

MASTER OF SCIENCE (ENVIRONMENTAL SCIENCE) – FOURTH SEMESTER

Fourth Semester			
S. No.	Name of Subject	Credits	Total Marks
1	Natural Resource and Biodiversity Conservation	5	100
2	Hydrogeochemical Processes	5	100
3	Environmental Plant Physiology and Biochemistry	5	100
4	Solid Waste Management and Technology	5	100
5	Project	4	100
Total		24	

Subject Name: NATURAL RESOURCE AND BIODIVERSITY CONSERVATION

Natural resource - introduction to earth's natural resources, types of natural resources and their classification, value of natural resources, extraction and uses of natural resources-linkages and benefits. Potentiality of natural resources for economic and livelihood development.

Conservation and management of natural resources- humans and conservation vice-versa, conservation and protection, sustainable use of natural resources. Natural resource management approaches: Community based natural resource management (CBNRM) and Integrated natural resource management (INRM).

Biodiversity - understanding biodiversity, dimensions of biodiversity, taxonomic diversity, speciation and extinction of species, mass extinction events, measurement of biodiversity: diversity indices. Megadiverse countries, Ecoregions, Biodiversity hotspots. Importance of biodiversity, threats to biodiversity, causes and consequences of biodiversity loss, biodiversity and vulnerability to climate change, biodiversity and human health.

Natural resources and biodiversity in India and Northeast India- biogeographic region of India, significance of NE India biodiversity, important forest resources and their diversity in NE India -medicinal plants, bamboo, orchids, palms, rattans, timbers, gymnosperm etc. Endemic and rare species biodiversity conservation with reference to NE India. Case studies.

Conservation of biodiversity: in situ and ex situ, selection criteria for protection of species, IUCN conservation status, Red Data book, ethics in conservation of biodiversity. Biodiversity related national and international conventions and organizations.

Management of biodiversity - Sacred groves, Community reserve forest, Reserve forests, National Parks, Wildlife Sanctuary, Biosphere Reserve, Private/corporate forest. Traditional ecological knowledge, CBD, Participatory Rural Appraisal (PRA), Constrains of conservation.

Suggested Readings:

1. Krishnamurthy K. V., Textbook of Biodiversity, CRC Press, 2003.pp. 276.
2. Krishnamurthy K. V., An Advanced Textbook on Biodiversity: principles and Practice, Oxford & IBH Pub. Co. Pvt. Ltd., 2008.
3. Maiti Prabodh K. and Maiti Paulami., Biodiversity: Perception, Peril and Preservation, PHI, New Delhi, 2001. pp.560.
4. Anne, E. Magurran. (2003). Measuring Biological Diversity. Wiley-Blackwell, pp-264.
5. Anne, E. Magurran and Brian, J.(2010). Biological Diversity Frontiers in Measurement and Assessment. McGill (Eds.), Oxford University Press. pp-368.
6. Joshi, P. C. and Joshi, N. (2004). Biodiversity and conservation. A.P.H. Pub., pp- 384.
7. Gabriel, Melchias. (2001). Biodiversity and conservation. Science, University of Michigan, pp-.236
8. Pandey, B.N. (2012). Biodiversity Issues Threats and Conservation. Narendra Publishing, pp.-202.
9. Navjot, S. Sodhi and Paul R. (2010). Conservation Biology for All. Ehrlich (Eds.), Oxford University Press. pp-360.
10. Gary A. Klee. (1991). Conservation of Natural Resources. Prentice Hall College Div., pp. 1180.
11. Rai, G. D. (1997). Non-conventional energy sources. Khanna Publishers, New Delhi. pp. 912.

Subject Name: HYDROGEOCHEMICAL PROCESSES

Catchment hydrology-The global system, fluxes, reservoirs, and residence times; Evaporation, condensation, precipitation; Regional water balances and resources; Structure and properties of water; Precipitation and Interception; Water and energy balance, Subsurface flow; Infiltration and soil moisture; Hydrographs.

Groundwater transport - Water in natural formations (aquifer, aquitard, aquiclude etc); Hydraulic head; conductivity, permeability, storativity, and porosity; Darcy's law, advection, dispersion, adsorption and decay; Steady state groundwater flow & Flow nets; Forces on water in the unsaturated zone; Tracer techniques.

Understanding of hydrogeochemical processes-Measurements and interpretation of water quality data; Identification of hydrogeochemical processes through Major ion chemistry, Graphical presentation and Statistical analyses; Groundwater flow and transport models; Modeling runoff and PhreeqC, MINTEQA.

