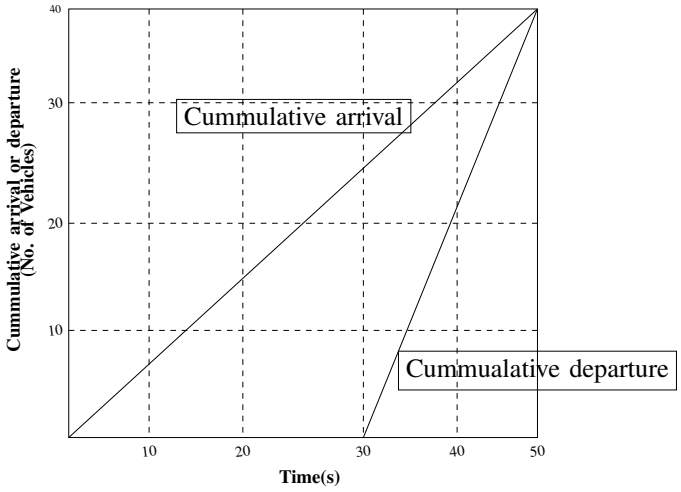
2011-CE-"40-52"

ai24btech11028 - Ronit Ranjan

1) A spillway discharges flood flow at a rate of $9m^3/s$ per metre width. If the depth of flow on the horizontal apron at the toe of the spillway is 46 cm, the tail water depth needed to form a hydraulic jump is approximately given by which of the following options? [2011-CE]
   a) 2.54m
   b) 4.90m
   c) 5.77m
   d) 6.23m
2) In an aquifer extending over 150 hectare, the water table was 20m below ground level. Over a period of time the water table dropped to 23m below the ground level. If the porosity of aquifer is 0.40 and the specific retention is 0.15, what is the change in ground water storage of the aquifer? [2011-CE]
   a) 67.5 ha-m
   b) 112.5 ha-m
   c) 180.0 ha-m
   d) 450.0 ha-m
3) Total suspended particulate matter (TSP) concentration in ambient air is to be measured using a high volume sampler. The filter used for this purpose had an initial dry weight of 9.787 g. The filter was mounted in the sampler and the initial air flow rate through the filter was set at $1.5m^3$/min. Sampling continued for 24 hours. The airflow after 24 hours was measured to be $1.4m^3$/min. The dry weight of the filter paper after 24-hour sampling was 10.283 g. Assuming a linear decline in the air flow rate during sampling, what is the 24-hour average TSP concentration in the ambient air? [2011-CE]
   a) 59.2 μg/m^3
   b) 118.6 μg/m^3
   c) 237.5 μg/m^3
   d) 574.4 μg/m^3
4) Chlorine gas (8 mg/L as Cl_2) was added to a drinking water sample. If the free chlorine residual and pH was measured to be 2 mg/L (as Cl_2) and 7.5, respectively, what is the concentration of residual OCl^- ions in the water? Assume that the chlorine gas added to the water is completely converted to HOCl and OCl^-. Atomic Weight of Cl: 35.5 [2011-CE] Given: $OCl^- + H^+ \rightleftharpoons HOCl$, $K = 10^{7.5}$
   a) 1.408×10^{-5} moles/L
   b) 2.817×10^{-5} moles/L
   c) 5.634×10^{-5} moles/L
   d) 1.127×10^{-5} moles/L
5) If the jam density is given as k_j and the free flow speed is given as u_f, the maximum flow for a linear traffic speed-density model is given by which of the following options? [2011-CE]
   a) $\frac{k_j}{4} \times u_f$
   b) $\frac{k_j}{3} \times u_f$
   c) $\frac{2k_j}{5} \times u_f$
   d) $\frac{2k_j}{3} \times u_f$
6) If v is the initial speed of a vehicle, g is the gravitational acceleration, G is the upward longitudinal slope of the road, and f_r is the coefficient of rolling friction during braking, the braking distance (measured horizontally) for the vehicle to stop is [2011-CE]

a) $\frac{v^2}{g(G+f_r)}$
b) $\frac{v^2}{2g(G+f_r)}$
c) $\frac{vg}{(G+f_r)}$
d) $\frac{vf_r}{(G+g)}$

