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Paper Code : CE(PC)402 Environmental Engineering-I

UPID : 004446

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(I) The bacteria which survive in the absence of Oxygen, are called _____

(II) Settling velocity of inorganic particles follow _____

(III) A large whirling mass of air, at the centre of which the barometric pressure is low, is known as _____ .

(IV) Municipal Solid Waste (MSW) does not includes _____

(V) The earth's water circulatory system is known as _____

(VI) Sanitary landfill site should include _____

(VII) The maximum permissible concentration of sulphates is concrete curing and mixing water is _____

(VIII) The 100% removal line for Type-2 sedimentation is _____to time axis.

(IX) In double mass curve method, the size of a distribution reservoir is equal to maximum excess_____

(X) Per capita water demand is an averaged value over _____ Years

(XI) Peak Demand (Maximum Hourly Demand of the Maximum Day) is greater than the Annual Average Hourly Demand by _____ times

(XII) _____ waters typically have high dissolved solid concentration.

Group-B (Short Answer Type Question)

Answer any three of the following : [5 x 3 = 15]

2. Estimate the following for design population of 100000 and average 270 lpcd. Average Daily Demand, Maximum Daily Demand, Maximum Hourly Demand, Fire Demand, Coincident Demand. [5]

3. Derive the expressions for finding out the yield of an infiltration gallery. [5]

4. Derive the exponential population growth equation as proposed by Malthus. [5]

5. 600 m^3/dy of water is to be obtained from a proposed infiltration gallery, which is placed at 6m depth from sub-surface water table. The co-efficient of permeability of the soil aquifer is 100m/day. Find the length of the gallery if the drawdown in the gallery on pumping is not to exceed 4m. The radius of influence may be assumed to be 100m. [5]

6. List down the standards of any five of the below mentioned parameters of drinking water and the effect of their undesirable presence: Colour, Taste, Odour, pH, Turbidity, TDS, Chloride, Flouride, Nitrate, Iron, Manganeese, Total hardness, alkalinity, cyanide, lead, mercury, total arsenic, total chromium, Bacteria [5]

Group-C (Long Answer Type Question)

Answer any three of the following : [15 x 3 = 45]

7. (a) Derive the equations for the arithmetic increase method, geometric increase method, and incremental increase method with reference to population growth. [5]

(b) The population growth data for a city between 1992-2004 is given below. Estimate the future population for the year 2016. Adopt arithmetic increase, geometric increase, and incremental increase methods for population projection. [10]

Year	92	93	94	95	96	97	98	99	00	01	02	03	04
Population (Thousand)	110	111	113	116	118	119	123	125	126	128	131	133	136

8. (a) Derive the expressions for finding out the yield of a well in case of a steady flow in an unconfined aquifer. [5]

(b) A well penetrates an unconfined aquifer having a saturated depth of 100 metres. The discharge is 250 liters per minute at 12 metres drawdown. Assuming equilibrium flow conditions and a [10]

homogeneous aquifer, estimate the discharge at 18 metres drawdown. The distance from the well where the drawdown influences are not appreciable may be taken to be equal for both the cases.

9. (a) Derive the logistic population growth equation as proposed by Verhulst. [5]

   (b) In two periods of each of 20 years, a city has grown from 30000 to 170000 and then to 300000 population. Determine (a) the saturation population, (b) The equation of the logistic curve, (c) the expected population after the next 20 years. [10]

10. (a) Derive the expressions for finding out the yield of a well in case of a steady flow in a confined aquifer. [5]

    (b) A pumping test was made in a medium sand and gravel to a depth of 15 m where a bed of clay was encountered. The normal level of ground water was at surface. Observation holes are located at distances 3m and 7.5m from the pumping well. At the discharge of 3.6 L/Sec from the pumping well, a steady state was attained in about 24 hours. The drawdown in the test wells were 1.65m and 0.36m respectively. Compute the coefficient of permeability of the soil. [10]

11. (a) Write down the Carmen-Kozeny equation to determine the head loss through a sand filter bed with multiple-sand layers and explain each term. [5]

    (b) Water at 20°C ($\rho = 998.2 kg/m^3$, $\mu = 1.002 \times 10^{-3}$ N.s/m^2) is passed through a bed of uniform sand at a filtering velocity of 4.32m/h. The bed is 0.75m deep and is composed of non-uniform sand (specific gravity of 2.65) stratified so that the smallest particles are on top and the largest at the bottom. The shape factor is 0.85 and the porosity is 0.4. Determine the head loss through the bed. The size distribution of the granules is given below: [10]

Particle Size, mm		Mass Fraction in Size Range, X_{ij}
Passing	Retained	
	1.41	0.01
1.41	0.84	0.11
0.84	0.71	0.20
0.71	0.60	0.32
0.60	0.50	0.21
0.50	0.42	0.13
0.42		0.02

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