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

CLASS: BE **SEMESTER : VI**
BRANCH: CIVIL **SESSION : SP/19**

SUBJECT: CE6001 ENVIRONMENTAL ENGINEERING

TIME: 3.00 Hrs. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

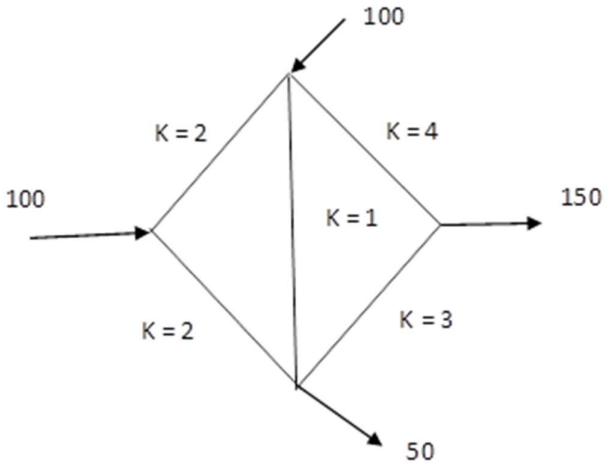
Q.1(a) Briefly mention the factors that affects water losses and wastes. [2]
Q.1(b) Describe the factors that influences per capita water demand. [4]
Q.1(c) The population of a city in three consecutive period 1990, 2000 and 2010 was 80,000, 250,000 and 480,000 respectively. Find out the following: (a) saturation population, (b) equation of logistic curve, (c) expected population in 2020. [6]

Q.2(a) Differentiate between dry intake and wet intake structures. [2]
Q.2(b) Describe the different formulae used for determining head loss in pipes. [4]
Q.2(c) Water has to be supplied to a city with 1.5 million population at 170 lpcd from a river which is 2 km far from city. The difference in elevation is between the lowest water level in the sump and the reservoir is 40 m. If water demand is to be met in 8 hours, estimate the size of main and horse power of pumps needed. Assume C_H = 120, velocity in pipe 2.0 m/sec and pump efficiency is 70%. [6]

Q.3(a) Mention the advantages and disadvantages of pressure sand filters. [2]
Q.3(b) Briefly discuss the various parts and appurtenances present in a pressure sand filter. [4]
Q.3(c) Rectangular sedimentation basin is designed to treat 15 MLD raw water. One detention basin of width to length ration of 1/3 is planned to settle particles >0.04 mm. If depth of the basin is 3.5 m determine the detention time and basin dimensions. (Assume particle density as 2.7 and average temperature as 25◦C) [6]

Q.4(a) Estimate the % available chlorine in $Ca(OCl)_2$. [2]
Q.4(b) Describe the split-treatment lime-soda ash process for water softening. [4]
Q.4(c) Describe Chick's law, Chick-Watson law and Hom-Haas Model. [6]

Q.5(a) What are the requirements of a good distribution system? [2]
Q.5(b) Briefly describe the different types of distribution system. [4]
Q.5(c) Estimate the flow distribution in the pipe network shown below. Assume flow is turbulent and pipe interiors are rough. [6]



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Q.6(a) What are the additions and subtractions considered for estimating sewage quantity? [2]

Q.6(b) Describe the hydraulic formulas used for determining flow velocity in sewerage system. [4]

Q.6(c) Design a combined circular sewer for a residential block in a city, with the following details: area of block – 40 ha; population - 10,000; water consumption – 180 lpcd; rainfall intensity – 5 cm/h; available slope – 1 in 1000; value of K = 0.55, Manning's coefficient N = 0.013. [6]

Q.7(a) Define ammonification, nitrification and denitrification. [2]

Q.7(b) With the help of a flow diagram represent a conventional ASP based STP. [4]

Q.7(c) Determine the size of a septic tank, desludging period in years and total trench area in m^2 of the percolation field, for a colony of 500 people where water supply is at 135 lpcd. Desludging will be carried out once the tank gets half full with sludge. Percolation test showed that an allowable hydraulic loading of 100 $L/m^2/day$. Other available data: length to width ratio 2.5, liquid depth 2 m and freeboard 0.3 m; sludge production 0.05 m^3 per capita per year and retention time is 3 days at start up. [6]

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