Chemical Weathering- Clay mineralogy, Cation exchange and Carbonate mineral equilibrium; Silicate weathering, Carbonate weathering, Contaminant transport Adsorption processes; Hydrogeochemical processes and its role in contemporary environmental scenario.

Arsenic and fluoride hydrogeochemistry; Remote sensing and hydrological networks; Desalination, Controlling demand and waste; Integrated water resources management; Case studies.

Suggested Readings:

1. Hornberger, G.M., Raffensberger, J.P., Wiberg, P.L., and Eshleman, K.N. (1998) Elements of physical hydrology. Johns Hopkins University Press, Baltimore, 302p.
2. Fetter, C.W., Applied Hydrogeology 4rd ed. (2001). This text will be supplemented by material from Freeze, A. and Cherry, J., Groundwater (1979),
3. Chow, V.T., Maidment, D.R. and Mays, L.W., Applied Hydrology (1988), Dingman, S.L., Physical Hydrology (1998).
4. Todd, D.K. Ground water Hydrology, John Wilay and Sons, N.Y.,USA.

Subject Name: ENVIRONMENTAL PLANT PHYSIOLOGY AND BIOCHEMISTRY

Plant growth and development in relation to environmental stress -water and temperature stress, drought stress and resistance

Anaerobiosis in soils, the effect of anoxia on plant metabolism, plant adaptation, survival and growth in waterlogged soils.

UV radiation and its effect on cellular processes and metabolism.

Effect of air pollutants in light reactions in chloroplasts, photosynthesis, photorespiration and dark respiration, membrane transport

Physiological and molecular aspects of plant tolerance to atmospheric pollutants

Oxyradicals and scavenging systems, enzyme system associated with plant defense mechanisms, superoxidedismutase, role of stomata in plant defense system

Bioconversion of pollutants- active vs. inactive process Enzymatic degradation by monooxygenase

Role of cytochrome P 450 and its multiple forms. Metal toxicity: metal biomacromolecule interaction.

Suggested Readings:

1. Fitter A.H. and Hay R.K.M., Environmental Physiology of Plants, Third edition, Academic Press, 2001.
2. Park S. Nobel., Physicochemical & Environmental Plant Physiology (3rd Edition) Academic Press, 2005
3. Levitt J., Responses of Plants to Environmental Stress, Volume-I, Second edition, Academic Press, New York,1972.
4. Lehninger, A.(1993). Biochemistry, Kalyani Publishers.
5. Taiz, L.and Zeiger, E.(1998). Plant Physiology, Sinauer Associates.
6. Pintan, Roberto., Varanini, Zeno. and Nannipieri, Paolo. (editors).(2007).The Rhizosphere- Biochemistry and Organic Substances at the Soil Plant interface 2nd Edition, CRC Press.
7. Voet, D. and Voet, J. (2004). Biochemistry, John Wiley and Sons.
8. Roger, R. (2001). Hand Book of Plant Ecophysiology Techniques, Kluwer.

Subject Name: SOLID WASTE MANAGEMENT AND TECHNOLOGY

Municipal Solid waste –Definitions, sources, generation, segregation, classification and physico-chemical characterization; principles of solid waste management; Hazardous wastes: definition, source, effects and management; Biomedical wastes: definition, source, effects and management; E-waste generation & management; Eco friendly disposal methods of solid wastes.

Flyash: definition, source, effects and management

Waste treatment technologies for resource and energy recovery - basic principles; techniques of resource & energy recovery; composting, vermicomposting, microbial decay, anaerobic digestion, incineration, pyrolysis.; landfill engineering and leachate management; mining of old landfills; advances in waste recycling and recovery technologies to deliver added-value products.

Interface of waste and resource management and engineering in the context of sustainable waste management in global cities and developing countries; life cycle analysis.

Suggested Readings:

1. White P.R. et al, Integrated Solid Waste Management, Lewis Publisher, 1989.
2. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Govt. of India, New Delhi, 2000
3. David L.H.F. and Liptak D. G., Hazardous waste and solid waste, Lewis Publisher, 2000
4. Oberoi N.K, Environmental Management, (2nd Edition) Excel Books, New Delhi, 2003.

Subject Name: PROJECT

Note: The Normal Rule and Regulation pertaining to the Examination and other issues will be applicable in Faculty of Science as per Arunachal University of Studies Act 2012, Subsequent Statute and Rules & Regulation