




Bangladesh Open University

 SARD SCHOOL OF AGRICULTURE AND RURAL DEVELOPMENT কৃষি ও পল্লী উন্নয়ন স্কুল	School of Agriculture and Rural Development (SARD)		
	Master of Science (MS) in Soil Science		

Curriculum layout for the degree of Master of Science (MS) in Soil Science

- Requirement for registration:** Bachelor of Science in Agriculture (BSc Ag) or related disciplines from any recognized University or Institute
- Duration:** One and a half ($1\frac{1}{2}$) years (Registration valid for consecutive four and a half years)
- Semester:** Three Semesters (Valid up to consecutive nine semesters), two semesters in a year each of six (6) months
- No. of courses = 12
- No. of credits = 40
- Total Marks = 2000

Distribution of courses, credits and marks

M.S. in Soil Science shall be offered with 40 credits in 3 semesters each of six months duration. The courses worth 24 credits of which 12 credits shall be offered during the first semester and the other 12 credits during the 2nd semester respectively for the students. Another 16 credits shall be reserved for the research (thesis and thesis defense). The students have to start their research work for thesis (equivalent to 6 courses) under the guidance and supervision of his/her Research Supervisors after the completion of one semester and the same shall be carried through to the last semester when it will be evaluated. After the evaluation of thesis the students have to face thesis defense (equivalent to 2 courses). The distribution of courses, credits and marks are shown below:

Course Type		No. of Courses	Credits	Marks
Course (compulsory)		12	24	1200
Research	a) Thesis	equivalent to 6 courses	12	600
	b) Thesis defense	equivalent to 2 courses	4	200
Total			40	2000

N.B. 1 course = 2 credits = 100 marks; Thesis = 12 credits = 600 marks, Thesis defense (4 credits) = 200 marks: Each course will carry 80 marks for theoretical examination and 10 marks for one course assignment and 10 marks for class attendance.


Course layout for MS in Soil Science

1st Semester

Sl.	Courses Title	Course code	Credit hrs.	Marks
1	Advanced Soil Physics	MSSS 1201	2	100
2	Advanced Soil Chemistry	MSSS 1202	2	100
3	Advanced Soil Fertility and Plant Nutrition	MSSS 1203	2	100
4	Soil Microbiology and Biochemistry	MSSS 1204	2	100
5	Soil, Plant and Water Analysis	MSSS 1205	2	100
6	Research Methodology	MSSS 1206	2	100
Total 6 courses			12	600



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2nd Semester

Sl.	Courses Title	Course code	Credit hrs.	Marks
1	Waste Management and Organic Manure	MSSS 2201	2	100
2	Soil and Water Pollution	MSSS 2202	2	100
3	Soil Ecology and Biodiversity	MSSS 2203	2	100
4	Soil Water Management	MSSS 2204	2	100
5	Soil degradation and Conservation	MSSS 2205	2	100
6	Soil Survey	MSSS 2206	2	100
Total 6 courses			12	600

3rd Semester

Title	Credit	Mark
a. Thesis (equivalent to 6 courses)	12	600
b. Thesis defense (equivalent to 2 courses)	4	200
Thesis + Thesis defense	16	800
Grand Total	(12× 2)+16 = 40 (Forty)	2000

Syllabus for MS in Soil Science

Course Title: Advanced Soil Physics

Credit hours: 2

Course Code: MSSS 1201

Unit	Title	Lesson
1	Soil Density	Compactness, penetration, resistance, mass-volume relationship, importance and management of soil density, porosity, consistence
2	Soil Aggregate	Formation, importance, degradation and management of soil structure
3	Soil Temperature	Soil temperature fluctuation and plant growth regulation of soil temperature
4	Soil Water	Retention and availability, characteristics of moisture release curve, pF curve and hysteresis, soil moisture constant, water flow in soil-saturated and unsaturated condition, Darcy's law, Poiseuille's equation, flux density, inflow and outflow boundaries, steady state flow in a homogeneous and layered profile, soil water potential-principle and methods of measurement, soil water determination
5	Evapotranspiration (ET)	Measurement of ET-water balance and soil water depletion method, irrigation scheduling-approaches, application of ET values in irrigation scheduling, management and regulation of ET, water use efficiency, critical soil moisture deficits
6	Irrigation and Drainage	Irrigation in relation to soil properties, importance of supplemental irrigation for deficient crops, water requirement of crops, drainage-importance and methods of draining agricultural lands

