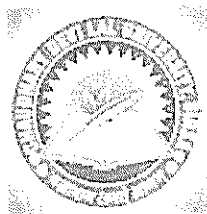


COURSE CURRICULUM AND SCHEME OF EXAMINATION

M. Sc. Environmental Science
Choice Based Credit System (CBCS)
(w.e.f Academic Session 2016-17)



SEMESTER	CORE COURSE (CC)	ELECTIVE (E)	OPEN ELECTIVE (OE)	TOTAL
I	26	4		30
II	25		4	25
III	24			24
IV	10	11		21
TOTAL	85	15		100

DEPARTMENT OF ENERGY AND ENVIRONMENTAL SCIENCES

CHAUDHARY DEVI LAL UNIVERSITY

SIRSA, (HARYANA)-125055
(Established by State Legislature Act 9 of 2003)

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M. Sc. Environmental Science (First Semester)

S.N o.	Course	Nomenclature	Type (Credit)	Contact hours		Examination schedule marks		Duration of Exam (Hour)
				L	PR	TH	Int. Assess	
1	EES-101	Biostatistics and Computer application	CC (4)	4		70	30	3
2	EES-102	Environmental Geology	CC (4)	4		70	30	3
3	EES-103	Ecology	CC (4)	4		70	30	3
4	EES-104	Environmental Chemistry	CC (4)	4		70	30	3
5	EES-105	Physical Environment	CC (4)	4		70	30	3
6	EES-106 (A)	Natural Resources	E (4)	4		70	30	3
	EES 106 (B)	IPR and Biosafety	E (4)	4		70	30	3
7	EES-107	Lab I	CC (3)		(3+3) (In two days & Two Groups)	75		6
8	EES-108	Lab II	CC(3)		(3+3) (In two days & Two Groups)	75		6
		Total	(CC-26)(E-4)=30	24	6x2=12x2= 24	750		

M.Sc. Environmental Science (Second Semester)

S.N o.	Course	Nomenclature	Type (Credit)	Contact hours		Examination schedule marks		Duration of Exam (Hour)
				L	PR	TH	Int. Assess	
1	EES-201	Environmental Impact Assessment	CC (4)	4		70	30	3
2	EES-202	Analytical Techniques	CC (4)	4		70	30	3
3	EES-203	Biodiversity and Conservation	CC (4)	4		70	30	3
4	EES-204	Environmental pollution	CC (4)	4		70	30	3
5	EES-205	Environmental Awareness	OE (4)	4		70	30	3
6	EES-206	Lab III	CC (3)		(3+3) (In two days & Two Groups)	75		6
7	EES-207	Lab IV	CC (3)		(3+3) (In two days & Two Groups)	75		6
8	EES-208	Lab V	CC (3)		(3+3) (In two days & Two Groups)	75		6
9	EES-209	Summer Traming (To be evaluated by Internal examiner in 4 th sem)	CC (2)					To be evaluated in 4 th Semester by committee of Internal examiners
		Total	(CC- 25)	20	6x3=18x2= 36	625		

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M.Sc. Environmental Science (Third Semester)

S.N o.	Course	Nomenclature	Type (Credit)	Contact hours		Examination schedule marks		Duration of Exam (Hour)
				L	PR	TH	Int. Assess	
1	EES-301	Environmental Microbiology	CC (4)	4		70	30	3
2	EES-302	Pollution Control & Management	CC (4)	4		70	30	3
3	EES-303	Environmental Biotechnology	CC (4)	4		70	30	3
4	EES-304	Environmental Law	CC (4)	4		70	30	3
6	EES-305	Lab VI	CC (3)		(3+3) (In two days & Two Groups)	75		6
8	EES-306	Lab VII	CC (3)		(3+3) (In two days & Two Groups)	75		6
9	EES-307	Seminar	CC (2)	2		50		To be evaluated by all faculty members
				18	6x2=12x2= 24		600	
		Total	(24)					

M.Sc. Environmental Science (Fourth Semester)

S.N o.	Course	Nomenclature	Type (Credit)	Contact hours		Examination schedule marks		Duration of Exam (Hour)
				L	PR	TH	Int. Assess	
1	EES-401	Energy Resources	CC (4)	4		70	30	3
2	EES-402	Remote Sensing and Modelling	CC (4)	4		70	30	3
5	EES-403 (A)	Environmental Issues	E (4)	4		70	30	3
	EES-403 (B)	Natural Resource management	E (4)	4		70	30	3
6	EES 404(A)	Environmental Health and Toxicology	E (4)	4		70	30	3
	EES 404(B)	Environmental awareness and planning	E (4)	4		70	30	3
7	EES-405 (A)	Lab VIII	E (3)		(3+3) (In two days & Two Groups)	75		6
	EES 405(B)	Lab IX	E (3)		(3+3) (In two days & Two Groups)	75		6
8	EES-209	Summer Training Evaluation	CC (2)			50		To be evaluated in 4 th Semester by committee of Internal examiners
			(CC-10)(E- 11)	16	6x2=12x2= 24		600	
		Total	(21)					

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EES-101
BIostatISTICS AND COMPUTER APPLICATIONS

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Basic concepts of computer, hardware, operating systems: Windows, Unix and Linux, use of common application software in biology: word processing, spreadsheets, graphics and data base, introduction to web browsing software and search engines with special reference to online environmental resources.

UNIT II

Statistics and its application in environmental data analysis, Sampling, Sampling Technique. Data collection, Data representation measures of central tendency: mean, median, mode, geometric mean, harmonic mean.

UNIT III

Measure of dispersion: moments, matrices, standard deviation, Variance, skewness and kurtosis

UNIT IV

Correlation and linear regression of one independent variable, Basic concept of binomial, poisson, and normal distribution, Testing of hypothesis and its significance, "t" test, chi square test, ANOVA.

Reference Books

1. Statistics for Environmental Science & Management- Bryar F.J. Manly
2. Introduction to Statistics- Kapoor & Sanchita.
3. Statistics for Earth and Environmental Science- Schuenemeyer & Drew
4. Biostatistics- Daniel
5. Principals of Biostatistics- Pagaro & Gauvrear

The image shows three handwritten signatures or initials in black ink. The first is a cursive signature, the second is a stylized signature, and the third is a signature that appears to read 'S. S. Patel'.

