tr><td>Year</td><td>population</td></tr>
<tr><td>1980</td><td>30000</td></tr>
<tr><td>1990</td><td>36000</td></tr>
<tr><td>2000</td><td>45000</td></tr>
<tr><td>2010</td><td>53000</td></tr>
</table></td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>11</td><td>Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>12</td><td>Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>13</td><td>Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.</td><td>5</td><td>CO1</td><td>L3</td></tr>
<tr><td>14</td><td>Explain with chemical equations, what happens when alum is added to water?</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>15</td><td>Explain the method of sampling of water.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>16</td><td>Write the desirable limits for the following parameters as per BIS : 10500 — 1991 :
i) Color ii) pH iii) Total hardness iv) Nitrate v) Total dissolved solids vi) Iron vii) Fluoride viii) Chloride ix) Alkalinity x) Turbidity.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>17</td><td>Explain in brief grab sampling and composite sampling.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>18</td><td>In a water treatment plant the pH values of incoming and outgoing water are 7.2 and 8.4 respectively. Find average value of pH, assuming linear variation of pH with time.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>19</td><td>What is aeration? with neat sketches, explain slat tray aerator and trickling bed aerator</td><td>5</td><td>CO2</td><td>L3</td></tr>
</table>

20	Mention the permissible limits for the following parameters and explain the environmental significance of each : Hardness, Nitrate, Fluorides and Iron.	5	CO2	L3
21	Write a note on properties of whole some water.	5	CO1	L3
22	Briefly explain the water borne diseases and their control.	5	CO1	L3
23	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO2	L3
24	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO2	L3
25	Explain with chemical equations, what happens when alum is added to water?	5	CO2	L3
26	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min.	5	CO2	L3
27	Explain the significance of the following impurities with respect to quality of water: i) Turbidity ii) Hardness iii) Fluoride iv) Nitrate	5	CO2	L3
28	Explain the multiple fermentation tube test.	5	CO1	L3
29	Write a note on water borne diseases and their control.	5	CO2	L3
30	Enumerate the various physical and chemical characteristics of testing of raw water supplies	5	CO2	L3
31	Give the drinking water standards for the following parameters. Discuss their effect when they exceed their limits : i) Turbidity ii) Hardness iii) Chlorides iv) Fluoride.	5	CO2	L3
32	Explain the method of sampling of water.	5	CO2	L3
33	Briefly explain the complete treatment process of a water supply scheme with flow chart.	5	CO2	L3
34	Write short notes on : a. Fire hydrants. b. Pressure release valve. c. Metering in distribution system. d. Jar test	5	CO2	L3
35	Explain necessity of water supply scheme	5	CO2	L3
36	Explain the various types of water demand.	5	CO1	L3
37	What is meant by percapita demand?	5	CO2	L3
38	Mention the factors that affect per capita demand	5	CO2	L3
39	What is meant by design period? Discuss the factors affecting design period.	5	CO2	L3
40	Define population forecasting	5	CO2	L3
41	Explain methods of population Forecasting	5	CO2	L3
42	Describe the incremental method of estimating the population of a locality.	5	CO2	L3
43	Describe the incremental method of estimating the population of a locality.	5	CO2	L3
44	Describe the incremental method of estimating the population of a locality.	5	CO1	L3
45	Explain briefly about Peak factor	5	CO1	L3
46	Discuss the environmental pollution due to human activities.	5	CO2	L3
47	What is meant by per capita demand? List and discuss the factors that affect the per capita demand.	5	CO2	L3
48	The following is the population data of a city available from past census records. Determine the future population of the city in 2030 by i) Arithmetical increase method and ii) Geometrical increase method. Year | Population	5	CO2	L3