Recommended Textbooks

1. Baver, L.D., Gardner, W.H. and Gardner, W.R. 1972. Soil Physics. 4th edition. John Wiley & Sons. Ins., New York.
2. Ghildyal, B.P. and Tripathi, R.P. 1987. Soil Physics. Wiley Eastern Ltd., New Delhi.
3. Hanks. R.J. and Ashcroft, F.L. 1980. Applied Soil Physics. Springer-Verlag, Berlin, Heidelberg.



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School of Agriculture and Rural Development (SARD)

Master of Science (MS) in Soil Science

- Hillel, D. 1980. Applications of Soil Physics. Acad. Press, New York, USA.
- Hiller, D. 1980. Fundamentals of Soil Physics. Acad. Press, New York, USA.
- William A.Jury, Robert Horton. 2004. Soil Physics, 6th Edition, John Wiley and Sons, NY.

Supplementary Textbooks

- Brady, N.C. and Weil, R.R. 2002. The Nature and Properties of Soils. Pearson Education Pte. Ltd. New Delhi, India.
- James, D.W., Hanks, R.J. and Jurianak, J.J. 1982. Modern Irrigated Soils, John Wiley & Sons., NY.
- Lambert, K.S. and Rhcroft, D.W. 1983. Land Drainage-Planning & Design of Agric. Drain. System. Batsf. Acad. & Edn. Ltd.
- Michael, A.M. 1978. Irrigation-Theory and Practice, Vikas Publishing House Pvt. Ltd. New Delhi.

Course Title: Advanced Soil Chemistry

Credit hours: 2

Course Code: MSSS 1202

Unit	Title	Lesson
1	Ion Sorption	Chemical composition of soil, types and nature of soil colloids, sorption, adsorption and desorption phenomena, adsorption isotherm-Freundlich and langmuir adsorption isotherms
2	Ion Exchange	Ion exchange phenomena, principles of cation exchange, cation exchange equations-Kerr and Gapon equation, double layer theories Stern and GouyChapman theories, zeta potential, anion exchange
3	Clay Minerals	Classification of silicate and non-silicate clays, genesis of silicate clays, physico-chemical and mineralogical properties of silicate clays, surface chemistry of soil clays, identification of clay minerals-X-ray diffraction technique, differential thermal analys (DTA), clay mineral distribution of soils in Bangladesh
4	Meta-organic Complex	Complex formation and chelation, metal-organic complex reactions, clay-humus complexes, importance of clay-humus complex in soil
5	Chemistry of Submerged Soils	Chemical behavior of submerged soils, electrochemical changes p^H , redox potential, Transformation of C, N, P, S, Fe and Mn

Recommended Textbooks

- Bear, F.E. 1967. Chemistry of the Soil. Reinhold Pub. Corp. Inc., USA.
- Bohn, H.L., Mc Neal, B.L. and O'Connor, G.A. 1974. Soil Chemistry, John Wiley & Sons, New York.
- Kim H. Tan. 2010. Principles of Soil Chemistry, 4th Edition, CRC Press.
- Lindsay, W.L. 1979. Chemical Equilibria in Soils. John Wiley & Sons Ltd., New York.
- Saleque, M.A. 2004. Review of Soil Chemistry. Anik Printers, Dhaka. Bangladesh.
- Sposito, G. 1989. The Chemistry of Soils. Oxford University Press, New York.