EES-102
ENVIRONMENTAL GEOLOGY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Origin and evolution of earth through geological time. Primary differentiation and formation of crust, mantle and core, Atmosphere and Hydrosphere, Geological time scale. Geochemical classification of elements

UNIT II

Rock Types: Magma generation and formation of Igneous Rocks, Sedimentary and Metamorphic rocks, Rock cycle, Weathering, Erosion, Transportation and deposition of Earths materials by Running water, winds and Glaciers.

UNIT III

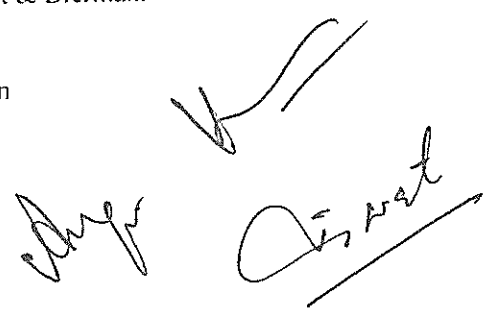
Thermal, Magnetic and gravitational fields of the earth, Theories of Continental Drift and Plate tectonics-Sea floor spreading, mountain building.

UNIT IV

Geological hazards and disaster: Earthquake and Seismic hazards, , Impacts, Himalayan Seismicity, Avalanches; Landslides, Volcano, Tsunami, Flood , Drought, Cyclone

Reference Books

1. Environmental Geology- Edward A. Keller
2. Physical Geology- C.W. Montgomery
3. Essentials of Geology- Tarback
4. Fundamentals of Geology- A. B. Roy
5. Geology and the Environment- Bernad, Trent, Hazlett & Bierman.
6. Essentials of Physical Geology- Wicander & Monroe
7. Historical Geology- Wicander & Monroe
8. Natural hazards and Disasters- Hyndman & Hyndman
9. Disaster management- Jagbir Singh



**EES-103
ECOLOGY**

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Introduction: Aims and Scope of Ecology, Organization level of biosphere, Laws of Tolerance and Limiting factor.

UNIT II

Ecosystem: Structure, Function and Services, Ecological pyramids, Food webs, Tropic levels, Ecological efficiencies, Model of energy flow, Energy budget, Primary and secondary production. Biogeochemical cycle: Gaseous cycles and Sedimentary Cycles, Human impact on Nutrient cycling.

UNIT III

Population Ecology: Demography, Population characteristics, Evolutionary strategy, r and k selection, Population growth and Regulation, Human population dynamics, Age structure, Population interaction, Symbiotic association, Competition, Parasitism, Prey-predator Relations.

UNIT IV

Community Ecology: Community Ecology, Analytical and Synthetic characters, Species diversity, Biomes and their types, Concept of niche, Keystone species, Ecad, Ecotype, Ecotone and Edge effect, Endemic species, Ecological succession: Types, trends and models, concept of climax.

Reference Books

1. Element of Ecology- Smith & Smith
2. Text Book of Ecology- Peter Sterling
3. Fundamentals of Ecology- E.P. Odum
4. Ecology- Russel, Rolfe, Hertz, Starr & Macmillan
5. Ecology and environment- P.D. Sharma
6. Ecology-Miller
7. Essentials of Ecology and Environmental Science- S.V.S. Rana

Handwritten signature and a stamp that reads "Assesst" (likely "Assessor").

EES-104
ENVIRONMENTAL CHEMISTRY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Atmospheric Chemistry: Chemical composition of the atmosphere-particles, ions, and radicals, Formation of particulate matter, Photochemical and chemical reaction in the atmosphere, Smog, Acid rain, Chemistry of Ozone layer depletion, Global warming, and Greenhouse effect.

UNIT II

Water Chemistry: Water quality parameters (Physical, chemical & biological parameters); Water quality standards for domestic, drinking and surface water quality ; Chemistry of inland water bodies (lentic system, lotic system); Solubility of gases in water, Carbonate system, Redox potential, Solubility product, Acids- Base reaction.

UNIT III

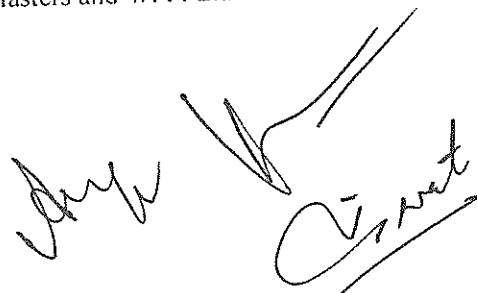
Soil Chemistry: Chemical and mineralogical composition, Soil formation, soil profile, Soil properties (physical, chemical, biological), soil nutrients (Organic and Inorganic nutrients), Ion exchange reactions in soil, soil fertility, soil pollutants (Pesticides, Heavy metals) and their effects.

UNIT IV

Thermodynamics: Stoichiometry; First law of thermodynamics, Enthalpy, Second law of thermodynamics, Carnot's cycle, Entropy. Third law of thermodynamics, Gibb's free energy, Chemical equilibrium and chemical potential.

Reference Books

1. Environmental Chemistry- Mannhan
2. Environmental Chemistry- A. K. De
3. Environmental Chemistry- Balram Pani
4. Soil sampling, preparation and analysis- Kim H. Tan
5. Soils: Micheal J. Singer and Donald N. Munns
6. Environmental Engineering and Science: Gilbert M. Masters and W. P. Ela
7. Fundamentals of Soil Sciences: Henery D. Futh
8. Text book of Limnology: G.A. Cole
9. Environmental Chemistry: Sharma and Kapoor



EES-105
PHYSICAL ENVIRONMENT

Credit : 4

Time: 3Hrs

Marks: 100

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Earth Atmosphere: Composition of Atmosphere, Atmospheric composition as a function of height, Thermal structure of atmosphere. Lapse rates and its types, Latent Heats, Concept of Air Parcel, Vertical stability of atmosphere, Inversions, Mixing Height, Atmospheric stability and Plume behavior, Hydrostatic equilibrium.

