Department of Soil Science

Course code: SS 1121 Course Title: Soil Genesis and Soil Physics
Credit: 3 Contact hours: 3 Level: 1 Semester: 1

Rationale

In order for the use and management of soil for sustainable crop production students need to be familiar with fundamental concepts and functions of soils as a whole and to learn soil physical properties and processes.

Course Learning Outcomes (CLOs)

1. Interpret soil and its components
2. Describe rocks and minerals and their weathering processes, soil forming processes and factors
3. Interpret soil physical properties & processes and their significance in crop production
4. Illustrate water cycle and hydraulic properties of soils to prepare irrigation schedule
5. Interpret thermal properties of soils and modify soil temperature
6. Explain soil mechanical processes, particle size analysis and predict plough pan formation in soil

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1		√√	√√							
CLO 2	√√	√√								
CLO 3			√√	√√						
CLO 4					√√			√√		
CLO 5	√√			√√						
CLO 6					√√		√√			

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Soil as a natural resource: Concept, major components and functions	1	2
Soil genesis: Rocks and minerals- classification and properties; Weathering – physical and chemical; Soil forming factors and processes; Soil profile	2	7
Soil physical properties: Soil particles – classification and properties; Soil texture – classification and importance; Soil structure – genesis, classification and importance; Particle density, bulk density and soil porosity; Soil air; Soil colour	3	9
Soil water: Soil water classes, measurement, constants and importance; Soil water potentials; Water movement – infiltration and hydraulic conductivity; Soil water balance- input and output pathways	4	10
Soil temperature: Thermal properties, heat flow equation, factors and management of soil temperature	5	6
Soil consistency: Forms of soil consistency, swelling, shrinkage, plough pan formation and impacts	6	8
Mechanical analysis: Principle and methods; Stokes's law	6	6
Total Lectures		48

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment
- Presentation

Books Recommended

Baver, L.D., Gardner, W. H. and Gardner, W.R. 1972. Soil Physics, 4thedition. John Wiley & Sons. Inc., New York.

Biswas, L.D., and Mukherjee, S.K. 1991. Text book of Soil Science. Tata McGraw-Hill Pub. Ltd., New Delhi.

Brady, N.C. and Weil, R.R. 2006. The Nature and Properties of Soils. Thirteen edition Pearson Education Pvt. Ltd. New Delhi, India.

Foth, H.D. 1991. Fundamentals of Soil Science. 8th edition, Willey and Black, USA.

Hanks, R.J. and Ashcroft, F.L. 1980. Applied Soil Physics. Springer - Verlag, Berlin

Hillel, D. 1980. Fundamental of Soil Physics. Acad. Press, New York, US

Department of Soil Science

Course code: SS 1122 Course Title: Soil Genesis and Soil Physics
Credit: 1 Contact hours: 2 Level: 1 Semester: 1

Rationale

Students wishing to get employed in agricultural development need to know how to determine the soil physical properties in order to measure soil bio-physico-chemical processes in relation to the sustainable crop production.

Course Learning Outcomes (CLOs)

1. Discuss safety measures to conduct laboratory analysis
2. Collect and process soil samples for quantifying soil density and porosity
3. Identify rocks and minerals
4. Estimate the moisture status of soil in different conditions
5. Predict nutrient flow in soil and estimate water and solute movement in soil
6. Classify soil into different textural types

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1									√√	
CLO 2				√√		√√				
CLO 3	√√	√√								
CLO 4					√√					√√
CLO 5						√√		√√		√√
CLO 6		√√		√√						

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Precautions to be taken while working in the laboratory	1	1
Identification of different rocks and minerals	3	1
Collection and preparation of soil samples	2	2
Determination of particle density of soil by volumetric flask method	2	1
Determination of bulk density of soil by core sampler method	2	1
Particle size analysis of soil by hydrometer method	6	2
Determination of soil water at saturation and field capacity by gravimetric method	4	2
Determination of soil water by tensiometer method	4	2
Determination of soil water infiltration by double ring infiltrometer method	5	2
Determination of hydraulic conductivity of saturated soil by constant head method	5	2
Total Lectures		16

