Department of Botany

Raghunath Girls' Post Graduate College, Meerut

I- **Disaster Management system in India**

Programme/Class: **Certificate Course**	Year: **I**	Semester**: I/II** **Paper- Minor/ Elective**
Subject: Offered by **Botany**		
Course Code: Q10006	Course Title: **Disaster Management system in India**	

Course outcomes:

1. The course focuses on basic concept of disaster(s) and disaster management, their significance andtypes.
2. The course will enable to develop the analytical skills to study relationship between vulnerability,disasters, disaster prevention and risk reduction.
3. The knowledge creates awakened group for integrated disaster management in the country.
4. It will enable young people in each city district or village to understand and explore avenues of reducing disaster risks and work towards preparedness and contribute towards minimizing losses andsaving lives.

Unit	**Topic**	**No. of L+T(75 hrs)**
I	Overview and understanding of Disaster, definitions of Disaster, Hazard, Vulnerability,Resilience and Risks.	**8**
II	Classification of disaster, natural hazards and Man-made disasters, Causes and socialimpacts, urban disasters, pandemics and climatic change.	**10**
III	Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and otherstake-holders. CBRN disaster, NDMA, NDRF, NIDM, STATE DM.	**12**
IV	Disaster Risk Management in India: Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Fire, WasteManagement Institutional arrangements	**12**
V	Mitigation, Response and Preparedness, DM Act and Policy, Other related policies,plans, programmes and legislation	**11**
VI	Disaster-induced Refugee problem – Problems of women and children during disasters;Principles of psycho-social care, issues and recovery Relationship between disasters, development and vulnerabilities	**8**
VII	Equity issues in disasters; Issues of rehabilitation and resettlement of survivors; Stakeholdersin disaster relief management	**6**
VIII	Disaster risk reduction – Strategies, Preparedness plans, Action Plans and procedures, EarlyWarning systems; Factors contributing to vulnerability. Capacity building	**8**

Department of Botany

Raghunath Girls' Post Graduate College, Meerut

II- **Global Environment and Challenges**

Programme/Class: **Diploma Course**	Year: **II**	Semester: **III/IV** **Paper- Minor/ Elective**
Subject: Offered by **Botany**		
Course Code: Q10013	Course Title: **Global Environment and Challenges**	

Course outcomes:

1. To acquaint the students with complex environment and global change driven by humans, their impactand mitigation;
2. To make them understand importance of biodiversity, conservation and its rolein maintaining structure and health of global ecology.
3. This knowledge is critical in understanding the adverse impact of human's consumeristnature, evolving strategies for sustainable development and natural resource management.
4. It will enable the students to know more about the challenges posed by massive economicgrowth, reckless development, unplanned strategies, and over utilization of natural resources.
5. It will facilitate the students to critically examine the leading discussion and practices of development, so as to enable them to participate effectively in decision making at various levels.

Unit	**Topic**	**No. of Lectures + Tutorials (75 hrs)**
I	Global Change: Driving factors, Anthropocene characteristics; Global land cover and land use change; Multiple impacts of land use change; Global climate change: Causes, effects andmitigation strategies; stratospheric ozone loss	**12**
II	Environmental Pollution: Causes and effects of air, water, soil, noise, radioactive pollution;Basic pollution abatement practices and technologies; Role of plants in reducing pollution impact	**14**
III	Invasive Ecology: Biotic Invasions; Invasive Alien Species (IAS), Invasibility characteristics, Phenotypic plasticity; Extent and mechanisms of biological invasions; Ecological and economic impacts; Management strategies	**10**
IV	Loss of Biodiversity: Biodiversity as indicator of well-being of an ecosystem; hot spots, ecotourism Threats and pattern of biodiversity loss - Natural and anthropogenic causes; IUCN threatcategories, Red data books; Conservation and restoration of biodiversity - Indian socio- cultural value system for nature's conservation.	**8**
V	Global Water Crisis: Distribution, withdrawal and consumption patternsCauses and effects of water crisis; Water conservation approaches	**8**

VI	Global Energy Crisis: Sources of energy supply; Current potential and future prospects ofenergy sources; Energy crisis; Energy conservation strategies	**8**
VII	Challenges of Urbanization: Trends of urbanization; Environmental impact of urbanization;Concept of green cities and sustainability.	**8**
VIII	Agro-Ecological Construction Strategies: Ecological home garden, medicinal plant garden, Kitchen garden; Vertical Stratification principle and application; man-made plant/forest communities (fruit-tree/commercially important tree/medicinal plant/ pepper /tea/ coffee/ creeper or climber-crop plant combinations); home/kitchen recyclable wastes (urban/rural) and Applied leaf biomass as manure in ecological constructions. Every household as experimental station.	**7**

