

Record of percentage change in Syllabus

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University						
Paper No	Name of Paper	Whether included in year 2013-14 (Yes/No)	Whether included in year 2017-18/2018-18 (Yes/No)	Percentage revised in Content #	Year of introduction or revision*	Remark (pls. mark which paper is a value added or skill development paper)
1	ESM-M-101 (Basics of Environmental Science)	Yes	Yes as Paper CC-1, 1 st Sem.	30	2015 & 2018	Value Added Paper
2	ESM-M-102 (Environmental Geoscience)	Yes	Yes as Paper CC-2, 1 st Sem.	60	2015 & 2018	Value Added Paper
3	ESM-M-103 (Statistical Method & Computer Application)	Yes	Yes as Paper CC-3, 1 st Sem.	15	2015 & 2018	Skill Development Paper
4	ESM-M-104 (Laboratory Course Work)	Yes	Yes as Paper CC-4, 1 st Sem.	15	2015 & 2018	Skill Development Paper
5	ESM-M-201 (Environmental Chemistry)	Yes	Yes as Paper CC-6, 2 nd Sem.	70	2015 & 2018	Value Added Paper
6	ESM-M-202 (Environmental Biology)	Yes	Yes as Paper CC-7, 2 nd Sem.	50	2015 & 2018	Value Added Paper
7	ESM-M-203 (Environmental Biotechnology, Instrumentation & Scientific Communications)	Yes	Yes as Paper CC-8, 2 nd Sem. Semester II	50	2015 & 2018	Skill Development Paper
8	ESM-M-204 (Laboratory Course Work)	Yes	Yes as Paper CC-9, 2 nd Sem.	60	2015 & 2018	Skill Development Paper
9	ESM-M-301 (Natural Resources, Environmental Monitoring, EIA)	Yes	Yes as Part of CC-5 in 2 nd Sem. and Part of CC-10 in 3 rd Sem.	50	2015 & 2018	Skill Development Paper
10	ESM-M-302 (Environmental Management)	Yes	Yes as Paper CC-11, 2 nd Sem.	45	2015 & 2018	Skill Development Paper
11	ESM-M-303 (Environmental Planning, Policy and Legislation)	Yes	Yes as Paper CC-12, 3 rd Sem	35	2015 & 2018	Value Added Paper
12	ESM-M-304 (Laboratory Course Work)	Yes	Yes as Paper CC-4, 3 rd Sem	30	2015 & 2018	Skill Development Paper
13	ESM-M-401 A ₁ (Natural Resources Wildlife and Biodiversity)	Yes	Yes as Paper CC-5, 2 nd Sem	50	2015 & 2018	Skill Development Paper
14	ESM-M-402 A ₂ (Environmental Pollution)	Yes	Yes as Paper CC-13, 3 rd Sem	75	2015 & 2018	Skill Development Paper

Head of the Dept. of Zoology

Patna University

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13	ESM-M-401 B ₁ (Disaster Management)	Yes	No		50	2015 & 2018	Skill Development Paper
14	ESM-M-402 B ₂ (Environmental Health)	Yes	No		50	2015 & 2018	Skill Development Paper
13	ESM-M-401 C ₁ (Hydrology and Water Resources)	No	No		30	2015 & 2018	Skill Development Paper
14	ESM-M-402 C ₂ (Restoration Ecology)	No	No		50	2015 & 2018	Skill Development Paper
13	ESM-M-401 D ₁ (Biodiversity and Conservation Biology)	No	No		50	2015 & 2018	Skill Development Paper
14	ESM-M-402 D ₂ (River and Wetland Ecosystem)	No	No		50	2015 & 2018	Skill Development Paper
15	AECC1 (Environmental Sustainability and Swachcha Bharat Abhiyan Activities,	No	Yes as AECC1 in CBCS in 1 st Sem		50	2018	Skill Development Paper
16	AEC-I/SEC-I (One Selected from Basket)	No	Yes As AECC1/SEC1 in 1 st Sem		50	2018	Skill Development Paper
17	AECC2 (Human values and Professional Ethics and Gender Sansitization)	No	Yes As in AECC2 in 3 rd Sem		50	2018	Skill Development Paper
18	DSF-1 (Opt a Course from other Department)	No	No (Opt a Course from other Department)		50	2018	Skill Development Paper
19	ESM-M-403 Laboratory Course Work based on 401A ₁ & 402 A ₂	Yes	Yes As part of CC-9 and CC14		50	2015 & 2018	Skill Development Paper
20	ESM-M-404 Desertation/ Project Work	Yes	Yes, Divided into Elective Paper SEC 15 and SEC 16 of 4 th Sem.		5	2015 & 2018	Skill Development Paper
Overall Change = Total Change in Percentage/Number of Papers offered in Year 2017-18 / 2018-19 → 1170/(20+6)							

Please Consult the attached performa for filling-up the data.