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self study/e-learning
- Presentation

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Klute, A. 1986. Methods of Soil Analysis, Part 1, Amer. Soc. Agron., Madison, Inc. Pub., Wis., USA
2. Page, A.L., Miller, R.H. and Keeney, D.R. 1982. Methods of Soil Analysis Part 3, Chemical methods, SSSA, Madison, Inc. Pub., Wis., USA
3. Singh, R.A. 1997. Soil Physical Analysis . Varun Exports, India.
4. Singh, D. Chhonkar, P.K. and Pandey, R.N. 1999. Soil Plant Water Analysis- A Methods Manual. ICAR, New Delhi.
5. Klute, A. 1986. Methods of Soil Analysis, Part 1. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA

Department of Soil Science

Course code: SS 2121 Course Title: Soil Survey and Soil Conservation
Credit: 3 Contact hours: 3 Level: 2 Semester: 1

Rationale

In order to engage in agricultural services students, need to deal with rapidly changing society and consequent shifts in public and private information highly relevant to the planning and execution of soil resource use.

Course Learning Outcomes (CLOs)

1. Perform soil survey and prepare soil survey map and report
2. Interpret general soil types and agro-ecology of Bangladesh
3. Analyze the soil related crop production constraints in Bangladesh
4. Design land use for crops and cropping patterns and evaluate the soil-crop management strategies
5. Assess soil erodibility and apply methods for soil conservation

Mapping CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1				√√		√√		√√		
CLO 2										√√
CLO 3					√√		√√		√√	
CLO 4	√√		√√					v		
CLO 5		√√			√√				√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Soil survey: Purpose, kinds and methods of soil survey, mapping and report preparation	1	6
Soil classification: Systems of soil classification - Soil taxonomy and equivalent soil types in Bangladesh	2	6
Land classification: Criteria for land evaluation; Land capability classification of Bangladesh	4	6
Soils of Bangladesh: Geological time scale, Geomorphology, General Soil Types, AEZs- principles and description	2	12
Land degradation: Types and status of land degradation in Bangladesh, Soil erosion, Soil loss equations, Salinization, heavy metal pollution and Acidification	3, 5	8
Soil conservation: Principles; Purposes; Techniques: Mechanical- Terrace, contour and minimum tillage; Biological- Hedge rows, strip cropping and mulching	5	10
Total Lectures		48

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning
- Presentation

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Presentation
- Assignment

Books Recommended

1. Brammer, H. 1996. The Geography of the Soils of Bangladesh. University Press Ltd., Dhaka, Bangladesh.
2. Dent, D. and Yong, A. 1981. Soil Survey and Land Evaluation. George Allen and Unwin Pub. Ltd., London.
3. FAO report. 1988. Land Resources Appraisal of Bangladesh for Agricultural Development, Agroecological Regions of Bangladesh. Report-2.
4. Greenland, D.J. and Lal, R. 1977. Soil Conservation and Management in the Humid Tropics. Wiley & Sons Inc., New York.
5. Hussain, M.S. 1992. Soil Classification with Special Reference to the Soils of Bangladesh. University Dhaka.
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.
7. Zachar, D. 1982. Soil Erosion, 1st edition, Elsevier, Netherlands.

Department of Soil Science

Course code: SS 2122 Course Title: Soil Survey and Soil Conservation
Credit: 1 Contact hours: 2 Level: 2 Semester: 1

Rationale
Students wishing to classify and evaluate soils for making interpretations as to the adaptability of particular soils for agricultural purpose will need to have in depth insight into soil survey, mapping and conservation.