DEPARTMENT OF BOTANY

RAGHUNATH GIRLS' POST GRADUATE COLLEGE, MEERUT

B.Sc. (NEP 2020) Syllabus

B.Sc. Ist Sem **Microbiology & Plant Pathology**	
Units	**Topics**
I	**A. Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists (in all branches), in context with the holistic development of modern science and technology, has to be taught, practiced and assessed via class interaction/ assignments / self-study mentioned under Continuous Internal Evaluation (CIE).** **B. Microbial Techniques & instrumentation** Microscopy – Elementary knowledge of Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy. Common equipment of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge. Colorimetry and spectrophotometry, immobilization methods, fermentation and fermenters.
II	**Microbial world** Cell structure of Eukaryotic and prokaryotic cells, Gram positive and Gram-negative bacteria, Structure of a bacteria and plasmids; Bacterial Chemotaxis and Quorum sensing, Bacterial Growth curve, factors affecting growth of microbes; measurement of growth; Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes; Sporulation and reproduction and recombination in bacteria. Viruses, general characteristics, viral culture, Structure of viruses,TMV and retro viruses, Bacteriophages, Structure of T4 &, λ-phage; Lytic and Lysogenic cycles, mycophages, viroid, Prions & mycoplasma & phytoplasma, Actinomycetes (Actinobacteria) and their economic uses.
III	**Phycology** Range of thallus organization in Algae, Pigments, Flagella, Reserve food, Types of Reproduction, Classification and comparative life cycle of –

	Nostoc, Chlorella, Volvox, Oedogonium, Chara; Ectocarpus, Sargassum, Polysiphonia. Phycoviruses, Economic importance of algae - Role of algae in soil fertility- biofertilizer – Nitrogen fixation- Symbiosis; Commercialproducts of algae –biofuel, Agar, Diatomite.
IV	**Mycology** Comparative study of general characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class. Distinguishingcharacters of **Myxomycota**: General characters of **True Fungi (Eumycota)**: Mastigomycotina *Synchytrium*: **Zygomycotina**: *Rhizopus,* **Ascomycotina:** *Saccharomyces, Penicillium, Peziza*. **Basidiomycotina:** *Ustilago, Puccinia, Agaricus;* **Deuteromycotina:** *Fusarium,Alternaria*. Heterothallism, Physiological specialization, Heterokaryosis & Parasexuality,
V	**Mushroom Cultivation, Lichenology & Mycorrhiza** Mushroom cultivation. General account of lichens, reproduction and significance; *Mycorrhiza: ectomycorrhiza* and *endomycorrhiza* and their significance.
VI	**Plant Pathology** Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inoculum, Infection, Pathogenicity and pathogenesis, Koch's Postulates. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post- penetration), Disease cycle (monocyclic, polycyclic and polyetic). Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic fungicides- Bordeaux mixture, Lime Sulphur, Tobacco decoction, Neem cake & oil
VII	**Diseases and Control** Symptoms, Causal organism, Disease cycle and Control measures of – Early & Late Blight of Potato, Black Stem Rust of Wheat, *Alternaria* spot' and 'White rust of Crucifers, Red Rot of Sugarcane, Wilting of Arhar, Mosaic diseases on tobacco and cucumber, yellow vein mosaic of bhindi; Citrus Canker, Little leaf of brinjal; Damping off of seedlings, Disease management: Quarantine, Chemical, Biological, Integrated pest disease management
VIII	**Applied Microbiology** Elementary knowledge of Food fermentations and food produced by microbes, Production of amino acids, antibiotics, enzymes, vitamins, alcoholic beverages, organic acid & genetic recombinant vaccines. Mass production of bacterial biofertilizers, blue green algae, *Azolla* and *mycorrhiza*. Plant growth promoting rhizobacteria & biopesticides— *Trichoderma sp.* and *Pseudomonas*, Single cell proteins (*Spirulina)*, Organic farming inputs, Microbiology of water, Biopolymers, Bioindicators, Biosensors, Bioremediation, Production of biofuels, Biodegradation of pollutants and Biodeterioration of materials & Cultural Property. Microbial Biofactories (*E.coli* and Yeast) for production of recombinant proteins