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50	Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.	5	CO2	L3
51	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO2	L3
52	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO1	L3
53	Explain with chemical equations, what happens when alum is added to water?	5	CO2	L3
54	Explain the method of sampling of water.	5	CO2	L3
55	Write the desirable limits for the following parameters as per BIS : 10500 — 1991 : i) Color ii) pH iii) Total hardness iv) Nitrate v) Total dissolved solids vi) Iron vii) Fluoride viii) Chloride ix) Alkalinity x) Turbidity.	5	CO2	L3
56	Explain in brief grab sampling and composite sampling.	5	CO2	L3
57	In a water treatment plant the pH values of incoming and outgoing water are 7.2 and 8.4 respectively. Find average value of pH, assuming linear variation of pH with time.	5	CO2	L3
58	What is aeration? with neat sketches, explain slat tray aerator and trickling bed aerator	5	CO2	L3
59	Mention the permissible limits for the following parameters and explain the environmental significance of each : Hardness, Nitrate, Fluorides and Iron.	5	CO2	L3
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64	Explain with chemical equations, what happens when alum is added to water?	5	CO2	L3
65	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min.	5	CO2	L2
66	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO2	L2
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ment to be assigned to each student.

D2. TEACHING PLAN - 2

Module – 3

Title:	Divide and Conquer	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Study drinking water quality standards and to illustrate qualitative analysis of water	CO3	L2
2	Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.	CO4	L3
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Sedimentation theory, settling tanks, types, design. Concept of Plate and Tube settlers.	CO3	L2
2	Coagulation aided sedimentation types of coagulants,	CO4	L2
3	Filtration: mechanism theory of filtration, types of filters,	CO3	L2
4	chemical feeding, flash mixing,	CO4	L2
5	Clarri flocculators	CO3	L2
6	slow sand, rapid sand and pressure filters including construction, operation, cleaning	CO4	L3
7	Operational problems in filters. Design of slow and rapid sand filter without under drainage system.	CO3	L3
8	Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability,	CO3	L3
9	fouling mechanism, Overview of ultra and microfiltration elements and systems,	CO4	L3
10	Fouling in MF/UF systems, fouling control and pre treatment	CO3	L3
c	**Application Areas**	**CO**	**Level**

1	Design of water and wastewater units	CO1	L3
2	Ultra and micrifiltration techniques in treatment process	CO2	L4
d	**Review Questions**	-	-
1	Briefly explain the complete treatment process of a water supply scheme with flow chart.	CO3	L3
2	What is Aeration? Explain the types of aerators.	CO4	L3
3	Describe briefly the various constituents of coagulation — sedimentation plant.	CO3	L3
4	Define sedimentation ow that settlement of the particles in sedimentation unit is independent of depth.	CO4	L3
5	Explain the method of determining optimum dosage of coagulant with the aid of neat sketch.	CO3	L3
6	A circular sedimentation fitted with standard mechanical sludge removal is to handle 5 million litres/day of sewage. Take detention period as 5 hr and depth of tank as 3 m. Find the dia. of the tank.	CO4	L3
7	Define filtration. Explain the principle underlying filtration process.	CO3	L3
8	List and explain the various operating problems during the filtration process.	CO4	L3
9	a. Explain in detail the theory of filtration.	CO3	L3
10	With the help of a neat sketch, explain the working of Rapid gravity filter	CO4	L3
11	Explain with a neat sketch working of a pressure filter	CO3	L3
12	Determine the dimensions of a set of rapid gravity filters for treating water required for a population of 50,000 with average rate of demand as 180 litres per day per person. Assume a peak factor of 1.8 by ignoring wash water requirements. Assume rate of filtration is 5001/h/sq.m	CO4	L3
13	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	CO3	L3
14	Explain with chemical equations, what happens when alum is added to water?	CO4	L3
15	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min	CO3	L3
16	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	CO3 CO4	L3
e	**Experiences**	-	-
1			
2			
3			
4			
5			

Module – 4

Title:	Divide and Conquer	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	To design various treatment units in the treatment plant in the water supply system	CO5	L2
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Softening: Overview of Lime soda,	CO5	L2
2	Zeolite process, RO and Nano filtration:	CO5	L2

