



**National University**  
**Subject: Soil Science**  
**Syllabus for Four Year B. Sc Honours Course**  
**Effective from the Session: 2009-2010**

**Year wise courses and marks distribution.**

**First year Honours**

Course Code	Course Title	Marks.	Credits
	Introductory Soils-I	100	4
	Introductory Soils-II	100	4
	Soil Physics-I	100	4
	General Microbiology	100	4
	Chemistry-I	100	4
	Chemistry-I Practical	50	2
	Botany-I	100	4
	Botany-I Practical	50	2
	<b>Total=</b>	<b>700</b>	<b>28</b>

**Detailed Syllabus**

**First Year**

**Course Code .....: Introductory soils-I      Marks 100, 4 Credits, 60 Lectures**

Soil Science as an independent discipline; historical development of Soil Science; Branches of Soil Science and their relationship with other branches of science; the scope of the application of the knowledge of soil science.

Concepts of soil- soil as a natural body, the earth and the soil, the formation and structure of the earth, the earth and it's biotic and abiotic environment, environmental segments. The ecosystem- soil as a component of the ecosystem.

Soil composition – Solid, liquid and gaseous proportions; chemical composition of soil solids. Soil forming rocks and minerals; organic fractions; characteristics of the liquid and gases.

Fundamental processes of soil formation – Weathering of rocks and minerals, silicate structure, synthesis of silicate clays. Development of soil horizons and soil profile, Master horizons. Ideal soil profile. Factors affecting soil formation.

**Books Recommended:**

1. The nature and Properties of Soil : Brady 12<sup>th</sup> ed .
2. Soils-An Introduction to Soil and Plant Growth 6<sup>th</sup> ed : R.W Miller and R.L Donahue.
3. Soil in our environment :
4. Soil Ecology : A. Wild

**Course Code .....: Introductory Soils-II**

**Marks 100, 4 Credits, 60 Lectures**

The Soil biota: types of biota, plant roots, interaction between plant roots and soil biota; occurrence, population, structure and functions of bacteria, actinomycetes, fungi and algae. Nutritional division of soil microflora; meso-and macro-fauna: oligochaetes (earthworms and enchytraeid worms), nematodes, arthropods, mollusks, viruses, protozoa (microfauna) and slime moulds.

The soil as source of energy and nutrient to soil biota- soil minerals as a source of nutrients; soil organic matter and living biomass as source of nutrients. The soil atmosphere as source of carbon and other nutrients.

Essential plant nutrient elements- criteria and classification, elementary idea about the function and deficiency symptoms of nutrient elements. Role of N P K S in plant nutrition.

Concept of soil fertility and productivity. Basic idea on the fertility status of Bangladesh soils. The need of soil fertility management. Basic idea about the soil fertility management techniques. Fertilizers- organic inorganic and biofertilizers.

**Books Recommended:**

1. Principles of Soil Chemistry : Kim H. Tan.
2. Soil Chemistry : Bohn. McNealed O'Conor, John Willy and Sons, New York.
3. Chemistry of the Soil : F.E Bear, Oxford IBH Publishing Co Pvt. New Delhi.
4. Soil Chemistry and its application : Malcolm Cresser & Ken Kilham & Tony Edwards. Cambridge University Press.

**Course Code .....: Soil Physics-I**

**Marks 100, 4 Credits, 60 Lectures**

**Soil** as a three-phase disperse system; description of the three phases of soil; mass and volume relations of soil constituents.

Physical nature of the soil particles-particle-size distribution, soil textural classes, soil structure-classification and importance; soil water-classification, forces of retention; effect of water stress and water logging on agriculture.

**The gaseous phase:** composition of soil air: gas transport through soil; gaseous exchange-the renewal of soil air: Measurement of soil aeration.

**The soil thermal regime:** atmospheric energy balance; extraterrestrial radiation, solar radiation, factors affecting solar radiation; soil surface energy balance. Thermal properties of soil: temperature, heat capacity and thermal conductivity; measurement of thermal conductivity.