*Mention all the years in which revisions have been carried out even in case of course/paper.

If the departments are running more than one programs, please do the same for all of them in the format given above.

Signature



Name of the Head of the Dept. of Zoology
(P. Nath) Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जल-विज्ञान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड संक्षिप्त (Name of the Course/Paper with Code)	पेपर से हटायें गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
1	Basic of Environmental Science ESM-M-101 Revised In 2015	Segments of environment: Structure and composition of atmosphere, lithosphere, hydrosphere, biosphere and their linkages Brief classification of plants with special reference to bioindicators, phytopremedial plants, nutraceutical organisms and medicinal plants Concept of pollution, types, sources and its effect	Segments of environment: Structure and composition of atmosphere, lithosphere, hydrosphere, biosphere and their interrelationship Classification of plants and animals upto class Pollution: Concept of air, noise, water and soil pollution; Sources, effects and control and measure of air, noise, water and soil pollution
	Revised in 2018	Definition of ecosystem Hydrological cycle	Concept of ecosystem
	Basic of Environmental Science MESCC-01	Laws of thermodynamics Energy flow models Classification of plants and animals upto class	Earth, man and environment, First and second laws of thermodynamics Energy flow models- Linear and Y-shaped models Modern classification of plants and animals upto class Common flora and fauna
		Pollution: Concept of air, noise, water and soil pollution; Sources, effects and control measure of air, noise, water and soil pollution	Land use plan; Soil survey in relation to land use planning : Diseases induced by human use of land

Signature


22-12-18

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2	Environmental Geoscience ESM-M-102 Revised In 2015	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
	Concept of Geosciences, origin and evolution of earth, Plate tectonics, rock forming.	Resource and reserve; Environmental impact of exploitation, process and smelting of minerals
	Geomorphic processes Mountains, plateaus, Karst topography, flood plains, estuaries, deltas etc.	Ocean as new areas for exploitation and exploitation of minerals fossils fuels- coal and petroleum
	Weathering and Soil formation, Soil profile, Soil classification, Soils of India	Hydrological cycles, Types of water, Global water Balance, Ice sheet and fluctuation of sea level, ocean pollution by toxic wastes
	Water resources of India, surface and ground water (aquifers, aquitards), Lakes and rivers of India.	Human use of surface and ground water,
	Ground water quality and Ground water contamination- Nitrate, Iron	Water crises, Conservation of water; Rain water harvesting- traditional methods and modern approaches
	Fundamental of Meteorology - Radiation	Cocept of major, Trace and Rare Earth Elements (REE), Classification of trace elements, Mobility of trace elements
	Climate - Elements of Weather & climate, Climatic Controls, Elementary idea about weather systems, climatic variability and climatic change	Geochemical cycles; Human use of trace elements; Possible effects of imbalance of some trace elements
	Climatic regions of India, ENSO	Climates of India - Tropical Cyclones and Western disturbances
		GIS and its application in Environmental Science
		Diseases induced by change in land use pattern.
		Fundamentals of Meteorology : Atmospheric stability, inversion and mixing heights, windroses, wind, wind system, Microscale, Mesoscale, Macroscale

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2	Environmental Geoscience		
	Revised In 2018	Earth, Man and Environment; Age and interior of earth	Origin of life
	MESCC-02	Earth Processes - Exogenic and Endogenic	Geographical classification and zones
		Geomorphic Processes - Catastrophic Natural Hazards, Tsunami, and Mountain building	Conservation of matter in various Geospheres- lithosphere, hydrosphere, atmosphere and biosphere, Earth's thermal environment and seasons
		Human use of surface and ground water, ground water pollution - Arsenic, Fluoride	Scale of Meteorology- radiation
		Rocks and their classification, Minerals & their classification	Climates of India : Droughts
		Resource and reserve, ore forming processes, Environmental impact of exploitation, processing and smelting of minerals	General relationship between landscape, biomes and climate
		Fossils fuels - coal and petroleum	Earth's perocesses; concepts of residence, time and rates of natural/cycles
		Rain water harvesting - Traditional methods and modern approaches	Rain water harvesting
		Diseases induced by change in land use pattern	Prediction and perception of the hazards and adjustments to hazardous activities.
		Climate of India - La- Lina, drought	Resources and Reserves, Minerals and Population
		Type of soil, soil surveys in relation to Land use planning	Environmental impact of exploitation, processing and smelting of minerals.
			Factors influencing the surface water. Types of water
			Resources of oceans. Ocean pollutions
			Eutrophication and restoration of Indian lakes. Wetlands conservation.
			Biogeochemical factors in environmental health.