B.Sc. IInd Sem

Archegoniates and Plant Architecture

Units	Topics
I	**Introduction to Archegoniates & Bryophytes** Unique features of archegoniates, Bryophytes: General characteristics, adaptations to land habit, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Riccia, Marchantia , Anthoceros, Sphagnum and Funaria*. (Developmental details not tobe included). economic importance of bryophytes
II	**Pteridophytes** General characteristics, Early (fossil)land plants (*Rhynia*). Classification (up to family) with examples, Heterospory and seed habit, stelar evolution, economic importance of Pteridophytes. Comparative study of morphology, anatomy and reproduction of *Selaginella, Equisetum and Azolla*.
III	**Gymnosperms** Classification and distribution of gymnosperms; Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, their examples with special reference to *Cycas, Ginkgo,Pinus*, *Ephedra*, structure and reproduction; economic importance
IV	**Palaeobotany** General account of Cycadofilicales, Bennettitales, Pentoxylales and Cordaitales; Geological time scale; Brief account of process of fossilization & types of fossils and study techniques;
V	**Angiosperm Morphology** Morphology and modifications of roots; stem, leaf and bud. Types of inflorescences;flowers, flower parts, fruits and types of placentation; Definition and types of seeds.
VI	**Plant Anatomy:** Meristematic and permanent tissues, Organs (root, stem and leaf). Apical meristems & theories on apical organization. Secondary growth - Root and stem- cambium (structure and function) annual rings, Periderm, Anomalous secondary growth - *Bignonia, Boerhaavia, Dracaena, Nyctanthes*
VII	**Reproductive Botany** Plant Embryology, Structure of microsporangium, microsporogenesis, Structure of megasporangium and its types, megasporogenesis, Structure and types of female gametophyte,Types of pollination, Methods of pollination, Germination of pollen grain, Structure of male gametophyte, Fertilization, Structure of dicot and monocot embryo, Endosperm, Double fertilization, Apomixis and Polyembryony.
VIII	**Palynology:** Pollen structure, pollen morphology, pollen allergy, Applied Palynology: Basic concepts, Palaeopalynology, Aeropalynology, Forensic palynology, Role in taxonomicevidences.

B.Sc. III Semester

Flowering Plants Identification &Aesthetic Characteristics

Unit	Topic
I	**Taxonomic Resources & Nomenclature** Components of taxonomy (identification, nomenclature, classification) ; Taxonomic resources: Herbarium- functions & important herbaria, Botanical gardens, Flora, Artificial Keys. Binomial Nomenclature:Principles and rules of Botanical Nomenclature according to ICN (ranks and taxa;principle of priority, type method, author citation, valid publication).
II	**Types of classification & Evidences** Artificial, natural and phylogenetic. Bentham and Hooker (upto series), Takhtajaan, Angiosperm Phylogeny Group (APG IV) classification.Introduction to taxonomic evidences from cytology, phytochemistry & Molecular biology data (Protein and Nucleic acid homology).
III	**Identification of Angiospermic families -I: (Families can be chosen University wise as per local available flora)** A comparative study of the following families with emphasis on the morphological peculiaritiesand economic importance of its members (based on Bentham & Hooker's system) Ranunculaceae, Papaveraceae, Malvaceae, Rutaceae, Fabaceae, Myrtaceae , Cucurbitaceae, Apiaceae, Rubiaceae, A s t e r a c e a e .
IV	**Identification of Angiospermic families -II: (Families can be chosen University wise as per local available flora)** A comparative study of the following families with emphasis on the morphological peculiaritiesand economic importance of its members (based on Bentham & Hooker's system)- Apocynaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Liliaceae, Musaceae, Poaceae.
V	**Phylogenetic systematics:** Brief idea on Phenetics, Biometrics (Neighbour joining), Cladistics: Basics and Methodology; Supraspecific taxa (Monophyletic, polyphyletic and paraphyletic groups); Plesiomorphy and Apomorphy).
VII	**TOOLS & SOFTWARES IN PLANT IDENTIFICATION-** GIS (Mapping of (i) Patterns(ii) Features (iii) Quantities Free Phylogenetic Software: PAUP and MESQUITE Digital Taxonomy (e-flora), Description Language for Taxonomy – DELTA Internet directory for Botany.
VII	**Computer usage, Android Applications & Character Analysis** MS Office: PPT, Microsoft Excel, data entry, graphs,. GPS tagging, Plant Identification Apps. Concept of Character, Selection of characters, Character coding, Character step matrix, Character x Taxon Matrix
VIII	**Aesthetic Characteristics of Plants:** Elementary knowledge of Aesthetic characteristics of plants, English, Italian, French, Persian, Mughal and Japanese; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Trees, shrubs and shrubberies, climbers and creepers, rockery, Flower beds, Shrubbery, Borders, Water garden). Some Famous gardens of India. Conservatory, green houses, Indoor garden, Roof garden, Topiary, Bonsai.