**Books Recommended:**

1. Environmental Soil Physics-D. Hillel
2. Soil Physics-Helmut Kohnke
3. Soil Physics- L.D. Baver, B.H. Gardner and W.R. Gardner
4. Methods of Soil Analysis, Part I-C.A. Black and others

**Course Code .....: General Microbiology                    Marks 100, 4 Credits, 60 Lectures**

Microorganism: the place of microorganisms in the living world, traditional two kingdom classification; Haeckel's kingdom; protista concept; eucaryotic protist and prokaryotic protist. Whittaker's Five kingdom concept, nutritional requirements of microorganisms.

The soil environment: Soil as a source of energy and nutrients for the biota. Soil organic matter and living biomass as sources of nutrients. Microscopy: Principles, functions, applications and care of various microscopes. Isolation of pure culture from various sources; aseptic techniques in microbiology; different physical and chemical methods; techniques of microbial control by physical and chemical means; anti-microbial agents mode of action.

Microbial metabolism of carbohydrates and protein synthesis with reference to enzymes involved. Oxidative and fermentation pathways. Enzymes: types, mode of action, Km, factors affecting enzyme activities.

**Books Recommended:**

1. Ecology- Ken Killham
2. Principles of Microbiology-Ronald M. Atlas
3. Fundamentals of Microbiology-Edward Almamo
4. Microbiology-Michael J. Peloczar Jr., E.C.S. Ohan and Noel R. Krieg
5. General Microbiology- Roger Y. Stainer, Edward A. Adelberg and John L. Ingraham
6. Introduction to Soil Microbiology-Walter, McBee and Temple
7. Introduction to Soil Microbiology- Martin Alexander

**Course Code .....: Chemistry-I                                    Marks 100, 4 Credits, 60 Lectures**

1. **Measurements and the Scientific Method:** Measurements, units, SI units, reliability of measurements – precision and accuracy, rounding off, significant figures, significant figures in calculation, mean and median, errors, sources of errors.
2. **Structure of atom:** Atom , isotopes, atomic masses, mass spectroscopy, atomic nucleus, nuclear binding energy, nuclear reactions –fission and fusion reactions, Bohr atom model, spectrum of atomic hydrogen, dual nature of electron, Heisenberg uncertainty principle,

quantum numbers, atomic orbitals, Aufbau principle, Pauli exclusion principle, Hund's rule of maximum multiplicity, electronic configuration of atoms.

3. **Periodic Table:** Periodic law, periodic table, electronic configurations from the periodic table, periodic properties of the elements such as ionization energies, electron affinity, electronegativity, atomic/ionic radius along a period and down a group, diagonal relationship
4. **Chemical Bonds:** Chemical bond, types of chemical bonds – ionic, covalent coordination, metallic, hydrogen, polar and non-polar covalent bonds, Lewis dot structure, shapes of molecules, VSEPR theory, valence bond theory, hybridization,  $\sigma$ - and  $\pi$ -bonding in compounds, molecular orbital theory.
5. **Oxidation and reduction:** redox reactions, writing and balancing redox reactions,
6. **States of Matter:** Comparison between solids, liquids and gases, changes of state, m.p. and b.p, phase transition, phase diagram of water.
7. **Gaseous and Their Properties:** The gas laws, the perfect gas equation, the kinetic theory of gases, Van der Waals equations, real gases, Graham's laws of diffusion and effusion.
8. **Solutions:** Solubility and intermolecular forces, solubility product, types of concentration units, colligative properties, of solutions, Henry's law, Nernst distribution law.
9. **Acids and Bases:** Various concepts on acids and bases, conjugate acids and bases, neutralization reactions acid-base strength, pH, acid-base titrations, acid-base indicators, acid-base properties of salts, the common ion effect, buffer solutions, hard and soft acids and bases.
10. **Chemical Equilibrium:** Reversible reactions and the equilibrium state, the equilibrium law, reaction quotients and equilibrium constants, calculations using  $K_c$ ,  $K_p$ .  
  
