Combined Geo-Scientist (Main)
Examination-2025

BGSP-O-HDG

HYDROGEOLOGY

*Time Allowed : **Three** Hours*	*Maximum Marks : **200***

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions :

*There are **NINE** questions divided under **FIVE** sections.*

*Candidate has to attempt **FIVE** questions in all.*

*The **ONLY** question in Section **A** is **compulsory**.*

*Out of the remaining **EIGHT** questions, the candidate has to attempt **FOUR**, choosing **ONE** from each of the other Sections **B, C, D** and **E**.*

The number of marks carried by a question / part is indicated against it.

Symbols, abbreviations and notations have their usual standard meanings.

Neat sketches are to be drawn to illustrate answers, wherever required.

Wherever required, graphs / tables are to be drawn on the Question-cum-Answer (QCA) Booklet itself.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.

Any page or portion of the page left blank in the Question-cum-Answer (QCA) Booklet must be clearly struck off.

*Answers must be written in **ENGLISH** only.*

SECTION A

(Compulsory Section)

Q1. Write short notes on the following in not more than 5 sentences each : *5×8=40*

(a) Artesian aquifers *5*

(b) Specific yield *5*

(c) Gravimeter *5*

(d) Specific retention *5*

(e) Drawdown *5*

(f) Secondary porosity *5*

(g) Drilling-time log *5*

(h) Magnetic methods *5*

SECTION B

*Attempt any **one** question.*

Q2. (a) Discuss Global Water Cycle and add a note on Water Budget. *15*

(b) Explain the types of aquifers. Add a note on the direction of groundwater flow and the volume of the aquifers. *15*

(c) What are groundwater basins ? Explain their geophysical characteristics. *10*

Q3. (a) Describe the concepts of groundwater flow. Add a note on water flow rates and their direction techniques. *15*

(b) Define permeability and hydraulic conductivity of aquifers. Add a note on their ranges in representative rocks. *15*

(c) Explain the concepts of groundwater dispersion and diffusion. How do they relate with other aquifer properties ? *10*

SECTION C

*Attempt any **one** question.*

Q4. (a) What is Bernoulli's equation ? Explain its application in groundwater studies. *15*

(b) Explain Darcy's law with an illustration. Add a note on its validity in isotropic and anisotropic media. *15*

(c) Describe porosity and representative porosity range. *10*

Q5. (a) Give an account on the effects of stream-flow and base-flow on the quantity and quality aspects of groundwater. *10*

(b) Explain the types of wells used for groundwater exploration. Add a note on the methods of constructing shallow wells and tube wells. *15*

(c) What are slug tests ? Differentiate the results of slug tests between unconfined and confined aquifers. *15*

SECTION D

*Attempt any **one** question.*

Q6. (a) Explain the major geological features identifiable in satellite images, that are suitable for groundwater exploration. *15*

(b) Describe the principle and procedure for conducting electrical resistivity profiles. Add a note on the method of interpreting the profiling data. *10*

(c) Explain the purpose of conducting geophysical logging techniques. Add a note on the types of geophysical logging methods employed in groundwater surveys. *15*

Q7. (a) Explain the principles of seismic methods employed in subsurface investigations. Add a note on their suitability in groundwater prospecting. *15*

(b) What are pumping tests ? Enumerate their types. Give an account on the procedures of conducting a pumping test, and their uses in hydrogeological studies. *15*

(c) Explain the direct and indirect impacts of global climate change on groundwater resources. *10*

SECTION E

*Attempt any **one** question.*

Q8. (a) Elucidate with suitable sketches the changes in hydrochemical facies of groundwater and thermodynamic impacts due to rock-water interaction and its effect on groundwater quality. *15*

(b) Discuss the concept of mass balance calculations implied in groundwater and various methods of graphical representation of chemical data. *15*

(c) Elucidate the concept of B.O.D. and C.O.D. and the role of micro-organisms in groundwater. *10*

Q9. (a) Discuss various parameters that ascertain the groundwater quality along with suitability criteria for drinking, industrial and agricultural utility of groundwater. *15*

(b) Enumerate and elaborate the impact of urbanisation and solid-liquid waste disposal on the groundwater regime along with plume migration detection. *15*

(c) Elucidate the role of stable and unstable isotopes in the study of groundwater regime. Add a note on the age determination of groundwater. *10*