Bapuji Educational Association ®
Bapuji Institute of Engineering and Technology, Davangere – 577 004
Department of Civil Engineering

Course File Check List

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Revised-Academic Calendar of EVEN semesters of UG Programmes for 2020-2021

Semesters / EVENTS	IV semester B.E./B.Tech.	IV semester B.Arch./ B.Plan.	VI semester B.E./B.Tech.	VI semester B.Plan./B.Arch	VIII semester B.E./B.Tech.	VIII semester B.Plan.	VIII semester B.Arch
Commencement of EVEN Semester	19.04.2021	19.04.2021	19.04.2021	19.04.2021	19.04.2021	19.04.2021	19.04.2021
Last Working day of EVEN Semester	07.08.2021	07.08.2021	07.08.2021	07.08.2021	#20.07.2021	#20.07.2021	07.08.2021
Practical Examinations	09.08.2021 To 19.08.2021	09.08.2021 To 19.08.2021	09.08.2021 To 19.08.2021	---	---	---	---
Theory Examinations	23.08.2021 To 09.09.2021	23.08.2021 To 09.09.2021	23.08.2021 To 09.09.2021	10.08.2021 To 31.08.2021	22.07.2021 To 30.07.2021	22.07.2021 To 30.07.2021	10.08.2021 To 17.08.2021
Internship	---	---	---	---	---	---	---
Internship Viva-Voce/ Project Viva-Voce	---	---	---	---	02.08.2021 To 06.08.2021	---	---
Professional training / Organization study	---	---	---	---	---	---	---
Commencement of ODD Semester	13.09.2021	13.09.2021	13.09.2021	13.09.2021	---	---	23.08.2021

- The classroom sessions for even the semester should commence from the dates mentioned above.
- The Institute needs to function for **six days** a week with additional hours **(Saturday is a full working day).** #if required the college can plan to have extra classes even on Sundays also.
- If any of the above dates are declared to be a holiday then the corresponding event will come into effect on the next working day.
- Notification regarding the Calendar of Events relating to the conduct of **University Examinations** will be issued by the Registrar (Evaluation) from time to time.
- The faculty/staff shall be available to undertake any work assigned by the university.
- Academic Calendar may be modified based on guidelines/directions issued in the future by MHRD/UGC/AICTE/State Government.
- Revised Academic Calendar is also applicable for **Autonomous Colleges.** In case if any changes are to be affected by Autonomous Colleges in the academic terms and examination schedule, they could do so with the approval of the University.

21.04.2021

REGISTRAR

Bapuji Institute of Engineering and Technology, Davanagere

CALENDER OF EVENTS-EVEN SEMESTER: APRIL 2021-SEP 2021 (Tentative)

PARTICULARS	IV sem BE/B.Tech	VI sem BE/B.Tech	VIII sem BE/B.Tech
Commencement of even sem	19-04-2021	19-04-2021	19-04-2021
Last Working Day	07-08-2021	07-08-2021	20-07-2021
1st IA Test Series	31-05-2021 To 05-06-2021	31-05-2021 To 05-06-2021	24-05-2021 To 29-05-2021
2nd IA Test Series	01-07-2021 To 07-07-2021	01-07-2021 To 07-07-2021	21-06-2021 To 26-06-2021
3rd IA Test Series	31-07-2021 To 05-08-2021	31-07-2021 To 06-08-2021	13-07-2021 To 19-07-2021
Practical Examination	09-08-2021 To 14-08-2021	09-08-2021 To 19-08-2021	----
Theory Examination	23-08-2021 To 05-09-2021	23-08-2021 To 04-09-2021	22-07-2021 To 30-07-2021
Internship Viva-Voce	----	----	02-08-2021 To 06-08-2021
Commencement of odd semester	18-09-2021	13-09-2021	----

Forum activities:

Dept. of Chemical Engg.	Dept. of E& C	Dept. of EEE	Dept. of Mech. Engg.
Interdepartmental Sports 25-05-2021 Anthyakshari 29-05-2021 CHEMEXCEL-2021 04-06-2021 Industrial Visit 05-06-2021 Guest Lecture 28-06-2021	NB Cup Cricket tournament inauguration 24-5-2021 E-Utsav 2021, Papyrus 2,3 June 2021	Online Impulse 26-5-2021 5 Day online Webinar on Operational Planning in Power System 10-14 May 2021	Mech-I-Prix State Level Paper Presentation Competition 25-05-2021

Principal

Scanned with CamScanner

Vision of BIET

To be a center of excellence recognized nationally and internationally, in distinctive areas of engineering education and research, based on a culture of innovation and invention.

Mission of BIET

BIET contributes to the growth and development of its students by imparting a broad based engineering education and empowering them to be successful in their chosen field by inculcating in them positive approach, leadership qualities and ethical values

VISION OF THE DEPARTMENT

To train the students to become Civil Engineers with leadership qualities, having ability to take up professional assignments and research with a focus on innovative approaches to cater to the needs of the society.

MISSION OF THE DEPARTMENT

1. To provide quality education through updated curriculum and conducive teaching learning environment for the students to excel in higher studies, competitive examinations and professional career.
2. To impart soft skills, leadership qualities and professional ethics among the graduates to handle the projects independently with confidence.
3. To deal with the contemporary issues and to cater to the socio-economic needs.
4. To build industry-institute interaction and to establish good rapport with alumni.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Core Competence: Graduates will be able to plan, analyse, design and construct sustainable Civil Engineering Infrastructure.

PEO 2: Professional Skills: Graduates will be professional engineers with a sense of ethics, creativity, leadership, self-confidence and independent thinking to cater to the needs of the society.

PEO 3: Societal Needs: Graduates will be able to contribute effectively for the development of industry and professional bodies.

PEO 4: Cognitive Intelligence: Graduates will be able to take up competitive examinations, higher studies and involve in research and entrepreneurship activities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Students after the completion of the Program will be able to

1. Apply the fundamental concepts, software and codal provisions in the analysis, design and construction of sustainable civil engineering infrastructure.
2. Inculcate professional and leadership qualities, sense of ethics and confidence related to civil engineering.

Faculty will be able to

3. Contribute to the overall development of civil engineering community through the professional bodies and offer services to the society.

Name of the Faculty: Smt. Sumana Y B							
Time / Day	8 – 9	9 – 10	10.30 – 11.30	11.30 – 12.30	2 – 3	3 – 4	4 – 5
Mon	18CV653			18CV46 – A	18CVL67 – A2 (SYB+AGV)		
Tue		18CV653					
Wed			18CV653	18CVL67 – T (A)	18CVL67 – A1 (GBP+SYB)		
Thu		18CV46 – A			18CVL67 – B2 (SYB+SZH)		
Fri							
Sat	18CV46 – A						

1.
2.

Time Table Coordinator

HOD

Principal

Course Title: **WATER SUPPLY AND TREATMENT**

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER: VII

Subject Code	**18CV46**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water.

Module -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 per capita 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.

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Module -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.

1.1 1.2 1.3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers.

Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing.

Clarriflocculators . 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 pre treatment.

1.1 1.2 1.3

Module -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 nano filtration 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.

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.

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

1.1 1.2 1.3

Course Outcomes: After studying this course, students will be able to:

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Question Paper Pattern:

1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
2. There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
3. Each full question shall cover the topics as a module
4. The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010

Reference Books:

1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T., Environmental Engineering - McGraw Hill International Edition, New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Class : 4th 'A' | Subject Code : 18CV46 | Subject : .....

Sl No.	USN	NAME	DATE	26/04/21	29/04/21	03/05/21	06/05/21	08/05/21	10/05/21	13/05/21	15/05/21	17/05/21	20/05/21	22/05/21	24/05/21	27/05/21	29/05/21	01/06/21	03/06/21	05/06/21	08/06/21	10/06/21	12/06/21	14/06/21	17/06/21	19/06/21	21/06/21	24/06/21	26/06/21	28/06/21	01/07/21	No. of Days Present	%	Test Marks I	Test Marks II	Test Marks III	Test Marks Avg	Assignment	Total Marks
01	4BD17CV052	MOHAMMED AZHAR BASITH		00	01	02	03	04	05	06	07	08	09	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	23	24	24		27	27	10	22	10	32
02	4BD18CV027	HARSHITH N		00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	23	24		28	28	12	23	10	33
03	4BD18CV076	SHIVARAJ KH		00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24	25		27	27	11	22	10	32
04	4BD18CV099	VINAY KUMAR M		00	00	01	02	03	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	21	22	23	24		29	27	10	22	10	32
05	4BD19CV001	ABAN SHARIEF		01	02	03	04	04	05	06	07	08	09	10	11	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24	25		28	27	14	23	10	33
06	4BD19CV003	AFZAL NOORSABNAVAR		01	02	03	04	04	05	06	07	08	09	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		20	29	13	21	10	31
07	4BD19CV005	AKASHDEEP R ANDANUR		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	25	26	27		29	29	17	25	10	35
08	4BD19CV006	AKHILA C AKULA		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26		29	29	21	26	10	36
09	4BD19CV007	AKSHATHA ASHOKA PUTALEKARA		01	02	03	04	04	05	06	07	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	20	21	22	23	24		28	29	19	26	10	36
10	4BD19CV009	AKSHAYA KUMARA L M		00	01	02	03	03	04	04	05	05	06	06	07	07	08	09	10	11	12	13	13	14	15	16	17	18	18	19	20		29	28	14	24	10	34
11	4BD19CV011	AMITH K M		00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24	25		27	20	20	23	10	33
12	4BD19CV013	ARPITHA BASAVANAGOUDA PATIL		00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		29	29	24	28	10	38
13	4BD19CV015	BASAVARAJ S PATIL		00	00	01	02	03	04	04	05	06	07	08	09	10	11	12	13	13	14	15	15	16	17	18	18	19	20	21	22		18	18	18	18	10	28
14	4BD19CV017	BHUMIKA P		01	02	03	04	05	06	07	07	08	09	10	11	11	12	12	13	13	14	15	16	16	17	17	18	18	19	20	21		29	29	28	29	10	39
15	4BD19CV019	CHINMAYEE K		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	24	25	26		29	29	27	29	10	39
16	4BD19CV021	DARSHAN V N		00	01	02	03	04	05	06	07	08	09	10	10	11	12	13	14	15	16	17	17	18	19	19	20	21	22	23			28	28	09	22	10	32
17	4BD19CV023	GANESH U SHIRIGERI		00	00	01	02	03	04	05	06	07	08	09	10	11	11	12	13	13	14	15	16	17	18	19	20	21	22	23			28	28	16	24	10	34
18	4BD19CV025	HEMANTH KUMAR DV		00	00	01	02	03	04	05	05	06	07	08	09	10	11	11	12	13	13	14	15	16	17	17	18	19	20	21	22		27	27	10	21	10	31
19	4BD19CV029	KRUTHIK S P		01	02	03	03	04	05	06	07	08	08	09	10	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24		29	28	12	23	10	33
20	4BD19CV033	MANJUNATHA M		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	16	17	18	18	19	20	21	22	22	23	24		27	28	13	23	10	33
21	4BD19CV035	MITHUN Y		00	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23			23	28	11	21	10	31
22	4BD19CV037	MOHAMMED FAIZAN MAKANDAR		01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	16	17	18	19	20	21	22	23	24	24	25		27	27	10	21	10	31
23	4BD19CV039	NADEEM SHA AZ		00	00	01	02	03	04	05	06	06	07	08	09	10	11	11	12	13	14	15	16	16	17	18	19	20	21	22	23		25	29	13	23	10	33
24	4BD19CV041	NANDA K B		01	02	03	04	05	06	07	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24	24	25		28	29	16	24	10	34
25	4BD19CV043	NIRANJAN B M		00	01	02	03	04	05	06	07	08	09	10	11	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		24	28	10	21	10	31
26	4BD19CV047	POOJA P		00	01	02	03	03	04	05	06	07	08	09	10	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24		27	29	13	23	10	33
27	4BD19CV049	PRADEEP P N		01	02	03	04	05	04	05	06	07	08	09	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		29	29	11	23	10	33
28	4BD19CV051	PRASHANTH N R		00	01	02	03	04	05	06	07	08	09	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	25		28	27	10	22	10	32
29	4BD19CV053	RAGHAVENDRA VADITRA		00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	24		27	27	10	21	10	31
30	4BD19CV055	RAKESH H N		00	00	02	03	04	05	06	07	08	08	09	10	11	12	13	13	14	15	16	16	17	18	18	19	20	21	22	23		27	27	13	22	10	32
31	4BD19CV057	SAMBHRAM S PATIL		00	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	16	17	18	19	20	21	22	23	24	25		29	29	10	23	10	33
		Initials of Teacher																																		

Sl No.	USN	NAME \ DATE	03/07/21	05/07/21	08/07/21	10/07/21	12/07/21	15/07/21	16/07/21	19/07/21	22/07/21	24/07/21	26/07/21	29/07/21	31/07/21	02/08/21	05/08/21	09/08/21	09/08/21	09/08/21	10/08/21	11/08/21	13/08/21	12/08/21	12/08/21	13/08/21	13/08/21	14/08/21	14/08/21	14/08/21	No. of Days Present	%	Test Marks I	Test Marks II	Test Marks III	Average	Remarks
			25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	41	42	43	44	45	46	47	47	48	49	50							
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			24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			27	28	29	30	31	32	33	34	35	36	37	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	52							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			25	26	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	43	44	45	46	47	48	49	50							
			24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
		Initials of Teacher																																			
		Initials of H.O.D.																																			

