

**MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD,  
PUNE**

**SEMESTER END EXAMINATION**

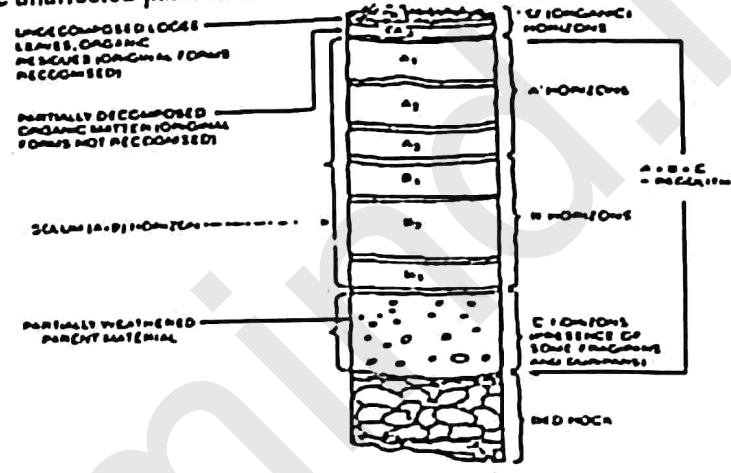
**B.Sc. (Hons.) Agri.**

Semester	: 1 <sup>st</sup> New	Academic year	2018-2019
Course No	: SSAC-111		
Credit	: 3 (2+1)	Title	: Fundamentals to Soil Science
Day and Date		Time	Total Mark : 80

**Model Answer**

**SECTION "A"**

Q1. Ans.	a	Define pedology. How soil is dynamic natural body? "It deals with the study of soil origin, its classification, and its description"	Marks
		Soil is a natural body developed by natural forces acting up on natural materials. It is usually differentiated into horizons from mineral and organic constituents of variable depth which differ from the parent material below in morphology, physical properties and constituents, chemical properties and composition and biological characteristics. It also differs from place to place under similar climate and landform.	1 3
	b	Give the classification of rocks as per mode of formation with suitable examples. Classification on the basis of mode of formation a) Igneous rocks : Intrusive eg. - granite Extrusive eg. - basalt b) Sedimentary rocks : Arenaceous rocks: eg-sand stone Argillaceous rocks: eg- mud stone Calcareous rocks. eg- lime stone Carbonaceous rocks: eg - peat, coal Siliceous rocks eg- diatomaceous earth Precipitated rocks : eg- rocks salt c) Metamorphic rocks : Hydro-metamorphic rocks: eg -quartzite Thermo-metamorphic rocks: eg- marble Dynamo-metamorphic rocks:eg- schist	4
Q2 Ans.	A	Give the physical properties of mineral and explain any two of them. 1) Colour 2) Lustre 3) Light transmission 4) Hardness 5) Streak 6) Specific gravity 7) Form and structure 8) Cleavage 9) Fracture 10) Tenacity 11) Chemical nature Explanation: any two of them	2
	b	Enlist the weathering processes. Explain in brief chemical weathering. 1. Physical weathering 2. Chemical weathering 3. Biological weathering Chemical Weathering : Explanation with reactions a. Solution b. Hydration c. Hydrolysis d. Oxidation e. Reduction f. Carbonation	2 1 3

Q3 Ans.	<p>a) State Jenny equation (1941) and explain in brief. Jenny (1941) formulated the following equation :</p> <p>Where,</p> <p><math>S = f(cl, o, r, p, t, \dots)</math></p> <p><math>S</math> - any soil property, such as pH, N, clay etc.  <math>Cl</math> - environmental climate ;  <math>o</math> - organisms and vegetation (biosphere)  <math>r</math> - relief or topography  <math>p</math> - parent material  <math>t</math> - Time  <math>\dots</math> - additional unspecified factors (Like fire, storms etc.)</p>	4
	<p>b) Define soil profile. Draw well labeled diagram of soil profile. Definition of soil profile: The vertical section of the soil showing the various layers from the surface to the unaffected parent material is known as a <i>soil profile</i>.</p>  <p>Diagram :</p> <p>Fig 1.2 Theoretical soil profile consisting of all horizons</p>	1 3
Q4 Ans.	<p>a) State Stokes law and give its limitation. Stokes's Law: The simplest form of Stokes law tells that Stokes (1851) stated that "the velocity of a falling particle is proportional to the radius square and not to its surface.</p> $V = kr^2$ <p>Where <math>V</math> is velocity of a falling particle, <math>k</math> is a constant and <math>r</math> is radius</p> <p>Limitation of Stokes law :</p> <ol style="list-style-type: none"> <li>1. Shape of particle :</li> <li>2. Viscosity of fluid :</li> <li>3. Particle density :</li> <li>4. Brownian movement :</li> </ol> <p>Brief explanation on above points :</p> <p>b) Define porosity and differentiate between capillary and non capillary pore. "The volume of soil mass that is not occupied by soil particles is known as <i>pore space</i> or <i>porosity</i>"</p> <ol style="list-style-type: none"> <li>1. Macro or non-capillary pores: These are the large pores, allow ready movement of air and water and do not hold much water under normal condition. Sands and sandy soils have a large number of macro pores.</li> <li>2. Micro of capillary pores: In contrast, in the micro pores movement of an air and water is restricted to some extent. Clays and clayey soils have a greater number of micro pores, than in sands and sandy soils.</li> </ol>	2 2 1 3