B.Sc IVth Semester

Economic Botany, Ethnomedicine & Phytochemistry

Unit	Topic
I	**Origin and domestication of cultivated plants** Centers of diversity of plants, origin of crop plants. Domestication and introduction of crop plants. Concepts of sustainable development; cultivation, production and uses of Cereals, legumes, Spices & beverages.
II	**Botany of oils, Fibers, timber yielding plants & dyes** Study of the plants with Botanical names, Family, part used, and economic uses yielding Edible & essential oils; Sugar, Starch; Fibers; Paper, Fumigatories & Masticatories, Rubber, Dyes, Timber,biofuel crops.
III	**Commercial production of Flowers, Vegetables, and fruits (To be Chosen area wise)** Commercial greenhouse cultivation of rose, *Gerbera, Gladiolus, Anthurium*/lilium/lily, tomato, bell pepper, cucumber, strawberry & Exotic leafy vegetables using Hydroponics.
IV	**IPR & Traditional Knowledge** IPR and WTO (TRIPS, WIPO), Patent Act 1970 and its amendments, TIFAC, NRDC, Rights, Procedure of obtaining patents, Working of patents, Infringement, Copyrights, Trademarks, Geographical Indications, Traditional Knowledge Digital Library, Protection of Traditional Knowledge & Protection of Plant Varieties and Biotech inventions.
V	**Ethnobotany** Methodologies of ethnobotanical research: Field work, Literature, Herbaria and Musea and other aspects of ethnobotany. Importance of ethnobotany in Indian systems of medicine (Siddha, Ayurveda and Unani), Role of AYUSH, NMPB, CIMAP and CARI. Tribal knowledge towards disease diagnosis, treatment, medicinal plants, plant conservation and cultivation.
VI	**Medicinal aspects** Study of common plants used by tribes (*Aegle marmelos, Ficus religiosa, Emblica officinalis, Eclipta alba, Rauvolfia serpentina, Oxalis and Ocimum sanctum)* Ethnobotanical aspect of conservation and management of plant resources, Preservation of primeval forests in the form of sacred groves of individual species and Botanical uses depicted in our epics. Plants in primary health care*:* common medicinal plants*: Tinospora, Acorus, Ocimum, Turmeric* and *Aloe*. Indian Pharmacopeia, Quality Evaluation of crude drugs & adulteration
VII	**Pharmacognosy** Preparation of drugs for commercial market - Organoleptic evaluation of drugs - Microscopic evaluation of drugs - Physical evaluation of drugs - Active and inert constituents of drugs - Classification of drug plants - individual drugs - drug adulteration. Sources of crude drugs – roots, rhizome, bulb, corm, leaves, stems, flowers, fruits and seeds ; organoleptic study of *Adhatoda vasica, Andrographis paniculata, Azadirachta indica, Coriandrum sativum, Datura metel, Eclipta alba, Emblica officinalis, Ocimum sanctum,* *Phyllanthus amarus, Ricinus communis, Catharanthus roseus* and *Zingiber officinale.*
VIII	**Herbal Preparations & Phytochemistry :** Collection of wild herbs - Capsules - compresses - Elixirs - Glycerites - Hydrotherapy or Herbal bath - Herbal oils - Liquid extracts or Tincture - Poultices - Salves - Slippery elm slurry and gruel - Suppositories - Teas. Plant natural products , general detection, extraction and characterization procedures. Glycosides and Flavonoids and therapeutic applications. Anthocyanins and