Course Learning Outcomes (CLOs)

1. Conduct qualitative estimation of soil texture
2. Perform qualitative assessment of soil properties and reaction (pH)
3. Interpret the effects of alkalinity &salinity level on soils and plants processes
4. Interpret soil genesis and horizon differentiation
5. Compute aggregate size stability in soil
6. Explain the geomorphological processes related to soil erosion

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1		√√		√√						
CLO 2	√√							√√		
CLO 3		√√		√√			√√			
CLO 4				√√					√√	√√
CLO 5							√√	√√		
CLO 6					√√		√√		√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Identification of different textural types of soil by finger feel method	1	1
Determination of soil colour by Munsell's colour chart	2	1
Determination of pH by BAU Soil Testing Kit	2	1
Determination of carbonate and bicarbonate of soil by differential titration method	3	1
Determination of electrical conductivity of soil by conductivity meter	3	1
Measurement of soil aggregate size distribution by wet sieving method	5	3
Study of soil profile at different AEZs	4	4
Preparation of soil survey report	4	1
Measurement of soil erosion by meso-plot technique	6	3
Total Lectures		16

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Hesse , P.R. 1994. Textbook of Soil Chemical Analysis. Varun Exports, India.
2. Jackson, M.L. 1962. Soil Chemical Analysis. Prentice Hall, New York.
3. Klute, A. 1986. Methods of Soil Analysis, Part 1. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA.
4. Lal, R. and Stewart B.A. 1995. Soil Management Experimental Basis for Sustainability and Environmental Quality. CRC Press.
5. Morgan, RPC 2005. Soil Erosion and Conservation. Third edition, Blackwell publishing Ltd.

Department of Soil Science

Course code: SS 3101 Course Title: Soil Chemistry
Credit: 2 Contact hours: 2 Level: 3 Semester: 2

Rationale

In order to possess the basic knowledge on functions of agro-ecosystems students will need to understand the soil chemical properties & processes and also the mechanisms that regulate the plant nutrients availability and uptake by crops

Course Learning Outcomes (CLOs)

1. Diagnose the properties of soil colloids and silicate clays to plan effective management of soil silicates
2. Interpret the influence of ion exchange on plant nutrients dynamics
3. Assess lime requirement and explain the mechanisms of nutrient uptake by plants
4. Evaluate soil quality on the basis of soil organic matter content and plan for sustainable techniques of managing soil fertility
5. Interpret nutrient dynamics and gaseous fluxes in submerged soils

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1	√√			√√			√√			
CLO 2		√√		√√				√√		
CLO 3			√√				√√			
CLO 4	√√				√√					√√
CLO 5					√√		√√		√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Soil colloids: Classification and properties of soil colloids; Types and properties of oxides and hydroxides of Fe, Al and Mn	1	6
Silicate clays: Classification and basic structures; Properties of kaolinite, mica, smectite, vermiculite and chlorite	1	6
Ion exchange: Development of charges in soil colloids, cation exchange, anion exchange, base saturation	2	4
Soil pH and liming: Causes of soil acidity; buffering capacity of soil; Soil pH and nutrient availability. Liming - liming materials, effects on soil properties, mechanism of pH change	2	4
Chemistry of submerged soil: Characteristics of submerged soils, electrochemical changes in submerged soils and GHG emissions	5	6
Soil organic matter: Sources and composition, effects on soil properties, C/N ratio, carbon sequestration and waste recycling	4	6
Total Lectures		32

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Brady, N.C. and Weil, R.R. 2002. The Nature and Properties of Soils. Pearson Education Pvt. Ltd. Delhi, India.
2. Dixon, J.B. and Wood S.B. 1989. Minerals in Environments 2nd Edition. Soil Sci. Soc. Amer., Madison, Wis., USA.
3. Sparks, D.L. 2002. Environmental Soil Chemistry, Second edition, Academic press.
4. Tan, K.H. 2010. Principles of Soil Chemistry, 4th edition, CRC press, USA.
5. Klaus, J. Lorenz and Rattan Lal. 2018. Carbon Sequestration in Agricultural Ecosystems. Springer International Publishing AG, Switzerland.
6. Magdoff, F, Ray R. Weil. 2004. Soil Organic Matter in Sustainable Agriculture. CRC press, USA.