Class: 4th 'A' Subject Code: 18CV46 Subject: .... Total No. of Classes:

Sl No.	USN	NAME	26/04/21	29/04/21	03/05/21	06/05/21	08/05/21	10/05/21	13/05/21	15/05/21	17/05/21	18/05/21	20/05/21	24/05/21	26/05/21	29/05/21	31/05/21	03/06/21	05/06/21	07/06/21	10/06/21	12/06/21	14/06/21	17/06/21	19/06/21	21/06/21	24/06/21	26/06/21	28/06/21	01/07/21	No. of Days Present	%	Test Marks I	Test Marks II	Test Marks III Avg	Average Assgn	Remarks Total
32	4BD19CV059	SEVANTH BM	01	01	02	03	04	05	06	07	08	09	10	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	23	23		28	27	14	23	10	33
33	4BD19CV061	SHREYA DK	01	02	03	04	05	06	07	08	08	09	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	25	28		29	28	17	25	10	35
34	4BD19CV063	SOUNDARYA N M	01	02	03	04	05	06	06	07	08	09	10	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24	25	25		29	29	14	24	10	34
35	4BD19CV065	SWATHI V KOTE	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		29	29	24	27	10	37
36	4BD19CV067	U MADHUSHREE	01	02	03	04	05	06	07	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		29	29	27	29	10	39
37	4BD19CV071	VEERESH K K	00	01	02	03	04	05	06	06	07	08	09	10	11	12	13	14	15	15	16	17	18	18	19	20	21	22	23	24		27	27	10	21	10	31
38	4BD19CV073	VIJAYALAKSHMI R TELKAR	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		29	30	21	27	10	37
39	4BD19CV075	VIKAS S M	00	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24		27	26	08	20	10	30
40	4BD19CV077	VIVEKANANDA H M	00	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	20	21	22	23		27	27	10	21	10	31
41	4BD19CV079	YUGH B JAIN	01	02	03	03	04	05	06	06	07	08	09	10	11	12	13	13	14	15	16	17	17	18	19	20	21	22	23	24		27	27	10	21	10	31
42	4BD19CV081	KIRAN M M	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	23	23		25	28	14	23	10	33
43	4BD19CV082	SANTHOSH S BAGOOR	00	00	00	01	02	03	04	05	06	07	08	09	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24		28	28	11	23	10	33
44	4BD20CV400	ABHILASH S V	01	02	03	04	05	06	07	07	08	09	10	11	12	13	14	15	15	16	17	18	19	20	21	22	23	24	25	26		28	28	12	23	10	33
45	4BD20CV402	AMBIKA H J	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	15	16	17	18	19	20	21	22	23	24	25	26	26		28	29	22	26	10	36
46	4BD20CV404	BHARATH REDDY N	01	02	03	04	05	06	07	07	08	09	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	25	26		29	28	14	24	10	34
47	4BD20CV406	CHANNESH H PATEL	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	23	24	25	26	27		27	28	12	22	10	32
48	4BD20CV407	CHETAN KOTRAIAH	01	02	03	03	04	05	06	07	08	09	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	25	25		27	28	10	22	10	32
49	4BD20CV411	DEEPAK L	01	02	03	04	05	06	07	08	09	09	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		27	28	13	23	10	33
50	4BD20CV412	DHANUSH R	01	02	03	03	04	05	06	07	08	09	10	11	12	12	13	14	15	15	16	17	17	18	19	20	21	22	23	24		28	29	16	24	10	34
51	4BD20CV413	FIRDOSH ANJUM H	01	02	03	04	05	06	07	08	09	10	11	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	24	25		28	29	12	23	10	33
52	4BD20CV416	HARISH L G	01	02	03	04	05	06	07	08	08	09	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22	23	24	25		28	29	12	23	10	33
53	4BD20CV417	HARISH S D	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	25	26	27		27	28	10	22	10	32
54	4BD20CV418	HARSHA C N	01	02	03	04	05	06	07	08	09	10	11	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26		28	28	16	24	10	34
55	4BD20CV423	MOHAMMED KHADIR	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		28	27	12	22	10	32
56	4BD20CV428	MURUGARAJENDRA H V	00	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		27	27	10	22	10	32
57	4BD20CV429	MANDISH G MATHAD	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26	27		27	28	12	22	10	32
58	4BD20CV430	PALLAVI O	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		28	29	27	28	10	38
59	4BD20CV431	ROHITH A	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26		24	28	11	21	10	31
60	4BD20CV433	SANDEEP BN	00	01	02	03	03	04	04	05	06	07	08	09	10	11	12	13	14	15	16	16	17	18	18	19	20	21	22	23		27	29	10	22	10	32
61	4BD20CV435	SHANKAR RAO KULKARNI C	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24	25		28	28	10	22	10	32
62	4BD20CV437	SHREE HARSHA J R	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	22	23	24	25		27	28	14	23	10	33
		Initials of Teacher																																			

Class : | Subject Code : | Subject : | Total No. of Classes :

Sl No.	USN	NAME / DATE	03/07/21	05/07/21	08/07/21	10/07/21	12/07/21	15/07/21	17/07/21	19/07/21	22/07/21	24/07/21	26/07/21	29/07/21	31/07/21	02/08/21	05/08/21	06/08/21	09/08/21	07/08/21	09/08/21	10/08/21	11/08/21	11/08/21	12/08/21	13/08/21	13/08/21	14/08/21	14/08/21	14/08/21	No. of Days Present	%	Test Marks I	Test Marks II	Test Marks III	Average	Remarks
			24	25	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	43	44	45	46	47	47	48	49							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	41	42	43	44	45	46	47	48	48	49	50	51							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			29	30	31	32	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	53	54							
			28	29	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			25	26	27	28	29	30	31	32	33	34	35	36	37	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51							
			29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56							
			25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	50							
			24	25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39	40	41	41	42	43	44	45	46	47	48	49							
			24	25	26	26	27	28	29	30	31	32	33	34	35	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49							
			24	25	26	27	28	29	30	31	32	33	34	34	35	36	36	37	37	38	39	40	41	42	43	43	44	45	46	47							
			25	26	27	28	29	30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	47	48	49	50							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	47	48	49	50	51	52							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55							
			26	27	28	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			25	26	27	28	29	30	31	32	33	34	35	36	37	37	38	39	40	41	42	43	44	45	46	47	47	48	49	50							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	46	47	48	49	50	51	52							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			28	29	30	31	32	33	34	35	35	36	37	38	39	40	41	42	43	44	45	45	46	47	48	49	50	51	52	52							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	46	47	48	49	50	51	52							
			28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55							
			29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	51	52	53	54	55							
			27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54							
			24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	51	52							
		Initials of Teacher																																			
		Initials of H.O.D																																			

Class : 4th 'A' | Subject Code : 18CV46 | Subject : ..... | Total No. of Classes :

Sl No.	USN	NAME	DATE																											No. of Days Present	%	Test Marks I	Test Marks II	Test Marks III	Average	Remarks
63	4BD20CV439	SURABHI S BHARADWAJ	00	01	02	03	04	05	06	07	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		28	27	19	23	10	33
64	4BD20CV440	SURAJ N RAIKAR	01	02	03	04	05	06	07	08	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		29	28	22	27	10	37
65	4BD20CV441	THRIVENI G	00	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	15	16	17	18	19	20	21	22	23	23	24		30	20	11	21	10	31
66	4BD20CV442	TRUPTI S BALIKAI	00	01	02	03	04	04	05	06	07	07	08	09	10	11	12	13	14	15	16	17	18	18	19	20	21	22	23	24		27	29	16	24	10	34
67	4BD20CV443	TRUPTI SADANAND RAMAGIRI	01	02	03	03	04	05	06	06	07	08	09	10	11	12	13	14	15	16	16	17	18	18	19	20	21	22	23	23		28	27	10	22	10	32
68	4BD20CV444	VEENA B BHARAMAGOUDRA	00	00	01	02	03	04	05	06	07	08	09	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		27	26	16	23	10	33
69	4BD20CV448	VINODKUMAR BUDIHAL	01	02	03	04	05	06	07	08	09	10	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		23	28	10	21	10	31
		Initials of Teacher																																	

Class : Subject Code : Subject : Total No. of Classes :

Sl No.	USN	NAME	DATE																												No. of Days Present	%	Test Marks			Average	Remarks
																																	I	II	III		
			27	28	29	30	31	32	33	34	35	36	37	38	39	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53							
			28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	53	54							
			25	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	42	43	44	45	45	46	47	48	49							
			25	26	26	27	28	29	30	31	32	33	34	35	36	36	37	38	39	40	41	42	43	44	45	46	47	47	48	49							
			24	25	26	27	28	29	30	31	32	33	34	35	36	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50							
			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	50	51	52							
			28	29	30	31	32	33	34	34	35	36	37	38	39	40	40	41	42	43	44	45	46	47	47	48	49	50	50	51							
		Initials of Teacher																																			

Subject : Water Supply and Treatment Engg Subject Code : 18CV46 Class : IV' A

Period	Date	Topics Planned	Date	Topics Covered	Remarks
1	26/04/21	Introduction : Need for protected water supply	26/04/21	Introduction : Need for protected water supply	
2	29/04/21	Demand of water: Types of water demand	29/04/21	Demand of water: Types of water demands	
3	03/05/21	Domestic demand, industrial, institutional and commercial	03/05/21	Domestic demand, industrial, institutional & commercial	
4	06/05/21	Public use, fire demand factors affecting per capita demand	06/05/21	Public use, fire demand, Factors affecting per capita demand	
5	08/05/21	Variations in demand of water, peak factor	08/05/21	Variations in demand of water, peak factor	
6	10/05/21	Design period and factors governing design period	10/05/21	Design period and factors governing design period	
7	15/05/21	Different methods of population forecasting	15/05/21	Different methods of population forecasting	
8	17/05/21	Population forecasting - with merits & Demerits	17/05/21	Population forecasting - with merits & Demerits	
9	20/05/21	Numerical problems	20/05/21	Numerical problems	
10	22/05/21	Numerical problems	22/05/21	Numerical problems	
11	24/05/21	Numerical problems	24/05/21	Numerical problems	
12	27/05/21	Water Treatment: objectives	27/05/21	Water Treatment: Objectives	
13	29/05/21	Treatment flow chart - Significance of each unit	29/05/21	Treatment flow chart - Significance of each unit	
14	31/05/21	Sources and characteristics	31/05/21	Sources and characteristics	
15	03/06/21	Surface and Subsurface Sources: Suitability with regard to quality & quantity	03/06/21	Surface and Subsurface Sources: suitability with regard to quality & quantity	
16	05/06/21	Sampling - Objectives, methods	05/06/21	Sampling - Objectives, methods	
17	07/06/21	Preservation Techni-	10/06/21	Preservation Techni-	

Subject : Water Supply and Treatment Engg Subject Code : 18CV46 Class : IV' A

Period	Date	Topics Planned	Date	Topics Covered	Remarks
18	12/06/21	Water quality characteristics: physical	12/06/21	Water quality characteristics : physical	
19	14/06/21	Chemical and microbiological characteristics	14/06/21	Chemical and microbiological characteristics	
20	17/06/21	Sedimentation - theory Settling tanks	17/06/21	Sedimentation - Theory Settling tanks	
21	19/06/21	Types, design of Sedimentation tanks	19/06/21	Types, design of Sedimentation tanks	
23	21/06/21	Concept of plate and Tube Settlers	21/06/21	Concept of plate and tube Settlers	
24	24/06/21	Coagulation aided Sedimentation - Types of coagulants	24/06/21	Coagulation aided Sedimentation - Types of coagulants	
25	26/06/21	Chemical feeding, flash mixing	26/06/21	Chemical feeding, flash mixing	
26	28/06/21	Clarifloculators, Filtration : mechanism	28/06/21	Clarifloculators, Filtration : mechanism	
27	01/07/21	Theory of filtration, Types of filters, Slow Sand	01/07/21	Theory of filtration, Types of filters, Slow Sand	
28	05/07/21	Rapid sand and pressure filters including construction	03/07/21	Rapid sand and pressure filters including construction	
29	05/07/21	Operation, cleaning, Operational problems in filters	05/07/21	Operation cleaning, Operational problems in filters	
30	07/07/21	Design of flow and Rapid Sand filter without underdrainage	09/07/21	Design of flow and rapid sand filter without underdrainage system	
31	10/07/21	Ultra and micro filtrations : Basic principles	10/07/21	Ultra and micro filtrations : Basic principles	
32	12/07/21	membrane materials, pore size, flux, normalizing permeability	15/07/21	Membrane materials, pore size, flux, normalizing permeability	
33	17/07/21	Fouling mechanisms, Overview of ultra and micro filtration	17/07/21	Fouling mechanisms, Overview of ultra & micro filtration	
34	19/07/21	Fouling in MF/UF Systems	19/07/21	Fouling in MF/UF Systems	
35	24/07/21	Fouling control	24/07/21	Fouling control	

