

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE  
SEMESTER END EXAMINATION

B. Sc. (Hons.) A.B.M.

Semester : II (New)	Term : II	Academic Year : 2018-19
Course No. : SSAC 122		
Credits : 2 (1+1)	Title : Soil, Water And Plant Analysis	
Day & Date : Tuesday, 07.05.2019	Time : 09.00 to 11.00	Total Marks : 40

- Note :
1. Solve ANY EIGHT questions from SECTION "A".
  2. All questions from SECTION "B" are compulsory.
  3. All questions carry equal marks.
  4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 What is Nutrient mobility? Explain the mobility of various nutrients within plants.
- Q.2 Give the importance and objectives of soil, water and plant analysis.
- Q.3 Describe how the processes of Mass flow. Diffusion affect nutrient uptake.
- Q.4 What is the composition of soil air? Explain the factors affecting the composition of soil air.
- Q.5 Write short notes (Any Two):
- a) Soil Pollution
  - b) Water Pollution
  - c) Basic principle of pH meter
- Q.6 Describe the role of soil microorganisms in soil health.
- Q.7 What are the management practices for acid soils?
- Q.8 Describe the effects of saline water irrigation on plant growth.
- Q.9 Explain the reclamation and management of saline soil by chemical and mechanical methods.
- Q.10 Describe the chemical and mineral composition of horticultural crops.

SECTION "B"

- Q.11 Define the following terms.
- 1) Nutrient
  - 2) Leaching
  - 3) Soil
  - 4) Diffusion
- Q.12 Fill in the blanks.
- 1) EC of alkali soils is less than \_\_\_\_\_.
  - 2) Soil analysis has been used as an aid to assessing \_\_\_\_\_.
  - 3) The technique of emission flame photometry is used for determining \_\_\_\_\_ and \_\_\_\_\_ in biological fluids.
  - 4) \_\_\_\_\_ and \_\_\_\_\_ are immobile nutrients.



## MODEL ANSWER SHEET

## SECTION "A"

**Q. 1. What is Nutrient mobility? Explain the mobility of various nutrients within plants.**

**Ans:** The location of symptoms of nutrient deficiencies within plants will depend on the extent and rate of retranslocation of the nutrient from old leaves to new growth. Nutrient differs markedly in their mobility within the plant.

1. Mobile Nutrients: Nitrogen, Phosphorus, Potassium, Magnesium and Iron.
2. Variably mobile nutrients: Copper, Zinc, Sulfur and Molybdenum.
3. Immobile Nutrients: Calcium, Boron and Manganese.

**Q. 2. Give the importance and objectives of soil, water and plant analysis?**

**Ans: Importance of soil, water and plant analysis:**

1. Soil analysis enables to find out the makeup of soil and helps to determine how much lime and fertilizer need to apply.
2. Increases productivity by identifying soil nutrients or soil chemical factors that are limiting plant growth.
3. Water analysis identifies polluted or contaminated water supplies.
4. It indicates the suitability of water for various uses.

**Objectives of soil, water and plant analysis**

1. Soil fertility evaluation for making fertilizer recommendations for specific fields and farming situations.
2. Prediction of likely crop response to applied nutrients.
3. Classification of soil into different fertility groups for preparing soil fertility maps of a given area.
4. Assessment of the type and degree of soil related problems like salinity, sodicity, acidity etc.
5. Suggesting appropriate reclamation/ amelioration measures.

**Q. 3. Describe how the processes of Mass flow and Diffusion affect nutrient uptake?**

**Ans:** **Mass flow** also known as mass transfer and bulk flow, is the movement of dissolved nutrients into plant as the plant absorbs water for transpiration. The process is responsible for most transport of nitrate, sulfate, calcium and magnesium.

**Diffusion** is the movement of nutrients to the root surface in response to concentration gradient. When nutrients are found in higher concentration in one area than another, there is a net movement to the low-concentration so that equilibrium is reached. Thus a high concentration in the soil solution and a low concentration at the root cause the nutrients to move to the root surface, where they can be taken up. This is important for the transport of phosphorus and potassium.



**Q. 4.** What is the composition of air in soil and atmosphere? Explain the factors affecting the composition of soil air.

**Ans:** Composition of air in soil and atmosphere:

- Nitrogen: Soil Air: 79.2% Atmosphere: 79.0%
- Oxygen: Soil Air: 20.6% Atmosphere: 20.9%
- Carbon Dioxide: Soil Air: 0.25% Atmosphere: 0.04%

**Factors Affecting the Composition of Soil Air:**

**1. Nature and condition of soil:**

The quantity of oxygen in soil air is less than that in atmospheric air. The amount of oxygen also depends upon the soil depth. The oxygen content of the air in lower layer is usually less than that of the surface soil. This is possibly due to more readily diffusion of the oxygen from the atmosphere into the surface soil than in the subsoil. Light texture soil or sandy soil contains much higher percentage than heavy soil. The concentration of CO<sub>2</sub> is usually greater in subsoil probably due to more sluggish aeration in lower layer than in the surface soil.

**2. Type of crop:**

Plant roots require oxygen, which they take from the soil air and deplete the concentration of oxygen in the soil air. Soils on which crops are grown contain more CO<sub>2</sub> than fallow lands. The amount of CO<sub>2</sub> is usually much greater near the roots of plants than further away. It may be due to respiration by roots.

**3. Microbial activity:**

The microorganisms in soil require oxygen for respiration and they take it from the soil air and thus deplete its concentration in the soil air. Decomposition of organic matter produces CO<sub>2</sub> because of increased microbial activity. Hence, soils rich in organic matter contain higher percentage of CO<sub>2</sub>.