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3	Statistical Methods and Computer Application ESM-M-103 Revised In 2015	Hypothesis testing Type I & Type II errors, critical region Graphical representation of data	Errors in hypothesis testing Standard error
		MS office and some other high level languages application of computer in environmental science	MS office and some packed languages, MS word, MS excel, Power point Concept of Data base management System
	Revised In 2018		
	MESCC-3	Central tendency : Mean	Central tendency: Mean (Arithmetic, geometric and harmonic)
4	Laboratory Course Work ESM-M-104 Revised In 2015	Identification of different environmental affected organisms	Estimation of Dissolved Oxygen of water body
		Preparation of food chain/Ecological pyramids in different ecosystem,	GIS and GPS application in environmental survey and montory
		Identification of medicinal plants/ bioindicators/phytochemical plants	
		Weather instruments - Thermographs	
	Revised In 2018		
	MESCC-4	Climatograph and rainfall variability graph	Graph based on Atmospheric temperature, rainfall, relative humidity etc

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5	Environmental Chemistry ESM-M-201		
	Revised In 2015	Definition and explanation of various terms - Molecular weight, gram molecular weight, valency, oxidation state, chemical equations Acid base reaction, osmosis, chemical equilibrium Thermodynamics-concept of energy, entropy, free energy, bond energy	Stoichiometry- Mole concept and equivalent concept, Normality, Molarity, Molality, Mole fraction Chemical equilibrium - Kc, Kp and Kx, Le chatelier's Principle Ionic equilibrium: Concept of Acid and base, ionic product of water, solubility of gas in water Law of thermodynamics- spontaneity of physical and chemical process, Cp and Cv,
		Oxygen and ozone chemistry, Concept of aerosol chemistry, Green chemistry/Green house effect	Reaction in atmosphere, earth's radiation balance, particles, ions, radicals and particulate matters, Chemistry of ozone layer, green house gases and global warming El-Nino phenomenon, photochemical reaction in atmosphere, chemistry of air pollutants.
		Distribution of water on the earth Role of water in the environment	Sedimentation, coagulation, filtration, redox potential.
		Physical and chemical properties of soil, texture, bulk density	Acid base and ion - exchange reaction in soil
		Chemistry of cleaning agent- soap, detergents, and bleaching agents	Nitrogen pathway and NPK in soil
		Chemistry of gaseous, liquid and solid fuels-gasoline, antiknock agents, lubricants and grease fossil, fire wood, biogas	Biochemical effects of Arsenic, Cadmium, Lead, Mercury, Ozone
		Chemistry and biochemical effects of fluoride, Mercury and Carbon monoxide on human beings	Biochemical effects of carbon monoxide, Aerosol, phytochemical smog

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स्नातकोत्तर विभाग **जसंविज्ञान विभाग** के विगत पॉच वर्ष 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: **Environmental Science & Management, (A Self Financing Course)** Department of Zoology, Patna University

पूर संख्या	पूर का नाम तथा पूर कोड संज्ञित (Name of the)	पूर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पूर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
5	Environmental Chemistry		
	Revised In 2018	Cocept and scope of environmental chemistry	
	MESCC-6	Stoichiometry: Mole concept and euivalent concept, Normality, Molarity, Molality, Mole fraction, oxidation and reduction	Stoichiometry, chemical equilibrium, Acid base reaction, the carbonate system,
		Kc, Kp and Kx, Relation between Kc, Kp and Kx, Le Chatelier's Principle	Unsaturated and saturated hydrocarbons, Radionuclides
		Ionic equilibrium, concept of acid and base, Ionic product of water, pH, buffer solutions, Solubility	
		Thermodynamics: Law of thermodynamics, enthalpy, entropy, spontaneity of physical and chemical process, Cp and Cv	
		Chemical composition of the atmosphere, reaction in atmosphere, reaction in atmosphere earth's radiation balance, particulate matters, formation of smog	Classification of elements, Chemical speciation,
		PAN, Acid rain, Chemistry of ozone layer, depletion of ozone layer, green house gases and global warming	Chemical process for formation of inorganic and organic particulate matter, Oxygen and Ozone chemistry, photochemical smog
		El-Nino phenomenon, Photochemical reactions in atmosphere,	Chemistry of water, concept of DO, BOD, COD
		Physical and chemical properties of water (fresh and marine)	Pesticides in water,
		DO, BOD and COD as test of water quality.	Emerging water contaminants- Pharmaceutical residues, Micro plastics, Cosmetics, Detergents etc.
		Composition of soil, soil properties (physical and chemical)	Biochemical effects/aspects of carcinogens in the air
		Water holding capacity, pH, buffering capacity, humus, acidity, alkalinity, acid-base and ion-exchange reaction in soil.	Titrimetry, Gravimetry, Colorimetry, Spectrophotometry, Chromatography, Gas chromatography, Atomic Absorption Spectrophotometry, GLC, HPLC, Electrophoresis, X-ray fluorescence, X-ray diffraction, Flame photometry
		Biochemical effects of Aerosol, photochemical smog	