LESSON PLAN

Subject : Water Supply and Treatment Engg Subject Code : 18CV46 Class : IV 'A'

Period	Date	Topics Planned	Date	Topics Covered	Remarks
36	24/03/21	Softening : Overview of lime soda, zeolite process	24/07/21	Softening : Overview of lime soda, zeolite process	
37	26/03/21	RO & Nano filtration : Basic principles, flux salt passage	26/07/21	RO & Nano filtration : Basic principles, flux salt passage	
38	27/03/21	Rejection and concentration polarization	27/07/21	Rejection and concentration polarization	
39	31/03/21	Overview of RO and nano filtration membranes and elements	31/03/21	Overview of RO and nano filtration membranes and elements	
40	02/04/21	Conventional pre-treatment techniques for RO and nano filtration	02/08/21	Conventional pre-treatment techniques for RO & nano filtration	
41	05/08/21	Disinfection : methods of disinfection with merits and demerits	05/08/21	Disinfection : methods of disinfection with merits and demerits	
42	07/08/21	Theory of disinfection emphasis on treatment of water for bathing	07/08/21	Theory of disinfection emphasis on treatment of water for bathing	
43	09/08/21	Fluoridation and De-fluoridation	09/08/21	Fluoridation and De-fluoridation	
44	09/08/21	Collection and conveyance of water : Intake structures	09/08/21	Collection and conveyance of water : Intake structures	
45	09/08/21	Types of intakes - factors to be considered in selection of intake structures	09/08/21	Types of intakes - factors to be considered in selection of intake structures	
46	10/08/21	Pumps : Types of pumps with working principles	10/08/21	Pumps : Types of pumps with working principles	
47	10/8/21	Numerical problems	10/8/21	Numerical problems	
48	11/08/21	Numerical problems	11/08/21	Numerical problems	
49	11/08/21	Pipes : Design of the economical diameter for the rising main	11/08/21	Pipes : Design of the economical diameter for the rising main	
50	12/08/21	Numerical problems	12/08/21	Numerical problems	
51	12/08/21	Pipe appurtenances, valves, fire hydrants	12/08/21	Pipe appurtenances, valves, fire hydrants	

LESSON PLAN

Period	Date	Topics Planned	Date	Topics Covered	Remarks
56	13/08/21	Distribution system : methods - Gravity, pumping	13/08/21	Distribution system : methods - Gravity pumping	
57	13/08/21	Combined gravity and pumping system	13/08/21	Combined gravity and pumping system	
58	14/08/21	Service reservoirs and their capacity determination	14/08/21	Service reservoirs and their capacity determination	
59	14/08/21	Visit to intake structure, water treatment plant and report preparation	14/08/21	Visit to intake structure, water treatment plant & report writing	
60	14/08/21	Design of water treatment plant units & distribution system	14/08/21	Design of water treatment plant unit & distribution system	

Text Books :

1. S. K. Garg, Environment Engg. vol-I, Water Supply Engg
2.

Reference Books :

1. B.C. Punmia & Ashok Jain, Environmental Engg-I, Water Supply Engg
2. Howard S Peavy, Donald R. Rowe, George T., Environment Engg.
3. CPHEEO manual on water Supply and Treatment Engineers
4.
5.

Period	Date	Topics Planned	Date	Topics Covered	Remarks

Text Books :

1. .....

2. .....

Reference Books :

1. .....

2. .....

3. .....

4. .....

5. .....

Signature of Faculty HOD

Date	Topics Discussed	Remarks

.....

Test	Date	Class Strength	No. of Students Appeared	No. of Students Scored < 15	Signature of the HOD
T1	09/06/2021	69	69	NIL	
T2	07/07/2021	69	69	NIL	
T3	04/08/2021	69	69	NIL	

MODULE 1

Importance of water

Water is one of the most important resources on the planet. Without water, life cannot exist. But Water has several unique characteristics that make it an extremely valuable resource. Some such properties of water are listed below.

- Water is a very good solvent – it has the ability to dissolve many substances.
- The boiling point and freezing point of water make it easily available in all three states (solid, liquid, and gaseous).
- The specific heat of water is quite high. This enables water to absorb and release heat slowly, thereby regulating the temperature of its environment.
- Owing to its transparency, water can allow light to reach the life forms that are submerged in it. This is crucial for the survival of plant life in the oceans, lakes, and rivers.
- Water is neither acidic nor basic in nature. It has a pH of 7, making it a neutral substance.

These unique qualities of water, along with its abundance on the planet (approximately 71% of the Earth's surface is made up of water), make it a crucial resource for plants, animals, and human beings.

Need for protected water supply.

- Protected water supply means the supply of water that is treated to remove the impurities and made safe to public health. Water may be polluted by physical and bacterial agents.
- The protected water supply system is only available in urban areas and only to some extent in rural areas. But the country like India is essentially a village based country and majority of population which lives in rural villages need safe and portable water for usage.
- Most of the rural population if not provided with protected water supply systems. They are mostly depending upon the conventional sources like wells, ponds and streams etc are generally in polluted condition.
- People consuming this water without any treatment they are bound to suffer from water borne diseases like typhoid, dysentery, cholera, poliomyelitis, Jaundice, gunia worm etc.
- The rural water supply system aim to provide reasonable quantity of safe wholesome water to satisfy demands of people and thus helping in maintaining better sanitation and beautification of surroundings, thereby reducing environmental pollution.

Wholesome water:

The water which is safe and potent for drinking to human health is called wholesome water.The following are the requirements of wholesome water.

- It should be free from bacteria.
- It should be colourless, odourless and tasty.
- It should be free from objectionable matter
- It shouldnot corrode pipes.
- It should have sufficient dissolved oxygen.

The Per Capita Demand (q)

It is the annual average amount of daily water required by one person, and includes the domestic use, industrial and commercial use, public use, waster etc. It may, therefore, be expressed as

Per Capita Demand (q) in litres per day per head

$$= \frac{\text{total yearly water requirements of the city in liters (i.e. V)}}{365 \times \text{Design population}}$$

Total yearly water requirement of the city can, therefore, be worked out by using above equation, provided the per capita demand is known or assumed.

For an average Indian town, the requirement of water in various uses is as under

i.	Domestic purpose	135 litres/c/d
ii.	Industrial use	40 litres/c/d
iii	Public use	25 litres/c/d
iv.	Fire Demand	15 litres/c/d
v.	Losses, Wastage and thefts	55 litres/c/d

Total : 270 litres/capita/day

Factors affecting Per Capita Demand

(1) Size of the city. The per capita demand for big cities is generally large as compared to that for smaller towns. This is because of the fact that in big cities, huge quantities of water are required for maintain clean and healthy environments. For example, big cities are generally sewered, and as such require large quantities of water (a sewered house requires four to five times the water required by an unsewered home). Similarly, in a big city, commercial and industrial activities are generally more, thus requiring more water. Affluent rich living in air cooled homes may also increase the water consumption in cities.

(2) Climatic Conditions. As hotter and dry places, the consumption of water is generally more, because more of bathing, cleaning, air cooling, sprinkling in lawns, gardens, roofs, etc., are involved. Similarly, in extremely cold countries more water may be consumed, because the people may keep their taps open to avoid freezing of pipes, and there may be more leakage from pipe joints, since metals contract with cold.

(3) Types of luxury used and Habits of people. Rich and upper class communities generally consume more water due to their affluent living standards. Middle class communities consume average amounts.

(4) Industrial and Commercial Activities. The pressure of industrial and commercial activities at a particular place increases the water consumption by large amounts. Many industries require really huge amounts of water (much more than the domestic demand), and as such, increase the water demand

considerably.

(5) Quality of Water Supplies. If the quality and taste of the supplied water is good, it will be consumed more, because in that case, people will not use other sources such as private wells, hand pumps, etc. Similarly, certain industries such as boiler feeds, etc., which require standard quality waters will not develop their own supplies and will use public supplies, provided the supplied water is up to their required standards.

(6) Pressure in the Distribution System. If the pressure in the distribution pipes is high and sufficient to make the water reach at 3rd or even 4th storey, water consumption shall definitely be more.

(7) Development of Sewerage Facilities. As pointed out earlier, the water consumption will be more, if the city is provided with 'flush system' and shall be less if the old 'conservation system' of latrines is adopted.

(8) System of Supply. The water may be supplied either continuously for all the 24 hours of the day, or may be supplied only of peak periods during the morning and evening. The second system, i.e, the intermittent supplies, may lead to some saving in water consumption due to losses occurring for lesser time and a more vigilant use of water by the consumers.

(9) Cost of Water. If the water rates are high, lesser quantity many be consumed by the people. This may not lead to large savings as the affluent and rich people are little affected by such policies.

(10) Policy of Metering and Method of Charging. Water tax is generally charged in two different ways:

(a) On the basis of meter reading (meters fitted at the head of the individual house connections and recording the volume of water consumed).

(b) On the basis of certain fixed monthly flat rate.

(11) Industrial and Commercial Activities. The pressure of industrial and commercial activities at a particular place increases the water consumption by large amounts. Many industries require really huge amounts of water (much more than the domestic demand), and as such, increase the water demand considerably.

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(17) Policy of Metering and Method of Charging. Water tax is generally charged in tow different ways:

a)On the basis of meter reading (meters fitted at the head of the individual house connections and recording the volume of water consumed).

b)On the basis of certain fixed monthly flat rate.

VARIATIONS IN DEMAND. (q)

The per capita demand (q), so far discussed, has been based upon the annual consumption of water. It was, therefore, defined as the **annual average daily consumption** per person.

There are wide variations in the use of water in different seasons, in different months of the year, in different days of the month, in different hours of the day, and even in different minutes of the hour.

1) **Seasonal variations.** The water demand varies from season to season. Occur due to larger use of water in summer season, lesser use in winter, and much less in rainy season. These variations may also be caused by season use of water in industries such as processing of cash crops at the time of harvesting, etc.

Maximum seasonal consumption= 1.3 times of annual average daily rate of Demand

2)Daily variation. Day to day variation is called **daily variation.** This variation depends on the general habits of people, climatic conditions and character of city as industrial, commercial or residential. For example, the water consumption is generally more on Sundays and holidays, on days of dust storms, etc.

- **Maximum Daily consumption= 1.8 times the average demand**

3)Hourly variation. Again there are variations in hour to hour demand called hourly variations. For example, the consumption in the early hours of morning (0 to 6 hours-say) is generally small, increases sharply as the day advances, reaching a peak value between about 8 to 11 AM, then decreases sharply upto about 1 PM, remains constant upto about 4 PM, again increases in the evening reaching a peak between 7 to 9 PM, finally falling to a low value in the late hours of night, as shown if Fig.

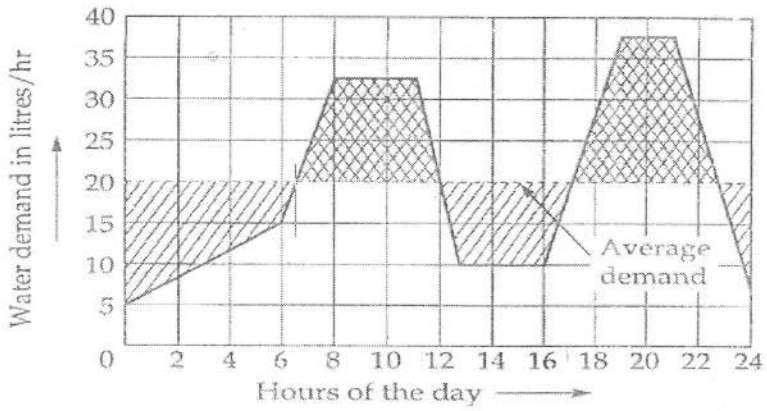


Fig : Showing hourly rate of water consumption.

