

GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3161306

Date: 22/05/2026

Subject Name: Design of water Treatment Units

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) List the selection criteria for choosing a water treatment scheme. **03**
 - (b) Create a labeled sketch of a rapid mixer showing important parts. **04**
 - (c) Explain with neat sketch the surface water treatment scheme and compare it with groundwater treatment scheme. **07**

- Q.2**
- (a) Explain the purpose of a Parshall flume in water treatment plants. **03**
 - (b) A bar screen is inclined at 60° angle from the horizontal. The circular bars have a diameter of 20 mm & a clear spacing of 25 mm. Determine the headloss when the bars are cleaned, the velocity approaching the screen is 1 m/s and $C = 0.7$. **04**
 - (c) Calculate the lime and soda dose required to soften water with the following characteristics: $\text{Ca}^{2+} = 60 \text{ mg/l}$, $\text{Mg}^{2+} = 30 \text{ mg/l}$, $\text{HCO}_3^- = 200 \text{ mg/l}$. **07**

OR

- Q.2**
- (c) Design a flocculator for 20 MLD plant using suitable detention time and velocity gradient assumptions. **07**

- Q.3**
- (a) Calculate the number of coarse screen bars required for a channel width of 1.2 m if clear spacing is 40 mm and bar thickness is 10 mm. **03**
 - (b) Explain the factors affecting efficiency of screens in water treatment. **04**
 - (c) Analyze the working and design considerations of a primary sedimentation tank. **07**

OR

- Q.3**
- (a) Differentiate between rapid mixing and flocculation units. **03**
 - (b) Identify the specific parameters used to determine the G-value (velocity gradient) in rapid mixers. **04**
 - (c) Evaluate various parameters governing design of a clariflocculator and justify optimum detention period. **07**

- Q.4**
- (a) Justify the need of tube settlers over conventional sedimentation tanks. **03**
 - (b) State design criteria for a rapid sand filter. **04**
 - (c) Design a rapid sand filter unit for 20 MLD plant including number of units and filter area. **07**

OR

- Q.4**
- (a) Design a flow chart for treatment of groundwater containing iron and manganese. **03**

- (b)** Explain sludge minimization methods in treatment plant residual management. **04**
- (c)** Design a tube settler module of square cross section with following data; Design flow = 5 MLD; Cross section of square tube = 50 mm x 50 mm; Length of tube = 1 m and Angle of inclination of tube = 60° with horizontal. **07**

- Q.5**
- (a)** State any three functions of under-drainage system in rapid sand filters. **03**
 - (b)** Calculate chlorine dose required for 10 MLD water if demand is 1.5 mg/L and residual chlorine required is 0.5 mg/L. **04**
 - (c)** Compare the performance of Rapid Sand Filters versus Slow Sand Filters regarding filtration rates and cleaning methods. **07**

OR

- Q.5**
- (a)** Explain the concept of residual chlorine in disinfection. **03**
 - (b)** Illustrate the mechanism of the Nalgonda technique used for defluoridation. **04**
 - (c)** Evaluate and design a suitable treatment system for groundwater containing excess hardness and fluoride. **07**