3	Basic principles, Flux, Salt passage,	CO5	L2
4	rejection and concentration polarization.	CO5	L2
5	Overview of RO and nano filtration membranes and elements,	CO5	L2
6	Conventional pretreatment techniques for RO and nano filtration.	CO5	L2
7	Disinfection: Methods of disinfection with merits and demerits,	CO5	L2
8	emphasis on treatment of water for community bathing. (melas and fairs)	CO5	L2
9	Theory of disinfection,	CO5	L2
10	Fluoridation and Defluoridation	CO5	L2
c	**Application Areas**	**CO**	**Level**
1	To design water and wastewater treatment plant	CO5	L3
2	To provide safe and portable water to public	CO5	L3
d	**Review Questions**	-	-
1	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	CO5	L3
2	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.	CO5	L3
3	Briefly explain Zeolite process of hardness removal	CO5	L3
4	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" of defluoridation.	CO5	L3
5	What is aeration? Explain the type of aerators.	CO5	L3
6	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each	CO5	L3
7	With the help of a neat sketch, explain the working of Rapid gravity filter.	CO5	L3
8	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	CO5	L3
9	Explain briefly the following processes : i) Break point chlorination ii) Superchlorination.	CO5	L3
10	Mention the methods of softening the water. Describe zeolite process of softening water in detail	CO5	L3
11	explain briefly : i) Defluoridation ii) Desalination.	CO5	L3
12	With sketches, explain briefly dead end system and grid iron system of distribution networks.	CO5	L3
13	What is aeration? with neat sketches, explain slat tray aerator and trickling bed aerator.	CO5	L3
14	How you will determine the optimum coagulant dosage in Lab using Jar test apparatus? Discuss with sketch.	CO5	L3
15	Determine quantity of alum needed to treat 13 million litres of water per day in treatment plant. The dosage of alum12mg/f. Also find amount of CO2 released per liter of water treated. Assume molecular weight of At = 26.97 , S = 32.066 , 0 = 16 , H = 1.008	CO5	L3
16	write explanatory note on : i) Ozone treatment ii) UV treatment iii) Chlorination iv) Electro — Katadyn process v) Treatment with KMn04.	CO5	L3
17	Write the comparison between soda lime process and Zeolite process of softening of water techniques	CO5	L3
18	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	CO5	L3
19	Briefly explain Zeolite process of hardness re	CO5	L3
20	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams	CO5	L3

	per litre and chlorine demand of the water.		
e	**Experiences**	-	-
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	18CV46	Sem:	4	Marks:	30	Time:	75 minutes		
Course:	Water supply and treatment engineeing								
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 3, 4**					**Marks**	**CO**	**Level**
1	a	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.					8	CO5	L3
	b	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.					7	CO5	L3
		OR						CO5	
2	a	With the help of a neat sketch, explain the working of Rapid gravity filter.					8	CO5	L3
	b	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.					7	CO5	L3
3	a	write explanatory note on : i) Ozone treatment ii) UV treatment iii) Chlorination iv) Electro — Katadyn process v) Treatment with KMn04.					8	CO5	L3
	b	Write the comparison between soda lime process and Zeolite process of softening of water techniques					7	CO5	L3
		OR						CO5	
4	a	With the help of a neat sketch, explain the working of Rapid gravity filter.					8	CO5	L3
	b	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.					7	CO5	L3

b. Assignment – 2

Model Assignment Questions							
Crs Code:	18CV46	Sem:	6	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Water supply and treatment engineering						

SNo	**Assignment Description**	**Marks**	**CO**	**Level**
1	Briefly explain the complete treatment process of a water supply scheme with flow chart.	5	CO5	L3
2	What is Aeration? Explain the types of aerators.	5	CO5	L3
3	Describe briefly the various constituents of coagulation — sedimentation plant.	5	CO5	L3
4	Define sedimentation ow that settlement of the particles in sedimentation unit is independent of depth.	5	CO5	L3
5	Explain the method of determining optimum dosage of coagulant with the aid of neat sketch.	5	CO5	L3
6	A circular sedimentation fitted with standard mechanical sludge removal is to handle	5	CO5	L3