- **Maximum hourly consumption= 1.5 times the average demand**

The determination of this hourly variations is most necessary, because on its basis the rate of pumping will be adjusted to meet up the demand in all hours.

PEAK FACTOR

- Maximum hourly consumption of the maximum day is called **Peak demand.** Which is nothing but a factor of safety.

The GOI manual on water supply has recommended the following values of the **Peak factor,** depending upon the population

Table : Peak Factors

Sl. No.	Population	Peak factor*
1	i) upto 50,000 ii)50,001- 2,00,000 iii)Above2lakhs	3.0 2.5 2.0
2	For Rural water supply schemes, where supply is effected through stand post for only 6 hours.	3.0

- Evidently, the peak factor tends to reduce with increasing population, since the different habits and customs of several groups in larger population, tend to minimize the variation in demand pattern.

DESIGN PERIODS

Water supply projects are designed to serve over a specified period of time after completion of the project. This time period is called **Design period.**

OR

A water supply scheme includes huge and costly structures (such as dams, reservoirs, treatment works, penstock pipes, etc.) which cannot be replaced or increased in their capacities, easily and conveniently. For example, the water mains including the distributing pipes are laid underground, and cannot be replaced or added easily, Without digging the roads or disrupting the traffic In order to avoid these future complications of expansions, the various components of water supply scheme are purposely made larger, so as to satisfy the community needs for the reasonable number of years to come. This future period or the number of years for which a provision is made in designing the capacities of the various components of the water supply scheme is known as **Design period.**

Factors Governing the Design Period

1. Useful life of the pipes, structures and equipment used in the water works and the chances of their becoming old and absolute. The design period should not exceed those respective values . If the useful life is more, design period is also more.
2. The anticipated rate of growth of population. If the rate is more, design period is less.
3. The rate of interest of loans taken for the construction of the project. If this rate is more the design period will be less.
4. The rate of inflation during the period of repayment of loans. When the inflation rate is high, a longer design period is adopted.
5. Use
6. Efficiency of component units of the project during the early years of working, when they are not loaded to their capacity. The more the efficiency, the longer the design period.

Demand of Water

Following are the various types of water demand of a city or town: 1. Domestic Water Demand 2. Commercial and Industrial Demand 3. Fire-Demand 4. Demand for Public Use 5. Compensate Losses Demand.

Type # 1. Domestic Water Demand:

It includes the quantity of water required in the houses for drinking, bathing, cooking, washing etc. The quantity of water required for domestic use mainly depends on the habits, social status, climatic conditions and customs of the people. In India on an average, the domestic consumption of water under normal condition is about 135 litres/day/capita as per IS: 1172-1171.

Structure

1. Introduction
2. Objectives
3. Water treatment
4. Sources
   4.1 Surface
   4.2 Subsurface sources – suitability with regard to quality and quantity.
5. Quality of water
   5.1 Objectives of water quality management -wholesomeness & palatability
   5.2 water borne diseases.
6. Water quality parameters
   6.1 Physical
   6.2 Chemical
   6.3 Microbiological
7. Water borne diseases
8. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics.
9. Drinking water standards BIS &WHO guidelines
10. Sampling of Water
11. Outcome
12. Assignment questions
13. Further reading

1. INTRODUCTION

Water is the most abundant compound in nature. It covers 75% of the earth surface. About 97.3% of water is contained in the great oceans that are saline and 2.14% is held in icecaps glaciers in the poles, which are also not useful. Barely the remaining 0.56% found on earth is in useful form for general livelihood. Total quantity of water available on the planet "EARTH" in various states and religions are given in the table,

2. OBJECTIVES

1. To know the different types of sources of water along with its quality and quantity.
2. To know the different types of intake structures to collect the water
3. To know different types of pumps, pipes and pipe appurtenances to convey the water

LOCATION	VOLUME	% OF TOTAL
Land Areas		
Fresh water lakes	152×10^{12}	0.009
Saline lakes	104×10^{12}	0.008
Inland seas, Rivers	1.25×10^{12}	0.001
Soil moisture	67×10^{12}	0.005
Ground water	8350×10^{12}	0.005
Icecaps and glaciers	52×10^{12}	0.610
TOTAL	$37,800 \times 10^{12}$	2.80
Atmosphere	13×10^{12}	
Water vapour (clouds)	$13,20,000 \times 10^{12}$	0.001
Oceans	$13,60,000 \times 10^{12}$	
Water in the oceans		97.3
TOTAL ON PLANET		100

to units.

4. To know the quality of water and objectives of water quality management
5. To study the different parameters of water and to check water quality by using analytical and instrumental techniques
6. To know drinking water standards given by BIS and WHO guidelines

Hydrological concepts

Hydrology is the science, which deals with the increment of the water on the ground, under the ground, evaporation from the land and water surface and transportation from the vegetation and going back into atmosphere where it precipitates.

Definition

The water which goes in atmosphere by evaporation and transpiration again comes back in the form of precipitation under favourable climatic conditions is known as hydrological cycle of water.

Precipitation

The evaporated water from the surfaces of streams, rivers, sea, ponds, wet surfaces, trees and plants etc again returned to the earth surface by the condensation in the form of rain, hails, dew, sleet etc is known as precipitation. The major part of the precipitation occurs in the form of rain and other forms quantities are very small. The water of precipitation further goes off in the following ways.

Run-off

After precipitation a portion of its water flows over the ground in the form of rivers and streams and some water flows towards lakes and ponds and collected there.

Infiltration: A portion of precipitation percolates in the ground and it is stored in the form of sub-soil or ground water.

Evaporation: some portion of the precipitation is also evaporated from the lakes, rivers, reservoirs and wet surfaces in the form of vapour due to sun"s heat is known as evaporation

Evapo-transpiration: The roots of the trees sucks water from the ground and some portion of it evaporates in the atmosphere through leaves in the form of transpiration.

3. WATER TREATMENT

The principal objective of water treatment is to provide potable water that is chemically and biologically safe for human consumption. It should also be free from unpleasant tastes and odors. Water treatment objective is to produce both "**potable**" and "**palatable**".

- Potable: - Water that can be consumed in any desired amount without concern for adverse health effects. Potable dose not necessarily mean that the water tastes good.
- Palatable: - it is a water that is pleasing to drink but not necessarily safe.

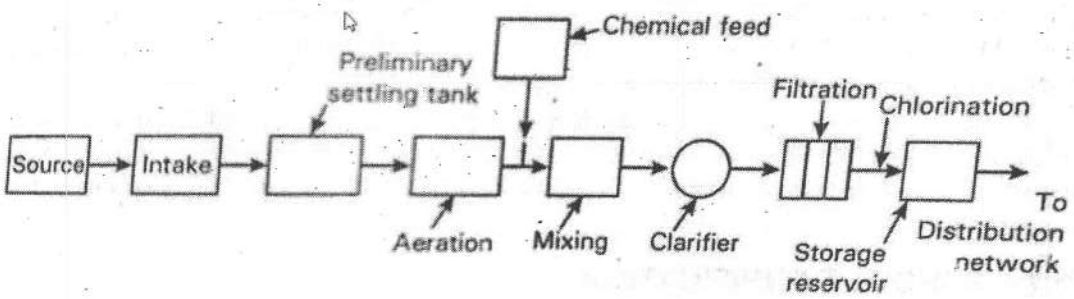


Fig.3.1 Flow Diagram

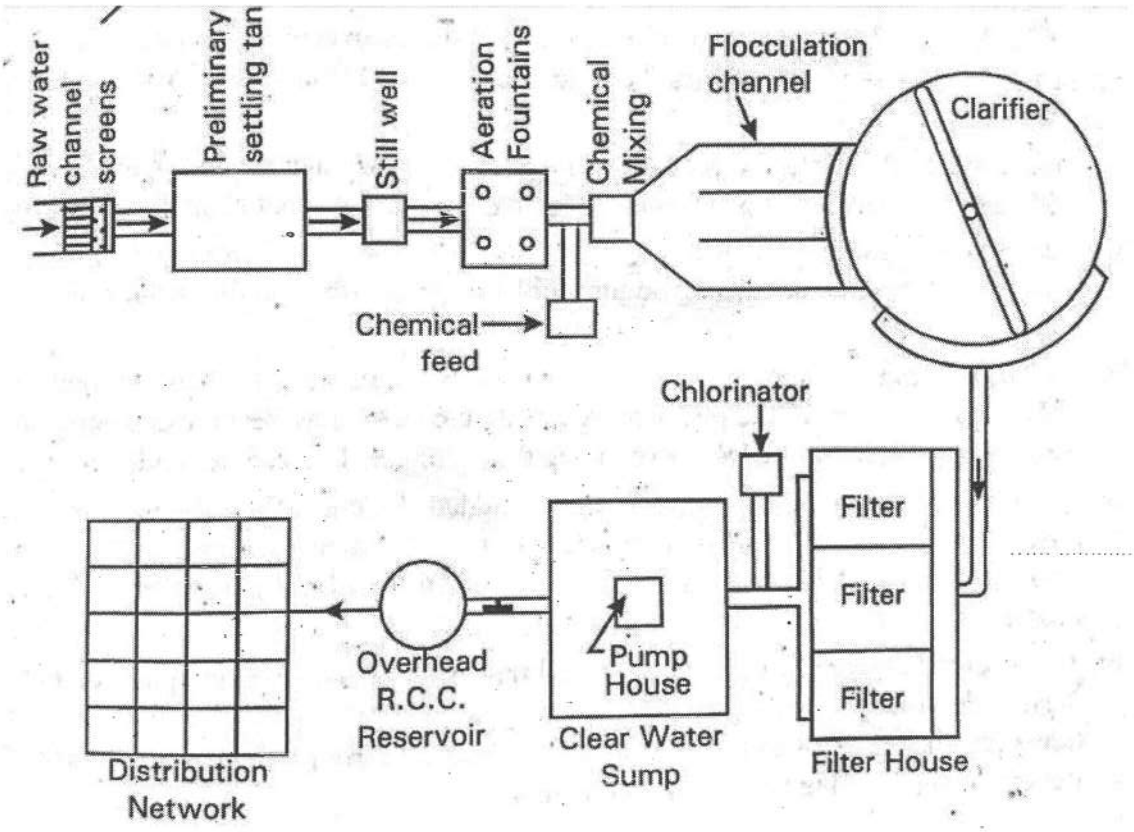


Fig.3.2 Typical layout of water treatment plant

Sequence of unit processes: pre-sedimentation- mixing, flocculation, settling-filtration - adsorption disinfection. The Function of unit processes are solids removal ,removal of ions, and solids using chemical addition, removal of smaller particles, removal of organic compounds and ions, oxidation of oxygen demanding wastes and chemical killing of pathogens in water. Chlorine is added in sedimentation and filtration tank to avoid microbial growth. Chorine is used as a oxidizing agent as well as a disinfection solution.

4. SOURCES

All the sources of water can be broadly divided into,

- ✓ Surfaces sources and
- ✓ Sub surface sources

4.1Surfaces sources

- ✓ Streams

- ✓ Rivers
- ✓ Ponds
- ✓ Lakes
- ✓ Impounding reservoirs etc

Natural ponds and lakes

In mountains at some places natural basin's are formed with impervious bed by springs and streams are known as "lakes". The quality of water in the natural ponds and lakes depends upon the basin's capacity, catchment area, annual rainfall, porosity of ground etc. But lakes and ponds situated at higher altitudes contain almost pure water which can be used without any treatment. But ponds formed due to construction of houses, road, railways contains large amount of impurities and therefore cannot be used for water supply purposes.

Streams and rivers

Rivers and streams are the main source of surface source of water. In summer the quality of river water is better than mansoon because in rainy season the run-off water also carries with clay, sand, silt etc which make the water turbid. So river and stream water require special treatments. Some rivers are snow fed and perennial and have water throughout the year and therefore they do not require any arrangements to hold the water. But some rivers dry up wholly or partially in summer. So they require special arrangements to meet the water demand during hot weather. Mostly all the cities are situated near the rivers discharge their used water of sewage in the rivers, therefore much care should be taken while drawing water from the river.

Impounding reservoirs

In some rivers the flow becomes very small and cannot meet the requirements of hot weather. In such cases, the water can be stored by constructing a bund, a weir or

Module -3

Structures

1. Introduction
2. Objectives
3. Sedimentation
   - 3.1 Settling tanks
   - 3.2 Types of settling tank
   - 3.3 Design
   - 3.4 Testing of sedimentation
4. Filtration – Theory of Filters
5. Types of Filters
   - 5.1 Slow sand filter
   - 5.2 Rapid sand filter/Gravity filters
   - 5.3 Pressure filter
6. Outcomes
7. Assignment questions
8. Further reading

1. INTRODUCTION

Water available in various sources contains various types of impurities and cannot be directly used by the public for various purposes, before removing the impurities. For potability water should be free from unpleasant tastes, odours and must have sparkling appearance. The water must be free from disease-spreading germs. The amount and type of treatment process will depend on the quality of raw water and the standards of quality of raw water and the standards of quality to be required.