Supplementary Textbooks

- Greenland, D.J. and Hayes, M.H.B. 1981. The Chemistry of Soil Processes. John Wiley & sons Ltd., New York.
- Grim, R.E. 1953. Clay Mineralogy, McGraw Hill Book Co., Inc., New York.
- Mengel, K. and Kirkby, E.A. 1987. Principles of Plant Nutrition. Int. Potash Inst. Pub., Switzerland.
- Miller, R.W. and Donahue, R.L. 1990. Soils-An Introduction to Soils and Plant Growth Prentice Hall Inc., USA.
- Ponnamperuma, F.N. 1972. Advances in Agronomy, Vol. 24. Amer. Soc. Agron., Inc. Pub., Wis., USA.

Course Title: Soil Fertility and Plant Nutrition


Credit hours: 2

Course Code: MSSS 1203

Unit	Title	Lesson
1	Soil Fertility	Soil fertility & plant growth, plant growth equations, soil fertility assessment-soil analysis, crop response to fertilizers, plant analysis, diagnosis & recommendation integrated system (DRIS) and nuclear techniques, soil fertility management-use of manures, fertilizers and biofertilizers, soil management, integrated plant nutrition system, fertilizer management-mixed, compound & slow release fertilizers, soil amendment, strategies for fertilizer application for crops & cropping patterns, nutrient balance, fertilizer use efficiency



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2	Plant Nutrition	Macro and micronutrients, mechanisms of nutrient uptake, movement of nutrients in soil, nutrient mobility, nutrient interactions, nutritional disorders-deficiency and toxicity symptoms, nutrient concentration-normal, deficiency and toxic levels, biofortification of seeds-methods of biofortification and micronutrients biofortification
3	Problem Soils of Bangladesh	Nutrient deficiency in Bangladesh soils, types of problems soils, their location extent, potentiality, constraints to crop production and management for improving productivity

Recommended Textbooks

1. BARC, 2005. Fertilizer Recommendation Guide. Soils Publication no. 41. Bangladesh Agricultural Research Council, Farm-gate, Dhaka.
2. Bennett, W.F. 1996. Nutrient Deficiencies and Toxicities in Crop Plants. Amer. Phytopath. Soc., St. Paul Minnesota, USA.
3. Havlin, J.L., Beaton, J.D., Nelson, W.L., and Tisdale, S.L. 1999. Soil Fertility and Fertilizers. Prentice Hall, Upper Saddle River, New Jersey.
4. Mengel, K. and Kirkby, E.A. 1987. Principles of Plant Nutrition. Int. Potash Inst. Pub. Switzerland.
5. Miller, R.W. and Donahue, R.L. 1990. Soils An Introduction to Soils and Plant Growth. prentice Hall Inc., USA.
6. Thomson, L.M. and Troeh, F.R. 1978. Soils and Soil Fertility, McGraw Hill, New York.

Supplementary Textbooks

7. Brady, N.C. and Weil, R.R. 2002. The Nature and Properties of Soils. Pearson Education Pte. Ltd. New Delhi, India.
8. Kanwar, N.C. 1976. Soil Fertility-Theory and Practice. ICAR. New Delhi.
9. Mortvedt, J.J., Cox, F.R., Shuman, L.M. and Welch, R.M. 1991. Micronutrients in Agriculture. 2nd ed. Soil Sci. Soc. Amer. Inc., Madison, Wis., USA.
10. Stevenson, F.J. 1985. Cycles of Soils-Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons Inc., New York.

