

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: MSc/PRE-PHD  
BRANCH: ENVIRONMENTAL SCIENCE & TECHNOLOGY**

**SEMESTER : I  
SESSION : MO/2025**

**SUBJECT: MET25503 WATER AND WASTEWATER TREATMENT**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
- 

- |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |         |         |         |         | CO   | BL   |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|------|------|------------|--------|---------|---------|---------|---------|---------|--|--|--|--|--|--|--|
| Q.1(a)     | Discuss the different types of population forecasting methods used in water supply schemes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [5]     | 2       | 2       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.1(b)     | Considering the data provided in the example, predict the population for the year 2051 using the geometric progression method.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [5]     | 2       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
|            | <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="text-align: left;">Year</th><th style="text-align: center;">1971</th><th style="text-align: center;">1981</th><th style="text-align: center;">1991</th><th style="text-align: center;">2001</th><th style="text-align: center;">2011</th><th style="text-align: center;">2021</th></tr></thead><tbody><tr><td style="text-align: left;">Population</td><td style="text-align: center;">850000</td><td style="text-align: center;">1010000</td><td style="text-align: center;">1200000</td><td style="text-align: center;">1690000</td><td style="text-align: center;">2070000</td><td style="text-align: center;">2580000</td></tr></tbody></table> | Year    | 1971    | 1981    | 1991    | 2001    | 2011 | 2021 | Population | 850000 | 1010000 | 1200000 | 1690000 | 2070000 | 2580000 |  |  |  |  |  |  |  |
| Year       | 1971                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1981    | 1991    | 2001    | 2011    | 2021    |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Population | 850000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1010000 | 1200000 | 1690000 | 2070000 | 2580000 |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.2(a)     | Discuss intake towers used in water supply systems for withdrawing water from rivers/reservoirs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [5]     | 1       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.2(b)     | Discuss the forces acting on pressure conduits used in water supply schemes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [5]     | 1       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.3(a)     | Explain the mechanism by which impurities are removed in the filtration process. Draw a flow diagram and explain the slow sand filtration process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | [5]     | 3       | 2       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.3(b)     | Describe the process of chlorination, demonstrating all possible reactions, considering the terms chlorine demand, breakpoint chlorination, free residual chlorine and combined chlorine.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | [5]     | 3       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.4(a)     | Discuss the important aspects of the design and planning of a sewerage system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | [5]     | 4       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.4(b)     | Discuss briefly the importance and use of the important sewer appurtenances.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [5]     | 4       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.5(a)     | Draw a conventional layout of a domestic wastewater/ sewage treatment plant (STP) and explain the role of individual units used in STP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | [5]     | 5       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |
| Q.5(b)     | Draw a schematic flow diagram of the activated sludge process (ASP) and list the assumptions in designing ASP. Additionally, discuss the process microbiology and kinetic parameters in ASP designing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | [5]     | 5       | 3       |         |         |      |      |            |        |         |         |         |         |         |  |  |  |  |  |  |  |

:25/11/2025:E