Department of Soil Science

Course code: SS 3102 Course Title: Soil Chemistry

Credit: 1 Contact hours: 2 Level: 3 Semester: 2

Rationale

In order for the students to contribute to the sustainable management of soil-crop-water towards higher crop productivity and better soil fertility, measurement of soil chemical properties and processes and understanding of their interactions with plant nutrient availability are inevitable.

Course Learning Outcomes (CLOs)

1. Evaluate the fertility status of soil in-terms of soil organic carbon
2. Predict nutrient retention capacity of the soil
3. Evaluate soil reaction to modify soil pH
4. Interpret the redox potential of wetland soil
5. Identify the clay minerals to plan effective management of soil silicates
6. Perform the measurement of methane exchanges between soils and the atmosphere

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1	√√	√√								√√
CLO 2				√√	√√			√√		
CLO 3		√√	√√							
CLO 4			√√		√√			√√		
CLO 5			√√	√√	√√					
CLO 6	√√					√√			√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Determination of soil organic carbon by wet oxidation method	1	2
Determination of cation exchange capacity of soil by sodium saturation method	2	2
Determination of soil pH by glass electrode pH meter	3	1
Determination of lime requirement of soil	3	1
Determination of buffering capacity of soil	3	2
Determination of redox potential in wetland soil by redox meter	4	2
Identification of clay minerals by X-ray diffraction method	4	3
Measurement of methane emissions from rice field by gas chromatography	5	3
Total Lectures		16

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Klute, A. 1986. Methods of Soil Analysis, Part 1. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA.
2. Singh, D. Chhonkar, P.K. and Pandey, R.N. 1999. Soil Plant Water Analysis- A Methods Manual. ICAR, New Delhi.
3. Jackson, M.L. 1962. Soil Chemical Analysis. Prentice Hall, New York.
4. Lal R., Kimble J.M., Follett R.F. and Stewart B.A. Assessment Methods for Soil Carbon, CRC press, USA.
5. Moore, D.M., Robert, C. Reynolds. 1997. X-ray diffraction and the identification and analysis of clay minerals. Oxford University Press.
6. Rosenstock, T.S., Rufino, M.C., Butterbach-Bahl, K., Wollenberg, E., Richards, M. 2016. Methods for Measuring Greenhouse Gas Balances and Evaluating Mitigation Options in Smallholder Agriculture. Springer International Publishing AG, Switzerland.

Department of Soil Science

Course code: SS 4201 Course Title: Soil Microbiology and Soil Fertility

Credit: 3 Contact hours: 3 Level: 4 Semester: 2

Rationale

To understand cutting-edge research and to develop problem solving skills and innovative technologies, students need to enrich their knowledge on microbial role in soil fertility, soil fertility assessment and soil fertility & fertilizer management.

Course Learning Outcomes (CLOs)

1. Illustrate soil microbial diversity and its role in soil fertility
2. Explain biological nitrogen fixation systems and beneficial role of bio-fertilizers and mycorrhiza
3. Identify the mechanisms and factors of nutrient availability in soils for crop uptake.
4. Assess soil fertility status and make fertilizer recommendations for crops & cropping patterns
5. Explain the functions of plant nutrients for sustainable crop production
6. Identify causes of soil fertility depletion in Bangladesh and management options for sustainable soil fertility

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1	√√			√√		√√				
CLO 2		√√			√√					
CLO 3		√√		√√						
CLO 4	√√						√√		√√	
CLO 5	√√	√√								
CLO 6					√√		√√			√√

