Minor For Genetics And Plant Breeding
(P.G. 1st Sem)

I. Course Title : Soil Physics

II. Course Code : Soil 501 **Credit Hours: 2+1**

(M.M.:100- Mid term-25, End term- 50, Practical-25)

III. Aims and objectives - To impart basic knowledge about soil physical properties and processes in relation to plant growth.

IV. Theory

Unit I

Basic principles of physics applied to soils, soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts. Alleviation of soil physical constraints for crop production. Soil erosion and edibility

Unit II

Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting - mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.

Unit III

Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential. Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.

Unit IV

Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

V. Practical

• Determination of B.D., P.D. and mass volume relationship of soil, Mechanical analysis by hydrometer and international pipette method,

• Measurement of Atterberg limits, Aggregate analysis - dry and wet, Measurement of soil-water content by different methods, Measurement of soil-water potential by using tensiometer and gypsum Blocks, Determination of hydraulic conductivity under saturated and unsaturated conditions, Determination of infiltration rate of soil, Determination of aeration porosity and oxygen diffusion rate, Soil temperature measurements by different methods, Estimation of water balance components in bare and cropped fields.

VI. **Teaching methods/activities** -Classroom teaching with AV aids, group discussion, oral presentation by students.

VII. **Learning outcome** -Experience on the knowledge of soil physical properties and processes in relation to plant growth.

VIII. Suggested Reading

- Baver, L.D., Gardner, W.H. and Gardner, W.R. (1972). Soil Physics. John Wiley & Sons.
- Ghildyal, B.P. and Tripathi RP. (2001). Soil Physics. New Age International.
- Hanks, J.R. and Ashcroft, G.L. (1980). Applied Soil Physics. Springer Verlag.
- Hillel, D. (1972).Optimizing the Soil Physical Environment toward Greater Crop Yields Academic Press.
- Hillel, D. (1980). Applications of Soil Physics. Academic Press.
- Hillel, D. (1980). Fundamentals of Soil Physics. Academic Press.
- Hillel, D. (1998). Environmental Soil Physics. Academic Press.
- Hillel, D. (2003). Introduction to Environmental Soil Physics. Academic Press.
- Indian Society of Soil Science. (2002). Fundamentals of Soil Science. ISSS, New Delhi.
- Kirkham, D. and Powers W.L. 1972. Advanced Soil Physics. Wiley-Interscience.
- Kohnke, H. (1968). Soil Physics. McGraw Hill.
- Lal, R. and Shukla, M.K. (2004). Principles of Soil Physics. Marcel Dekker.
- Oswal, M.C. (1994). Soil Physics. Oxford & IBH.