Course Title: Soil Microbiology and Biochemistry

Credit hours: 2

Course Code: MSSS 1204

Unit	Title	Lesson
1	Soil Microbes	Soil microorganisms and their nutrition, biological equilibrium in soil, soil enzymes and their significance, biochemical activities of soil microbes
2	Biochemical Transformations	Protein mineralization-proteolysis, ammonification, nitrification and denitrification, phosphorus-mineralization of organic phosphorus, phosphatase activity, solubilization of inorganic phosphates, sulphur-mineralization of organic sulfur, oxidation and reduction of sulfur, iron and manganese-oxidation and reduction of sulfur, iron and manganese-oxidation and reduction, carbohydrate metabolism
3	Biological Nitrogen Fixation	Symbiotic fixation, non-symbiotic and associated nitrogen fixation systems, rhizosphere environment, biochemistry of nitrogen fixation, nitrogenase enzyme, oxygen protection mechanisms and regulation, nif genes, methods for measuring nitrogen fixation

Recommended Textbooks


1. Alexander, M. 1977. Introduction to Soil Microbiology. John Wiley & Sons Inc., New York.
2. Coney, 1999. Soil Microbiology: An Exploratory Approach. Delmar Publishers, Albany, New York.
3. Jan Dirk van Elsas et. al. 2006. Modern Soil Microbiology, 2nd Edition, CRC Press.
4. Rangaswami, G. and Bagyaraj, D.J. 2004. Agricultural Microbiology, Prentice Hall of India (Pvt.) New Delhi.
5. Subba Rao, N.S. 1987. Advances in Agricultural Microbiology. Oxford and IBH. Pub. Co. New Delhi.
6. Sylvia, D., Fulhmann, J., Hartel, P. and Zuberer, D. 1997. Principles and Applications of Soil Microbiology. Upper Saddle Rivs, N.J. Prentice Hall.

Supplementary Textbooks

7. Keister, D.L. and P.B. Cregan 1991 The Rhizosphere and Plant Growth. Kluwer Academic Publishers, Dordrecht, The Netherlands.
8. Roger, L.J. and Gallon, J.R. 1988. Biochemistry of algae and cynnobacteria. oxford University press, London.
9. Modigan, M.T., J.M. Martiinko and J. Parker, 1997. Brock Biology of Microorganisms. 8th ed. Prntice hall, Upper Saddle River, N.J.
10. Roger, L.J. and Gallon, J.R. 1988. Biochemistry of Algae and Cyanobacteria. Oxford university press, London.
11. Tugel, A.J. and Lewand Owski, A.M. 1999. Soil Biology Primer. Natural Resource Conservation Service. Soil Quality Institute. Iowa.



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12. Vincent, J.M. 1982. Nitrogen Fixation in Legumes. Academic Press, Paris, San, Diego, Tokyo, Toronto.

Course Title: Soil, Plant and Water Analysis

Credit hours: 2

Course Code: MSSS 1205

Unit	Title	Lesson
1	Principles of Analytical Methods	Volumetric, gravimetric, turbidimetric, spectrophotometric, flame emission spectroscopy, atomic absorption spectroscopy, errors in analysis
2	Soil Analysis	Collection, preparation and preservation of soil samples, total nutrient analysis-acid digestion and fusion, fractionation of plant nutrients in soil, available nutrient analysis-concepts, selection of extractant, for determining available nutrients, interpretation of soil analytical data
3	Plant Analysis	Sampling, processing and preservation of plant samples, principles of plant analysis, plant tissue test, leaf analysis, and total analysis, critical nutrient range in plants, interpretation of plant analysis data
4	Water Analysis	Collection, preservation and analysis of water samples, rating of water for irrigation, water quality

Recommended Textbooks

1. Singh, D., Chhonkar, P.K. and Pandey, R.N. 199. Soil Plant and Water Analysis: A Methods Manual. Indian Agricultural Research Institute. New Delhi, India.
2. Hesse, P.R. 1994. A Text Book of Soil Chemical Analysis. CBS Publishers & Distributors, Shadara, New Delhi, India.
3. J. Benton Jones, Jr. 2001. Laboratory guide for conducting soil tests and plant analysis, CRC Press.
4. Kim H. Tan, 2005. Soil sampling, preparation and analysis, 2nd Edition, CRC Press.
5. Page, A.L., Miller, R.H. and Keeney, D.R. 1982. Methods of Soil analysis, Part 2. Amer. Soc. Agron., Madison.