Homogeneous and heterogeneous equilibria, the principle of Le Chatelier and Brown.
11. **Hydrocarbons:** Hydrocarbons, saturated and unsaturated hydrocarbons, alkanes, alkenes, and alkynes, nomenclature of organic compounds- the IUPAC system natural gas, petroleum, petrochemicals.
12. **Study of different classes of organic Compounds:** Alcohols, aldehydes, ketones, carboxylic acids, esters, amines and amides.

#### Books recommended:

1. General Chemistry, D. D. Ebbing, Houghton Mifflin Co.
2. Chemistry – The Molecular Nature of Matter and Change, M. Silberberg. WCB /Mc Graw- Hill.
3. Introduction to Modern Inorganic Chemistry, S.Z. Haider, Friends' International.
4. Principles of physical chemistry, M. M. Huque and M. A Nawab, students' publications.
5. Essentials of Physical chemistry, B.S Bahl, G.D Tuli and A Bahl, S. Chand & Co.Ltd.
6. Advanced Organic Chemistry, B.S. Bahl and A Bahl, S. Chand & Co. Ltd.
7. A Level chemistry by C.W. Ramsden
8. Organic Chemistry: T Morrison and R.N Boyed,
9. Fundamental of Organic Chemistry by W Solomons

**Course Code .....: Chemistry-I Practical**

**Marks 100, 4 Credits, 30 Lectures**

1. Preparation of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , Mohr's salt and potash alum.
2. Separation and identification of four radicals from a mixture of anions and cations. The cations are  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$   
 $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ , and  $\text{NH}_4^+$ , the anions are  $\text{NO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$  and  $\text{I}^-$
3. Standardization of NaOH solution using standard oxalic acid solution,
4. Determination of  $\text{Fe}^{2+}$  using standard permanganate solution
5. Iodometric determination of copper(II) using standard  $\text{Na}_2\text{SO}_3$  solution.
6. Gravimetric determination of nickel as  $\text{Ni}(\text{HDMG})_2$  complex
7. Determination of the enthalpy change for the decomposition sodium dicarbonate into sodium carbonate.
8. Determination of the  $\text{p}^{\text{H}}$ - neutralization curves of a strong acid by a strong base.
9. Investigation of the conductance behaviour of electrolytic solution and applications (acetic acid)
10. Determination of the presence of nitrogen, halogen and sulphur in organic compounds.
11. Identification of the functional groups (unsaturation, alcohol, phenol, carbonyl, aldehyde, ketone, carboxylic acid, aromatic amine, amide and nitro- groups) in organic compound.

**Books Recommended:**

1. A Text Book of Quantitative Inorganic Analysis, A.I. Vogel, 3<sup>rd</sup>/4<sup>th</sup> edition, ELBS and Longman Green & Co. Ltd.
2. A Text Book of Quantitative Inorganic Analysis, A.I. Vogel 3<sup>rd</sup> /4<sup>th</sup> edition, ELBS and Longman Green & Co. Ltd.
3. Practical physical chemistry, A Faraday.
4. A Text Book of practical organic chemistry, A.I. Vogel, ELBS edition.

**Course Code .....: Botany -I    Marks 100, 4 Credits, 60 Lectures**

1. Introduction: Origin and evolution of life; differences between plants and animals; modern concepts of classification of living organisms.
2. Microbiology:
  - a) Introduction to Viroids, Prions, Rickettsia and Mycoplasma.