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पूर से हटाये गये विषय-वस्तु का विवरण
(Details of the remove content)

पूर में जोड़े गये विषय-वस्तु का विवरण
(Details of the added content)

पूर संख्या	पूर का नाम तथा पूर कोड सहित	पूर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पूर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
6	Environmental Biology ESM-M-202	Effect of topographic factor (altitudes, slope etc) on biotic community Autoecology of species, biological clocks Major aquatic and terrestrial ecosystems - pond, lake, marine Aquatic Environment Types of aquatic ecosystem (freshwater and marine ecosystem), Major physical and chemical factors (light, temperature, gases, nutrients)	Topographic factors Concept of biological clocks, Lotka- Volterra Model Major ecosystems of the World: fresh water, river, wetland , desert
	Revised In 2015	Microbiological methods: sterilization - Different methods (moist heat, dry heat, chemical filtration, radiation); Microbiological media: types and significance; culture techniques; techniques of pure culture, staining: stains and dyes, types of staining techniques.	Microbial Methods - Isolation and pure culture of microbes (Sterilization, media preparation, isolation technique, incubation and growth curve)
		Microbial growth: Growth Curve, determination of growth, factors affecting growth; Microbial systematic- a general idea of classification of microbes; nutritional classification of microorganisms; Extremophiles: Acidophiles, alkaliphiles and halophiles	Aerobiology: Basic idea of microflora of air, Identification of aeroallergens and their impact as diseases causing agents, Air-born diseases
		Aerobiology: Micro- flora of air, air sampling technique, identification of aeroallergen	
		Hybridoma Technology and production of monoclonal antibodies.	
6	Environmental Biology		Human ecology and human settlement
	Revised In 2018		Models of population growth and interactions: Leslie's Matrix Model
	MESCC - 07		General idea of Structure and reproduction of bacteria and virus, ultrastructure of bacteriell cell and bacteriophage, Microbes in extreme climate
		Immunological methods: ELISA	Modern applications of immunological methods: ELISA

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7	Environmental Biotechnology, Instrumentation, and Scientific Communication ESM-M-203 Revised In 2015	Basic concept of genetics, DNA, RNA, Passenger Microscopy : Principles and application of light microscopes, phase contrast microscope, scanning microscope and electron microscope	Concept of genetic engineering, Vermiculture technology, Fermentation technology, Basic idea of biosensors
	Revised In 2018	Concept of genetic engineering, Biological enzymes, vectors	Restriction enzymes - types and cleavage pattern; DNA ligase - types and ligation of DNA
	MESCC - 08	Role of genetic engineering in medicine and environmental protection. Application and products of biotechnology - Bio -fuels, Microbial leaching, Fermentation technology.	Cloning vectors; Plasmids (natural, pBR322), phages, cosmid Different strategies used for isolation/synthesis of gene; Organ chemical synthesis of gene; Construction of genomic and cDNA libraries
		Genetically modified organisms (GMOs), Bt-cotton, Bt- brinjal, Pomato, Golden Rice.	Construction of rDNA: Different strategies for construction of rDNA (Use of restriction enzymes, Linkers, Adaptors, Homopolymer tailing)
		Principles and applications of colorimeter, spectrophotometer, flame photometer, and atomic absorption spectrophotometer.	Methods of DNA transfer in suitable host: Electroporation, electrofusion, microinjection, particle gun method.
		Principles and applications of chromatography: paper chromatography, column chromatography, GLC and HPLC	Selection strategies: Different methods for selection of clone (antibiotic resistant markers, colony hybridization, plaque hybridization, immuno screening)
		Basic Concept of Biosensors	Application of rDNA technology: In medicine, agriculture and environment protection
			Bio-fuels (Bioethanol and biogas), Biomining, Vermiculture technology
		Ethics regarding Scientific Communication	Ethics regarding Scientific experimentation
			Environmental ethics and global Imperatives.