The process of passing the water through beds of sand or other granular materials is known as filtration. For removing bacteria, colour, taste, odours and producing clear and sparkling water, filters are used by sand filtration 95 to 98% suspended impurities are removed.

Membrane filtration is a treatment process based on the physical separation of compounds from the water phase with the use of a semi-permeable membrane. Until recently membrane filtration was regarded as a futuristic, expensive and complicated treatment process. Because of the development of the technique during the past years, the process can be regarded as proven technology. The quality of the permeate of a membrane filtration installation is excellent.

The costs of membrane filtration have strongly decreased over the past ten years because of the decreased costs of membrane elements.

Membrane filtration can be divided into two categories based on the pore sizes of the membrane:

1. Micro and ultrafiltration (MF and UF) remove colloidal substances and microorganisms
2. Nanofiltration and reverse osmosis (NF and RO) remove colloidal substances and microorganisms but also dissolved substances like micropollutants and ions

2. OBJECTIVES

1. To know the water treatments before the water conveyed to different units or systems

2. To Study the objectives of water treatments
3. To know the aeration process and to study the different methods of aeration
4. To know the sedimentation process, types, design and different types of testing of water by sedimentation.
5. To know about filtration method of treatment of water before it is conveyed to the distribution system/units
6. To know about the different types of filtration methods for the treatment of water.

3. SEDIMENTATION

3.1 Settling tanks

Settling

Solid liquid separation process in which a suspension is separated into two phases –

1. Clarified supernatant leaving the top of the sedimentation tank (overflow).
2. Concentrated sludge leaving the bottom of the sedimentation tank (underflow).

Purpose of Settling

To remove coarse dispersed phase.

1. To remove coagulated and flocculated impurities.
2. To remove precipitated impurities after chemical treatment.
3. To settle the sludge (biomass) after activated sludge process / tricking filters.

Principle of Settling

1. Suspended solids present in water having specific gravity greater than that of water tend to settle down by gravity as soon as the turbulence is retarded by offeringstorage.

2. Basin in which the flow is retarded is called settling tank.
3. Theoretical average time for which the water is detained in the settling tank is called the detention period.

Screening

Screens are fixed in the intake works or at the entrance of treatment plant so as to remove the floating matters as leaves, dead animals etc.

Sedimentation

It is the process in which the suspended solids are made to settle by gravity under still water conditions is called plain sedimentation.

Plain sedimentation

By plain sedimentation the following are the advantages.

1. Plain sedimentation lightens the load on the subsequent process.
2. The operation of subsequent purification process can be controlled in better way.
3. The cost of cleaning the chemical coagulation basins is reduced.
4. No chemical is lost with sludge discharged from the plain settling basin.
5. Less quantity of chemicals are required in the subsequent treatment processes.

3.2Types of settling tank

Type I: Discrete particle settling - Particles settle individually without interaction with neighboring particles.

Type II: Flocculent Particles Flocculation causes the particles to increase in mass and

settle at a faster rate.

Type III: Hindered or Zone settling –The mass of particles tends to settle as a unit with individual particles remaining in fixed positions with respect to each other. Type IV: Compression –The concentration of particles is so high that sedimentation can only occur through compaction of the structure.

Settling of discrete particles (Type I Settling)

1. Size, shape and specific gravity of the particles do not change with time.
2. Settling velocity remains constant.
3. If a particle is suspended in water, it initially has two forces acting upon it: force of gravity: $F_g=\rho_p g V_p$
4. Buoyant force quantified by Archimedes as: $F_b=\rho g V_p$
5. If the density of the particle differs from that of the water, a net force is exerted and the particle is accelaratd in the direction of the force: $F_{net}=(\rho_p-\rho)gV_p$
6. This net force becomes the driving force.
7. Once the motion has been initiated, a third force is created due to viscous friction. This force, called the drag force, is quantified by: $F_d=C_D A_p \rho v^2/2$
8. C_D= drag coefficient.
9. A_p = projected area of the particle
10. Because the drag force acts in the opposite direction to the driving force and increases as the square of the velocity, accelaration occurs at a decreasing rate until a steady velocity is reached at a point where the drag force equals the driving
11. force:
12. $(\rho_p-\rho)gV_p = C_D A_p \rho v^2/2$
13. For spherical particles,

and $A_p=\pi d^2/4$, $V_p=\pi d^3/6$

15. Thus, $v2 = 4g(\rho p - \rho)d / 3CD\rho$
16. Expressions for CD change with characteristics of different flow regimes. For laminar, transition, and turbulent flow, the values of CD are:
17. $CD = \frac{24}{Re}$ (laminar)

$CD = \frac{24}{Re} + \frac{3}{R^{1e/2}} + 0.34$ (transition)

$CD = 0.4$ (turbulent)

where Re is the Reynolds number

$$Re = \frac{\rho v d}{\mu}$$

Reynolds number less than 1.0 indicate laminar flow, while values greater than 10 indicate turbulent flow. Intermediate values indicate transitional flow.

Stokes Flow

For laminar flow, terminal settling velocity equation becomes:

$$v = \frac{(\rho p - \rho)gd^2}{18\mu}$$

which is known as the stokes

equation. Transition Flow

Need to solve non-linear equations:

$$v^2 = \frac{4g(\rho p - \rho)d}{3CD\rho}$$

$$CD = \frac{24}{Re} + \frac{3}{R^{1e/2}} + 0.34$$

$$Re = \frac{\rho v d}{\mu}$$

MODULE 4

Lime Soda Process

The hardness of a water is defined as soap settling property of that water. The soap is sedimentedby the presence of Ca^{+2} and Mg^{+2} ions in the water. Ions such as Fe^{+2}, Zn^{+2}, and Al^{+3} also help settling. However, the presence of high amounts of Ca^{+2} and Mg^{+2} ions in water usually leads to water hardness. This is the most common type of hardness in natural waters. The hardness caused by these materials is known as total hardness. The part of the total hardness corresponding to carbonate and bicarbonate ions in the water is defined as carbonate hardness. These ions also determine water alkalinity.

Waters are classified according to hardness grades as follows.

(mg/L) $CaCO_3$	**Degree of Hardness**
0-75	Soft
75-150	Middle
150-300	Hard
300 and over	Very hard

The Aim of Softening:

Hard water can cause various problems. The problems created by hard waters are as follows;

- They cause excessive soap consumption.

- They cause to skin irritation.

- They cause lime accumulation in boilers, hot water pipes and heaters.

- They cause discoloration in porcelain. Especially in homes, the white color of the sinks and bathtubs are discolored.

- They reduce the life of fabrics and cause them to wear out.

- They cause problems in canned food industry.

Hardness removal (chemical softening) is a process that removes all or part of the hardness by

adding various chemical substances into the water. The processes used for water softening are chemical sedimentation and ion exchange methods. Chemical sedimentation can be carried out in 3 ways.

1-Lime-soda process

2-Caustic-soda process

3-Sodium phosphate process

Lime soda process: In lime-soda process, hard water is treated with lime (CaO or Ca $(OH)_2$) firstly, after that with soda. In this process, the hardness is removed by sedimentation as calcium carbonate or magnesium hydroxide. Lime is added either as calcium hydroxide or calcium oxide, and soda is added as sodium carbonate. The substances form hardness in water and the reactions of lime and soda can be written as follows.

$Ca(OH)_2 + CO_2 \dashrightarrow CaCO_3 + H_2O$

$Ca(OH)_2 + Ca(HCO_3)_2 \dashrightarrow 2\,CaCO_3 + 2\,H_2O$

$Mg(HCO_3)_2 + Ca(OH)_2 \longrightarrow MgCO_3 + CaCO_3 + 2\,H_2O$

$MgCO_3 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaCO_3$

$MgCl_2 + Ca(OH)_2 \longrightarrow CaCl_2 + Mg(OH)_2$

$MgSO_4 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaSO_4$

$2NaHCO_3 + Ca(OH)_2 \longrightarrow CaCO_3 + Na_2CO_3 + 2H_2O$

$CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + NaCl$

$CaSO_4 + Na_2CO_3 \longrightarrow CaCO_3 + Na_2CO_3$

The usual method for lime soda processing is treatment by excessive lime amount. The pH should be greater than 9 for sedimentation of the magnesium hydroxide. Usually pH is between 10-10.5. The process contains lime dosing. A small amount of alum or sodium aluminate is added to ensure good sedimentation. The recycling of some sediment sludge can also help to sediment.If the water contains excessive alkalinity after the softening process has been completed, there is a possibility that the calcium carbonate will settle in the pipes. The softened water is treated with H_2SO_4 or CO_2 to remove this from the softened water. This reaction is called recarbonization. In addition to the recarbonization process, addition small amount of polyphosphate (0.5-5 mg / L) may prevent this sedimentation after

purification. If it is requested to retain permanent hardness in water, soda should not be used after softening. This application is defined as partial softening operation.

Ion Exchange Softening

Ion-exchange is used extensively in small water systems and individual homes. Ion-exchange resin, (zeolite) exchanges one ion from the water being treated for another ion that is in the resin (sodium is one component of softening salt, with chlorine being the other). Zeolite resin exchanges sodium for calcium and magnesium. The following chemical reactions show the exchange process, where X represents zeolite, the exchange material. Removal of carbonate hardness: Ca(HCO3)2 + Na2X ------> CaX + 2NaHCO3 Mg(HCO3)2 + Na2X ------> MgX + 2NaHCO3 Removal of non-carbonate hardness: CaSO4 + Na2X -----> CaX + Na2SO4 CaCl2 + Na2X ------> CaX + CaCl2 MgSO4 + Na2X ------> MgX + Na2SO4 MgCL2 + Na2X ------> MgX + 2NaC1 These reactions represent cation exchange, the exchange of positive ions. To replenish the sodium ions used, units need to be regenerated with material containing high amounts of sodium, normally salt brine. This allows the resin to be reused many times. Ion-exchange does not alter the water's pH or alkalinity. However, the stability of the water is altered due to the removal of calcium and magnesium and an increase in dissolved solids. For each ppm of calcium removed and replaced by sodium, total dissolved solids increase by 0.15 ppm. For each ppm of magnesium removed and replaced by sodium, total dissolved solids increase by 0.88 ppm. Measurements used to express water hardness in ion-exchange differ from units used in limesoda softening. Hardness is expressed as grains per gallon rather than mg/l of calcium carbonate. 1 grain/gallon 17.12 mg/l If water contains 10 grains of hardness, would hardness be expressed 171.2 mg/l? 10 grains x 17.12 mg/l / grain = 171.2 mg/l of hardness

ADVANTAGES OF ION-EXCHANGE SOFTENING Compared with lime-soda ash softening, ion-exchange has certain advantages. It is compact and has a low capital cost. The chemicals used are safer for the operator to handle and operation is much easier. It can be almost totally automated. Because resins have the ability to remove all hardness from the water, treated water must be blended with water that has been by-passed around the softener (or adjustments made) to obtain a hardness level the operator needs to maintain. Many systems have found ion-exchange to be the most cost effective way to produce quality water

for their customers. If zeolite units are used to soften surface water, it must be preceded by surface water treatment

MODULE-5

Quality and Quantity of Surface Water and Their Usefulness for Public water Supplies

Quantity.

- The quantities of available surface waters are dependent upon rainfall. Since on an average, in India, rainfall is sufficient and considerable, there should, therefore, be no scarcity of water in these surface sources.
- But since the rainfall is not uniformly and regularly spread throughout the year, considerable variations in the available flows do occur during the year or years, Thus, the available flow in a stream channel or a river may be too high to be controlled or may be too less to fulfill the demand.
- Storage reservoirs, therefore, provide good means of storing and utilizing rain waters.

Quality.

- The rain water, though pure in the beginning, gets considerably polluted till it reaches the river streams. The gases, dusts, etc., from the atmosphere, get added to the rain water till it reaches the ground; from where onward, it flows on earth's surface and also through drains, channels, etc., which add a lot of organic as well as inorganic impurities to it. Many a times, sewage and industrial wastes get added to this water, making it s contaminated.
- Inorganic impurities like silt, clay, etc., get added due to erosion from the beds of the stream channels. The organic impurities get added in the form of vegetable washings, dead organic matters, and dead animals, etc.
- The inorganic suspended matter, though largely present in direct river or stream waters, get settled considerably in still waters of lakes, ponds and reservoirs. However, the algae weed and plant growth in still waters increase enormously, thus giving colors and tastes to these waters. Surface waters are, however, generally soft and less corrosive than ground waters.
- On the whole, it can be stated that the surface supplies are generally contaminated and cannot be used with minor treatment or without any treatment.
- They, therefore, need building up of proper water treatment plants (WTP s)and other connected works before being used for public supplies. They are useful for big cities and large industrial towns where huge quantities of water are required by the public.