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Soil microbes: Classification and functions of soil microorganisms, microbial interactions in soils.	1	6
Biological nitrogen fixation: Symbiotic N_2- fixation: Legume- *Rhizobium* symbiosis, *Azolla -Anabaena* symbiosis; Non-symbiotic N_2- fixation: *Azotobacter, Azospirillum,* Cyanobacteria	2	4
Bio-fertilizers: Types and role in soil fertility; Mychorrhiza – Types and use in agriculture	2	3
Plant nutrients: Criteria for essentiality, available forms, macro and micronutrients	5	4
Nutrient availability in soils: Nitrogen - occurrence, mineralization, immobilization, mechanisms of N loss and N cycle; Phosphorus and potassium - occurrence, fixation and availability. Sulphur - occurrence, oxidation-reduction and availability; Magnesium- occurrence and availability; Zinc and boron - occurrence and availability	3	10
Soil fertility evaluation: Methods of soil fertility evaluation; soil testing, fertilizer trial, critical limits, fertilizer recommendation	4	6
Fertilizer management: Principles and rationale of fertilizer use; methods of fertilizer application; fertilizer use efficiency; bio-fortification of micronutrients in food crops	4	7
Soil fertility problems and management: Extent and causes of organic matter depletion; nutrient mining, unbalanced use of fertilizers; organic amendments, integrated nutrient management, conservation agriculture	6	8
Total Lectures		48

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Rao, S.N.S. 1984. Biofertilizers in Agriculture. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
2. Stevenson, F.J. 1985. Cycles of Soils- Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. Wiley & Sons Inc., New York.
3. Mengel, K. and Kirkby, E.A. 1987. Principles of Plant Nutrition. Int. Potash Inst. Pub., Switzerland.
4. Elsan, J.V.D., Trevors, J.T. and Elizabeth, M.H.W.1997. Modern Soil Microbiology. Marcel Dakker.
5. Havlin, J.L , Beaton, J.D., Nelson, W.L., and Tisdale, S.L. 1999. Soil Fertility and Fertilizers. Sixthedition. Prentice Hall, Upper Saddle River, New Jersey.
6. BARC, 2012. Fertilizer Recommendation Guide. Soils Publications no. 41. Bangladesh Agricultural Research Council. Farmgate, Dhaka.
7. Brady, N.C. and Weil, R. R. 2012. The Nature and Properties of Soils. 15th Edition. Pearson Education Pvt. Ltd. New Delhi, India

Department of Soil Science

Course code: SS 4222 Course Title: Soil Microbiology and Soil Fertility
Credit: 1 Contact hours: 2 Level: 4 Semester: 2

Rationale

To evaluate soil fertility and to recommend fertilizer rates for crops and cropping pattern for sustainable intensification towards the challenges of food security, students need to gain knowledge on soil quality evaluation and bio-fertilizer/bio-compost production as soil amendments.

Course Learning Outcomes (CLOs)

1. Perform quick assessment of nutrients
2. Calculate the limiting nutrient elements (N, P, K, S) in soil for crop production
3. Demonstrate agents of sterilization
4. Characterize and quantify bacterial population in soil and inoculants
5. Design and plan bio-fertilizers production techniques

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1				√√		√√		√√		
CLO 2	√√						√√			√√
CLO 3						√√		√√		
CLO 4				√√		√√				
CLO 5	√√				√√					√√

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Determination of N, P and K in soil by BAU Soil Testing Kit	1	2
Determination of total N in soil by Kjeldahl method	2	2
Determination of available P in soil by Olsen method	2	2
Determination of available K in soil by ammonium acetate extraction method	2	2
Determination of available S in soil by calcium chloride extraction method	2	2
Techniques of sterilization	3	1
Isolation and authentication of Rhizobium from legume root nodules	4	2
Preparation of Rhizobium inoculant	5	1
Total count of bacteria in Rhizobial inoculant	4	1
Isolation and identification of Azotobacter in soil	4	1
Total Lectures		16