7) The cumulative arrival and departure curve of one cycle of an approach lane of a signalized intersection is shown in the adjoining figure. The cycle time is 50s and the effective red time is 30s and the effective green time is20s. What is the average delay? [2011-CE]



a) 15s
b) 25s
c) 35s
d) 45s

8) The observations from a closed loop transverse around an obstacle are [2011-CE]

Segment	Observation from station	Length (m)	Azimuth (clockwise from magnetic north)
PQ	P	Missing	33.7500
QR	Q	300.000	86.3847
RS	R	354.524	169.3819
ST	S	450.000	243.9003
TP	T	268.000	317.5000

What is the value of the missing measurement(rounded off to the nearest 10mm)?

a) 396.86 m
b) 396.79 m
c) 396.08 m
d) 396.94 m

Common Data Questions

Common Data for Questions 48 and 49:

A sand layer found at sea floor under 20 m water depth is characterized with relative density = 40%, maximum void ratio = 1.0, minimum void ratio = 0.5, and specific gravity of soil solids = 2.67. Assume the specific gravity of sea water to be 1.03 and the unit weight of fresh water to be 9.81 kN/m^3.

9) What would be the effective stress (rounded off to the nearest integer value of kPa) at 30 m depth into the sand layer? [2011-CE]

a) 77 kPa
b) 273 kPa
c) 268 kPa
d) 281 kPa

10) What would be the change in the effective stress (rounded off to the nearest integer value of kPa) at 30 m depth into the sand layer if the sea water level permanently rises by 2 m? [2011-CE]

a) 19 kPa
b) 0 kPa
c) 21 kPa
d) 22 kPa

Common Data for Questions 50 and 51:

The ordinates of a 2-h unit hydrograph at 1 hour intervals starting from time $t = 0$, are 0, 3, 8, 6, 3, 2 and 0 m^3/s. Use trapezoidal rule for numerical integration, if required.

11) What is the catchment area represented by the unit hydrograph? [2011-CE]

a) 1.00 km^2
b) 2.00 km^2
c) 7.92 km^2
d) 8.64 km^2

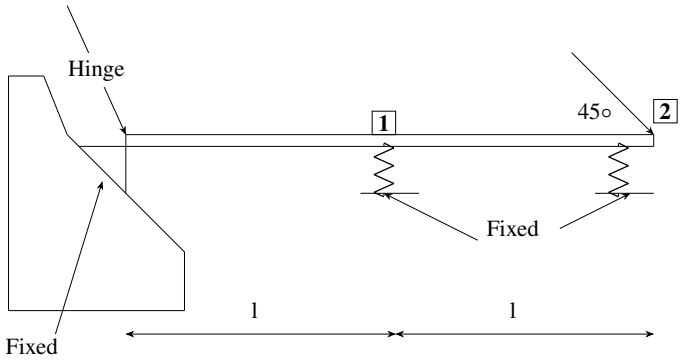
12) A storm of 6.6 cm occurs uniformly over the catchment in 3 hours. If ϕ-index is equal to 2 mm/h and base flow is 5 m^3/s, what is the peak flow due to the storm? [2011-CE]

a) 41.0 m^3/s
b) 43.4 m^3/s
c) 53.0 m^3/s
d) 56.2 m^3/s

Linked Answer Questions

Statement for Linked Answer Questions 52 and 53:

A rigid beam is hinged at one end and supported on linear elastic springs (both having a stifness of 'k') at points '1' and '2', and an inclined load acts at '2', as shown. [2011-CE]



13) Which of the following options represent the deflections δ_1 and δ_2 at the points 1 and 2 [2011-CE]

a) $\delta_1 = \frac{2}{5}\frac{2P}{k}$ and $\delta_2 = \frac{4}{5}\frac{2P}{k}$
b) $\delta_1 = \frac{2}{5}\frac{P}{k}$ and $\delta_2 = \frac{4}{5}\frac{P}{k}$
c) $\delta_1 = \frac{2}{5}\frac{P}{\sqrt{2}k}$ and $\delta_2 = \frac{4}{5}\frac{P}{\sqrt{2}k}$
d) $\delta_1 = \frac{2}{5}\frac{\sqrt{2}P}{k}$ and $\delta_2 = \frac{4}{5}\frac{\sqrt{2}P}{k}$