Quality and quantity of sub-surface or underground sources

- The water which gets stored in the ground water reservoir through infiltration is known as the underground water. This water is generally pure, because it undergoes natural filtration during the percolation through the soil pores. Moreover, these waters are less likely to be contaminated by bacteria. However, they generally rich in dissolved salts, minerals, gases, etc. the extent of the

salts and minerals present in the ground water depends upon the type and extent of geological formations through which the water is passing before joining the water table.

- Sometimes, the ground water is brought to the surface by some natural processes like springs, and sometimes theses waters are tapped by artificial means by constructing wells, tube wells, infiltration galleries, etc.,
- The replenishment (i.e., filling up) and drainage (i.e., tapping out) of the ground water reservoir is a full topic in itself, involving the hydrological concepts of ground water flow, the possible yields, the construction details of wells, tube wells, galleries, etc.
- Since the ground water is largely tapped in our country for water supplies and there is a scope for its development in future also.

OR

SURFACE SOURCES OF WATER SUPPLIES

Surface sources are those sources of water in which the water flows over the surface of the earth, and is thus directly available for water supplies. The important of these sources are these sources are:

(i) Natural ponds and lakes;
(ii) Streams and rivers; and
(iii) Impounding reservoirs.

These sources are discussed below:

a) Ponds and Lakes as Surface Sources of supplies

- A natural large sized depression formed within the surface of the earth, when gets filled up with water, is known as a pond or a lake. The difference between a pond and a lake is only that of size.
- The quality of water in a lake is generally good and does not need much purification. Larger and older lakes, however, provide comparatively purer water than smaller and newer lakes.
- Self-purification of water due to sedimentation of suspended matter, bleaching of color, removal of bacteria, etc. makes the lake's water purer and better. On the other hand, in still waters of lakes and ponds, the algae, weed and vegetable growth take place freely, imparting bad smells, tastes and colors to their waters.
- The quantity of water available from lakes is, however, generally small. It depends upon the catchment area of the Lake Basin, annual rainfall, and geological formations. Due to the smaller quantity of water available from them, lakes are usually not considered as principal sources of water supplies. They are, therefore, useful for only small towns and hilly areas.
- However, when no other sources are available, larger lakes may become the principal sources of supplies. For example, in Bombay city, water is supplied and brought from lakes about 70 km from there.

b) Streams and Rivers as Surface Sources of Supplies

- Small stream channels feed their waters to the lakes or rivers. Small streams are, therefore, generally not suitable for water supply schemes, because the quantity of water available in them is generally very small, and they may even sometimes go dry.
- They are, therefore, useful as sources of water only for small villages, especially in hilly regions.

- Rivers are the most important sources of water for public water supply schemes. It is a well known fact that most of the cities are settled near the rivers, and it is generally easy to find a river for supplying water to the city.
- The quality of water obtained from rivers is generally not reliable, as it contains large amounts of silt, sand and a lot of suspended matter.
- The disposal of the untreated or treated sewage into the rivers is further liable to contaminate their waters. The river waters must, therefore, be properly analysed and well treated before supplying to the public.

c) Storage Reservoirs as Surface sources of supplies

- A water supply scheme drawing water drawing water directly form a river or a stream may fail to satisfy the consumer demands during extremely low flows; while during high flows, it may again become difficult to carry out its operations due to devastating floods.
- A barrier in the form of a dam may, therefore, sometimes be constructed across the river, so as to form a pool of water on the upstream side of the barrier. This pool or artificial lake formed on the upstream side of the dam is known as the storage reservoir.
- The quality of this reservoir water is not much different from that of a natural lake. The water stored in the reservoir can be used easily not only for water supplies but also for other purposes.
- Generally, multipurpose reservoirs are planned these days and operated so as to get optimum benefits. The subject of design and planning of dams and reservoirs is a big topic in itself, and is generally dealt under the subject of Irrigation.
- However, its salient features such as, Selection of dam site and types of dam ; Storage capacity of reservoirs, Reservoir sedimentation, Reservoir losses, etc. are, however being reproduced here.

INTAKES

Intakes are the structures used for admitting water from the surface sources (i.e., river, reservoir or lake), and conveying it further to the treatment plant. Generally, an intake is a masonry or concrete structure with an aim of providing relatively clean water, free from pollution, sand and objectionable floating material.

Selection of site

The following points should be considered in selecting a suitable site for the intake structure:

1. The site should be so selected that it may admit water even under worst condition of flow in the river, or under lowest possible water level in a lake or reservoir, if possible, intake should be located sufficiently inside the shore line.
2. Its site should be as near to the treatment work as possible.
3. It should be so located that it admits relatively pure water free from mud, sand or other floating materials. It should be located at a place protected from rapid currents.
4. It should be so located that it is free from the pollution. River intakes should be constructed well upstream of points of discharge of sewage and industrial wastes. If located near a city, it should be located to the upstream of the city so that water is not contaminated.
5. It should not interfere with river traffic, if any.

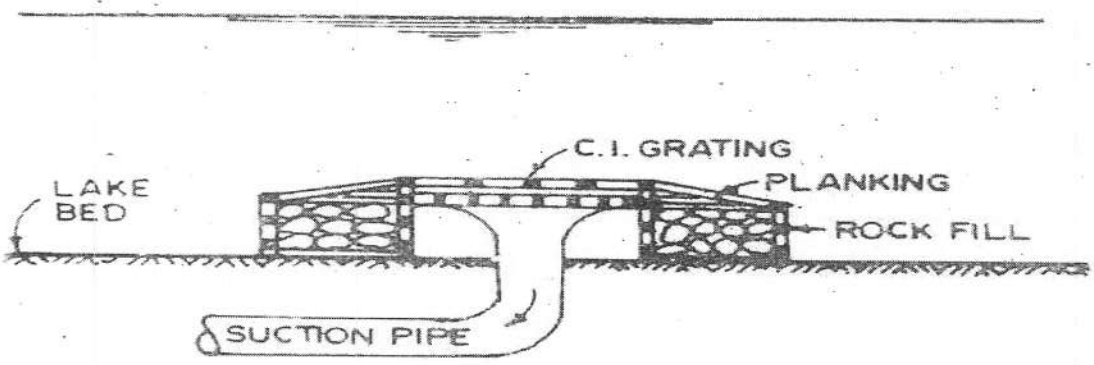
6. The intake should be so located that good foundation conditions are available and the possibility of scouring is the least.
7. Site should be so selected that its further expansion is possible.

Types of intake

a) Depending upon their position. (*Submerged and Exposed intake)*

1. Simple Submerged Intake

- *Submerged intake* is the one which is constructed entirely under water. Such an intake (Fig.a) is commonly used to obtain supply from a *lake.*
- A pipe is buried in a dredged channel across the bed of the river and the pipe is covered with soft earth. The remaining depth of the trench is covered with gravel and stone.
- Pipes are jointed with watertight joints and end with a bell-mouth, protected by a timber or concrete crib. The crib protects the conduit against damage and it is covered with rocks or rip-rap. The bell-mouth is covered with a coarse screen to eliminate the entry of submerged objects, debris, ice etc.
- Sometimes a fine screen is also provided to avoid the entry of fish and small floating objects. The conduit draws water from the source into a wet-well. Inspection of water-quality in the wet-well, shows the performance of the screens. From the wet-well, water is drawn by gravity or pumping to the treatment plant or distribution centre, as the case may be the area of the openings of the crib satisfy the entry velocity of not more than 15cm/s, to avoid the carrying of settleable particles into the intake pipe.
- The crib and the bell-mouth are submerged in water. This type of intake is cheap and there is no obstruction to navigation. They are therefore used for small water supply projects. But, there is a possibility of choking of the crib openings and bell-mouth. It is difficult to inspect and repair and allows draw water only from one level.



