

DETAILED COURSE CONTENTS (SYLLABI) OF THE COURSES OFFERED (JAN-JUNE, 2019)
FOR M.SC ENVIRONMENTAL SCIENCES

SEMESTER -IV

ENV 575 – M.Sc. Dissertation

[6 Credits]

The work will be based on the specialization of respective supervisor

ENV 412- Analytical Technique

[2 Credits]

Unit I

Computation of analytical results, significant figures, concept of error, precision and accuracy, standard deviation, rejection of doubtful values with special reference to volumetric and gravimetric analysis, calibration of analytical equipments.

Unit II

Methods of expressing concentrations, primary and secondary standards. Theory and indicators for neutralizations, oxidation- reduction, precipitation titration.

Unit III

Method of gravimetric analysis, physical gravimetry, thermogravimetry and combustion analysis, precipitative gravimetric analysis, electrodeposition.

Unit IV

Complexometric titrations: Complexometric methods using EDTA, principle of complexometric titrations, chelating agents, indicators, titrations with disodium edetate.

Unit V

Nonaqueous titrations: General discussion and principle of titrations in non-aqueous media, aprotic, protophil protogenic and amphiprotic solvents.

ENV 428 – Himalayan Geology

[2 Credits]

Unit I

Introduction, importance and significance of Himalaya, their morphology, What is faults, folds, their definitions and their types and classifications.

Unit II

Internal structure of Earth, Internal structure of Earth, fundamental characteristics of crust, mantle, core; fundamentals on rock-forming minerals; weathering and erosion of rocks and minerals. Concept of plate tectonics, types of plate boundaries, features of convergent and divergent boundaries, causes of plate motion, dynamic evolution of continental and oceanic crust, Sea floor spreading, morphological features of ocean floor.

Unit III

Sedimentary rocks their types and classification, metamorphic rocks their classifications. Geosynclines: Classification and evolution of Geosyncline, causes of subsidence and upliftment.

Unit IV

Origin of Himalayas, different phases in evolution of Himalaya. Study of major groups and formations of Himalaya, lithology and thrust boundaries – HFF (Himalayan frontal fault), MBT (main boundary thrust), MCT (main central thrust), STD (south Tibetan detachment), indo-Tsangpo suture zone.

Unit V

Earth's Earthquake seismology, palaeoseismology, seismites, Seismology: seismic waves, intensity and isoseismic lines, earthquake belts. Earthquake zones of India, Seismograph, causes of earthquake in Himalaya.

ENV 561 – Science of Climate Change

[2 Credits]

Unit I

The Climate System: an overview: Weather Vs Climate, Components of the Climate System, The Driving Forces of Climate, Climate Parameters and Data-sets available to study Climate Change, Observed Natural Vs Anthropogenic Climate Change

Unit II:

Human and Natural Drivers of Climate Change: The Sun and The Earth Geometry, Milankovitch Cycles, Solar Constant, The Effect Temperature of the Earth, Green House Effect, The concept of Radiative Forcing, Climate Sensitivity

Unit III

Radiative effects of Aerosol and Gases: Greenhouse gases: Halocarbon radiative forcing and radiative forcing due to stratospheric ozone changes, Tropospheric Aerosols: Direct forcing due to Sulphate aerosols and Soot aerosols, Indirect forcing due to effect of aerosols on cloud properties, Stratospheric Aerosols

Unit IV

Observations of Changes in Climate: Atmospheric Changes: Instrumental Record, Changes in the Ocean: Instrumental Record, Changes in the Cryosphere: Instrumental Record, A Palaeoclimatic Perspective, Extreme Weather Events.

Unit I

Importance of geology in civil engineering: geological properties of rocks used in civil engineering- porosity, density, absorption. Effects of load imposed on rocks and stones - compressive stress and strength of rocks, tensile stress, tensile strength, elasticity of rocks. Geological properties of stones and road materials.

Unit II

Ecological considerations in construction of dams, its parts and its types. Silting and de-silting of dam reservoirs. Types of bridges and tunnels and geological considerations for construction of tunnels and Bridges.

Unit III

Landslides and classification, its causes and effects. Slope, slope angle, and slope analysis, angle of repose.

Unit IV

Problems of ground water in engineering projects. Geo technical study of Bhakra Nangal projects.

