Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May – 2017**

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| **Code :** | **14CE3039** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ISOTOPE TECHNIQUES IN WATER RESOURCES MANAGEMENT** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Define radioactivity, half life and mean life. | CO1 | 4 |
| b. | Define isotope and isobar. Give an example for each. | CO1 | 3 |
| c. | Give different classification of isotopes with at least one example for each. | CO1 | 2 |
| d. | Derive an equation for the radioactive disintegration of an element. | CO1 | 5 |
| e. | 1H, 2H, 3H and 16O, 17O, 18O are the naturally occurring isotopes of hydrogen and oxygen respectively. Find out how many isotopically different water molecules are possible if the same isotope can not occupy more than one place in the same molecule. How many of them are radioactive? | CO1 | 6 |
| (OR) | | | | |
| 2. | a. | What do, a. CF-IRMS b. DI-IRMS c. SMOW d. SLAP e. GISP and e. IAEA stands for? | CO1 | 5 |
| b. | Explain isotope ratio and isotopic concentration. Derive a relationship  between them. | CO2 | 4 |
| c. | Explain the terms δ, α and ε. Distinguish between δ and ε. | CO2 | 6 |
| d. | A radionuclide ZAXN undergoes disintegration by the emission of α radiation. The daughter element further decays by the emission of β radiation. Give the symbols of the daughter and the final product. | CO2 | 5 |
| 3. | a. | Define isotope fractionation factor and fractionation. Discuss kinetic isotope fractionation. Give at least three examples for kinetic isotope fractionation.What are the limitations for measuring the kinetic fractionation effect. | CO1 | 10 |
|  | b. | Discuss in detail the reasons for the physical and chemical properties observed in a molecule labelled with a heavier isotope taking water molecule as anexample. | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | Define isotope ratio. Show that isotope concentration is nearly equal to R ( 1-R ) where R is isotope ratio. | CO2 | 8 |
|  | b. | If α = ε + 1, show that lnα ≈ ε, where α and ε are the isotopic fractionation factor and fractionation respectively. | CO2 | 8 |
|  | c. | Give the condition for enrichment and depletion when a material undergoes 8isotope exchange. | CO2 | 4 |
| 5. | a. | Explain the working of a mass spectrometer with the help of a simple diagram showing different components of the system. | CO1 | 10 |
|  | b. | Why solid scintillation technique is preferred over liquid scintillation for the analysis of isotopes emitting gamma radiation? | CO1 | 2 |
|  | c. | Explain the role of PPO and POPOP in the scintillation cocktail used during the analysis on a liquid scintillation spectrometer. | CO1 | 3 |
|  | d. | Draw a simple sketch of the electrolytic cell used for enriching water samples for natural tritium. What are the cathode and anode made of ? | CO1 | 5 |
| (OR) | | | | |
| 6. | a. | Derive a relationship between 2H and 18O for water. What is D-excess? Why does it vary from region to region? | CO1 | 8 |
|  | b. | What are the values for δ2H and δ18O for ocean water? | CO1 | 2 |
|  | c. | What do GMWL and LMWL stand for? Explain. | CO1 | 4 |
|  | d. | Explain the following: a. Altitude effect b. Latitude effect  c. Continental 8 effect d. Amount effect. | CO2 | 6 |
| 7. | a. | Derive a relationship between 2H and 18O for water. | CO2 | 6 |
|  | b. | Explain briefly how 15δ values are used to find the origin of nitrate pollution. Which is the other isotope whose δ value aides to find the source of nitrate. | CO2 | 7 |
|  | c. | If δA  = {(RA / RR) -1}x 1000, show that αA-B = (1000+ δA) / (1000+ δB) where αA-B isthe isotopic fractionationfactor between two phases A and B of a compound and δA andδB are their isotope composition. | CO2 | 7 |
| (OR) | | | | |
| 8. | a. | What is a percolation tank ? How is environmental tracers like 2H or 18O is used to find the fractions of water from percolation tank and groundwater which reach a well in the vicinity of a percolation tank. | CO1 | 10 |
|  | b. | Which are the isotopes used to find the sedimentation rate in a lake? | CO1 | 2 |
|  | c. | Explain what is meant by supported lead (210Pb supported ) and excess lead (210Pbexcess) | CO1 | 2 |
|  | d. | Describe how Cesium -137 (137Cs) is used to find the sedimentation rate in a lake. | CO1 | 6 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Describe how the groundwater inflow (IG), component of lake water balance is found using environmental stable isotope. Illustrate your answer with 18O as a tracer. | CO1 | 10 |
|  | b. | Give two examples of radioactive tracers used for the investigation on lake dynamics. Mention their merits and demerits. | CO1 | 5 |
|  | c. | Explain how the stable isotopes of water help to predict the recharge to groundwater from i) Precipitation ii) Lake. | CO1 | 5 |

ALL THE BEST