UNIT II

Earth Sun Relations: Relationship between earth and sun, Latitudinal and seasonal distribution of Insolation, Solar radiation, Interaction of solar radiation with atmosphere, Terrestrial radiation, Atmospheric window, Albedo, Planetary Albedo, Heat budget of the earth, History of climate change, Methods for climate change detection, Milankovitch's theory of climatic change, Climatic feedback mechanism,

UNIT III

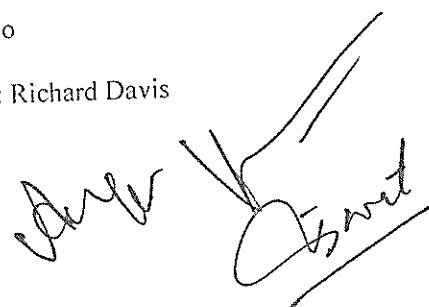
Meteorology: Scales of meteorology, Atmospheric Moisture, Coriolis force, Pressure, Global pressure belt systems, Concept of Air Masses and Air Fronts, Cloud formation and classification, Precipitation, South-Westerly and North-Easterly Monsoon and its patterns

UNIT IV

Aquatic Ecosystems: Limnology- Physicochemical properties of Water, Types of freshwater bodies lentic and lotic; water mixing in lakes; Oceanography- Origin and Composition of sea water, Variation in Sea water Salinity and pH, Marine biological environment, Marine Biozones, Ocean waves and currents, Marine geological environment, Marine sediments.

Reference Books

1. The atmosphere: An introduction to Meteorology: F.K. Lutgens and E.J. Tarbuck
2. Atmospheric science: An Introductory Survey: J.M. Wallace and P.V. Hobbs
3. Confronting climate change: I.M. Mintzer
4. Atmosphere, Weather and Climate: Navarraa
5. Essentials of Oceanography: T. Garrison
6. Essentials of Oceanography: H.V. Thurman and A.P. Trujillo
7. Oceanography: G. Gross
8. Oceanography, An introduction to the Marine Environment: Richard Davis



EES-106 (A)
NATURAL RESOURCES

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Biological resources

Forest types in India, Range lands and their importance. Floral and Faunal resources of the world, Floral and Faunal resources of India, BSI, FSI, ZSI, plants of medicinal importance, Ethno botanical importance.

UNIT II

Water Resources

Water resources types, Surface water: Rivers, Lake etc, Underground water, Current scenario.

UNIT III

Land Resources

Major Soil types of India, Mineral resources and reserves, ocean ore and recycling of resources, processing and smelting of Mineral, oceans as need areas for exploitation of mineral resources.

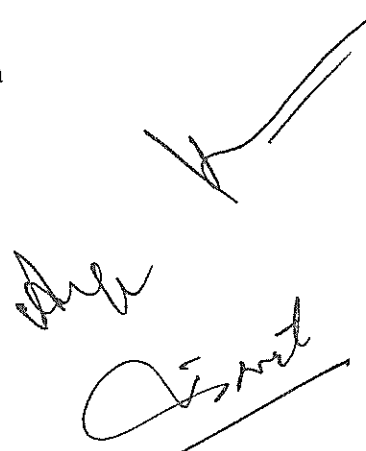
UNIT IV

Energy Resources

Sources of renewable and non renewable resource. Solar energy, solar radiations, fossil fuels classification, composition, physico- chemical characteristics and energy content of coal, petroleum& and Natural gas, Wind Energy, Geothermal Energy, Tidal energy, Biomass Energy, Nuclear Energy

Reference

1. Ecology and Environment- P.D. Sharma
2. Essentials of Ecology and Environmental Science- S.V.S. Rana
3. Natural resources conservation: Oliver Owen and Chiras
4. Living in the environment: T. J. Miller
5. Ecology of Natural resources: Ranade
6. Global biodiversity: W.R.L. (IUCN)
7. www.moef.gov.in
8. www.unep.org



EES-106 (B)
IPR & BIOSAFETY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

Unit I

Introduction to Intellectual Property Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of GMOs IP as a factor in R&D. Agreements and Treaties History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments

Unit II

Basics of Patents and Concept of Prior Art Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in context of "prior art"; Patent databases; Searching International Databases; Country-wise patent searches(USPTO, esp@cenet(EPO), PATENTSCOPE(WIPO), IPO, etc.)

Unit III

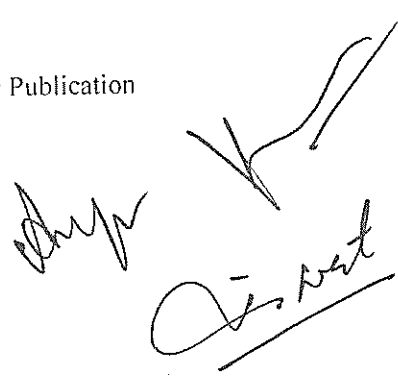
Patent filing procedures National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes Patent licensing and agreement Patent infringement-meaning, scope, litigation.

Unit IV

Introduction to Biological Safety Cabinets; Primary containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including Cartagena Protocol.

References

1. P. Narayanan, Intellectual Property Laws, Eastern Law House.
2. Meenu Paul, Intellectual Property Laws, Allahabad Law Agency.
3. Intellectual Property Law containing Acts and Rules, Universal Law Publication Company.



EES-107
Lab I: ECOLOGY

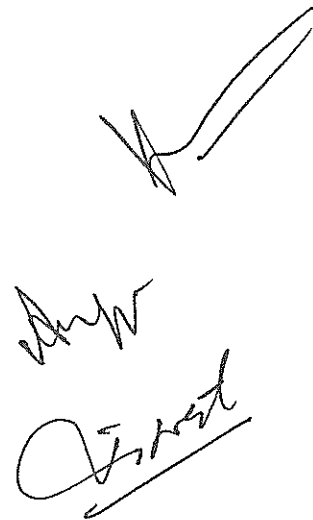
Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Biomass Estimation of Plant Sample.
2. Determination of minimum size of the quadrat.
3. Determination of minimum numbers of the quadrat.
4. Determination of population density by quadrat method.
5. Species richness and evenness (Biodiversity) by quadrat method.
6. Determination of Frequency of a plant community by quadrat method.
7. Determination of Abundance of a plant community by quadrat method.
8. Determination of Relative Dominance of plant community by quadrat method.
9. Determination of Importance Value Index (IVI) of species by quadrat method.



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EES-108

Lab II: Biostatistics & Computer Application

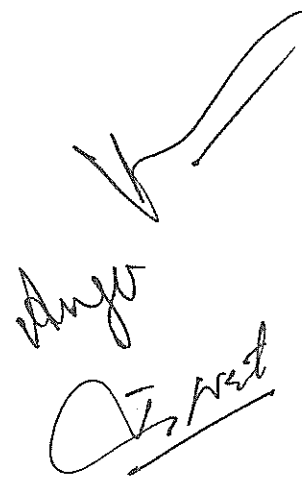
Credit : 3

Marks: 75

Practical Hrs: 3 + 3

Exam duration: 6 hrs

1. Environmental Sampling by different methods
2. Data Analysis
3. Estimation of mean
4. Estimation of mode
5. Estimation of median
6. Estimation of Standard deviation
7. Correlation analysis
8. Regression analysis
9. Computer application in Environmental Science
10. Application of MS-Word in Environmental Science
11. Application of MS-Excel in Environmental Science
12. Application of Power Point in Environmental Science
13. Internet application in Environmental Science


A handwritten signature in black ink, appearing to read 'Ange' above a larger signature that looks like 'D. S. Patel'.

