

**M. TECH.-III (CIVIL-HYDRAULIC ENGINEERING) (CBCS – 2015
COURSE) : WINTER - 2017**

SUBJECT : SELF STUDY PAPER – I : GROUND WATER HYDROLOGY

Day : **Thursday**
Date : **25/01/2018**

Time : **11.00 AM TO 02.00 PM**
Max. Marks : 60

W-2017-2835

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable calculator is allowed.
- 4) Assume suitable data if necessary.

SECTION – I

- Q.1**
- a) Discuss the hydrologic cycle in detail with neat sketch. What is the role of ground water in hydrological cycle? **(06)**
 - b) Discuss with a neat sketch: **(04)**
 - i) Aquiclude ii) Specific yield iii) Aquitard iv) Aquifuge
 - v) Artesian well vi) Perched water table vii) Confined aquifer
 - viii) unconfined aquifer

OR

- a) Discuss the concept of storage coefficient. **(03)**
 - b) What is water budget equation? Discuss the role of water budget equation in ground water studies. **(03)**
 - c) Derive a general relationship between water level in a well and the inflow/out flow (yield) from the well depending on time. **(04)**
- Q.2**
- a) Discuss Darcy's law with reference to its application in ground water hydrology specifically. State the assumption and range of validity. **(06)**
 - b) Derive Laplace equation for 2-D flows through homogeneous isotropic soil medium. Discuss how the concept of flownet developed from it. Derive the equation for discharge through given section. **(04)**

OR

- a) Groundwater flows through an aquifer with a cross sectional area of $1.0 \times 10^4 \text{ m}^2$ and a length of 1500 m. Hydraulic heads are 300 m and 250 m at the groundwater entry and exit points in the aquifer, respectively. Groundwater discharges into a stream at the rate of $1500 \text{ m}^3/\text{day}$. What is the hydraulic conductivity of the aquifer? If the porosity of the material is 0.3. what is the pore velocity of water? **(03)**
- b) A fully penetrating well with radius r_w in a confined aquifer is located at the centre of a circular groundwater basin having constant head boundary condition at the outer periphery. The well is recharged maintaining a constant head at the well face. Derive the recharge rate per unit rise at the well face considering the flow to be laminar. **(04)**
- c) Discuss briefly about flownet, its application and importance. Draw typical flownet for the weir foundation. The weir has only the u/s sheet piles. **(03)**

P.T.O.

- Q.3** a) Derive the equation for constant rate of pumping from the well for the case of steady radial flow into the well. Consider two cases of unconfined and confined aquifer independently. **(05)**
- b) A tube well taps an artesian aquifer find its yield in litres per hour for a drawdown of 3 m when the diameter of the well is 20 cm and the thickness of the aquifer is 30 m. Assume the coefficient of permeability to be 35 m/day. If the diameter of the well is made half find the percentage change in the yield, the other conditions remaining same. Assume the radius of influence as 300 m in both cases. **(05)**
- OR**
- a) A fully penetrating well of diameter 0.3 m is located in an unconfined aquifer of saturated depth 45 m . If the drawdown in the well is 15 m for the discharge of 1200 m³/day and radius of influence is 300 m, compute the hydraulic conductivity. **(04)**
- b) Derive the governing equation for groundwater flow in transient saturated condition applying the concept of conservation of mass. **(04)**
- c) Discuss saturated and unsaturated groundwater flow conditions. What are the driving forces for unsaturated ground water flow? State the field situations in which unsaturated groundwater flow condition apply. **(02)**

SECTION – II

- Q.4** Discuss perennial yield of groundwater basin. Explain the method to estimate perennial yield. **(10)**

OR

Describe different types of data to be collected and field work for groundwater yield estimation.

- Q.5** Explain in brief electrical analogy model for groundwater hydraulics. **(10)**

OR

Describe in brief basics of finite different method for groundwater modeling.

- Q.6** Explain the role of groundwater board for ground water exploration and management. **(10)**

OR

Discuss various agricultural and industrial sources and causes of groundwater pollution.

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