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8	(Laboratory Course Work) ESM-M-204 Revised In 2015	Study of animal communities in a terrestrial ecosystem	Microbial Analysis - Isolation and characterization of bacteria and fungi from soil and water
	Revised In 2018	Principles and applications of biological instruments	Principles and application of biological instruments - pH, colorimeter, Spectrophotometer, flame photometer
	MESSCC-09	Identification and comments upon planktons, neuston, nektion, benthos and macrophytes Principle and application of biological instruments- pH, Colorimeter, Spectrophotometer, flame photometer	Estimation of fluoride, arsenic and iron Principles and application of instruments/equipments applied in environmental Science Collection of plankton/benthos; Identification and comments upon planktons, neustons, nektons, benthos, and macrophytes; Qualitative and Quantitative analysis of plankton of an aquatic body Estimation of diversity indices, richness, evenness, dominance. Determination of the minimum size of quadrate for a grassland/forest by species-area curve method. Determination of frequency, density, abundance, and Importance Value Index of grassland/ forest area with the help of Quadrate method Vegetation studies by line, quadrates and belt transect methods and their analysis.
			Study of Conservation Projects in India; Characterization & categorization of threatened Species data
			Experiments based on immunology: Blood group, ELISA etc. Visit to various biodiversity rich centres/ National park/ Wild life sanctuary/ Bird sanctuary/Biological park

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पैपर संख्या	पैपर का नाम तथा पैपर कोड सहित (Name of the Course/Paper with Code)	पैपर से हटायें गये विषय-वस्तु का विवरण (Details of the remove content)	पैपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
9	Natural Resources, Environmental Monitoring and EIA ESM-M-301 Revised In 2015	Principles of site selection and sampling distribution of water, Air and soil Air quality indices Water quality indices Noise quality indices Soil/ Land quality indices	Principles of site selection and sampling distribution - water, air and soil as per IS:3025 and IS : 2720 Ecotoxicology - Concept of dose response relationship, bioaccumulation Median tolerance limit
	Revised In 2018	Introduction of environmental impact assessment and methodology - EIA process, EIA matrices, networks, identification, prediction and EIA report. Introduction of risk assessment - identification and quantification Introduction of risk management programmes; Risk assessment application to environmental management problems and industrial accidents Statistical concept of LC ₅₀	Statistical concept of LC ₅₀ pilot test
	MESCC-10	Natural Resources and their conservation; Conservation and management of soil, land and water. Wildlife - Meaning and its values, threats to wildlife Wildlife conservation & preservation Scope and functions of IUCN and other conservation agencies	Environmental Audit-Concept, Audit process, Pre-and Post-audit activities &Format of Audit Documents, Benefits of Environmental Audit.
		Animal Toxicity test, Concept of dose response relationship; Aquatic toxicity test, Statistical concept of LC ₅₀ , Statistical Concepts of LD ₅₀	Regulatory requirements of pollution control in Industries.

Signature

 20-12-18

Name of the HOD

(P.Nath)

Head of the Dept. of Zoology
Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जसंविज्ञान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पत्र संख्या	पत्र का नाम तथा पत्र कोड सहित (Name of the Course/Paper with Code)	पत्र से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पत्र में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
10	Environmental Management ESM-M-302	Method of collection; Conservancy system and water and carriage system, storm water and sanitary sewer, layout of sewers.	Biomedical wastes, Recycling of waste materials, waste minimization technologies
	Revised In 2015	Characteristics of wastes of industries - Cement, pulp and paper, distillery, sugar, fertilizer, dairy, textile, oil refineries, thermal power plant	Hazardous waste management and Handling Rules - 1991
	Revised In 2018	Air pollution and its control - Types of air pollution and their control measuras, control of (a) Particulate and (b) Gaseous contaminants	Disaster management and risk analysis
	MESCC - 11	Properties of solid waste : Physical and Chemical composition, of Municipal Solid Wastes,	Sources and generation of solid wastes, their characterization, chemical composition, classification
		Fundamentals of solid waste management : Source, segregation, collection, transportation and disposal	Different methods of disposal and management of solid wastes (hospital wastes and hazardous, recycling of waste material), Fly ash utilization, waste disposal and power generation
		Environmental Audit and reputation	
		Environmental Audit - Concept, Audit process, Pre - And Post - audit activities & Format of Audit Documents, Benefits of Environmental Audit.	Definition of Toxicology, Toxic substances in environment: Acute toxicity, Chronic toxicity, Lethal concentration, Bioconcentration, Biomagnifications.
		Regulatory Requirements of Pollution control in industries.	Animal Toxicity Tests, Concept of dose response relationship: Aquatic toxicity test, Statistical concept of LC ₅₀ , Statistical concepts of LD ₅₀ .