**SEMESTER II
EES-201**

ENVIRONMENTAL IMPACT ASSESSMENT

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Origin and development of EIA, EIA Methodology-project screening, scoping, base line data, impact identification, and prediction, evaluation, monitoring and auditing and mitigation, public participation, presentation, review and decision making in EIA process; Environmental impact statement (EIS).

UNIT II

Environmental impact of mining industries, Nuclear power plants; Coal Fired Thermal Power plant, EIA of Hydroelectric Projects-Tehri dam, Sardar sarovar and Almetti dam.

UNIT III

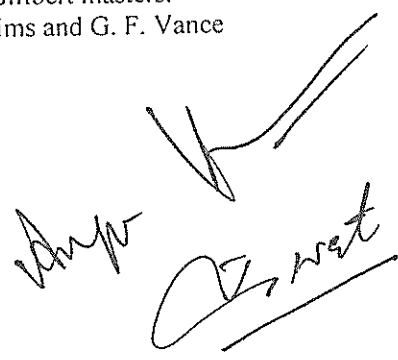
Environmental Management Systems: Elements of environmental management, environmentally sound technologies, concept of cleaner production, clean development mechanism (CDM), Environmental management plan ISO-14000, Life Cycle Analysis (LCA), Strategic Environmental Assessment (SEA).

UNIT IV

Environmental Risk: Definition of risk, nature of risk (voluntary and in voluntary risk), risk perception, important environmental risk, risk assessment- hazard identification, exposure assessment Dose-response assessment and risk characterization (integrated exposure uptake biokinetic-IEUBK model); ecological risk assessment; uncertainty; risk management- risk identification, risk estimation, risk evaluation

Reference Books

1. Environmental impact assessment: John Glasson
2. Methods of Environmental impact assessment: Morris & Therivel
3. Environmental impact assessment: L.W. Canter
4. Introduction to Environmental Engineering and Science: Gilbert masters.
5. Soil and Environmental Quality: G. M. Pierzynski, J. T. Sims and G. F. Vance



EES-202
ANALYTICAL TECHNIQUES

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Environmental Sampling: Water, Air and Soil, High Volume Air Sampler, Cascade Impactor.

UNIT II

Spectroscopy: Principles of spectroscopy, UV-Visible spectrophotometry, Colorimetry, Flame photometry, Atomic Absorption Spectroscopy, Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES).

UNIT III

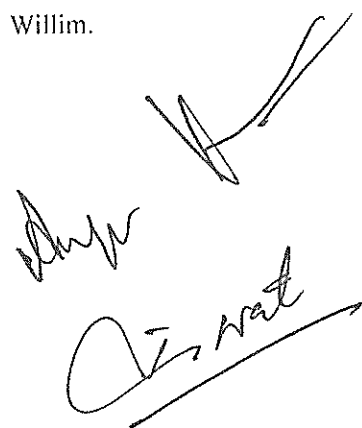
Chromatographic technique: Theory and Principle, Paper chromatography, Thin layer chromatography (TLC), Column chromatography, Ion exchange chromatography, Gas chromatography (GC), High Pressure Liquid Chromatography (HPLC).

UNIT IV

Fluorometry, X-Ray Diffraction (XRD), Electrophoresis, Titrimetry: Complexometry, Neutralization titrations, Oxidation-Reduction Titrations, Potentiometric titrations.

Reference Books

1. Textbook of Quantitative Chemical Analysis: J. Mendham, R.C. Denney, J.D. Barnes
2. Instrumental Methods of Chemical Analysis: G.R. Chatwal, S.K. Anand
3. Undergraduate instrumental analysis: James W. Robinson
4. Model method of chemical analysis: Robert, Shields, Carins, Willim.



EES-203
BIODIVERSITY AND CONSERVATION

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Biodiversity: Definition, Significance, Threats, Genetic variability, Status of Wild Life of India and world, Forest Types, Forest wealth of India. Floral, Faunal and Microbial Diversity in India, Agro-diversity in India. Biogeographical zones of India. Status of Biodiversity in Haryana

UNIT II

IUCN, Concept of Red Data Book, and Red list Categories, concept of species extinction, Mega diversity zones of the world, Concept of Biodiversity Hotspot, Biodiversity Hotspots in India.

UNIT III

Biodiversity conservation strategies: *In situ* and *Ex-situ* conservation, Concept of Gene bank, Gene banks in India, National Parks, Sanctuaries and Biosphere reserves in India, Status of Biodiversity in India. Conservation efforts of Indian government..

UNIT IV

Sustainable Development:- Principles and practices in relation to Biodiversity, Concept of Exotic Species, Invasive Species, Endemic species, Bioprospecting.

Reference

1. Natural resources conservation: Oliver Owen and Chiras
2. Living in the environment: T. J. Miller
3. Ecology of Natural resources: Ranade
4. Global biodiversity: W.R.L. (IUCN)
5. <http://www.enfor.nic.in>.
6. <https://www.iucn.org/>
7. www.moef.gov.in



EES-204
ENVIRONMENTAL POLLUTION

Marks: 100

Credit : 4

Theory +Internal assessment: 70+30

Time: 3Hrs

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Water pollution: Sources, Consequences, Ecological and Biochemical aspects of water pollution, Characteristic of domestic, industrial, and agricultural wastes, their effect on water bodies, Water quality parameters, Criteria and standards. Marine pollution, Thermal pollution.

UNIT II

Air pollution: sources, Classification and properties of air pollutant, Behavior fate of air pollutant, Effect of air pollution on human health and materials, Air pollution meteorology.