B.Sc. Vth Semester Plant Physiology, Metabolism & Biochemistry (Paper 1)	
Unit	**Topic**
I	**Plant water relation, Mineral Nutrition, Transpiration and translocation in phloem** Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation. Criteria of essentiality of elements; Role of essential elements; Symptoms of mineral deficiency in major crops, Transport of ions across cell membrane, active and passive transport, Composition of phloem sap, girdling experiment; Pressure flow model.
II	**Carbon Oxidation** Krebs cycle, Glycolysis, fate of pyruvate- aerobic and anaerobic respiration and fermentation, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of Krebs cycle, mitochondrial electron transport, oxidative phosphorylation, ATP-Synthetase, Chemiosmotic mechanism, P/O ratio, cyanide-resistant respiration, factors affecting respiration.
III	**Nitrogen Metabolism** Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes), Physiology and biochemistry of nitrogen fixation, Ammonia assimilation (GS-GOGAT), reductive amination and transamination, amino acid synthesis.
IV	**Lipid Metabolism & Photosynthesis** Lipid Metabolism: Synthesis and breakdown of triglycerides, -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilization of lipids during seed germination, -oxidation. ; Photosynthesis: Pigments, Action spectra and Enhancement effect, Electron transport system and Photophosphorylation, C3 & C4 photosynthesis, CAM- Reaction and Significance
V	**Plant Development, Movements, Dormancy & Responses** Developmental roles of Phytohormones (auxins, gibberellins, cytokinins, ABA, ethylene.) autonomic & paratonic movements, Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red-lightresponses on photomorphogenesis, Seed physiology & Dormancy, Vernalization & Senescence
VI	**Biomolecules** *Carbohydrates:* Nomenclature and classification; Role of monosaccharides (glucose, fructose, sugar alcohols – mannitol and sorbitol); Disaccharides (sucrose, maltose, lactose), Oligosaccharides and polysaccharides (structural-cellulose, hemicelluloses, pectin, chitin, mucilage; storage – starch, inulin). *Lipids*: Storage lipids: Fatty acids structure and functions, Structural lipids: Phosphoglycerides; Lipid

	functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers
VII	**Proteins**: Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, Ramchandran plot, tertiary and quaternary; Isoelectric point; Protein denaturation and biological roles of proteins **Nucleic acids:** Structure of nitrogenous bases; Structure and function of nucleic acids,Nucleic acid denaturation &Re-naturation , MiRNA
VIII	**Enzymes:** Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; mechanism of action (activation energy, lock and key hypothesis, induced-fit theory), enzyme inhibition and factors affecting enzyme activity, Allosteric enzymes & Abzymes. Elementary knowledge of Phytonutrients, Nutraceuticals, dietary supplements and antioxidants.

B.Sc. Vth Semester

Molecular Biology & Bioinformatics (Paper 2)

Units	Topics
I	**Genetic material** Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase, bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): semi– conservative. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi– conservative, semi discontinuous RNA priming, Ǿ (theta) mode of replication, replication of linear, dsDNA, replicating the 5′end of linear chromosome including replicationenzymes.
II	**Transcription & Regulation of gene expression** Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation, (Prokaryotes and eukaryotes), genetic code. Regulation of gene expression in Prokaryotes: Lac operon and Tryptophan operon; and in Eukaryotes, RNAi, Gene editing
I II	**Principles & Techniques of genetic engineering** Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Antibody Engineering. Enzymes used in Genetic Engineering and Gene cloning
IV	**Applications of Genetic engineering** Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products, Biosafety concerns..
	Bioinformatics & its applications Computer fundamentals - programming languages in bioinformatics, role of supercomputers in biology. Historical background. Scope of bioinformatics - Genomics, Transcriptomics, Proteomics, Metabolomics, Molecular Phylogeny, computer aided Drug Design (structure based and ligand based approaches), Systems Biology and Functional Biology. Applications and Limitations of bioinformatics. Primer designing
VI	**Biological databases :** Introduction to biological databases - primary, secondary and composite databases, NCBI, nucleic acid databases (GenBank, EMBL, DDBJ, NDB), protein databases (PIR, Swiss- Prot, TrEMBL, PDB), metabolic pathway database (KEGG, EcoCyc, and MetaCyc), small molecule databases (PubChem,)
VII	**Data Generation and Data Retrieval** Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)
VIII	**Phylogenetic analysis** Similarity, identity and homology, Alignment – local and global alignment, pairwise and multiple sequence alignments, alignment algorithms. Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Phylogenetic analysis: Construction of phylogenetic tree, dendrograms, methods of construction of phylogenetic trees.