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22-12-18

Name of the HOD

(P.Nath)

Head of the Dept. of Zoology
Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जसंविधान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management , (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटायें गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
11	Environmental Planning, Policy and Legislation ESM-M-303		
	Revised In 2015		
		Constitutional Provisions	
		Statutory Provisions for Environmental control and prevention.	
		Eutrophication of water bodies, wetland conservation, Arsenic and Fluoride pollution	Narmada dam, Tehri dam, Almati dam
		Salient Features of biodiversity bill, biopiracy, biosafety & patent, WCED	WCED (Brundtand) Commission, Salient features of Biodiversity Act, 2002
	Revised In 2018		
	MESCC-12	The Environment (Protection) Act, 1986 & Rules, 1986	The Environment (protection) Act Including E waste Magement rule 2016 amended upto 2018 & 1986 & Rules 1986 (vis-à-vis EIA) Scheme of labelling of Environmentally friendly products (Ecomark), Public liability Insurance Act 1991& Rules 1991
		Climate change, fly ash utilization	Soil erosion, formation and reclamation of usar, alkaline and saline soil, waste lands and their control

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Name of the HOD
(P. Nath) of the Dept. of Zoology
Patna University

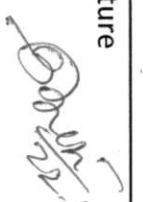
Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जसंविज्ञान विभाग के विगत पाँच वर्ष 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
12	Practical (based on ESM-M-301, 302, 303, ESM-M-304)		
	Revised In 2015	Finding water Quality index / Air Quality index / Soil quality index based on given data	
	Revised In 2018	Study of ambient air quality at high and low traffic zones with respect to parameters (a) SPM (b) SO ₂ (c) NOX and O ₃	
	MESCC - 14	Collection of plankton / Benthos : Qualitative and quantitative analysis of plankton of an aquatic body	
		Estimation of diversity of plankton, Preparation of synopsis for minor project	
			Estimation of DO, BOD and COD of different types of water
			Soil quality analysis - Colour, moisture, texture, water holding capacity, pH, NPK and organic carbon of soil
			Dust fall, SPM, CO ₂ , CO, NO ₂ and SO ₂ monitoring
			Measure of noise in relatively silent, industrial, residential and commercial zones

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Name of the HoD of the Dept. of Zoology,
(P. Nath) Head Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग **जंतुविज्ञान विभाग** के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
13	Natural Resources, Wildlife and Biodiversity ESM-M-401(A.) Elective Paper		
	Revised In 2015	Definition, Renewable and Non Renewable Resources	Concept and strategies of sustainable development
		Forest resources, case studies, timber extraction, mining, dams and their effect on forest and tribal people	Bio-energy, energy biomass and bio gas, anaerobic digestion, energy use pattern in different parts of the world.
		Food Resources : World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizer, pesticide problem, water logging salinity, case studies.	Sun as source of energy, solar radiation and its spectral characteristics and energy content of coal, petroleum and natural gas
		Energy resource : Growing energy, needs, renewable and non-renewable energy source, use of alternate energy source, case studies	Environmental implicant of energy use, CO ₂ emission, global warming, air and thermal pollution, radioactive waste and radioactivity from nuclear reactors, impact of large scale, exploitation of solar, wind, hydro and ocean energy
		Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification	Endangered and endemic species of India.
		Role of an individual in conservation of natural resources	Gene pool, Biodiversity conservation and agenda 21
	Revised In 2018	Wild life protection act, Forest conservation Act	-Bioprospecting, Biopiracy, Biosafety and Patent
	MESCC-06	Biodiversity bill	Causes of depletion of natural resources
	DSE -01 for other Department		Various threats for biodiversity conservation, Functions of IUCN and other conservation agencies