UNIT III

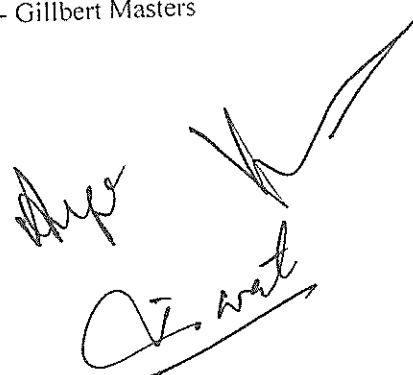
Soil pollution: Soil pollution form the use of Fertilizers, Pesticides, Heavy metals, Industrial effluent and surfactant. Detrimental effects of soil pollutant, Soil sediment as pollutant, Remedial measures for soil pollution.

UNIT IV

Noise pollution: Definition, Sound pressure level, noise spectra, Octave band. Frequency, Weighting network, noise monitoring and sound level meter, equivalent continuous noise level, Effects of noise pollution.

Reference Books

1. Industrial Noise Control – Bell & Bell
2. Introduction to Environmental Engineering and Science- Gillbert Masters
3. Geoenvironment- V. Aswathanarayan
4. Soil chemistry – Bolt & Buggenwert



EES-205
ENVIRONMENTAL AWARENESS

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Definition, Fundamental Concepts, components and Significance of Environment

UNIT II

Global issues: Climate Change, Global warming, Ozone depletion, Sea level rise, melting of glacier, population explosion, Pollution and its effects.

UNIT III

International organizations and initiatives, national organizations and initiatives, Non-governmental organizations and initiatives,

UNIT IV

Role of Environmental education in environmental awareness, Role of Society and people in environmental awareness, Role of Mass media in environmental awareness, Tehri movement, Narmada Movement, Chipko Movement.

Reference Books

1. Environmental Economics- Charles D Kolstad
2. Environmental Ethics- David R Keller
3. Environmental studies & Ethics- Gouri Suresh
4. Environmental Awareness- Annette Bogler



Two handwritten signatures in black ink. The top signature is a stylized, cursive name. The bottom signature is also cursive and appears to be 'Suresh'.

EES-206

LAB III: ENVIRONMENTAL MONITORING (WATER)

Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Determination of pH in a given water sample.
2. Determination of various form of alkalinity in a given water sample
3. Determination of Total hardness, calcium and magnesium hardness in a given water sample.
4. Determination of Total solids, suspended solid and dissolved solids in a given water sample.
5. Determination of conductivity in a given water sample.
6. Determination of Turbidity in a given water sample.
7. Determination of DO in given water sample.
8. Determination of BOD 5 day and ultimate BOD in sewage sample.
9. Determination of COD by open and closed reflux method in given waste water sample.
10. Determination of mineral contents in a given water sample (Calcium, Sodium, Potassium Fluoride, Chloride, Phosphate and Sulphate).




EES-207

LAB IV: ENVIRONMENTAL MONITORING (SOIL)

Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Determination of pH in soil sample.
2. Determination EC in soil sample.
3. Determination of Carbonate content in soil sample.
4. Determination of Total Organic Carbon (TOC) in soil sample.
5. Determination of Particle Size Analysis (PSA) in soil sample.
6. Mineralogical analysis of soil and rock samples.
7. Heavy metal analysis of soils.
8. Determination of water holding capacity of soil sample.
9. Determination of different forms of nitrogen by Kjeldahl method.

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EES-208
LAB V: PRACTICAL: ENVIRONMENTAL BIOCHEMISTRY

Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Spectrophotometric estimation of Chlorophyll a, Chlorophyll b, Total Chlorophyll
2. Spectrophotometric estimation of Total Carotenoid in plant sample.
3. Spectrophotometric estimation of Total Carbohydrate in plant sample.
4. Spectrophotometric estimation of Total Phenol in plant sample.
5. Spectrophotometric estimation of Proline in plant sample
6. Spectrophotometric estimation of Protein in plant sample


Dr. Anil K. Singh

SEMESTER III
EES-301
ENVIRONMENTAL MICROBIOLOGY

Credit : 4

Time: 3Hrs

Marks: 100

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Microbial world: Introduction of environmental microbiology, relation with other allied sciences. Major groups of micro-organisms, Microbial interactions- neutralism, commensalism, synergism, mutualism, competition, ammensalism, parasitism, predation; interaction of microorganisms with plant and animals.

UNIT II

Air microbiology: Microflora of air: Outdoor and indoor microflora, Transmission of Microflora in air, enumeration and assessment of microorganisms in air, sources of contaminations, control of airborn microorganisms.

UNIT III

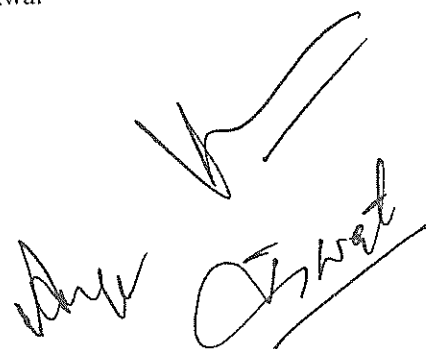
Water microbiology: Microbes in aquatic system, pathogens in water, Biofilms, bacteriological analysis of water and tests for indicator organisms, standard plate count method (SPC), most probable number count method (MPN), membrane filter method (MF), Role of microbes in wastewater treatment.

UNIT IV

Soil microbiology: distribution of different types of soil microorganisms, factors influencing microbial population, Rhizosphere effect, microbes in decomposition, mineralization and recycling process, Bioremediation, Solubilization of phosphate (PSB).

Reference Books

1. Microbiology: J.G. Black
2. Environmental and applied Microbiology: K.C. Agrawal
3. Microbiology: Pelzar
4. Microbial Botechnology: A.N. Glazer
5. Microbial Ecology: R.M. Atlas and Barthas



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EES-302
POLLUTION CONTROL MANAGEMENT

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Waste water management: Primary treatment methods-screening, grit removal, primary sedimentation; Secondary treatment methods-activated sludge process, trickling filters, rotating biological contactors, oxidation ponds and lagoons. Advanced waste water treatment methods-removal of nutrients and solids; waste water reuse and sludge treatment and disposal.

UNIT II

Air pollution control: Control methods for particulates-gravitational settling chambers, centrifugal collectors, wet collectors/scrubbers, fabric filters, electrostatic precipitators, Control methods for gaseous pollutants-adsorption, absorption, condensation and combustion.