(Fig.a) *Submerged intake*

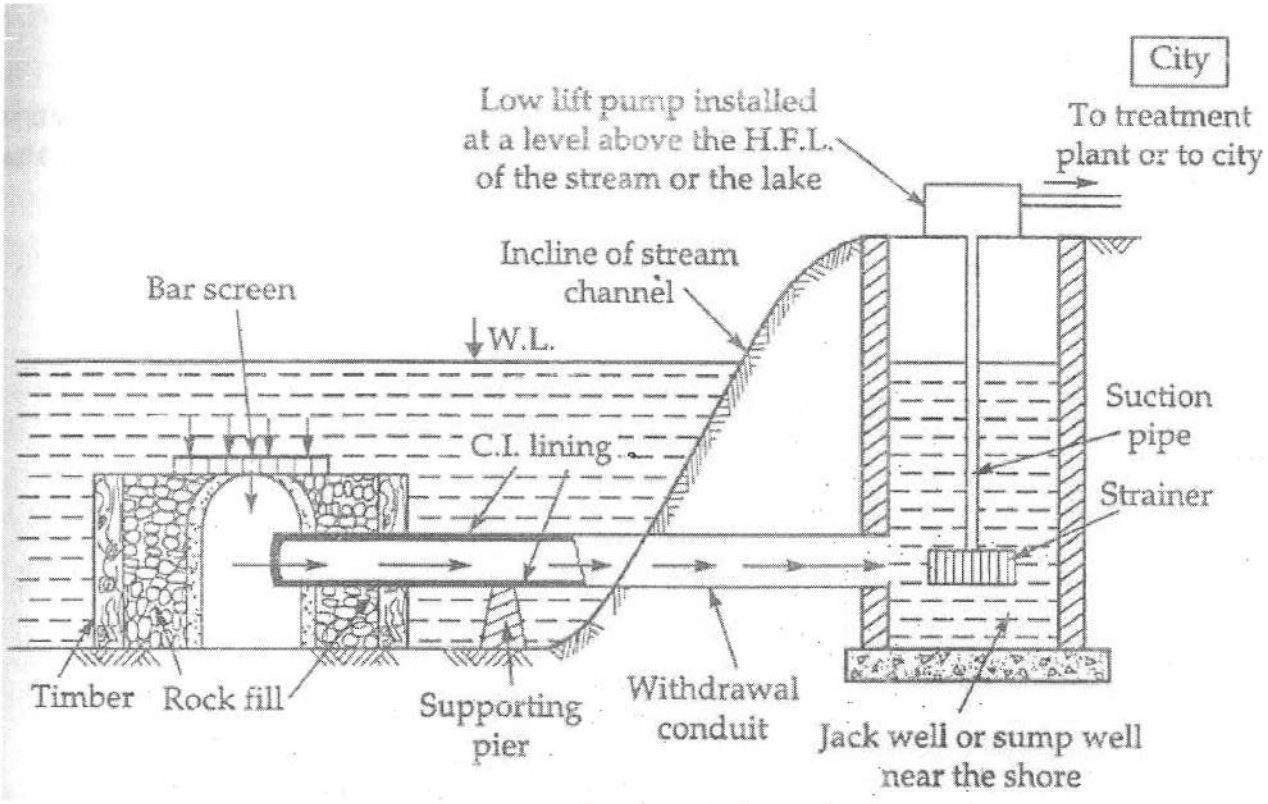


Fig.a-1: Simple Concrete block- ***Submerged intake***

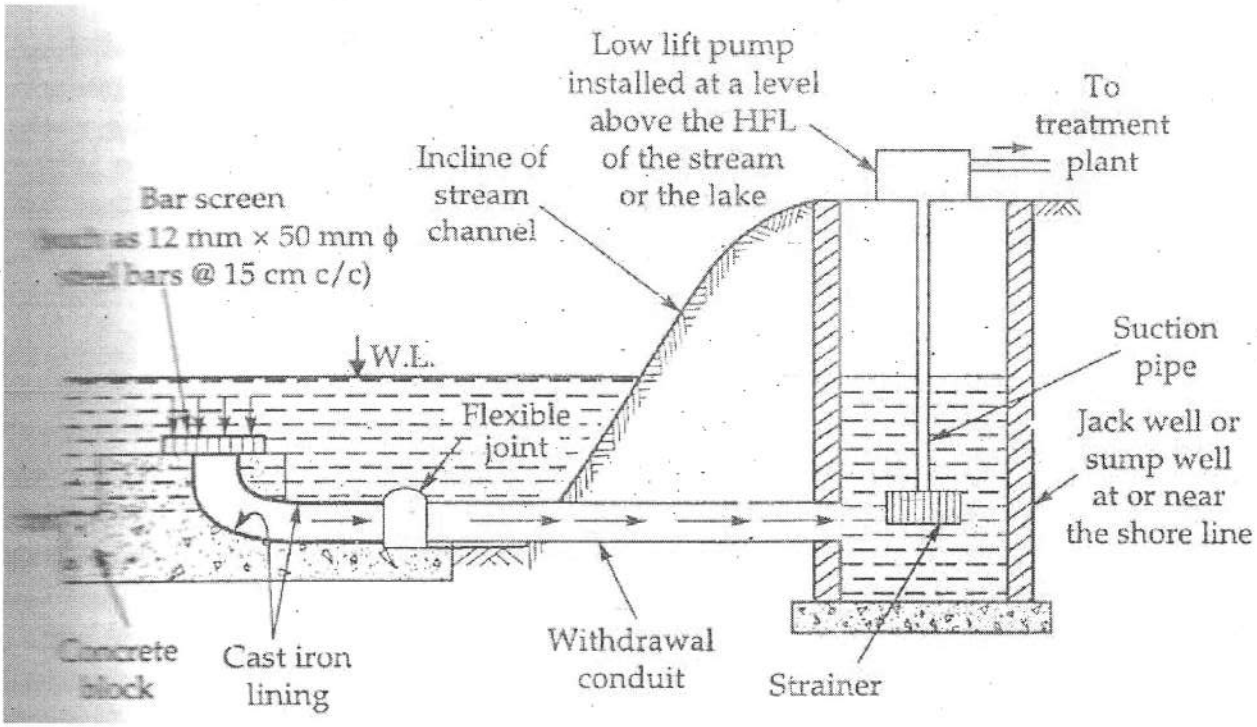
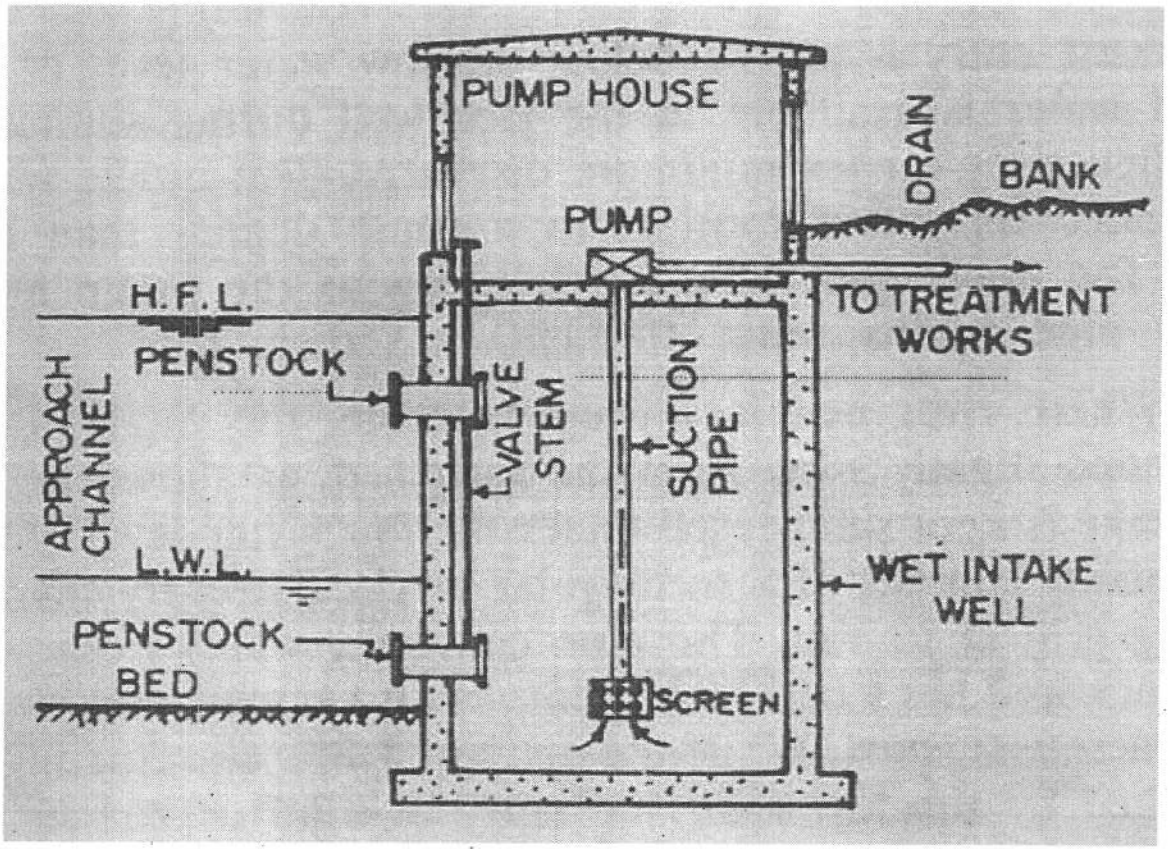


Fig.a-2: Rock filled timber crib- ***Submerged intake***

2. Exposed intake

- *Exposed intake* is in the form of a well or tower constructed near the bank of a river, or in some cases even away from the river bank.
- This type of intake may be used for tapping water from reservoirs, lakes or rivers. Exposed intakes are more common due to ease in its operation **(Fig b).** They are located (a) in the dams of reservoirs as a part of the dam, or (b) on the banks or rivers and lakes.
- An exposed intake can be called as "gate-house" or "valve-tower" in the case of a reservoir. It is easier to inspect and operate then a submerged intake. Water can be drawn at any desired level.



(Fig b). ***Exposed intake***

(b) Intake towers

3. Wet intake

- *Wet intake* is that type of intake tower in which the water level is practically the same as the water level of the sources of supply. Such an intake is sometimes known as *jack well* and is most commonly used.
- A typical section of a wet intake tower is shown in **(Fig.c).** It may consist of a concrete circular shell filled with water up to the reservoir level and has a vertical inside shaft which is connected to the withdrawal pipe. The withdrawal may be taken directly to the treatment plant in case no lift is required (such as in reservoir) or to the sump well in case a low lift is required (such as in case of a river).

15CV64

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Water Supply and Treatment Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the need and importance of protected water supply to a community. **(05 Marks)**

b. Explain briefly different types of water demand. **(05 Marks)**

c. Briefly explain :

(i) Factors affecting per capita demand of water.

(ii) Factors affecting design period **(06 Marks)**

OR

2 a. List different methods of populations forecasting. Explain briefly any two methods. **(08 Marks)**

b. The population census of a city is as shown in the following table. Estimate the expected population of the city by 2041 using arithmetical increase method and geometrical increase method.

Year	1971	1981	1991	2001	2011
Population in lakhs	1.50	1.85	2.18	2.50	2.85

(08 Marks)

Module-2

3 a. What are the objectives of water treatment? Draw a flow chart of conventional water treatment plant and indicate various units. **(08 Marks)**

b. Classify various sources of water and explain briefly their suitably with respect to quantity and quality for a town. **(08 Marks)**

OR

4 a. What is sampling of water? Discuss the objectives of sampling and preservative techniques. **(06 Marks)**

b. Explain briefly physical, chemical and bacteriological water quality characteristics. **(06 Marks)**

c. Give the maximum permissible limits as per the BIS for the following water quality parameters:

(i) Total hardness (ii) Fluoride (iii) Nitrate (iv) Iron. **(04 Marks)**

Module-3

5 a. What is Sedimentation process? With the help of sketch of an ideal settling tank, show that the efficiency of the settling tank is independent of its depth. **(05 Marks)**

b. Design a set of here circular settling tanks to handle 6 million litres of water per day. Take detention time as 4 hours and side water depth as 3m. Check for the design and sketch the designed tank. **(06 Marks)**

c. What is coagulation of water? Estimate the quantity of alum required per month at a treatment plant to treat 10 MLD of water with alum dosage of 20 mg/ℓ. **(05 Marks)**

OR

6 a. Briefly explain the mechanism of filtration. **(04 Marks)**

b. With the help of a sketch explain the working of a rapid sand filter. **(06 Marks)**

c. Design a set of Ten slow sand filter units to treat water for a town of 2 lakh population with assured water supply of 135 lpcd and maximum daily water is 1.5 times the average demand. The rate of filtration is 200 litres per square metre per hour **(06 Marks)**

Module-4

7 a. What are the objectives of water softening? Give a comparison of Lime - Soda process with Zeolite process of water softening. **(05 Marks)**

b. A river was proposed as the raw water source for a near by town. Chemical analysis of the water indicates the constitutes as given below. If the hardness of water supplied to the residents is to be limited to 160 mg/ℓ, determine the need of softening if any.

Zn = 4 mg/ℓ	Na^+ = 18 mg/ℓ
$Cℓ^-$ = 68 mg/ℓ	Mg^{2+} = 16 mg/ℓ
SO_4^{2-} = 20 mg/ℓ	Ca^{2+} = 60 mg/ℓ
Turbidity = 45 mg/ℓ	Alkalinity = 45 mg/ℓ

Given equivalent weight of Ca^{2+} = 20; Mg^{2+} = 12.2 and $CaCO_3$ = 50. **(05 Marks)**

c. Estimate the quality of Zeolite required to soften 2 MLD of water with hardness 360 mg/ℓ which should be reduced to 60 mg/ℓ. The interval between successive regeneration is 4 hours and the capacity of exchanger is 24000 grams/cu.m. **(06 Marks)**

OR

8 a. What is disinfection of water? What are the requirements of a good disinfectant? **(04 Marks)**

b. A college hostel having 500 students used well water for drinking. The rate of water supply is 120 lpcd. The water is to be disinfected using bleaching powder containing 25% chlorine available. Determine the monthly requirement of the bleaching powder with the following data:

(i) Chlorine demand of well water = 1.2 mg/ℓ

(ii) residual Chlorine expected = 0.2 mg/ℓ **(06 Marks)**

c. Write a note on : (i) Fluoridation (ii) De-fluoridation **(06 Marks)**

Module-5

9 a. What are intake works? What are the factors to be considered for selection of site intake structures? **(05 Marks)**

b. Write a note on : (i) Pumps and their types (ii) Pipe materials and pipe appurtenances **(06 Marks)**

c. A town with prospective population of 80,000 is to be supplied with water from a river 5 km away and 25m below the level of the town. Design the economical section of the rising main and pumping unit where power is available. Take water supply rate as 150 lpcd and f = 0.01. Assume other relevant details if required. Given pumping hours = 12/day. **(05 Marks)**

OR

10 a. Explain the various methods of water distribution system. **(05 Marks)**

b. For the water supply of a small rural town with the population of 10,000 with the rate of water supply as 100 lpcd. It is proposed to construct a distributing reservoir. The pattern of draw off is as under.

5 am to 10 am ..... 75% of days supply
10 am to 4 pm ..... 10% - " -
4 pm to 9 pm ..... 13% - " -
9 pm to 5 am ..... 2% - " -

The pumping is to be done for 8 hrs per day (8 am to 4 pm). Determine the storage capacity of the reservoir. **(06 Marks)**

c. Write a note on different types of water distribution reservoir. **(05 Marks)**

15CV64

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
Water Supply and Treatment Engineering

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Draw neat sketches wherever necessary.***

Module-1

1 a. Discuss the need for a protected water supply. **(06 Marks)**
b. List the various types of water demand and explain any four only. **(10 Marks)**

OR

2 a. Explain the term "Design Period" and factors affecting the same. **(06 Marks)**
b. The census record of a town shown population of 50000 , 110000 and 160000 for the years 1971, 1991, 2011 respectively. Estimate
i) Saturation population and
ii) Expected population in 2031. Use Logistic curve method. **(06 Marks)**
c. Explain the term variations in demand of water. **(04 Marks)**

Module-2

3 a. Draw a neat treatment flow chart for a river source drawn from a balancing reservoir and explain the significance of each unit operation or process. **(10 Marks)**
b. Explain the term surface and sub – surface sources. **(06 Marks)**

OR

4 a. Explain the grab sampling and composite sampling techniques for water. **(04 Marks)**
b. Discuss the terms Palatability and Wholesomeness of water. **(04 Marks)**
c. Give the permissible limits (as per IS 10500 : 1991) and ill effects caused if exceeded (for any eight parameters only) in water used for drinking purpose. **(08 Marks)**

Module-3

5 a. Explain the term plain sedimentation and sedimentation aided with coagulation. **(08 Marks)**
b. A settling tank with a continuous flow regime is 3m deep and 60m long. Determine the velocity of water to be maintained for effective removal of particles for the following data :
Diameter of particle = 0.025mm ; Sp. gr. Of particles = 2.65 ;
Kinematic viscosity of water at $25^0C = 0.01\ cm^2/sec$. **(08 Marks)**

OR

6 a. Explain the theory of Filtration. **(04 Marks)**
b. Discuss the types of filters used and their classification. **(06 Marks)**
c. Design a rapid sand filter unit for 4 MLD water supply.
Assume 4% filtered water for washing every day.
Rate of filtration = 5000 litres/hr/m^2.
Length of filter bed = 1.5 × width.
30 minutes are lost every day for washing filter. **(06 Marks)**