B.Sc. VIth Semester

Ecology & Environment (Paper 2)

Unit	Topic
I	**Natural resources & Sustainable utilization**: Land Utilization, Soil degradation and management strategies; Restoration of degraded lands. Water, Wetlands; Threats and management strategies, Ramsar sites, Forests: Major and minor forest products; Depletion, Biological Invasion, Energy: Renewable and non-renewable sources of energy, Contemporary practices in resource management: EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting.
II	**Ecology & Ecosystem** Definition of Ecology, Ecological Factors, Positive and negative interactions. Ecosystem – Concept of an ecosystem-structure and function of an ecosystem. Abiotic and biotic components and their interrelationship- Biogeochemical and hydrological cycles, and Energy flow in an ecosystem Ecological Succession-Definition & types. Processes and types (autogenic, allogenic, autotrophic, heterotrophic, primary & secondary), Hydrosere and Xerosere. Food chains and food webs, Concept of Ecological perturbations and balance, Ecological pyramids, Primary and Secondary Production and Productivity;Types of ecosystems: Natural and Man-made- Forest Grassland, Aquatic and Agro- Ecosystems. Ecological Adaptations – Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.
III	**Soil Formation, Properties & Conservation** Soil: Origin, Formation, composition, Soil types, Soil Profile, Soil Microorganisms, soil processes, Soil Erosion, Biogeochemical cycles, Soil Conservation: Biological– Contour farming, Mulching, Strip cropping, Terracing and Crop rotation. Mechanical–Basin Listing, Construction of dams, Watershed Management, Soil reclamation
IV	**Biodiversity and its conservation:** Definition -genetic, species, and ecosystem diversity. Value of biodiversity: I n d i a n socio-cultural,ethical and aesthetic values; hotspots of Biodiversity threats to biodiversity, Biotic communities and populations, their characteristics and dynamics. Endemic and endangered species of plants in India. Ecological niche, ecade, ecotypes, ecological indicators. Conservation of Biodiversity*:* *Ex-situ* and *in-situ* conservation, Red data book, botanical gardens, National park, Sanctuaries, hot & hottest spots and Biosphere reserves. Role of Seed Bank and Gene Bank Valuing plant resources, ecotourism, Role of NBPGR, FAO, BSI, Indian value system

V	**Phytogeography** Biogeographic regions of India & world, Agroecological & Floristic zones of India. Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, Phytogeographical regions of India, Vegetational types in Uttar Pradesh.
VI	**Environmental audit & Sustainability** Elementary knowledge: Concept of environmental audit; Guidelines of environmental audit; Methodologies adopted along with some industrial case studies; Environmental standards: ISO 14000 series; Scheme of labelling of environment friendly products (Ecomark); Life cycle analysis; Concept of energy and green audit, Strategies and debates on sustainable development; Concept of Sustainable Agriculture; India's environment action programme: issues, approaches and initiatives towards Sustainability; Sustainable development in practice.
VII	**Pollution, Waste management & Circular Economy** Environmental pollution, Environmental protection laws, Bioremediation, Activated Sludge Process (ASP) – Trickling Filters – oxidation ponds, fluidized bed reactors, membrane bioreactor, neutralization, ETP sludge management; digesters, up flow anaerobic sludge blanket reactor, fixed film reactors, sequencing batch reactors, hybrid reactors, bioscrubbers, biotrickling filters; regulatory framework for pollution monitoring and control; case study: Ganga Action Plan; Yamuna Action Plan; implementation of CNG ;Waste- Types , collection and disposal, Recycling of solid wastes (hazardous & non-hazardous) - classification, collection and segregation , Incineration, Pyrolysis and gasification, Sanitary landfilling; composting, Biogas production ,Circular Economy & sustainability.
VIII	**Environmental ethics, Carbon Credits & Role of GIS** Carbon credit: concept, exchange of carbon credits. Carbon sequestration, importance, meaning and ways. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Clean development mechanism. Geographical Information Systems: definitions and components; spatial and non-spatial data; GIS software packages; GPS survey, data import, processing, and mapping. Applications and case studies of remote sensing and GIS in land use planning, forest resources & agriculture studies.