	5 million litres/day of sewage. Take detention period as 5 hr and depth of tank as 3 m. Find the dia. of the tank.			
7	Define filtration. Explain the principle underlying filtration process.	5	CO5	L3
8	List and explain the various operating problems during the filtration process.	5	CO5	L3
9	a. Explain in detail the theory of filtration.	5	CO5	L3
10	With the help of a neat sketch, explain the working of Rapid gravity filter	5	CO5	L3
11	Explain with a neat sketch working of a pressure filter	5	CO5	L3
12	Determine the dimensions of a set of rapid gravity filters for treating water required for a population of 50,000 with average rate of demand as 180 litres per day per person. Assume a peak factor of 1.8 by ignoring wash water requirements. Assume rate of filtration is 5001/h/sq.m	5	CO5	L3
13	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO5	L3
9	Explain with chemical equations, what happens when alum is added to water?	5	CO5	L3
10	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min	5	CO5	L3
11	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	5	CO5	L3
12	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	5	CO5	L3
13	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.	5	CO5	L3
14	Briefly explain Zeolite process of hardness removal	5	CO5	L3
15	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" of defluoridation.	5	CO5	L3
16	What is aeration? Explain the type of aerators.	5	CO5	L3
17	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each	5	CO5	L3
18	With the help of a neat sketch, explain the working of Rapid gravity filter.	5	CO5	L3
19	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	5	CO5	L3
20	Explain briefly the following processes : i) Break point chlorination ii) Superchlorination.	5	CO5	L3
21	Mention the methods of softening the water. Describe zeolite process of softening water in detail	5	CO5	L3
22	explain briefly : i) Defluoridation ii) Desalination.	5	CO5	L3
23	With sketches, explain briefly dead end system and grid iron system of distribution networks.	5	CO5	L3

24	What is aeration? with neat sketches, explain slat tray aerator and trickling bed aerator.	5	CO5	L3
25	How you will determine the optimum coagulant dosage in Lab using Jar test apparatus? Discuss with sketch.	5	CO5	L3
26	Determine quantity of alum needed to treat 13 million litres of water per day in treatment plant. The dosage of alum12mg/f. Also find amount of CO2 released per liter of water treated. Assume molecular weight of At = 26.97 , S = 32.066 , 0 = 16 , H = 1.008	5	CO5	L3
27	write explanatory note on : i) Ozone treatment ii) UV treatment iii) Chlorination iv) Electro — Katadyn process v) Treatment with KMn04.	5	CO5	L3
28	Write the comparison between soda lime process and Zeolite process of softening of water techniques	5	CO5	L3
29	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	5	CO5	L3
30	Briefly explain Zeolite process of hardness re	5	CO5	L3
31	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.	5	CO5	L3
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33	List and explain the various operating problems during the filtration process.	5	CO5	L3
34	a. Explain in detail the theory of filtration.	5	CO5	L3
35	With the help of a neat sketch, explain the working of Rapid gravity filter	5	CO5	L3
36	Explain with a neat sketch working of a pressure filter	5	CO5	L3
37	Determine the dimensions of a set of rapid gravity filters for treating water required for a population of 50,000 with average rate of demand as 180 litres per day per person. Assume a peak factor of 1.8 by ignoring wash water requirements. Assume rate of filtration is 5001/h/sq.m	5	CO5	L3
38	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO5	L3
39	Explain with chemical equations, what happens when alum is added to water?	5	CO5	L3
40	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min	5	CO5	L3
41	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	5	CO5	L3
42	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	5	CO5	L3
43	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.	5	CO5	L3
44	Briefly explain Zeolite process of hardness removal	5	CO5	L3
45	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" of defluoridation.	5	CO5	L3