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Name of the Head of the Dept. of Zoology
(P. Nath) Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग **जैव विज्ञान विभाग** के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाने वाले विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
14	Environmental Pollution ESM-M-402 (A ₂) Elective Paper		
	Revised In 2015	Control of thermal pollution Ecological effects of water pollution	Heavy metals and pesticides Air quality standard
		Pesticides: Pesticide pollution, Classification, Sources, Impact, General law of Control in pollution, Super boss, Sewage Treatment	Ground water pollution including arsenic, fluoride and nitrate pollution, Water quality standards, Soil quality standards
		Human population as explosion, Issues, demography, dispersal, causes, Environmental effect, Waste management, types, solid, Bio-remediation, Phytoremediation	Pesticide: Classification, Sources, Impact of Pesticides.
		Biological magnification of toxic materials, pesticides	Biological Magnification of Toxic materials and pesticides, Antidotal procedures in toxicology.
		Types of Pesticides, Anti-dotal procedures in toxicology	Bio-monitoring of toxic chemicals, Bio assay and its application in toxicology.
		Biomonitoring of Toxic chemicals, monitoring program parameters of biomonitoring, Bio-indicators and environmental monitoring, bio assay and its applications in toxicology, environmental legislation, chemical safety Evaluation	Bio-remediation of pesticide pollution.

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Name of the ~~Head~~ **HOD** of the Dept. of Zoology
(P. Nath) Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग उत्तराखण्ड विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management , (A Self Financing Course) Department of Zoology, Patna University

पंर संख्या	पंर का नाम तथा पंर कोड सहित (Name of the Course/Paper with Code)	पंर से हटाने गये विषय-वस्तु का विवरण (Details of the remove content)	पंर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
14	Environmental Pollution ESM-M-402 A ₂ Elective Paper Revised In 2018 MESCC-13	Pollution : Definition and different types of pollution- Air, Water and Soil Pollution, Local, Regional and Global issues related to environment Environmental pollution- Definition and classification of pollutants, Heavy metals and pesticides, Causes of pollution. Air pollution- Definition, Air Pollutants, Causes of air pollution, Biological indicators, Ecological effects of Air pollution, Control of air pollution, Air quality Standards. Thermal pollution- Definition, Sources, Source of thermal pollution, Ecological effects and control of thermal pollution. Water pollution - Types, source and consequences of water pollution, Ground water pollution including Arsenic, Fluoride and Nitrate pollution, Water Quality Standards. Land pollution : Definition, Land pollutants, Causes of Land pollution, Soil Quality Standards. Radioactive pollution - Definition, fallout, radioactive elements, radiation, Source of Radiation, Natural radiation, man-made radiations, control of radioactive pollution. Noise Pollution - Definition, Causes of Noise pollution, Ecological effects of Noise pollution, Noise Quality Indices. Pesticide : Classification, Sources, Impact Of Pesticides. Biological Magnification of toxic materials and pesticides, Antidotal Procedures In toxicology. Bio-monitoring of toxic chemicals, Bio assay and its application in toxicology. Bio- remediation of pesticide pollution.	Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Gas laws governing the behavior of pollutants in the atmosphere. Methods of monitoring and control of air pollution SO ₂ , Nox, CO, SPM. Effects of air pollutants on human beings plants, animals, materials and on climate. Acid Rain. Air Quality Standards. Vehicular Pollution and urban air quality. Box Model, Gaussian Plume model Thermal pollution - Definition, sources, control and effects of thermal pollution. Types, sources and consequences of water pollution (ground water, surface water, Ocean water). Physicochemical and Bacteriological sampling and analysis of water quality. Standards, sewage and waste water treatment and recycling. Epidemiological issues related to ground water pollution (e.g. Goitre, Fluorosis, Arsenicosis). Water quality standard, Point Source Stream Pollution Model. Physicochemical and Bacteriological sampling as analysis of soil quality. Soil pollution Control.

Contd.

Name of the HoD
(P. Nath) Head of the Dept. of Zoology
Patna University

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Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जंतुविज्ञान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
14	Environmental Pollution ESM-M-402 A ₂ Elective Paper Revised In 2018 MESCC-13		Industrial waste effluents and heavy metals, their interactions with soil components. Soil micro-organisms and their functions, degradations of different insecticides, fungicides and weedicides in soil. Different kinds of synthetic fertilizer (NPK) and their interactions with different components of soil. Sources of noise pollution, measurement of noise and Indices. Effect of meteorological parameters on noise propagation Noise exposure levels and standards. Noise control and abatement measures. Impact of noise on human health. Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management.
			Radioactive pollution-Definition, fall out, radioactive elements, radiation, sources of radiation, natural radiation, manmade radiations, types of atom bombs, internal and external emitters, biological effects of radiations, control of radioactive pollution