Supplementary Textbooks

6. Havlin, J.L., Beaton, J.D., Nelson, W.L., and Tisdale, S.L. 1999 soil Fertility and Fertilizers. Prentice Hall, Upper Saddle River, New Jersey.
7. Klute. A. 1986. Methods of Soil Analysis, Part 1, Amer. Soc. Agron., Madison.
8. Skoog, D.A. and West, D.M. 1980. Analytical Chemistry. 3rd edition. Saunders College Pub. Washington.
9. Vogel, A.I. 1961. A Text Book of Quantitative Inorganic Analysis. 3rd edition. Lowe & Brydone Ltd., London.
10. West, C.D. 1987. Essentials of Quantitative Analysis. McGraw-Hill Book Co., New York.

Course Title: Research Methodology

Credit hours: 2

Course Code: MSSS 1206


Unit	Title	Lesson
1	Field Experimentation	Research protocols and proposals, selection of experiment site, soil sampling, treatments, experimental design, randomized completely block design, latin square design and split-plot design, basic principles of experimental design-layout, plot size and shape, block size and shape, number of replications, intercultural operations sampling, data collection
2	Data Analysis	Transformation of data-square root and logarithmic transformation, analysis of variance and multiple comparison tests, simple and multiple correlation, linear and non-linear regression
3	Report Writing	Types of report, procedure of scientific report writing, tabular and graphical forms of data presentation

Recommended Textbooks

1. Anonymous, 2004. A Handbook of Scientific Report Writing. Graduate Training Institute (GTI), Bangladesh Agricultural University (BAU), Mymensingh.
2. Cochran, W.G. and Cox, G.M. 1961. Experimental Designs. John Wiley & Sons, Inc., New York.
3. Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. Second Ed. John Wiley & Sons, New York.
4. Stell, R.G.D. and Torrie, J.H. 1960. Principles and Procedures of Statistics with Special Reference to the Biological Sciences. McGraw Hill Book Co., Inc., New York.



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5. Zaman, S.M.H., Rahman, K. and Howlader, M. 1982. Simple Lessons from Biometry. Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur, Dhaka.

Supplementary Textbooks

6. Babbie, E.R. 2007. The basics of social research, 4th Edition, Australia, Thomsin/Wadsworth.
 7. Graduate, W.G. and Cox, G.M. 1964. Experimental Designs. John Wiley & Sons, Inc., New York.
 8. Mead, R., Curnow, R.N. and Hasted, A.M. 1993. Statistical Methods of Agriculture and Experimental Biology, Chapman and Hall, London.

Course Title: Waste Management and Organic Manure

Credit hours: 2

Course Code: MSSS 2201

Unit	Title	Lesson
1	Waste Management	Concept, types and availability of wastes, scope and importance of wastes utilization in Bangladesh, organic recycling of wastes, composting of wastes, methods of composting, acceleration and enrichment of compost, maturity of composts, vermicomposting
2	Organic Manure	Concept, composition of manure, preparation of compost, classification of compost, effects of organic manures on soils and crops, green manure-green leaf manure, importance of manure, nutrient content of manure, farm yard manure-major & miner nutrients classification of organic and inorganic manure

Recommended Textbooks

1. Diaz, L.F., Savage, G.M., Eggerth, L.L. and Goluke, C.G. 1993. Composting and Recycling Municipal Solid wastes, Lewis Publishers, Boca raton.
 2. Krishna Murthi, R. 1978. A Manual on Compost and Other Organic Manures. Today and Tomorrow Printers and Publishers, New Delhi-110005.
 3. Oregon Tilth, 2014. Nutrient Management Plan for Organic Systems, USDA.
 4. Ram Chandra, 2015. Environmental Waste Management, CRC Press.
 5. Subba Rao, N.S. 1984. Biofertilizers in Agriculture. Oxford and IBH Pub. Co. Pvt. New Delhi.
 6. Subba Rao, N.S. 1987. Advances in Agricultural Microbiology. Oxford and IBH Pub. Co., New Delhi.