- b) Virus: Physical and chemical nature of phage, plant and animal viruses, multiplication of HIV virus and economic importance.
  - c) Bacteria: Types, fine structure, reproduction and importance.
  - d) Fungi: Habitat, characteristics, classification up to class (Alexopoulos), reproduction, importance, life history of *Saccharomyces*.
  - e) Cyanobacteria: Habitat, characteristics, structure, importance of Cyanobacteria .
  - f) Algae: Habitat, characteristics, classification up to class (Fritsch), reproduction, importance; life history of *Oeodogonium*.
  - g) Phytoplankton: Habitat, characteristics, classification and importance.
3. Lichen: Habitat, characteristics, classification and importance.
  4. Limnology: Definition, scope, importance and classification of lakes.
  5. Bryophyta: Habitat, characteristics, classification up to classes and reproduction; life history of *Riccia* and *Anthoceros*.
  6. Pteridophyta: Habitat, characteristics, classification up to classes, importance; life history of *Selaginella* and *Christella*.
  7. Gymnosperms: Habitat, characteristics and importance; life history of *Cycas* and *Gnetum*.
  8. Angiosperms: Habitat, characteristics, ICBN, classification systems of plant kingdom. (Artificial, natural & phylogenetic). Identifying characters and economic importance of the following families: (a) Fabaceae, (b) Solanaceae and (c) Malvaceae and (d) Poaceae.
  9. Plant Pathology: Concept of diseases in plants, causes, diagnosis, classification and importance of plant diseases, symptomatology and control measures; forecasting of plant diseases.  
Causal organisms, symptoms and control measures of brown spot of rice, stem rot of jute, citrus canker and tungro disease of rice.
  10. Economic Botany: Local and scientific names, parts used and importance of at least 8 prominent plants of each of the following groups: (a) Food, (b) medicine, (c) timber, (d) fibre, (e) oil and (f) vegetables. Cultivation and processing of tea and rubber.

### **Books Recommended**

1. Agrios, G.N. 1997 : Plant Pathology (4th ed.). Academic Press, London.
2. Bold, H.C. and M.J. Wynne. 1978 : Introduction to the Algae, Prentice Hall, India
3. Hawker, Lilian, E. 1967 : Fungi, Hutchinson Univ. Library, Cambridge Univ. Press, London.
4. Lawrence, G.H.M. 1951 : Taxonomy of Vascular Plants. The Macmillan Co. New York.
5. Pelczar, M.J., E.C.S. Chan : Microbiology: Concepts and Applications. McGraw Hill Book Co. and N.R. Krieg. 1993 Inc. New York.
6. Vashista, P.C. 1993 : Botany for Degree Students: Pteridophyta. S.C. Chand & Co. Ltd. Ramnagar, New Delhi.
7. Mukherji, H. and Ganguly, 2000: Plant Groups, Centrl Book Agency, Calcutta.
8. Hill, F.A. 1972. : Economic Botany, Tata McGraw-Hill Publishin Company, India.
9. রায়, শ্যামল কুমার, পাল, নিশীথ কুমার : অপুস্পক উদ্ভিদবিজ্ঞান (১ম ও ২য় খন্ড), বাংলা একাডেমী, ঢাকা ।  
পাশা, মোস্তফা কামাল, ১৯৯৫
10. খান, আজমাজদ আলী এবং : স্নাতক উদ্ভিদ বিজ্ঞান ১ম, ২য় ও ৩য় খন্ড ।

তরিকুল ইসলাম

11. খন্দকার মনিরুজ্জামান, ১৯৯৪ : লিমনোলজী, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা, ঢাকা।
12. বাসার, এম. এ., এম.এ. হাসান এবং  
ম. রফিকুল ইসলাম. ২০০৪ : উদ্ভিদ বিজ্ঞান, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।
13. হাসান, এম. এ. এবং  
এম. কে. আলম. ১৯৯৭ : উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউস, ঢাকা।
14. খাতুন, রাবেয়া, ২০০২ : উদ্ভিদ শ্রেণীবিন্যাস, ইউরেকা বুক এজেন্সি, রাজশাহী।