UNIT III

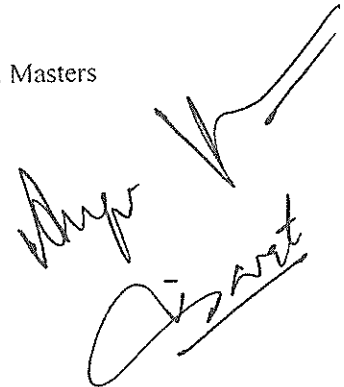
Solid and hazardous waste management: Types and sources of Municipal Solid waste, Characterization (Physical and Chemical), Collection, Transportation, Handling, Treatment, Disposal and Recycling of solid waste, composting, vermicomposting, incineration and Sanitary landfills; Hospital waste management; Hazardous waste: Definition, sources and categorization, generation, collection, treatment, and disposal; Basel convention, electronic waste management.

UNIT IV

Noise pollution control: Adsorbing materials, barrier materials, damping materials, acoustical enclosures, reactive silencers and filters; Active noise control methods.

Reference Books

1. Environmental Pollution Control Engineering: C.S. Rao
2. Management of Municipal Solid waste: T.V. Ramchandra
3. Prospects and Perspectives of Solid Waste Management: B.B. Hosetti
4. Air pollution: Rao & Rao
5. Environmental Engineering: Peavy
6. Introduction to Environmental Engineering and science: Gilbert M. Masters
7. Industrial Noise Control: Bell & Bell



EES-303
ENVIRONMENTAL BIOTECHNOLOGY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

An Introduction to Environmental Biotechnology, Fundamentals of Environmental Biotechnology. Concept of Genetic Engineering, Recombinant-DNA Technology, Genetically Modified Organism, *Bt* Cotton, Concept of Biosensor, types and its applications..

UNIT II

Application of Biotechnology in Agriculture, Forestry, wasteland, Environmental management Bioremediation, Phytoremediation, Biotechnological approaches for preserving biodiversity: Gene banks, Germ plasm bank, Microbial culture banks,

UNIT III

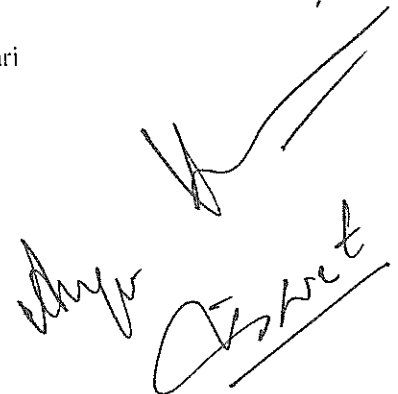
Green revolution, Environmental Issues related to agrochemicals, Concept of Sustainable Agriculture, Organic farming and its Ecological significance, Integrated Nutrient Management (INM), Integrated Pest Management (IPM), Allelopathy, Biofertilizer, Biopesticide, Fermentation Technology, Composting, Vermicomposting.

UNIT IV

Significance of Agriculture in Indian Economy, Role of Indian Council of Agriculture Research (I.C.A.R.), Concept of Crop rotation, Silviculture, Agro-forestry, Social Forestry, Joint Forest Management (JFM).

Reference Books

1. Environmental Biotechnology- S.N. Jogdanel
2. Text book of Environmental Biotechnology- P. K. Mohapatra
3. Biofertilizer and Biopesticide- Shalini Suri
4. Environmental Science & Biotechnology:- Murugesan & Rajakumari
5. Environmental Biotechnology- Indu Shekhar Thakur
6. Environmental Microbiology - Maier, Pepper & Gerba
7. Agriculture for Food security and Rural growth- Vibha Dhawan
8. Hand book of Agriculture- ICAR, NewDelhi



EES-304

ENVIRONMENTAL LAW

Marks: 100

Credit : 4

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Environmental legislation in India, India's Ancient Traditions for Protection of Environment, Constitutional Provisions for Protection of Environment. National conservation strategy and Policy statement on Environment and Development 1992.

UNIT II

Wildlife Protection Act, 1972, & 1991; Indian Forest Act, 1982 Forest Conservation Act, 1980 Indian Forest act, 1982; National Forest Policy, 1988; Biodiversity Conservation Act, 2002.

UNIT III

The Water (prevention and Control of Pollution) Act, 1974;; The Air (prevention and Control of Pollution) Act, 1981; ; Ozone depleting Substances Regulation and Control rules 2000; Environmental Protection Act, 1986; Noise Pollution Regulation and Control Rules, 2000. Environmental Audit Notification 1992; Environmental Impact Assessment Notification 1994, Ecomark.

UNIT IV

Biomedical Waste Management and Handling Rules, 1998, Hazardous Waste Management and Handling rules, 1989. Municipal Solid Wastes (Management and Handling) Rules, 2000, Energy Act 2002, Public Liability Insurance Act, 1991, Disaster Management Act 2005, National Green Tribunal Act 2010, Green Bench.

Reference Books

1. Environmental Law- Sumeet Malik
2. Environmental Law - S. C. Shastri
3. International Environmental Law- Sethi & Kulkarni
4. Environmental Noise Pollution-V. Mahandiyan
5. Environmental Laws in India- A. K. Tiwari
6. Environmental Law and Policy in India- Diwan & Armin
7. Environmental Policy & Law- Garg, Bishnoi & Mallik

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EES-305

Lab VI: ENVIRONMENTAL MONITORING (Air & Noise)

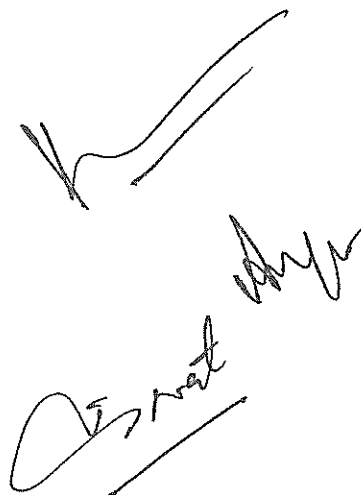
Marks: 75

Credit : 3

Practical Hrs: 3 + 3

Exam duration: 6 hrs

1. Determination of Suspended particulate matter using high volume sampler in Residential area.
2. Determination of Suspended particulate matter using high volume sampler in Institutional area.
3. Determination of SO_x in ambient air.
4. Determination NO_x in ambient air.
5. Estimation of Atmospheric Dust fall.
6. Estimation of Noise in Residential area.
7. Estimation of Noise in Institutional area.