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Hesse , P.R. 1994. Textbook of Soil Chemical Analysis. Varun Exports, India
2. Jackson, M.L. 1962. Soil Chemical Analysis. Prentice Hall, New York.
3. Klute, A. 1986. Methods of Soil Analysis, Part 1. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA
4. Page, A.L., Miller, R.H. and Keeney, D.R. 1989. Methods of Soil Analysis, Part 2. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA.
5. Singh, D. Chhonkar, P.K. and Pandey, R.N. 1999. Soil Plant Water Analysis-A Methods Manual. ICAR, New Delhi.
6. Seeley, H.W. and Van Demark, J.J. 1975. Microbes in Action. A Laboratory Manual of Microbiology. D.B. Taraporavala Sons Co. Pvt. Ltd., India.
7. Tyler, M.E. and Milam, J.R. 1969. Basic Bacteriology: Laboratory Manual. Department of Bacteriology, University. Florida.

Department of Soil Science

Course code: SS 3121 Course Title: Soil Pollution
Credit: 2 Contact hours: 2 Level: 3 Semester: 1

Rationale
Knowledge of heavy metals and other contaminants in soil and their uptake by plants will enable students to assess the level of their toxicity and impacts in soil-water-plant continuum.

Course Learning Outcomes (CLOs)

1. Illustrate the impacts of soil pollution on food security and agricultural productivity
2. Identify different sources of soil pollution
3. Describe heavy metal pollution in soil-plant-water system
4. Design waste management strategies
5. Apply remedial measure for soil pollution

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1	√√						√√		√√	
CLO 2		√√	√√							
CLO 3		√√								√√
CLO 4				√√		√√		√√		
CLO 5			√√				√√		√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Introduction to pollution: Concept of pollution and soil pollution, hazards of soil pollution	1	6
Sources of soil pollution: Fertilizers- residues and toxicity, Pesticides- residues, hazards and degradation	2	8
Heavy metals: Sources, maximum permissible limits and hazards of As, Cd, Pb and Cr in soil, water and crops	3	8
Remediation of soil pollution: Phytoremediation, microbial remediation, irrigation water quality; judicial use of fertilizers and pesticides	5	5
Waste management- Municipal solid waste; sewage sludge; industrial effluents.	4	5
Total Lectures		32

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Agrawal, S.B. and Agrawal, M. 2000. Environmental Pollution and Plant Responses. CRC Press, UK.
2. ASA. 1990. Impact of Carbon Dioxide, Trace Gases, and Climate Change on Global Agric. ASA Special Pub. No. 53, USA.
3. ASA. 1993. Agricultural Ecosystem Effects on Traces Gases, and Global Climate Change. ASA Special Pub. No.55, USA.
4. Kudesia, V.P. 1990. Pollution, Pragati Prakashani, India.
5. Mishra, P.C. 1989. Soil Pollution. Asia Pub. House, India.
6. Rahman, A.A. Huq, S., Huq, S., Haider, R. and Jansen, F. 1992. Environment and Development in Bangladsh. Bang. Cent. Adv. Stud., Dhaka.
7. Tan, K. H. 2000. Environmental Soil Science, 2nd edition, Revised and Expanded. Marcel Dekker USA & Canada.

Department of Soil Science

Course code: SS 3221 Course Title: Soil Biology
Credit: 2 Contact hours: 2 Level: 3 Semester: 2

Rationale

Student wishing to be employed in agricultural, ecological and environmental services, need to be familiar with soil microorganisms and their activities in soil, rhizosphere, compost technology and role of soil organisms in improving soil health.

Course Learning Outcomes (CLOs)

1. Describe soil organisms and their functions
2. Identify the beneficial microbes
3. Describe biochemical processes in soils
4. Illustrate the role of soil organisms in improving soil health
5. Predict residual effects of hazardous materials and their biodegradation in soil

