The Open University of Sri Lanka
Faculty of Engineering Technology
Diploma/Degree in Technology (Agricultural Engineering) and Industrial Studies (Agriculture)

Final Examination- 2014/2015

AEX5232 Soil Plant Water Relationship

Date : 25-08-2014
Time : 9.30-12.30

SECTION II -Answer any four (04) questions

(1) (a) Briefly explain how water deficit develops in plants using mid day and long term water deficits.

(b) Discuss the effect of water deficit in plants and how plants response o water deficit.

(2) a) Sketch and Derive the steady state equation for the water flux through a horizontal saturated soil column.

(b) Consider a case of steady downward percolation through a single layered soil profile, the top of which is submerged under a 1m head of water and the bottom of which is defined by a water table. The thickness of the soil layer is 150 cm and the conductivity is 10^{-6} cm/sec. Calculate the flux and comment on the suitability of this soil for agricultural purposes.

(3). (a) Briefly explain the composition of soil air and the factors affecting the soil aeration.

(b) Consider a soil profile in which the air-phase oxygen concentration diminishes linearly from 21% at the soil surface to half of that at 100cm depth. If the total porosity is a uniform 45% and the volume wetness is 35% calculate the diffusion rate using Penman's coefficient for the effective diffusion coefficient of oxygen in the soil (Ds). Assume steady –state diffusion. Use a value of 1.89×10^{-1} cm^2/sec for the bulk-air diffusion coefficient. Tortuosity factor is 0.66 (assumed by Penman to be constant).

(04) (a) Explain using a diagram and Derive the equation for the steady state downward percolation of water.

(b) Consider two cases of steady downward percolation through a two layered soil profile, the top of which is submerged under a 1m head of water and the bottom of which is defined by a water table. Each of the two layers is 50 cm thick. In the one case, the conductivity of the top layer is 10^{-4} cm/sec and that of the sub layer is 10^{-5} cm/sec. In the second case, the same layers are reversed (i.e. the less conducive soil overlies the more conductive). Calculate the flux, and the hydraulic and pressure heads at the interface between the layers, for each of the cases.

(5) (a) Briefly explain the methods for measuring water potential of plants.
(b) Explain four (04) root study techniques in brief.

(6) (a) Briefly explain the term " Effective Rainfall"
(b) What is meant by Gross Irrigation Requirement?
(c) A stream of 140 litres per second was diverted from a canal and 100 litres per second were delivered to the field. An area of 1.6 hectares was irrigated in eight hours. The effective depth of root zone was 1.8m. The runoff loss in the field was 432 cum. The depth of water penetration varied linearly from 1.8m at the head end of the field to 1.2 m at the tail end. Available moisture holding capacity of the soil is 20cm per metre depth of soil. Irrigation was started at a moisture extraction level of 50 percent. Calculate the following:
(i) Water conveyance efficiency
(ii) Water application efficiency
(iii)Water storage efficiency
(iv)Water distribution efficiency