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EES-306
Lab VII: ENVIRONMENTAL MICROBIOLOGY

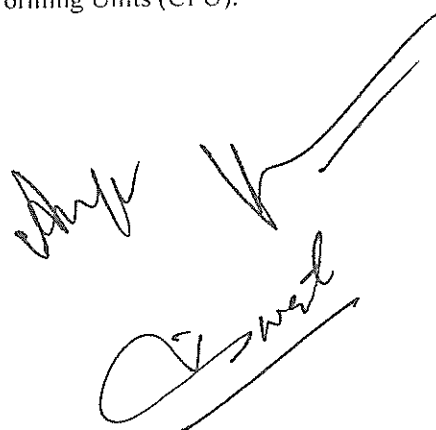
Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Preparation of Different culture media.
2. Isolation of Fungi from Soil sample.
3. Isolation of Bacteria from Soil sample.
4. Isolation of Fungi from Water sample
5. Isolation of Bacteria from Water sample.
6. Gram Staining.
7. Slide preparation of fungal and bacterial samples for Microscopic studies.
8. Estimation of Fungal biomass in liquid media
9. Estimation of Bacterial biomass in liquid media
10. Calculation of Fungal colony by Colony Forming Units (CFU).


Dr. S. S. S. S.

SEMESTER IV

EES-401 ENERGY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Energy consumption pattern in India, Energy conservation strategy, Energy sources, their availability and impacts on environment, Rural Energy consumption patterns, Rural Energy Programmes in India.

UNIT II

Non-renewable Energy- Fossil fuel (Classification, composition and characterization of Coal, Petroleum and Natural gas), Different Type of nuclear reactors and Nuclear energy in Indian scenario.

UNIT III

Renewable energy- Solar energy, Characteristic of solar radiation, Solar radiation measurement, solar collectors, Photo-Voltaic Cells, Solar pond, Hydro-Power

UNIT IV

Wind energy, Geothermal energy, Ocean energy: Tidal energy, wave energy and Ocean Thermal Energy Conversion (OTEC) and Bioenergy: Biomass conversion Technologies, Biogas, Producer gas, Energy Plantations/Petrocrops.

Reference Books

1. Natural resources conservation - Oliver S. Owen and Chiras
2. Living in the Environment - T.J. Miller
3. Environmental science - Cunningham Saigo
4. Non-conventional energy sources - G.D. Rais

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EES-402
REMOTE SENSING AND MODELLING

Marks: 100

Credit : 4

Theory +Internal assessment: 70+30

Time: 3Hrs

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Basic concepts and principals of remote sensing, Sensors and platforms, Physical Basis of remote sensing, Photo interpretation and photogrammetry. Geographical Information System (GIS) and Global Positioning System (GPS).

UNIT II

Application of remote sensing in Environmental Sciences: Environmental management, Forest Mapping, Landuse pattern, Natural disasters, Cryosphere studies, Vegetation studies, Identification of Paleo Channels.

UNIT III

Role of modelling in environmental sciences, Model classification: Deterministic model, Stochastic model, Steady state model, Dynamic model, Different stages involved in model building. Methods for the formulation of dynamic balance equation- Mass balance procedures, Energy balance procedures.

UNIT IV

Streeter Phelps Oxygen Sag model, Box model, Gaussian Plume model, Two Species population growth model of competition, Lotka-Volterra Prey predator model, Logistic Growth Curve, Maximum sustainable yield, Carrying capacity.

Reference Books

1. Fundamentals of Remote Sensing- G. Joseph
2. Remote Sensing and Image Interpretation- T.M. Lillesand, R.W. Kiefer, J.W. Chipman
3. Dynamics of Environmental Bioprocesses- Modeling and Simulation: Snaps and Dunn
4. Introduction to Environmental Remote Sensing- Curtis

EES-404 (A)
ENVIRONMENTAL HEALTH AND TOXICOLOGY

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Occupational Health Hazards

Major occupational Diseases, Safety measures, International and National organizations in the field of occupational health, Bhopal gas Tragedy.

UNIT II

Diseases and Disorders

Epidemiological Issues- Goiter, Fluorosis and Arsenic poisoning, Trace element deficiency and disorder. Water borne diseases and Food borne diseases. Malaria, Life cycle of *Plasmodium vivax* and *Plasmodium falciparum*, Tuberculosis and AIDS.

UNIT III

Toxicology

Introduction and Principles of Toxicology, Toxic responses in animal and plant system, Toxic chemicals in the environment and their effects, Xenobiotic Compounds, Types of Pesticide, Toxic effects of popular Pesticides such as DDT, Endosulphan, 2, 4 D. Mode of entry of Toxic substances in human body and Detoxification sites in human body, Bioaccumulation, Biotransformation. Harmful effects of Heavy Metal such as Lead, Cadmium, Chromium, and Mercury.

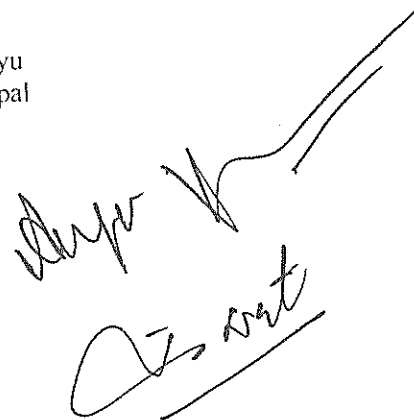
UNIT IV

Radioactive pollution

Sources of Radiation in Environment, Radioactivity, Radioactive waste. Effect of Radioactive pollution on Plants and Human Health, Chernobyl disaster.

Reference Books

1. Introduction to Environmental Toxicology- Landis, Sofield & Hoyu
2. Pesticides: Methods and their residue estimation- Kumari & Kathpal
3. Text Book of Toxicology- Balram Pani
4. Environmental Toxicology- Trivedi , Jaiswal, Pandey & Shukla



EES-403(A)
ENVIRONMENTAL ISSUES

Marks: 100

Credit : 4

Theory +Internal assessment: 70+30

Time: 3Hrs

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

National Issues and Initiatives:-Issues related to surface (Eutrophication, Heavy Metal, Pesticides etc) and Ground water (Arsenic, Fluoride), Desertification, Deforestation. Mass movement for Environmental conservation: Narmada Bachao Andolan, Tehri Movement, Chipko Movement, Appiko Movement, Silent Valley.