Q 7 Ans.	a)	<p>Explain in brief significance of soil reaction in plant nutrition.</p> <p>Influence on availability of plant nutrients; Description and Chart are given on page 337 of Daji (1996), Tamhane 182-183</p>
	b)	<p>Give the general properties of soil colloids.</p> <ol style="list-style-type: none"> <li>1. Size:</li> <li>2. Surface area:</li> <li>3. Isomorphous substitution:</li> <li>4. Broken bonds</li> <li>5. Adsorption of cations:</li> <li>6. Adsorption of water:</li> <li>7. Cohesion</li> <li>8. Adhesion:</li> <li>9. Swelling and shrinkage:</li> <li>10. Dispersion and flocculation:</li> <li>11. Brownian movement:</li> <li>12. Non permeability</li> </ol>
Q 8 Ans.	a)	<p>Give the composition of plant residues.</p> <ol style="list-style-type: none"> <li>1. Water 75%</li> <li>2. Dry matter 25 %               <ol style="list-style-type: none"> <li>A) Carbohydrates 60% , Protein 10%, Lignin 25% Fat and Wax 5 %</li> <li>B) Carbon 44%, Oxygen 40% Ash 8% and Hydrogen 8%</li> </ol> </li> </ol>
	b)	<p>Explain in brief the heavy metal pollution by pesticide.</p> <p>The pesticides are applied to plant foliage, to the soil surface or are incorporated into the soil, a high proportion of the chemicals moves into the soil. These chemicals then move in following one or more of six directions.</p> <ol style="list-style-type: none"> <li>1) They may vaporize into the atmosphere without chemical change.</li> <li>2) They may be adsorbed by humus and clay particles</li> <li>3) They may move downward through the soil in liquid or solution form and be lost from the soil by leaching.</li> <li>4) They may undergo chemical reactions within or on the surface of the soil.</li> <li>5) They may be broken down by soil microorganisms.</li> <li>6) They may be absorbed by plants.</li> </ol>

Q 9 Ans.	a)	Give the composition of soil air. Explain in brief the factors affecting soil air. Soil air : Nitrogen 79.2 %      Oxygen 20.6 %      Carbon dioxide 0.30 % Factors Affecting the Composition of Soil Air.: Explanation Nature and condition of soil. Type of crop. Microbial activity: Seasonal variation:.	3
	b)	Enlist and explain the fundamental soil forming processes 1. Humification 2. Eluviation). 3. Illuviation 4. Horizonation Explanation :	2 2 2
Q 10 Ans.	a)	Phyllosilicates : are comprised of two kinds of horizontal sheets, one dominated by silicon and other by aluminum and/or magnesium. The basic structure of silica tetrahedron and aluminum octahedron is explained below. 1. Silica Tetrahedron    2. Alumina-Magnesia Octahedron with diagram	2
	b)	C:N Ratio : The ratio of the weight of organic carbon ( C ) to the weight of total nitrogen (N) in a soil (or organic material), is known as C : N ratio The content of carbohydrates is high. This results in wide carbon nitrogen ratio which may be 40 to 1. Upon decomposition the organic matter of soils changes to humus and has an approximate C : N ratio of <u>10 : 1</u> . The ratio of carbon to nitrogen in the arable (cultivated) soils (organic matter) commonly ranges from 8 : 1 to 15 : 1. The carbon nitrogen ratio in plant material is variable, ranging from 20 : 1 to 30 : 1 in legumes and farm yard manure, to 100:1 in certain strawy residues. It is as high as <u>400:1</u> in <u>saw dust</u> . The C:N ratio of the body of microorganisms ordinarily ranges between <u>4:1</u> and <u>9:1</u> .	2
	c	Humic substances : It comprise about 60 to 80% of the soil organic matter. They comprised of huge molecules with variable, rather than specific , structures and composition. Humic substances are characterised by aromatic, ring-type structures that include polyphenols and comparable polyquinones, which are even more complex. Fulvic acid- 2. Humic acid- 3. Humin-	2
	d	Acid rain : Acid precipitation is called as acid rain, which is due to oxidation of N and S present in exhaust gasses and smokes of industries Oxide of N and S dissolve in rain water to form nitric acid sulphuric acid which precipitate in soil.	2



Q11 Ans.	1	Field capacity : Soil moisture held at 1/3 bar call as field capacity
	2	Regolith: It is disintegrated mass of weathered rocks and soil material overlying a solid rock on the earth surface.
	3	Soil Colloids: The clay fraction of the soil contains particles less than 0.002 mm in size. Particles less than 0.001 mm size possess colloidal properties and are known as soil colloids.
	4	Humus: Humus is a complex and rather resistat mixture of brown or dark brown amorphous and colloidal organic substance that results from microbial decomposition and synthesis and has chemical and physical properties of great significance to soils and plants.
	5	Fortification: It is the process of enrichment of surface water bodies with nutrients.
	6	Cation exchange capacity : It is Sum of total exchangeable cation that soil can adsorb OR It is the capacity of a soil for ion exchange of cations between the soil and the soil solution.
	7	Soil survey : Soil survey is a study and mapping of soils in their natural environment. It is the systematic examination, description, classification and mapping of soils of an area.
	8	Particle density : The weight per unit volume of the solid portion of soil is called particle density. Particle density is also termed as <i>true density</i> .
Q12	1	<u>Greather than 65 %</u> composition of $\text{SiO}_2$ in acid rocks
	2	<u>Andisols</u> <del>the</del> soil is known as volcanic soil:
	3	As the water content of soil <u>increases</u> , soil moisture tension decreases
	4	Normally soil air contain about <u>8 times</u> more carbon dioxide than the atmospheric air
	5	The value of Munsell notation 10YR 3/6 is <u>3</u>
	6	Average particle density of mineral soil is <u>2.66 Mg/m<sup>3</sup></u>
	7	Natural soil aggregates are termed as <u>peds</u>
	8	<del>the</del> The C: N ratio of saw dust is <u>400:1</u>