46	Describe briefly the various constituents of coagulation — sedimentation plant.	5	CO5	L3
47	Define sedimentation ow that settlement of the particles in sedimentation unit is independent of depth.	5	CO5	L3
48	Explain the method of determining optimum dosage of coagulant with the aid of neat sketch.	5	CO5	L3
49	A circular sedimentation fitted with standard mechanical sludge removal is to handle 5 million litres/day of sewage. Take detention period as 5 hr and depth of tank as 3 m. Find the dia. of the tank.	5	CO5	L3
50	Define filtration. Explain the principle underlying filtration process.	5	CO5	L3
51	List and explain the various operating problems during the filtration process.	5	CO5	L3
52	a. Explain in detail the theory of filtration.	5	CO5	L3
53	With the help of a neat sketch, explain the working of Rapid gravity filter	5	CO5	L3
54	Explain with a neat sketch working of a pressure filter	5	CO5	L3
55	Determine the dimensions of a set of rapid gravity filters for treating water required for a population of 50,000 with average rate of demand as 180 litres per day per person. Assume a peak factor of 1.8 by ignoring wash water requirements. Assume rate of filtration is 5001/h/sq.m	5	CO5	L3
56	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.	5	CO5	L3
57	Explain with chemical equations, what happens when alum is added to water?	5	CO5	L3
58	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min	5	CO5	L3
59	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	5	CO5	L3
60	Explain the terms pre — chlorination, post -- chlorination, Break point chlorination and Super chlorination.	5	CO5	L3
61	Chlorine usage in the treatment of 20,000 cubic meter per day is 8kg/day. The residual after 10 min contact is 0.20mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water.	5	CO5	L3
62	Briefly explain Zeolite process of hardness removal	5	CO5	L3
63	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" of defluoridation.	5	CO5	L3
64	What is aeration? Explain the type of aerators.	5	CO5	L3
65	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each	5	CO5	L3
66	With the help of a neat sketch, explain the working of Rapid gravity filter.	5	CO5	L3
67	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	5	CO5	L3

68	Explain briefly the following processes : i) Break point chlorination ii) Superchlorination.	5	CO5	L3
69	Mention the methods of softening the water. Describe zeolite process of softening water in detail	5	CO5	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	Divide and Conquer	Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Evaluate the sources and conveyance systems for raw and treated water	CO5	L3
2	Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.	CO5	L3
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Collection and Conveyance of water: Intake structures	CO5	L4
2	types of intakes Factors to be considered in selection of intake structures.	CO5	L4
3	Pumps: Types of pumps with working principles.	CO5	L4
4	Pipe appurtenances, Valves, Fire hydrants	CO5	L4
5	Distribution system: Methods	CO5	L4
6	Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.	CO5	L4
7	Visit to Intake structure, Water treatment plant and report working of each unit	CO5	L4
8	Design of water treatment plant units and distribution system with population forecasting for the given city	CO5	L4
9	Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material	CO5	L4
10	Numerical Problems.	CO5	L4
c	**Application Areas**	**CO**	**Level**
1	Collection and conveyance of water and waste water	CO5	L3
2	Design of pipes and pumps	CO5	L4
d	**Review Questions**	-	-
1	With a neat sketch, explain the radial system and dead end system used in distribution networks.	CO5	L1
2	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	CO5	L3
3	Write short notes on any Four of the following : b. Systems of supply of water. c. House water connection. d. Water meter. e. Break point chlorination. f. Socket and Spigot joint.	CO5	L2
4	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" of defluoridation.	CO5	L4
5	What is aeration? Explain the type of aerators.	CO5	L2
6	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.	CO5	L5
7	Write explanatory notes with sketch on the following : a.Firehydrant. b. Air valves. c. Sluice valves. d. Pressure relief valves	CO5	L2
8	the different layout of distribution system and explain the Grid iron distribution system in detail.	CO5	L3