Supplementary Textbooks

7. Hamdi, Y.A. 1982. Application of Nitrogen Fixing Systems in Soil Improvement and Management. FAO Soils Bulletin 49. Rome, Italy.
 8. Malik, K.A. Naqvi, S.H.M. and Aleem, M.I.H. 1985. Nitrogen and the Environment, NIAB, Faisalabad, Pakistan,
 9. Vincent, J.M. 1982. Nitrogen Fixation in Legumes. Academic Press, Paris, San Diego, Tokyo, Toronto.
 10. Xinthian. D. 1993. Current Development in Soybean Rhizobium Symbiotic Nitrogen Fixation. Heilongjiang Sci. & Tech. Pub. House.

Course Title: Soil and Water Pollution

Credit hours: 2

Course Code: MSSS 2202


Unit	Title	Lesson
1	Soil Pollution	Heavy metals-sources, interactions with soil components, critical limits and hazards of As, Cd, Cr and Pb in soils and their remedial measures, pesticides-residues, degradation, hazards and remediation, fertilizers-residues, soil degradation and control measures, green house gases-formation of CH ₄ , nitrous oxide and carbon dioxide, ozone layer depletion, global warming and changes in soil properties, other pollutants-acid rain and radioactive materials
2	Water Pollution Sources	Heavy metals, fertilizers, pesticides, sewage sludge, industrial effluents, biochemical aspects of water pollution, maximum permissible limits of contaminants in water for potable and irrigation purpose, control of water pollution

Recommended Textbooks

1. Agrawal, S.B. and Agrawal, M. 2000. Environmental Pollution and Plant Responses. Cat. No. L. 1341, CRC Press, UK.
 2. Kudesia, V.P. 1990. Soil Pollution, Pragati Prakashani, India.
 3. Mishra, P.C. 1989. Soil Pollution: Soil Organisms. Asia Pub. House, India.



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- Tan, K.H. 2000. Environmental Soil Science, 2nd edition, Revised and Expanded. Marcel Dekker Inc. USA/Canada/South America.
- Marcel van der Perk, 2013. Soil and Water Contamination, 2nd Edition, CRC Press.

Supplementary Textbooks

- ASA. 1990 Impact of Carbon Dioxide, Trace Gases, and Climate Change on Global Agriculture. ASA Special Pub. No. 53. USA.
- ASA. 1993. Agricultural Ecosystem Effects on Traces Gases and Global Climate Change. ASA Special Pub. No. 55, USA.
- Orlov, D.S. 1992. Soil Chemistry. Oxford Pub. Co. Cal. India.
- Rahman, A.A. Huq, S., haider, R. and Jansen, F. 1992. Environment and Development in Bangladesh. Bang. Cent. Adv. Stud., Dhaka.

Course Title: Soil Ecology and Biodiversity

Credit hours: 2

Course Code: MSSS 2203

Unit	Title	Lesson
1	Ecology	Concept of ecology and ecosystems, ecology of soil organisms, ecological relationships among soil organisms, soil-plant-microbes relationship, soil ecology and plant growth, soil ecosystems, ecosystems of Bangladesh-high and low lands, hills and coasts, wetland ecosystems-prospects and constrains, ecological hazards
2	Biodiversity	Concept, classification and causes, factors affecting biodiversity, bio-adaptability-constrains and adaptation on biological equilibrium in soil, biodiversity of crops and forests in Bangladesh, effect of manuring, fertilization and pesticide application on biodiversity, status of ray and endangered species, methods of biodiversity conservation, management of biodiversity and sustainable farming, global and national biodiversity conservation policies

Recommended Textbooks

- Adrian Newton, 2007. Forest Ecology and Conservation, A Handbook Techniques, Oxford University Press.
- Kotwal, P.C. and Banerjee, S. 2002. Biodiversity Conservation. Agrobios, India.
- Kumar, H.D. 1994. Modern Concepts of Ecology. Vikas publishing House Pte., Ltd, New Delhi, India.
- Solbrig, Ot., van Emdew, H.M. and Van Oordt, P.G.W.J. 1994. Biodiversity and Global change. Cab International, UK.
- Trivedi, P.R. and Roy, G. 2002 Environmental Ecology. Akashdeep publishing House, New Delhi, India.
- Volobuev, V.R.1964. Ecology of Soils. Israel Program for Scientific Publication. Jerusalem.