**4. Seasonal variation:**

The quantity of oxygen is usually higher in dry season than during the monsoon. Because soils are normally drier during the summer months, opportunity for gaseous exchange is greater during this period. This results in relatively high O<sub>2</sub> and low CO<sub>2</sub> levels. Temperature also influences the CO<sub>2</sub> content in the soil air. High temperature during summer season encourages microorganism activity which results in higher production of CO<sub>2</sub>.

**Q. 5.** Write short note on following. (Any two)

**i) Soil Pollution.**

**Ans:** There are generally five different kinds of soil pollution namely:

- 1) Pesticides pollution
- 2) Inorganic pollutants
- 3) Organic wastes
- 4) Fertilizers and other salts
- 5) Radio nuclides

**ii) Water Pollution.**

**Ans:** Water is universal solvent and thus it can be contaminated very easily. The water is used by various ways like irrigation and live-stock, power, industry and domestic consumption and the annual return of such water after use from all consumption sources is about 286 thousand million cubic meter which actually become waste water because of dissolving industrial byproducts, pesticides, chemical fertilizers etc. one of the major users of such waste water is the agricultural sectors for irrigating the crops. In addition to surface water, ground water also contributes pollutants to soil when later is used, for irrigation purpose and accumulates in the plant grown on such soils as their toxic amounts. Precipitation or rainfall sometimes encourages water pollution.

**i) Basic principle of pH meter:**

**Ans:** A pH meter is used to measure the reaction of a solution. pH meter is nothing else but a precise voltmeter scaled in such a way that it displays not the measured potential, but ready pH value. The pH determination with the help of a pH meter involves the use of a pH cell consisting of a glass electrode, sensitive to  $H^+$  ions and a reference electrode. The pH can be represented as given below:

$(H^+)$ sensitive electrode	Reference buffer or test solution	Salt bridge	Reference Electrode
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**Q. 6. Describe the role of soil microorganisms in soil health.**

**Ans:** Soil, microorganisms plays very important role in improving soil fertility. Microorganisms like Bacteria, Fungi, and Actinomycetes etc. carries out the decomposition of organic material in soil. In this process of decomposition, microorganisms break down complex organic substances to their constituent minerals which get added in to the soil. Transformation of certain elements is also carried out by soil microorganisms. For eg: recycling of Nitrogen is carried out by nitrogen fixing bacteria.

And many other roles can be explained.

**Q. 7. What are the management practices for acid soils.**

**Ans:-** Management practices for acid soils.

- 1) Addition of lime.
- 2) Controlling water table.
- 3) Keeping the area flooded.
- 4) Liming & leaching.

**Q. 8. Describe the effects of saline water irrigation on plant growth.**

**Ans:-** Effects of saline water irrigation on plant growth.

- 1) Reduction in germination.
- 2) Effect on growth.
- 3) Varietal tolerance to saline water.
- 4) Growth stages tolerance.
- 5) Quality of crops grown with saline water.



**Q. 9. Explain the reclamation and management of saline soil by chemical and mechanical methods.**

**Ans:**

**A) Mechanical Methods:**

- i) Flooding and leaching down of the soluble salts.
- ii) Scrapping of the surface soil.

**B) Chemical Methods:**

- i) Application of Gypsum
- ii) Application of sulphur
- iii) Addition of Organic Matter
- iv) Addition of Molasses

**Q. 10. Describe the chemical and mineral composition of horticultural crops.**

**Ans:** Fruits and vegetables are consumed at all times, and due to their convenient size they are an excellent between-meal snack. They are relatively low in calories and they have no cholesterol, they are rich in carbohydrates and fiber, they contain vitamin C and carotene, and some are a good source of vitamin B6. Fruits and vegetables are relatively low in sodium and high in potassium.

**A. Water**

The most abundant single component of fruits and vegetables is water, which may account for up to 90% of the total mass. The maximum water content varies between individual fruits and vegetables, because of structural differences.

**B. Organic acids**

There are two types of acids, namely aliphatic (straight chain) and aromatic acids. The most abundant acids in fruits and vegetables are citric and malic (both aliphatic) acids. However, large amounts of tartaric acid occur in grapes. Malic acid is the major component in oranges and apples. The acid content of fruits and vegetables generally decreases during maturation.

**C. Proteins:**

Proteins represent less than 1% of the fresh mass of fruit and vegetable tissues. Leguminous seeds are rich in protein, containing 15% to 30%. The proteins of fruits and vegetables are built from amino acids, but other related simple nitrogenous compounds also occur.

## SECTION "B"

**Q.11 Define following terms.**

- Ans:**
- 1) **Nutrient:-** The element which is required to complete the life cycle of the plant & its relative deficiency produces specific deficiency symptoms.
  - 2) **Leaching :-** It is the natural process in which water soluble substances are washed out from soil or wastes.
  - 3) **Soil :** It is Natural body developed as a result of pathogenic process that take place during and after the weathering of rocks and in which plants and other forms are able to grow. .
  - 4) **Diffusion:-** The movement of molecules from the region of higher concentration to the region of lower concentration.

**Q.12. Fill in the blanks.**

i) EC of alkali soils is less than \_\_\_\_\_

**Ans: 4 ds/m**

ii) Soil analysis has been used as an aid to assessing \_\_\_\_\_

**Ans: Soil fertility**

iii) The technique of emission flame photometry is used for determining \_\_\_\_\_ and \_\_\_\_\_ in biological fluids.

**Ans: Sodium and Potassium**

iv) \_\_\_\_\_ and \_\_\_\_\_ are immobile nutrients.

**Ans: Calcium, Boron**