9	Explain fluoridation and defluoridation in detail.	CO5	L4
10	Explain the Sluice valve used usually in distribution system with a neat sketch.	CO5	L1
11	a. Explain briefly : i) Defluoridation ii) Desalination.	CO5	L4
12	Write short notes on : a. Fire hydrants. b. Pressure release valve. c Metering in distribution system. d. Jar test.	CO5	L1
13	Briefly explain the complete treatment process of a water supply scheme with flow chart	CO5	L3
14	Explain the method of sampling of water.	CO5	L2
15	Give the drinking water standards for the following parameters. Discuss their effect when they exceed their limits : i) Turbidity ii) Hardness iii) Chlorides iv) Fluoride.	CO5	L4
16	Enumerate the various physical and chemical characteristics of testing of raw water supplies.	CO5	L2
17	Write short notes on any four of the following : a. Five demands of water b. Infiltration Gallery c. Indicator organism. d. Air Binding e. Nalgonda technique f. Nomograms.	CO5	L5
18	With sketches, explain briefly dead end system and grid iron system of distribution networks.	CO5	L2
19	With a neat sketch, explain the radial system and dead end system used in distribution networks.	CO5	L3
20	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	CO5	L4
e	**Experiences**	-	-
1			
2			
3			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Course Code:	18CV46	Sem:	4	Marks:	30	Time:	75 minutes
Course:	Water supply and treatment engineering						

-	-	**Note: Answer all questions, each carry equal marks. Module : 5**	**Marks**	**CO**	**Level**
1	a	With a neat sketch, explain the radial system and dead end system used in distribution networks.	8	CO5	L3
	b	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	7	CO5	L3
		OR		CO5	
2	a	Write explanatory notes with sketch on the following : a.Firehydrant. b. Air valves. c. Sluice valves. d. Pressure reliefvalves	8	CO5	L3
	b	the different layout of distribution system and explain the Grid iron distribution system in detail.	7	CO5	L3
				CO5	
3	a	Write short notes on any four of the following : a. Five demands of water b. Infiltration Gallery c. Indicator organism. d. Air Binding e. Nalgonda technique f. Nomograms.	8	CO5	L3
	b	With sketches, explain briefly dead end system and grid iron system of distribution networks.	7	CO5	L3
		OR		CO5	
4	a	What is aeration? Explain the type of aerators.	8	CO5	L3
	b	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.	7	CO5	L3

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Course Code:	18CV46	Sem:	4	Marks:	5	Time:	90 – 120 minutes
Course:	Water supply and treatment engineering						

SNo	Assignment Description	Marks	CO	Level
1	With a neat sketch, explain the radial system and dead end system used in distribution networks.	5	CO5	L3
2	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	5	CO5	L3
3	Write short notes on any Four of the following : b. Systems of supply of water. c. House water connection. d. Water meter. e. Break point chlorination. f. Socket and Spigot joint.	5	CO5	L3
4	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" ofdefluoridation.	5	CO5	L3
5	What is aeration? Explain the type of aerators.	5	CO5	L3
6	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.	5	CO5	L3
7	Write explanatory notes with sketch on the following : a.Firehydrant. b. Air valves. c. Sluice valves. d. Pressure relief valves	5	CO5	L3
8	the different layout of distribution system and explain the Grid iron distribution system in detail.	5	CO5	L3
9	Explain fluoridation and defluoridation in detail.	5	CO5	L3
10	Explain the Sluice valve used usually in distribution system with a neat sketch.	5	CO5	L3
11	a. Explain briefly : i) Defluoridation ii) Desalination.	5	CO5	L3
12	Write short notes on : a. Fire hydrants. b. Pressure release valve. c Metering in distribution system. d. Jar test.	5	CO5	L3
13	Briefly explain the complete treatment process of a water supply scheme with flow chart	5	CO5	L3
9	Explain the method of sampling of water.	5	CO5	L3
10	Give the drinking water standards for the following parameters. Discuss their effect when they exceed their limits : i) Turbidity ii) Hardness iii) Chlorides iv) Fluoride.	5	CO5	L3
11	Enumerate the various physical and chemical characteristics of testing of raw water supplies.	5	CO5	L3
12	Write short notes on any four of the following : a. Five demands of water b. Infiltration Gallery c. Indicator organism. d. Air Binding e. Nalgonda technique f. Nomograms.	5	CO5	L3
13	With sketches, explain briefly dead end system and grid iron system of distribution networks.	5	CO5	L3
14	With a neat sketch, explain the radial system and dead end system used in distribution networks.	5	CO5	L3
15	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post firhydrant.	5	CO5	L3
16	With a neat sketch, explain the radial system and dead end system used in distribution networks.	5	CO5	L3

