UNIVERSITY OF SARGODHA

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES, UNIVERSITY COLLEGE OF AGRICULTURE

COURSE OUTLINE **Spring 2020**

Course Title: Advanced Soil Physics

Course Code: SAES-7118

Credit Hours: 3(3-0)

Instructor: **Dr. Ghulam Sarwar**

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DESCRIPTION AND OBJECTIVES

This course is designed to give the post doctorate students an insight about water flow equations and their applications, thermodynamic potentials and chemical potential of soil water, use of models for artificial drainage, factors influencing drainage, heat flow equations: application and calculations, pollutant transport in soil environment: Analytic solutions of the CDE model. Similarly, Mobile-immobile water flow model for solute transport, behavior assessment model for pesticide and hormones transport, application of soil physics for remediation of hazardous wastes, spatial variability analysis of soil properties and significance, analysis of frequency distribution, techniques for characterizing variability, irrigation water scheduling; Water balance; Old and modern concepts of irrigation, irrigation and water use efficiency, calculation of evapo-transpiration by various methods will be described in detail.

INTENDED LEARNING OUTCOMES

After learning this course students will be able to know water flow equations and their applications in crop production. Thermodynamic potentials and chemical potentials of soil water, use of models for development of artificial drainage will be studied.

COURSE CONTENTS

1. Water flow equations and their applications
2. Thermodynamic potentials and chemical potential of soil water
3. Use of models for artificial drainage

3.1 Factors influencing drainage

4. Heat flow equations: Application and calculations
5. Application of gas flow equations
6. Pollutant transport in soil environment: Analytic solutions of the CDE model
7. Mobile-immobile water flow model for solute transport
8. Behavior assessment model for pesticide and hormones transport
9. Application of soil physics for remediation of hazardous wastes
10. Spatial variability analysis of soil properties and significance
11. Analysis of frequency distribution
12. Techniques for characterizing variability
13. Irrigation water scheduling; Water balance; Old and modern concepts of irrigation
14. Irrigation and water use efficiency
15. Calculation of evapo-transpiration by various methods

READINGS

1. Bhatti, A.U. 2005. Spatial Variability and its Management in Agriculture. Higher Education Commission, Islamabad, Pakistan.
2. Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library.
3. Hillel, D. 1998. Environmental Soil Physics. Academic Press Inc., San Diego, CA, USA.
4. Hillel, D. 2004. Introduction to Environmental Soil Physics. Elsevier Academic Press. San Diego, CA, USA.
5. Hillel, D. 2008. Soil in the Environment: Crucible of Terrestrial Life. Elsevier Inc., Burlington, MA, USA.
6. Jury, W.A. and R. Horton. 2004. Soil Physics. 5th Ed. John Wiley & Sons, Inc., NY, USA.
7. Marshall, T.J., J.W. Holmes and C.W. Rose. 1996. Soil Physics. 3rd Ed., Cambridge University Press, Cambridge, UK.

COURSE SCHEDULE

Week	Topics and Readings	Books with Page No.
1.	Importance of Soil Physics Basic Definitions and Concepts: Soil Components and Phases	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 1-28.
2.	Water flow equations and their applications	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 234-267.
3.	Thermodynamic potentials and chemical potential of soil water: Soil Temperature and Heat Flow in Soil	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 475-514.
4.	Use of models for artificial drainage & factors affecting drainage	Guidelines and computer programs for the planning and design of land drainage systems. FAO IRRIGATION AND DRAINAGE PAPER 62. 2007. PP 1-233 The Evolution of Agricultural Drainage from the Earliest Times to the Present. 2020. Mohammad Valipour, Jens Krasilnikof, Stavros Yannopoulos, Rohitashw Kumar, Jun Deng, Paolo Roccaro, Larry Mays, Mark E. Grismer and Andreas N. Angelakis. Sustainability 2020, 12, 416; doi:10.3390/su12010416
5.	Heat flow equations: Application and calculations Soil Temperature and Heat Flow in Soil	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 475-514.
6.	Application of gas flow equations Soil Air and Aeration	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 515-553.