**Course Code .....: Botany -I Practical Marks 50, 2 Credits, 30 Lectures, Time : 6 hours**

1. Detail study including dissection (where necessary), mounting, drawing, description and identification with classification of the following genera: ..... 10  
Cyanobacteria : *Nostoc, anabaena.*  
Algae : *Chlamydomonas, Oedogonium .*  
Fungi : *Saccharomyces and Ascobolus.*  
Bryophyte : *Riccia and Marchantia.*  
Pteridophyte : *Selaginella, Christella.*  
Gymnosperms : *Cycas.*  
Angiosperm : Poaceae and Fabaceae
2. Identification of the following genera with reasons: ..... 06  
Algae : *Volvox, Polysiphonea and Fucus.*  
Fungi : *Rhizopus, Agaricus, Puccinia and Penicillium.*  
Lichen : Crustose, Foliose and Fructose.  
Bryophyte : *Anthoceros, Semibarbula.*  
Pteridophyte : *Selaginella, Marsilea, Azolla and Pteris*  
Gymnosperms : Male and female cones of *Cycas*,  
Angiosperms : Scientific names of common plants around the institution.
3. Find out algal specimens from local fresh water sample; draw and describe. .... 05
4. Study of the symptoms and causal organisms of Brown spot of rice and stem rot of Jute. .... 05
5. Detailed taxonomic study of the families as included in the theory syllabus. .... 08
6. Study of plant and plant parts, and economic uses of angiosperms included in the syllabus. .... 06
7. Preparation of herbarium specimens of local plants and submission during examination. .... 05

**Books Recommended**

1. Agrios, G.N. 1997 : Plant Pathology (4th ed.). Academic Press, London.
2. Bold, H.C. and M.J. Wynne. 1978 : Introduction to the Algae, Prentice Hall, India
3. Devlin, M.R. and H.F. Witham. 1986 : Plant Physiology (4th ed.). CBS Publishers and Distributors, New Delhi.
4. Esau, K. 1953 : Plant Anatomy. John Wiley & Sons, Inc., New York.
5. Goodwin, T.W. and E.I. Mereer. 1983 : Introduction to Plant Biochemistry (2nd ed.). Pergamon Press.
6. Hawker, Lilian, E. 1967 : Fungi, Hutchinson Univ. Library, Cambridge Univ. Press, London.
7. Kumar, H.D. 1995 : General Ecology, Vikash Pub. House, India.
8. Lawrence, G.H.M. 1951 : Taxonomy of Vascular Plants. The Macmillan Co. New York.
9. Pelczar, M.J., E.C.S. Chan and N.R. Krieg. 1993 : Microbiology: Concepts and Applications. McGraw Hill Book Co. Inc. New York.
10. Vashista, P.C. 1993 : Botany for Degree Students: Pteridophyta. S.C. Chand & Co. Ltd. Ramnagar, New Delhi.
11. পাশা, মোস্তফা কামাল রায়, শ্যামল কুমার, ১৯৮৬ : ব্যবহারিক উদ্ভিদবিজ্ঞান, বাংলা একাডেমী, ঢাকা।
12. আখতারুজ্জামান, ম. : বংশগতি বিদ্যা, হাসান বুক হাউজ, ঢাকা।
13. আখতারুজ্জামান, ম. ২০০০ : বিবর্তন বাদ, হাসান বুক হাউজ, ঢাকা।
14. ইসলাম, এ.এস. ১৯৮৪ : বংশগতি বিদ্যার মূল কথা, বাংলা একাডেমী, ঢাকা।
15. কর্মকার, যদুলাল. ২০০০ : উদ্ভিদ শরীর বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।
16. খান, আমজাদ আলী এবং তরিকুল ইসলাম : স্নাতক উদ্ভিদ বিজ্ঞান ১ম, ২য় ও ৩য় খন্ড।
17. খন্দকার মনিরুজ্জামান, ১৯৯৪ : লিমনোলজী, ঢাকা বিশ্ববিদ্যালয় প্রকাশনা, ঢাকা।
18. জামান, এম. এ. ১৯৭৫ : কোষবিদ্যা, বাংলা একাডেমী, ঢাকা।
19. বাসার, এম. এ., এম.এ. হাসান এবং ম. রফিকুল ইসলাম. ২০০৪ : উদ্ভিদ বিজ্ঞান, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।
20. হাসান, এম. এ. ১৯৯৬ : বাংলাদেশের ভেষজ উদ্ভিদ, আশরাফিয়া বই ঘর, বাংলা বাজার, ঢাকা।
21. হাসান, এম. এ. এবং এম. কে. আলম. ১৯৯৭ : উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউস, ঢাকা।