17	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	5	CO5	L3
18	Write short notes on any Four of the following : b. Systems of supply of water. c. House water connection. d. Water meter. e. Break point chlorination. f. Socket and Spigot joint.	5	CO5	L3
19	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" ofdefluoridation.	5	CO5	L3
20	What is aeration? Explain the type of aerators.	5	CO5	L3
21	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.	5	CO5	L3

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Water supply and treatment engineering					Month / Year	May /2018
Course Code:	18CV46	Sem:	6	Marks:	100	Time:	180 minutes

Module	Note	Answer all FIVE full questions. All questions carry equal marks.	Marks	CO	Level
1	a	Explain necessity of water supply scheme	6	CO1	L1
	b	Explain the various types of water demand.	5	CO2	L2
	c	Mention the factors that affect per capita demand	4	CO1	L2
		OR			
2	a	What is meant by design period? Discuss the factors affecting design period.	6	CO2	L3
	b	Write the desirable limits for the following parameters as per BIS : 10500 — 1991 : i) Color ii) pH iii) Total hardness iv) Nitrate v) Total dissolved solids vi) Iron vii) Fluoride viii) Chloride ix) Alkalinity x) Turbidity.	5	CO3	L2
	c	Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.	4	CO4	L2
3	a	Explain with chemical equations, what happens when alum is added to water?	8	CO3	L2
	b	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min.	8	CO4	L2
		OR			
4	a	With the help of a neat sketch, explain the working of Rapid gravity filter.	8	CO3	L3
	b	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	8	CO4	L3
4	a	With the help of a neat sketch, explain the working of Rapid gravity filter.	8	CO3	L3
	b	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	8	CO3	L3
		OR			

5	a	write explanatory note on : i) Ozone treatment ii) UV treatment iii) Chlorination iv) Electro — Katadyn process v) Treatment with KMn04.	8	CO5	L3
	b	Write the comparison between soda lime process and Zeolite process of softening of water techniques	8	CO5	L3
6	a	With the help of a neat sketch, explain the working of Rapid gravity filter.	8	CO5	L3
	b	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth.= 0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.	8	CO5	L3
		OR			
7	a	With a neat sketch, explain the radial system and dead end system used in distribution networks.	8	CO3	L3
	b	With a sketch, explain : i) Ground level storage reservoir (GLSR) ii) Air valve iii) Pressure relief valve iv) Post fire hydrant.	8	CO3	L3
		or			
8	a	Write explanatory notes with sketch on the following : a.Firehydrant. b. Air valves. c. Sluice valves. d. Pressure reliefvalves	8	CO4	L3
	b	the different layout of distribution system and explain the Grid iron distribution system in detail.	8	CO4	L3
		OR			
9	a	Write short notes on any four of the following : a. Five demands of water b. Infiltration Gallery c. Indicator organism. d. Air Binding e. Nalgonda technique f. Nomograms.	8	CO5	L3
	b	With sketches, explain briefly dead end system and grid iron system of distribution networks.	8	CO5	L3
10	a	What is aeration? Explain the type of aerators.	8	CO5	L3
	b	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.	8	CO5	L3

2. SEE Important Questions

Course:		Water supply and treatment engineering					Month / Year	May /2018
Crs Code:		18CV46	Sem:	6	Marks:	100	Time:	180 minutes
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-
Module	Qno.	Important Question					**Marks**	**CO**	**Year**
1	1	Explain necessity of water supply scheme					16 / 20	CO1	2004
	2	Explain the various types of water demand.						CO1	2004
	3	What is meant by percapita demand?						CO1	2004
	4	Mention the factors that affect per capita demand						CO1	2007
	5	What is meant by design period? Discuss the factors affecting design period.						CO1	2007
	6	Define population forecasting.Explain methods of population Forecasting						CO1	
2	1	The population of a town is as below Year | population 1980 | 30000 1990 | 36000 2000 | 45000					16 / 20	CO2	2005