UNIT II

National River Conservation Directorate, National Ganga River basin authority, Capacity Building for Industrial Pollution Management. Project Elephant, Project Tiger, Rain water harvesting, Wetland conservation

UNIT III

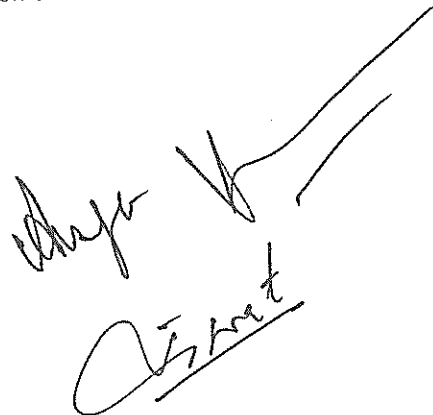
International Issues and Initiatives:- Climate Change, Transboundary Movement of Pollutants, The Club of Rome report, United Nations Conference on the Human Environment (Stockholm Declaration 1972), Agenda 21, WCS (World Conservation Strategy), IGBP(International Geosphere Biosphere Programme) Outer Space treaty, Vienna convention & Montreal Protocol, Kyoto Protocol, united nations Conference on Environment and Development- Rio Convention (Earth Summit 1992), Antarctic Treaty, IPCC (Inter-governmental panel for Climate change), UNFCCC(United Nations Framework Conventions of Climate Change)..

UNIT IV

IUCN (International union for Conservation of Nature and Natural Resources), CITES (Convention on international Trade of Endangered Species of Wild Flora and Fauna), Man and Biosphere Programme (MAB). Convention on Biodiversity (CBD), Ramsar Convention on wetlands

References

<http://www.enfor.nic.in>
<http://www.ipcc.ch>
<https://www.iucn.org>
<http://www.ramsar.org/>
<http://www.cbd.int>
<http://www.cites.org>



EES-403(B)

NATURAL RESOURCE MANAGEMENT

Credit : 4

Marks: 100

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Natural Resource: Definition, Principle of natural resource conservation, types of natural resources, major issues related to natural resources.

UNIT II

Biological resource management

Forest and their importance, Range lands and their importance. Management of tropical and temperate forest, effects of de-forestation, desertification, Management of Wetlands, Wildlife Management, Forest management.

UNIT II

Water Resource management

Water resources management-management of watersheds, Rehabilitation of Eutrophicated lakes, rehabilitation of polluted rivers- Ganga action plan, Yamuna action plan; rain water harvesting.

UNIT III

Land Resource management

Soil conservation; Watershed Management, wasteland management, Wetland Management, Reclamation of usar, alkaline and saline soil.

Reference Books

1. Conservation Ecology – G.W. Cox
2. Restoration of degraded lands (Ed)-J.S. Singh
3. Natural Resource Conservation- Owen & Chiras
4. Biotechnology Environmental Management-Biotol Series
5. Environmental Chemistry- B K Sharma
6. Wetland Ecosystem- Mitsch, Gosselink, Anderson & Zhang



EES-404(B)

ENVIRONMENTAL AWARENESS & PLANNING

Marks: 100

Credit : 4

Time: 3Hrs

Theory +Internal assessment: 70+30

Note for the Paper setter: The question paper will consist of nine questions in all. The first question (5X2 =10 marks) will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition eight more questions will be set unit-wise comprising of two questions (15 marks each) from each of the four units. The candidate is required to attempt four questions of 15 marks each, selecting at least one question of 15 marks from each unit.

UNIT I

Environmental awareness approach, Role of different media in environmental awareness, Role of NGOs, Role of public participation in Environmental awareness.

UNIT II

Environmental ethics, Ecomark, Basic concepts of environmental planning, Energy resources and water resources planning in India, Urban and rural planning, Landuse planning, Major issues related to Himalayan ecology, Deserts and Mangroves.

UNIT III

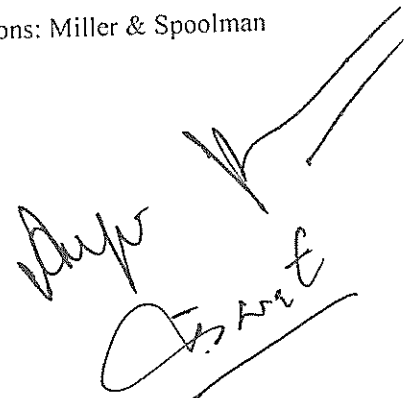
Environmental Economics: Cost and benefit of GHG's controlling, carbon trading and CDM mechanism, Cost benefit analysis-its relevance, concept of consumer surplus, willingness to pay and accept, estimation methods of non market benefits-Contingent valuation, Travel cost approach, Hedonic price approach, Green accounting, Agricultural marketing, Ecomark.

UNIT IV

Concept of Sustainable development, Principals of Sustainability, Pillars of Sustainability, Ecological and Economic and Social aspects of Sustainability, Ecological Footprint, Natural Capital, Poverty and Environment, Millennium Development Goals (MDGs), World Summit on Sustainable Development (WSSD).

Reference Books

1. Environmental Economics- Charles D Kolstad
2. Environmental Ethics- David R Keller
3. Environmental Studies & Ethics- Gouri Suresh
4. Environmental Awareness- Annette Bogler
5. Living in the Environment: Principles, Connections, and Solutions: Miller & Spoolman



EES-405(A)

Environmental Pollution Management

Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Removal of Hardness of water
2. Removal of colour from dye Industry waste water
3. Determination of Residual chlorine in water.
4. Visit to Effluent Treatment Plant ETP (Report)
5. Visit to Sewage Treatment Plant (Report)



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EES-405(B)

Solid Waste

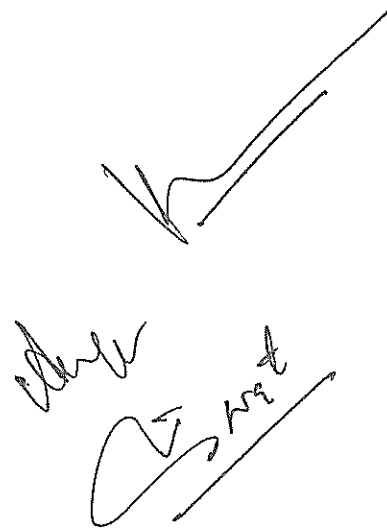
Credit : 3

Practical Hrs: 3 + 3

Marks: 75

Exam duration: 6 hrs

1. Characterization of Solid Waste
2. Composition of Solid waste in Rural settlement
3. Composition of Solid waste in Urban settlement
4. Estimation of Bulk Density of solid waste
5. Estimation of Moisture Content of Solid waste
6. Estimation of Volume of Solid waste
7. Field Visit to Sanitary land Fill site (Report)



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