Unit V

Instrumentation in Geo-engineering like Standard penetration test, Spectral analysis of surface waves and Multichannel analysis of surface waves for shear wave velocity/ stiffness of the soil column and their applications Case studies with type example.

Unit I

Introduction to Microbes and definition of Microbiology, History of Microbiology-brief overview of contribution of: Anton Van Leeuwenhoek, Louis Pasteur (Pasteurization, Fermentation, Vaccination), Koch's postulates; Impact of Microbiology on Medicine and Public Health, Modern Environmental Microbiology-Historical perspective, Scope and relevance

Unit II

Challenges for Environmental Microbiology- Disease challenge, Bioremediation, Molecular Analysis, Bioremediation: A weapon to tackle oil spills - *Pseudomonas putida* Superbug of Anand Chakravarty-a solution to the oil pollution

Unit III

Single Cell Proteins (SCP): Introduction, definition, brief account of various microbes used as SCPs, SCP (e.g. TOPRINA, PRUTEEN, TORUTEIN); Microbial Biofilms.

Unit IV

Microbial Communication: Introduction, Communication via quorum sensing in Gram Negative Bacteria- N-Acyl Homoserine Lactones (AHLs), Quorum sensing in Marine Squid and *Agrobacterium tumefaciens.*, *Vibrio harveyi* Bioluminescence.

Unit I: Glacier Mass Balance and Processes

Surface mass balance, Mass balance variations of mountain glaciers, Englacial mass balance, Basal mass balance, Mass loss by calving, Glaciological method for determining glacier mass balance.

Unit II: Glacier Hydrology

Surface hydrology, Englacial hydrology, Subglacial Hydrology, Runoff from glaciers, Methods for determining glacial runoff

Unit III: Recent Advances in Glaciology

Glacial remote sensing, Glacier Hazard monitoring, Palaeo – climatology, Glacial surges, Different instruments used for studying glacier fluctuations.

Unit IV: Status of Glaciological Research

A global overview, Indian scenario, Polar Research (Arctic and Antarctic scientific expeditions)

EVN 546 Renewable and Non renewable Energy potential in HP State

[2 Credits]

Unit I

Introduction to renewable and non renewable energy resources, status of renewable and non renewable energy resource in Himachal Pradesh.

Unit II

Various energy options for Himachal Pradesh, renewable energy resource in Himachal Pradesh, District wise study of energy resources and energy need, renewable energy resources (solar, wind, ocean, hydropower and biomass) potential in Himachal Pradesh and its development status.

Unit III

Importance of renewable energy for sustainable development, renewable energy resources as a future of our society, various non renewable energy resource potential and status of its development.

Unit IV

Advantages and disadvantages of renewable and non renewable energy resource, decentralize renewable energy plan.

FOUNDATION COURSES (SEMESTER-II)

ENV 441 Water Resource Conservation in Hilly Region (Human Making Course)

[2 Credits]

Unit I

Brief outline of historic development, Water usage in evolution of history, Water Resources Development Scenario, Global and Indian Water Scenario

Unit II

World water resources: dimension and challenges, Hydrological cycle, Global water supply-demand management, Environmental impacts and water resource management

Unit III

Groundwater, structures of aquifers, Aquifer capacity, Determining aquifer flow velocity-Darcy Law, Integrated water resource management (IWRM) and virtual water

Unit IV

Water harvesting techniques in hilly region, Artificial ground water recharge techniques and designs: artificial recharge techniques, direct methods, combination methods, ground water conservation techniques both modern and traditional, Snow harvesting, roof top harvesting and dew drop harvesting, Sustainable agriculture and irrigation

ENV 528 Nanotechnology and Environment (Skill Development course)

[2 Credits]

Unit I

Introduction to nanomaterials, properties of materials & nanomaterials, role of size in nanomaterials, 0D, 1D, 2D structures – size effect – fraction of surface atoms – specific surface energy, different classes of nanomaterials quantum dots, wells and wires.

Unit II

Physical method of synthesis of nanoparticles, chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and co-precipitation, chemical vapor deposition (CVD), nucleation and growth of nanoparticles, synthesis of metal and semiconductor nanoparticles by colloidal route, microemulsions

Unit III

Experimental Techniques: Scanning and Transmission electron microscopy, difference between SEM and TEM, X-ray diffraction, Scherrer equation and its limitation,

Unit IV

Advanced nanomaterials for drug delivery and cancer therapy, dye sensitized photovoltaic solar cell.