		2010 53000			
	2	Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.		CO3	2005
	3	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.		CO2	2009
	4	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.		CO2	2006
	5	Explain with chemical equations, what happens when alum is added to water?		CO2	2004
				CO2	
3	1	Briefly explain the complete treatment process of a water supply scheme with flow chart.	16 / 20	CO2	2006
	2	What is Aeration? Explain the types of aerators.		CO2	2006
	3	Describe briefly the various constituents of coagulation — sedimentation plant.		CO2	2007
	4	Define sedimentation ow that settlement of the particles in sedimentation unit is independent of depth.		CO2	2004
	5	Explain the method of determining optimum dosage of coagulant with the aid of neat sketch.		CO2	2004
	6	A circular sedimentation fitted with standard mechanical sludge removal is to handle 5 million litres/day of sewage. Take detention period as 5 hr and depth of tank as 3 m. Find the dia. of the tank.		CO2	2004
4	1	Determine the dimensions of a set of rapid gravity filters for treating water required for a population of 50,000 with average rate of demand as 180 litres per day per person. Assume a peak factor of 1.8 by ignoring wash water requirements. Assume rate of filtration is 5001/h/sq.m	16 / 20	CO2	2004
	2	Give complete sequence of a water treatment plant with a flow diagram and mention the function of each treatment unit.		CO3	2004
	3	Explain with chemical equations, what happens when alum is added to water?		CO3	2006
	4	The maximum daily demand at a water purification tank plant is 8 MLD. Design the dimensions of a suitable rectangular sedimentation tank for the raw water supplies. Take detention time period of 4 hours and the depth of 3.0mts. The velocity of flow is 20cm/min		CO3	2004
	5	Design six slow sand filters beds from the following data : Population to be served = 50000 persons ; Per capita demand = 150 fpcd ;Rate of filtration = 180 litres/hr/sq.m ; Length of each bed = Twice the breadth0, 2 Assume maximum demand as 1.8 times the average daily demand. Also assume that one unit, out of six, will be kept as stand by.		CO3	2007
5	1	Write short notes on any Four of the following : b. Systems of supply of water. c. House water connection. d. Water meter. e. Break point chlorination. f. Socket and Spigot joint.	16 / 20	CO4	2009
	2	What is meant by defluoridation? Explain with a line diagram the "Nalagonda technic" ofdefluoridation.		CO4	2007
	3	What is aeration? Explain the type of aerators.		CO4	2007
	4	Describe the various methods of distribution of water and discuss the advantages and disadvantages of each.		CO4	2004
	5	Write explanatory notes with sketch on the following : a.Firehydrant. b. Air valves. c. Sluice valves. d. Pressure relief valves		CO4	2005
	6	the different layout of distribution system and explain the Grid iron distribution system in detail.		CO4	2015

Course Outcome Computation

Academic Year:

Odd / Even semester

INTERNAL TEST	T1						T2						T3			
Course Outcome	CO1		CO2		CO3		CO4		CO5		CO6		CO7		CO8	
QUESTION NO	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV
MAX MARKS																
USN-1																
USN-2																
USN-3																
USN-4																
USN-5																
USN-6																
Average CO Attainment																

LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%
CO1 Computation :(2+2+2+3)/4 = 10/4=2.5

PO Computation

Program Outcome Weight of CO - PO	PO1		PO3		PO3		PO1		PO12		PO12		PO6		PO1	
Course Outcome	CO1		CO2		CO3		CO4		CO5		CO6		CO7		CO8	
Test/Quiz/Lab	T1						T2						T3			
QUESTION NO	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV	Q3	LV	Q1	LV	Q2	LV
MAX MARKS																
USN-1																
USN-2																
USN-3																
USN-4																
USN-5																
USN-6																
Average CO Attainment																