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 22-12-18

Name of the HOD

(P. Nath) of the Dept. of Zoology
Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग **जल संवर्धन विभाग** के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
13	Disaster Management ESM-M-402 B ₁ Elective Paper	No Change	No Change
	Revised In 2015	Entire Syllabus Deleted	
14	Environmental Health ESM- M-402 B ₂ Elective Paper	No Change	No Change
	Revised In 2015	Entire Syllabus Deleted	
13	Hydrology and Water Resources ESM-M-402 C ₁ Elective Paper	No Change	Entire Syllabus included
	Revised In 2015	Entire Syllabus Deleted	
14	Restoration Ecology ESM- M-402 C ₂ Elective Paper	No Change	Entire Syllabus included
	Revised In 2015	Entire Syllabus Deleted	

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22.12.18

Name of the HoD of the Dept. of Zoology
(P. Nath) Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग **जल-विज्ञान विभाग** के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड (Name of the Course/Paper with Code)	पेपर से हटाये गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
13	Hydrology and Water Resources ESM-M-402 C ₁ Elective Paper Revised In 2015 Revised In 2018	No Change Entire Syllabus Deleted	Entire Syllabus included
14	Restoration Ecology ESM-M-402 C ₂ Elective Paper Revised In 2015 Revised In 2018	No Change Entire Syllabus Deleted	Entire Syllabus included
13	Biodiversity and Conservation Biology ESM-M-402 D ₁ Elective Paper Revised In 2015 Revised In 2018	No Change Entire Syllabus Deleted	Entire Syllabus included
14	River and Wetland Ecosystem ESM-M-402 D ₂ Elective Paper Revised In 2015 Revised In 2018	No Change Entire Syllabus Deleted	Entire Syllabus included

Signature

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Name of the HOD of the Dept. of Zoology
(P. Nath)
Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग जल-विज्ञान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा पेपर कोड सहित (Name of the Course/Paper with Code)	पेपर से हटाने गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
15	Laboratory Course Work (based on ESM-M-401 A ₁ & 402 A ₂) ESM-M-403 Elective Paper		
	Revised In 2015	Determination of bulk density porosity of soil	Soil quality analysis water holding capacity, Measure of noise in relativity silent, Industrial residential and commercial zone
	Revised In 2018	Deleted the entire syllabus of ESM-M-403 based on 401A ₁ & 402A ₂	Included in as part of MESSC-09 and MESSC-14
15	Laboratory Course Work (based on ESM-M-401 B ₁ & 402 B ₂) ESM-M-403 Elective Paper		
	Revised In 2015	No Change	No Change
	Revised In 2018	Entire syllabus deleted	
15	Laboratory Course Work (based on ESM-M-401 C ₁ & 402 C ₂) ESM-M-403 Elective Paper		
	Revised In 2015		Included
	Revised In 2018	Entire syllabus deleted	
15	Laboratory Course Work (based on ESM-M-401 D ₁ & 402 D ₂) ESM-M-403 Elective Paper		
	Revised In 2015		Included
	Revised In 2018	Entire syllabus deleted	

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Name of the HoD of the Dept. of Zoology
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Patna University

Proforma for Filling-Up Data Related to the Revision in Courses/Paper

स्नातकोत्तर विभाग उत्तुविज्ञान विभाग के विगत पाँच वर्षों 2013-18 के पाठ्यक्रमों में परिवर्तन का विवरण।

Name of the Program: Environmental Science & Management, (A Self Financing Course) Department of Zoology, Patna University

पेपर संख्या	पेपर का नाम तथा संक्षिप्त पेपर कोड (Name of the Course/Paper with Code)	पेपर से हटाने गये विषय-वस्तु का विवरण (Details of the remove content)	पेपर में जोड़े गये विषय-वस्तु का विवरण (Details of the added content)
16	Dissertation/Project Work ESM-M 404 Revised In 2015 Revised In 2018 MESEC - 01 & 02 Environmental Sustainability and Swachcha Bharat Abhayan Activity AECCI Revised In 2015 Revised In 2018	No Change	The topics are divided into 5 unit, other wise no change
17	Revised In 2015 Revised In 2018	No Change	Splitted into two elective Courses as SEC -01 and SEC -02
18	One selected from Basket of the Syllabus AEC-1/SECI Revised In 2015 Revised In 2018		Included
19	Human Values and Professional Ethics and Gender Sansitization AEC- 2 Revised In 2015 Revised In 2018		Included
20	Opt a Course from other Department DAC-1 Revised In 2015 Revised In 2018		Included

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Name of the ~~HOD~~ the Dept. of Zoology
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