Supplementary Textbooks

- Chowdhury, Q.I.2001. Bangladesh: State of Biodiversity, forum of Environmental journalists, Bangladesh, Dhaka.
- Faurie, C., Ferra, C., Medori, P. and Devaux, J. 2001. Ecology Science and Practice Oxford and IBH publishing Co. Ltd. New Delhi and Calcutta.
- Smith, RL, 1990. Ecology and Field Biology, Harper Collins publishers, USA.
- Adrian Newton, 2007. Forest Ecology and Conservation: A Handbook Techniques. Oxford University Press

Course Title: Soil Water Management


Credit hours: 2

Course Code: MSSS 2204

Unit	Title	Lesson
1	Soil Water	Sources, structure and properties of water, ground water distribution-aquifer depth, seasonal and yearly fluctuation, soil water losses and water balance, soil water stress-plant tolerance, ionic uptake, turgidity, osmotic adjustment, protein and hormone imbalance, plant rooting depth, growth and yield
2	Soil Moisture and Nutrient	Soil air-water interaction, nutrient uptake at different moisture levels, eater uptake by soil-root-stem-leaves due to water potential gradient, components of soil water potential and plant water potential
3	Irrigation	Irrigation water quality-ground and surface water, predicting irrigation needs for crops, efficiency and frequency of irrigation water, measurement of irrigation water, irrigation water quality and soil properties, irrigation projects of Bangladesh



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4 Soil Water Conservation Methods of soil water conservation-mulching, tillage, no tillage and crop varieties

Recommended Textbooks

- Hiller, D. 1980. Fundamentals of Soil Physics. Acad. Press, New York, USA.
- Michael, A.M. 1978. Irrigation-Theory and Practice. Vikas Publishing House Pvt. Ltd. New Delhi.
- Nilsen, E.T. and Ocrutt, D.M. 1996. The Physiology of Plants under Stress, John Wiley and Sons, Inc. New York.
- Pedro Martinet-Santos, et. al. 2014. Integrated Water Resources Management in the 21st Century: Revisiting the Paradigm.
- Turner, N.C and Kramer, P.J. 1980 Adaptation of Plants to Water and High Temperature Stress. John Wiley and Sons, Inc, New York.

Supplementary Textbooks

- Ghildyal, B.P. and Tripathi, R.P. 1987. Soil Physics. Wiley Eastern Ltd. New delhi.
- James, D.W., Hanks, R.J. and Jurianak, J.J. 1982. Modern Irrigated Soils, John Wiley & Sons. NY.
- Kramer, P.J. 1983. Water Relation of Plants. Academic press, New York, London.
- Lambert, K.S. and Rhcroft, D.W. 1983. Land Drainage-Planning & Design of Agric. Drain. System. Batsf. Acad. & Edn. Ltd.
- Levitt, J. 1972. Responses of Plants to Environmental Stress. Academic press. New York. London.
- Mengel, K. and Kirkby, E.A. 1987. Principles of Plant Nutrition. Int. Potash Inst. Pub. Switzerland.