7.	Pollutant transport in soil environment: Analytic solutions of the CDE model	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 433-474.
8.	Mobile-immobile water flow model for solute transport	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 433-474.
9.	Behavior assessment model for pesticide and hormones transport	Arzu Özkara, Dilek Akyıl and Muhsin Konuk. 2016. Pesticides, Environmental Pollution, and Health (Chapter 1). INTECH. http://dx.doi.org/10.5772/63094 Chapter 4: Pesticides as water pollutants. Web reference: http://www.fao.org/3/w2598e/w2598e07.htm#TopOfPage PESTICIDES. 2008. Children's Health and the Environment. WHO Training Package for the Health Sector. World Health Organization.*www.who.int/ceh*
10.	Application of soil physics for remediation of hazardous wastes	Muhammad Aqeel Ashraf, Mohd. Jamil Maah and Ismail Yusoff. 2014. Soil Contamination, Risk Assessment and Remediation (Chapter 1). INTECH. http://dx.doi.org/10.5772/57287 Ronald C. Sims. 2012. Soil Remediation Techniques at Uncontrolled Hazardous Waste Sites. Journal of the Air & Waste Management Association. https://doi.org/10.1080/10473289.1990.10466716
11.	Spatial variability analysis of soil properties and significance	Bhatti, A.U. 2005. Spatial Variability and its Management in Agriculture. Higher Education Commission, Islamabad, Pakistan. Latest research papers on spatial variability.
12.	Analysis of frequency distribution	Chapter 1. Introduction to Statistics and Frequency Distributions. Web reference: file:///F:/SAES-7118/LMS%20Materials/Week%2012/Introduction%20to%20statistics%20and%20frequency%20distribution.pdf
13.	Techniques for characterizing variability	Christopher, H. F. 1992. Quantitative analysis of uncertainty and variability in environmental policy making. Carnegie Mellon University Pittsburg, USA. file:///F:/SAES-7118/LMS%20Materials/Week%2013/Techniques%20for%20characterizing%20variability.pdf Andrea Bravi, André Longtin and Andrew JE Seely. Review and classification of variability analysis techniques with clinical applications. Web reference: file:///F:/SAES-7118/LMS%20Materials/Week%2013/Review%20and%20classification%20of%20variability%20analysis%20techniques%20with%20clinical%20applications.pdf
14.	Irrigation water scheduling; Water balance; Old and modern concepts of irrigation	Waller, P. and Yitayew, M. 2016. Irrigation and Drainage Engineering, Springer International Publishing Switzerland. DOI 10.1007/978-3-319-05699-9_1 Irene Fernández García, Sergio Lecina, M. Carmen Ruiz-Sánchez, Juan Vera, Wenceslao Conejero, María R. Conesa, Alfonso Domínguez, José J. Pardo, Bruno C. Léllis and Pilar Montesinos. 2020. Review: Trends and Challenges in Irrigation Scheduling in the Semi-Arid Area of Spain. Water 2020, 12, 785; doi:10.3390/w12030785

15.	Irrigation and water use efficiency	Maher Salman. 2019. Field guide to improve Water use efficiency in small-scale agriculture. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.
16.	Calculation of evapo-transpiration by various methods	Rattan Lal and Manoj K. Shukla. 2005. Principles of Soil Physics. The Ohio State University Columbus, Ohio, U.S.A. Taylor & Francis e-Library. PP: 409-432.

RESEARCH PROJECT/PRACTICAL/LABS/ASSIGNMENTS

1. Calculation of irrigation water scheduling, water balance and evapo-transpiration by various methods.

ASSESSMENT CRITERIA

Sessional: 12 (project, presentation, participation)
Project: 06
Presentation: 03
Participation: 03
Mid exam: 18
Final exam: 30

RULES AND REGULATIONS

75 % attendance is mandatory for the students to appear in the final examination.
No class assignments after due date will be entertained.