Department of Botany

Raghunath Girls' Post Graduate College, Meerut

I- **Disaster Management system in India**

Programme/Class: **Certificate Course**	Year: **I**	Semester**: I/II** **Paper- Minor/ Elective**
Subject: Offered by **Botany**		
Course Code: Q10006	Course Title: **Disaster Management system in India**	

Course outcomes:

1. The course focuses on basic concept of disaster(s) and disaster management, their significance andtypes.
2. The course will enable to develop the analytical skills to study relationship between vulnerability,disasters, disaster prevention and risk reduction.
3. The knowledge creates awakened group for integrated disaster management in the country.
4. It will enable young people in each city district or village to understand and explore avenues of reducing disaster risks and work towards preparedness and contribute towards minimizing losses andsaving lives.

Unit	**Topic**	**No. of L+T(75 hrs)**
I	Overview and understanding of Disaster, definitions of Disaster, Hazard, Vulnerability,Resilience and Risks.	**8**
II	Classification of disaster, natural hazards and Man-made disasters, Causes and socialimpacts, urban disasters, pandemics and climatic change.	**10**
III	Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and otherstake-holders. CBRN disaster, NDMA, NDRF, NIDM, STATE DM.	**12**
IV	Disaster Risk Management in India: Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Fire, WasteManagement Institutional arrangements	**12**
V	Mitigation, Response and Preparedness, DM Act and Policy, Other related policies,plans, programmes and legislation	**11**
VI	Disaster-induced Refugee problem – Problems of women and children during disasters;Principles of psycho-social care, issues and recovery Relationship between disasters, development and vulnerabilities	**8**
VII	Equity issues in disasters; Issues of rehabilitation and resettlement of survivors; Stakeholdersin disaster relief management	**6**
VIII	Disaster risk reduction – Strategies, Preparedness plans, Action Plans and procedures, EarlyWarning systems; Factors contributing to vulnerability. Capacity building	**8**

Department of Botany

Raghunath Girls' Post Graduate College, Meerut

II- **Global Environment and Challenges**

Programme/Class: **Diploma Course**	Year: **II**	Semester: **III/IV** **Paper- Minor/ Elective**
Subject: Offered by **Botany**		
Course Code: Q10013	Course Title: **Global Environment and Challenges**	

Course outcomes:

1. To acquaint the students with complex environment and global change driven by humans, their impactand mitigation;
2. To make them understand importance of biodiversity, conservation and its rolein maintaining structure and health of global ecology.
3. This knowledge is critical in understanding the adverse impact of human's consumeristnature, evolving strategies for sustainable development and natural resource management.
4. It will enable the students to know more about the challenges posed by massive economicgrowth, reckless development, unplanned strategies, and over utilization of natural resources.
5. It will facilitate the students to critically examine the leading discussion and practices of development, so as to enable them to participate effectively in decision making at various levels.

Unit	**Topic**	**No. of Lectures + Tutorials (75 hrs)**
I	Global Change: Driving factors, Anthropocene characteristics; Global land cover and land use change; Multiple impacts of land use change; Global climate change: Causes, effects andmitigation strategies; stratospheric ozone loss	**12**
II	Environmental Pollution: Causes and effects of air, water, soil, noise, radioactive pollution;Basic pollution abatement practices and technologies; Role of plants in reducing pollution impact	**14**
III	Invasive Ecology: Biotic Invasions; Invasive Alien Species (IAS), Invasibility characteristics, Phenotypic plasticity; Extent and mechanisms of biological invasions; Ecological and economic impacts; Management strategies	**10**
IV	Loss of Biodiversity: Biodiversity as indicator of well-being of an ecosystem; hot spots, ecotourism Threats and pattern of biodiversity loss - Natural and anthropogenic causes; IUCN threatcategories, Red data books; Conservation and restoration of biodiversity - Indian socio- cultural value system for nature's conservation.	**8**
V	Global Water Crisis: Distribution, withdrawal and consumption patternsCauses and effects of water crisis; Water conservation approaches	**8**

VI	Global Energy Crisis: Sources of energy supply; Current potential and future prospects ofenergy sources; Energy crisis; Energy conservation strategies	**8**
VII	Challenges of Urbanization: Trends of urbanization; Environmental impact of urbanization;Concept of green cities and sustainability.	**8**
VIII	Agro-Ecological Construction Strategies: Ecological home garden, medicinal plant garden, Kitchen garden; Vertical Stratification principle and application; man-made plant/forest communities (fruit-tree/commercially important tree/medicinal plant/ pepper /tea/ coffee/ creeper or climber-crop plant combinations); home/kitchen recyclable wastes (urban/rural) and Applied leaf biomass as manure in ecological constructions. Every household as experimental station.	**7**