Module-4

7 a. Give the comparison between Lime soda process and Zeolite process of softening water. **(10 Marks)**

b. Explain briefly with a neat sketch, the principle showing Reverse Osmosis. **(06 Marks)**

OR

8 a. Discuss the emphasis on treatment of water for community bathing during a fair. **(06 Marks)**

b. Explain briefly available technologies for Defluoridation of water. **(06 Marks)**

c. Write a note on waterborne diseases and their prevention. **(04 Marks)**

Module-5

9 a. Define the term intake structures and illustrate with neat sketches river intake. **(06 Marks)**

b. Obtain the size of the "Main" and BHP of pump required for following data :

Population of Town = One Lakh ; Per capita demand = 150 Lpcd ;
Length of pipe = 1800 m ; RL of sump = 100.00 ;
RL of service reservoir = 136.00 ; Maximum demand = 1.8 × Average demand
Working hour of pumps = 12 hours ; Flow velocity, through pipe = 1.5 m/s
Hazen William's coefficient = C_H = 120 for material of pipe. **(10 Marks)**

OR

10 a. Explain the different pipe materials used in water supply scheme along with advantages and disadvantages. **(08 Marks)**

b. Explain methods of Distribution system. **(08 Marks)**

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Bapuji Institute of Engineering and Technology, Davangere–577 004
Department of Civil Engineering

USN										

Course/Subject Title	Water Supply and Treatment Engineering	Course/Subject Code	18CV46
Semester	IV – A	Scheme	CBCS – 18
Date	09.06.2021	CIE No.	1
Time	3.00-4.00PM	Max. Marks	30

Course Outcome Statements : After the successful completion of the course, the students will be able to	
CO1	**Estimate** the average and peak water demand for a community
CO2	**Assess** the available sources of water quantitatively and qualitatively for a community/city use
CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note :Answerany one full question from each Part.

Q. No.	Question	Marks	RBT Level	CO
	Part A			
1	**What** is meant by per capita demand? List and discuss the factors that affect the per capita demand.	10	L1	1
2	**Explain** the importance and need for protected water supply.	10	L2	1
	Part B			
3	**a.What** is fire demand? Compute fire demand for a city having population1,40,000 by various formulae. and **b. Write** a neat flow chart of municipal water treatment plant with significance of each unit.	10 10	L1 L1	1 2
4	**a.** The population of 5 decades from 1970 to 2010 are given the table. **Find** the population after one, two and three decades beyond the last known decade by i)Geometrical increase method ii) Incremental increase method.	10	L3	1

Year	1970	1980	1990	2000	2010
Population	24000	27000	33000	41000	46000

	b.Explain briefly physical, chemical and bacteriological water quality characteristics.	10	L2	2

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

Course Coordinator
(Faculty in charge)

Coordinator
DQAC

Program Coordinator
(HOD, Civil)

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Bapuji Institute of Engineering and Technology, Davangere–577 004
Department of Civil Engineering

USN										

Course/Subject Title	Water Supply and Treatment Engineering	Course/Subject Code	18CV46
Semester	IV – A	Scheme	CBCS – 18
Date	07.07.2021	CIE No.	II
Time	3.00-4.00PM	Max. Marks	30

Course Outcome Statements : After the successful completion of the course, the students will be able to	
CO1	**Estimate** the average and peak water demand for a community
CO2	**Assess** the available sources of water quantitatively and qualitatively for a community/city use
CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note :Answer any one full question from each Part.

Q. No.	Question	Marks	RBT Level	CO
	Part A			
1	**Explain** the sedimentation process used in water treatment plant with a neat sketch.	10	L2	3
2	**Explain** the theory of filtration.	10	L2	3
	Part B			
3	**a.Explain** the working of a rapid sand filter with a neat sketch. and **b. Explain** zeolite process of removing hardness with the help of chemical formula.	10 10	L2 L2	3 4
4	**a.** A rectangular sedimentation tank without mechanical equipment is to treat 1.8million litres per day of raw water. The sedimentation period is to be 4 hours, the velocity of flow 8cm/min and the depth of water and sediment 4.2m. If an allowance of 1.2m for sediments is made. **Design** the dimension of the tank. **b.What** is softening of water?Discuss the lime soda process of water softening with chemical reactions.	10 10	L3 L1	3 4

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

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Department of Civil Engineering

USN										

Course/Subject Title	Water Supply and Treatment Engineering	Course/Subject Code	18CV46
Semester	IV – A	Scheme	CBCS – 18
Date	04.08.2021	CIE No.	III
Time	2.15- 3.15 PM	Max. Marks	30

Course Outcome Statements : After the successful completion of the course, the students will be able to	
CO1	**Estimate** the average and peak water demand for a community
CO2	**Assess** the available sources of water quantitatively and qualitatively for a community/city use
CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note :Answer any one full question from each Part.

Q. No.	Question	Marks	RBT Level	CO
	Part A			
1	Discuss the characteristics of ideal disinfectant and explain any two methods of disinfection.	10	L1	4
2	Explain Defluoridation and Fluoridation.	10	L2	4
	Part B			
3	a. Discuss the chemistry of chlorination and the factors affecting chlorination.	10	L1	4
	b. What are intake works? What are the factors to be considered for selection of site for intake structures?	10	L1	5
4	a. Explain i) Break point chlorination ii) Super chlorination	10	L2	4
	b. Explain with the help of neat sketch, twin well type of river intake.	10	L2	5

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

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Department of Civil Engineering

Scheme of Valuation

Course/Subject Title	Water Supply & Treatment Engg	Course/Subject Code	18CV46
Semester	IV	CIE No.	I
Date	09.06.2021	Max. Marks	30

Part - A

01. Definition of percapita demand — 02m
Factors affecting per capita demand — 08m

02. Explainations of
Importance of water supply — 05m
Need for protected water supply — 05m

part-B

03. a. Definition of fire demand — 02m
Computation of fire demand by
i) Freeman formula ii) Kuichlings formula iii) Buttes's formula iv) National board of fire formula — 08m

b. Flow chart of municipal water treatment plant — 05m
Significance of each unit — 05m

04. a. calculation of population by Incremental & Geometrical increase method after one two & three decades — 05m

i.e. $P_{2020} = 52,167$ $P_{2020} = 53787.8$ — 05m
$P_{2030} = 59001$ $P_{2030} = 62894$
$P_{2040} = 66502$ $P_{2040} = 73542$

b. Listing physical, chemical & biological characteristics of water — 02m
Explainations of characteristics of water — 08m

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Scheme of Valuation

Course/Subject Title	Water Supply & Treatment Engg	Course/Subject Code	18CV46
Semester	IV A	CIE No.	II
Date	07.07.2021	Max. Marks	30

Part - A

01. Sketch of Sedimentation tank — 05m
Explaination of Sedimentation process — 05m

02. Listing the actions involved in theory of filtration & explaination of each — 02m
Mechanical Straining — 0 2m
Sedimentation & flocculation — 02m
Biological action — 02m
Electric charges — 02m

Part - B

03.
a) Sketch of Rapid Sand filter — 05m
Working principle of Rapid Sand filter — 05m

b) Explaination of Zeolite process & water softening — 05m
Chemical Reactions
$Na_2Ze + Ca(HCO_3)_2 \rightarrow CaZe + 2NaHCO_3$
$Na_2Ze + Mg(HCO_3)_2 \rightarrow MgZe + 2NaHCO_3$ — 05m
$Na_2Ze + CaCl_2$ (or $CaSO_4$) $\rightarrow CaZe + 2NaCl$ (or Na_2SO_4)
$Na_2Ze + MgCl_2$ (or $MgSO_4$) $\rightarrow MgZe + 2NaCl$ (or Na_2SO_4)

04.
a) Water to be treated during detention time
$= \frac{1.8 \times 10^6 \times 4}{24} = 300\ m^3$ — 02m

P. T.O

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Scheme of Valuation

Course/Subject Title		Course/Subject Code	
Semester		CIE No.	
Date		Max. Marks	

Area of the tanks = $15.63m^2$ — 02m
Length of tanks = 19.2m — 02m
width of sedimentation tanks = 5.21m — 02m
Depth of tanks = 4.2m (water + Sediment) — 02m

4.
b. Definition of Softening of water — 02m
Explaination of Lime Soda process with chemical reactions — 08m

$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 \downarrow + 2H_2O$

$Mg(HCO_3)_2 + Ca(OH)_2 \rightarrow Ca(HCO_3)_2 + Mg(OH)_2 \downarrow$

$MgCO_3 + Ca(OH)_2 \rightarrow Mg(OH)_2 \downarrow + CaCO_3 \downarrow$

$MgCl_2 + Ca(OH)_2 \rightarrow Mg(OH_2) \downarrow + CaCl_2$

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Scheme of Valuation

Course/Subject Title	Water Supply and Treatment Engg	Course/Subject Code	18CV46
Semester	IV 'A'	CIE No.	III
Date	04.08.2021	Max. Marks	30

	Part - A	
01	Listing out the characteristics of ideal disinfectant	05m
	Explaining any two methods of disinfection	05m
02	Explaination of defluoridation and its methods	05m
	Explaination of fluoridation and its methods	05m
	Part - B	
03		
a.	chemistry of chlorination $Cl_2 + H_2O \rightarrow HOCl + HCl$ $HOCl \rightarrow H^+ + OCl^-$	05m
	Factors affecting chlorination	05m
b.	Definition of Intakes	02m
	Factors to be considered for selection of site for intake structures	08m
04		
a.	Explaination of i) Break point chlorination ii) Super chlorination	05m 05m

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Department of Civil Engineering

Scheme of Valuation

4 b.	Sketch of twin well type of ring intake Explaination of twin well type of ring intake	05m 05m

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Assignment No.	1	**Maximum Marks**	10
Semester	IV – A	**Scheme**	CBCS – 18
Course Co-ordinator	Sumana Y.B		

Course Outcome Statements : After the successful completion of the course, the students will be able to

CO1	**Estimate** the average and peak water demand for a community
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CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note : Answer all the questions.

Q. No.	Question	Marks	RBT Level	CO
1	**Explain** briefly different types of water demand.	2.5	L2	1
2	The population census of a city is as shown in the following table. **Estimate** the expected population of the city by 2041 using arithmetical increase method and geometrical increase method	2.5	L3	1
3	**Classify** various sources of water and explain briefly their suitability with respect to quantity and quality for a town.	2.5	L2	2
4	**What** is sampling of water? Discuss the objectives of sampling and preservation techniques.	2.5	L1	2

Year	1971	1981	1991	2001	2011
Population in lakhs	1.50	1.85	2.18	2.50	2.85

Last date for submission	**03**	**06**	**2021**

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

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Assignment No.	2	**Maximum Marks**	10
Semester	IV – A	**Scheme**	CBCS – 18
Course Co-ordinator	Sumana Y.B		

Course Outcome Statements : After the successful completion of the course, the students will be able to	
CO1	**Estimate** the average and peak water demand for a community
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CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note : Answer all the questions.

Q. No.	Question	Marks	RBT Level	CO
1	**Explain** briefly the operational problems in filters.	2.5	L2	3
2	**Differentiate** between Ultra and Microfiltration.	2.5	L2	3
3	**Explain** reverse osmosis process of softening of water.	2.5	L2	4
4	**What** are the objectives of water softening.	2.5	L1	4

Last date for submission	**15**	**07**	**2021**

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

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Assignment No.	3	**Maximum Marks**	10
Semester	IV – A	**Scheme**	CBCS – 18
Course Co-ordinator	Sumana Y.B		

Course Outcome Statements : After the successful completion of the course, the students will be able to	
CO1	**Estimate** the average and peak water demand for a community
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CO3	**Select** a site for suitable sources of water
CO4	**Design** the water treatment plant
CO5	**Explain** the method of collection and conveyance of water
CO6	**Select** a suitable method of distribution system for a community/city use

Note : Answer all the questions.

Q. No.	Question	Marks	RBT Level	CO
1	**Explain** briefly sluice valve and reflux valve.	2.5	L2	6
2	**Explain** i)Corrosion in pipes ii) Fire hydrant.	2.5	L2	6
3	**List** the advantages and disadvantages of dead end system.	2.5	L1	6
4	**Explain** briefly pipe materials and pipe appurtenances.	2.5	L2	6

Last date for submission	**31**	**07**	**2021**

RBT (Revised Bloom's Taxonomy) Levels : Cognitive Domain		
L1 : Remembering	L2 : Understanding	L3 : Applying
L4 : Analysing	L5 : Evaluating	L6 : Creating

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Civil Engineering Department
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