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1		√√		√√						
CLO 2			√√		√√		√√			
CLO 3	√√							√√		√√
CLO 4						√√			√√	
CLO 5	√√					√√		√√	√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Soil organisms: Soil as a habitat for organisms; Occurrence, diversity and classification of soil organisms; Factors affecting the activities and distribution of organisms in soils; Rhizosphere organisms and their influence on crops; Beneficial and harmful organisms in soil	1, 2	10
Bioactivity in soil: Organisms involved in biochemical processes in soils; Compost technology- macro and microorganisms involved in composting; vermicomposting; compost maturity tests; soil-plant-microbes interactions.	3	10
Soil organisms and the environment: Role of soil organisms in improving soil health; Effect of agricultural practices on soil organisms; Biodegradation of pesticides	4,5	12
Total Lectures		32

Teaching Strategy

- Lecture
- Question & answering
- Tutorial
- Self-study/e-learning

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment

Books Recommended

1. Alexander, M. 1977. Introduction to Soil Microbiology. John Wiley and Sons Inc. New York, USA.
2. Pramer, D. and E.L.Schmidt. 1967. Experimental Soil Microbiology. Burgen Publishing company.
3. Elsan, J.W.V., Trevors, J.T.andElezabeth, M.H.W. 1997. Modern Soil Microbiology. Marcel Dakker. UK, Paul, E.A. and Clark, F.E. 1989. Soil Microbiology and Biochemistry. Academic Press Inc. London.
4. Rangaswami, G. and Bagyaraj, D.J. 2004. Agricultural Microbiology, Prentice Hall of India Pvt. New Delhi, India.
5. Subba Rao, N.S. 1984. Biofertilizers in Agriculture. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
6. Tilak, K.V.B.R. 1998. Bacterial Fertilizers. Indian Council for Agricultural Research, New Delhi, India.

Department of Soil Science

Course code: SS 4223 Course Title: Project Design and Report Writing
Credit: 2 Contact hours: 2 Level: 4 Semester: 2

Rationale

Knowledge on planning and designing of a research project and subsequently writing and presentation of a project completion report following appropriate scientific format will enable students acquiring skills in project proposal writing for the employers and donors and building their career through research article publications.

Course Learning Outcomes (CLOs)

1. Identify a research gap/research question/problem
2. Describe the components of a good quality research proposal
3. Design a research programme briefly
4. Write a scientific report/article following appropriate format
5. Prepare and deliver a powerful presentation on a research proposal or report
6. Evaluate a good quality scientific presentation
7. Summarise the findings of a 'climate change and/or food security' related research project carried out at BAU/BARI/BRRI etc.

Mapping CLOs to PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO 1							√√			√√
CLO 2	√√		√√							
CLO 3								√√	√√	
CLO 4							√√		√√	
CLO 5		√√	√√			√√				
CLO 6			√√		√√					√√
CLO 7				√√			√√		√√	

Course Contents and corresponding CLOs

Course Content	CLOs	No. of lectures
Research Concept, objectives, types and planning; searching of literature	1	3
Designing a research program Structure of a research program, research problem/gap identification, objectives, conduction of the research work, time frame, outputs and outcomes	1, 2 & 3	7
Report writing Data collection and basics of data analysis, types of report, structure of a report/article, forms of data presentation, criteria of a good quality report/article	4	8
Proposal or report presentation Preparation of slides- quality and quantity, presentation of slides- induction, consideration of audiences, timing, gesture etc.	5 & 6	6
Visit to research institutes Acquaintance with current research programs at different government and private agricultural research institutes and extension organizations and preparing a short report	7	8
Total Lectures		32

Teaching Strategy

- Lecture
- Student Workshop/ Group study
- Question & answering
- Self-study/e-learning
- Research Visit

Assessment Strategy

- MCQ
- Short question
- Essay type question
- Assignment
- Presentation

Books Recommended

1. Project and Journal Article Writing for Agricultural Science and Related Disciplines. By-Ibrahim Hayatu Kubkomawa. ISBN: 978-1-940366-03-6. Publisher: Science Publishing Group. New York.
2. Scientific Writing and Communication: Papers, Proposals, and Presentations 1st Edition. By-Angelika H. Hofmann. ISBN-13: 978-0195390056. Oxford University Press; 1 edition (December 16, 2009). UK.