Course Title: Soil Degradation and Conservation

Credit hours : 2

Course Code: MSSS 2205

Unit	Title	Lesson
1	Soil Quality	Concept of soil quality, indicators of soil quality, soil resistance and soil resilience, factors affecting soil quality and agricultural productivity
2	Soil Degradation	Concept, causes of degradation, soil degradation classes, types of soil degradation-physical, chemical and biological, soil erosion, agents and processes of degradation: losses due to degradation-soil, nutrients, vegetation, properties of degraded soil, degraded rice soils, management of degraded soil
3	Soil Conservation	Concept of soil conservation, soil conservation methods: vegetative methods-cover crops, crop rotation, companion crops, strip cropping, crop residue utilization, mulching and windbreaks, mechanical methods-no tillage, minimum tillage, land leveling and bounding, contour and terrace cultivation, modification of soil properties-soil structure, infiltration, drainage, land reclamation

Recommended Textbooks

- BARC 2001. Impact of Land Degradation in Bangladesh: Changing Scenario in Agricultural Land use. Ed. Karim, Z. and Iqbal, A. Soils Publication No. 42, Soils Division, BARC, Dhaka.
- FAO. 1994. Land Degradation in South Asia: Its Severity, Causes and Effects Upon the People. Rome, Italy.
- Greenland, D.J. and Lal, R. 1977. Soil Conservation and Management in the Humid Tropics. John Wiley & Sons Inc., New York.
- Stallings, J.H. 1962. Soil Conservation. Prentice-Hall Inc., USA.
- Troeh, F.R., Hobbs, J.A. and Donhue, R.L. 1980. Soil and Water Conservation for Productivity and Environmental Protection. Prentice Hall, Inc., USA.

Supplementary Textbooks

- Brady, N.C. and Weil, R.R. 2002. The Nature and Properties of Soils. Pearson Education Pte. Ltd. New Delhi, India.
- Lal, R. 1988. Soil Erosion Research Methods. ISSS, Wageningen, The Netherlands.
- Miller, R.W. and Donahue, R.L. 1990. Soils An Introduction to Soils and Plant Growth. Prentice Hall Inc., USA.
- Schwab, G.O. Frevent, R.K. Edminister, T.W. and Bames, K.K. 1981. Soil and Water Conservation Engineering. John wiley & sons Inc., New York.



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Course Title: Soil Survey

Credit hours: 2

Course Code: MSSS 2206

Unit

Title

Lesson

1	Principles and Methods	User of soil surveys, application of soil survey in land use planning and development, planning a soil survey, orders of soil survey, base maps, generalized soil maps and schematic soil maps, planimetric and topographic maps, aerial photographs and mosaics, photo interpretation, mapping, units in soil survey, map legends soil survey reports, remote sensing, GIS and stereo imagery in soil survey, collection display of information and interpretation, field observations, examination and description of soils, use of land utilization guides, soil survey in Bangladesh
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Recommended Textbooks

1. Dent, D. and Yong, A. 1981. Soil Survey and Land Evaluation. George Allen and Unwin Pub. Ltd., London.
2. Hussain, M.S. 1992. Soil Classification with Special Reference to the Soils of Bangladesh. Univ. Dhaka.
3. Lillesand, T.M. and Kiefer, R.W. 1994. Remote Sensing and Image Interpretation. 3rd edition. Wiley, New York.
4. Soil Survey Staff, 1993. Soil Survey Manual. Hand Book No. 18. Washington, D.C. USDA
5. Soil Survey Staff, 2014. Keys to Soil Taxonomy, 12th Edition, USDA-Natural Resources Conservation Science, Washington DC.
6. USDA, 1978. Soil Taxonomy-A Basic System of Soil Classification for making and Interpreting Soil Surveys. National Bureau of Soil Survey and Land Use Planning (ICAR), New Delhi.

Supplementary Textbooks

7. Soil Survey Staff, 1992. Keys to Soil Taxonomy. SMSS Technical monograph no. 19, Pocahontas Press, Inc., Blacksburg, Virginia.
8. Star, J. and Estes, J. 1990. Geographical Information Systems: An Introduction. Prentice Hall, Englewood Cliffs, N.J.
9. USDA, 1951. Soil Survey Manual. Agriculture HandBook No. 18.

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