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UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21

Dated: 04.10.2023

Notification

Sub:- Modification Syllabus and Scheme of Examinations Environmental Science (UG) (III[rd] & IV[th] Semester) with effect from the Academic year 2023-24.

Ref:- Decision of Board of Studies in Environmental Science (UG) meeting held on 16.09.2023.

*****

The Board of Studies in Environmental Science (UG) which met on 16.09.2023 has resolved to recommended and approved the syllabus and scheme of Examinations of Environmental Science Programme (III[rd] & IV[th] Semester) with effect from the Academic year 2023-24.

Pending approval of the Faculty of Science & Technology and Academic Council meetings the above said syllabus and scheme of examinations are hereby notified.

The syllabus and scheme of Examinations contents may be downloaded from the University website i.e., www.uni-mysore.ac.in.

DRAFT APPROVED BY THE REGISTRAR

Deputy Registrar (Academic)

Deputy Registrar (Academic)
University of Mysore
Mysore-570 005

To;

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS in Environmental Science, Manasagangothri, Mysore.
4. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
5. The Director, PMEB, University of Mysore, Mysore.
6. Director, College Development Council , Manasagangothri, Mysore.
7. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
8. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
9. Office Copy.

GOVERNMENT OF KARNATAKA

Report on

Proposed Curricular Framework for UndergraduateProgramme

in Universities of Karnataka State

in

ENVIRONMENTAL SCIENCE

Submitted to

Karnataka State Higher Education Council Government of Karnataka
Bengaluru

7th June 2022

GOVERNMENT OF KARNATAKA

Report on

Proposed Curricular Framework for UndergraduateProgramme

in Universities of Karnataka State

in

ENVIRONMENTAL SCIENCE

Submitted by

Dr. N. Nandini **Chairperson, Subject Expert Committee - Environmental Science** Professor, Dept. of Environmental Science, Bangalore University, Bengaluru	**Dr. Jayappa, M.** **Member Convenor, Subject Expert Committee - Environmental Science,** Special Officer, Karnataka State Higher Education Council Bengaluru and Coordinator, Environmental Science Committee

and

Members of Subject Expert Committee - Environmental Science

1. **Dr. N. S. Raju**, Professor, Department of Studies in Environmental Science, University of Mysore, Mysuru.
2. **Dr. S. V. Krishna Murthy**, Professor, Department of PG Studies and Research in Environmental Science, Kuvempu University, Shankaraghatta.
3. **Dr. S. Suresha**, Professor and Head, Department of Environmental Science, Yuvaraja's College (Autonomous), University of Mysore, Mysuru.
4. **Dr. B. S. Prabhakar**, Associate Professor and Head, Department of Environmental Science, St. Joseph's College (Autonomous), Bengaluru.

7th June 2022

PREAMBLE

The course curriculum for undergraduate studies under choice based credit system (CBCS) for B.Sc. in Environmental Science (Basic/Hones.) is framed in this document. This exercise was undertaken as part of the nationwide curriculum restructuring initiative by the National Education Policy-2020.Many formal and informal meetings were held with a number of colleagues from the universities and colleges, who helped with crucial inputs as to the content of the course. This curriculum is a fresh exercise, but also represents a continuous effort of deliberations with the University and College teachers.

As enshrined in the National Education Policy-2020 vision of introducing course curriculum for undergraduate studies under Choice Based Credit System (CBCS), the main objective of framing this curriculum of B.Sc. (Basic/Hons.) in Environmental Science is to impart the students a holistic understanding of the subject giving substantial weightage to the core contents, skill, value-based and ability enhancement. The syllabus has given due importance on the main streams of the body of knowledge on 'Environment' with due recognition of its wide spectrum. The ultimate goal of the syllabus is to enable the students to have an in-depth knowledge on the subject and enhance their scope of employment at every level of exit. Adequate emphasis has been given on the new and emerging techniques and understanding of the subject under the changing regime and global context.

There is need to strengthen the students to understand essential aspects of environmental science in diverse subject areas such as ecology, environmental chemistry, environmentalpollution,environmentalgeoscience,atmosphericsciences,biodiversity,naturalresou rcesmanagement, global warming, climate change and waste management. The curriculum lays focus on creating new knowledge, acquiring new skills and capabilities in Environmental Science producing an intelligent human resource serving the Environment and society, focusing on problem solving critical thinking, team work and collaboration. There

Is also an additional emphasis in providing opportunities to understand the integration of modern disciplines such as environmental modeling, geographical information systems and remote sensing, environmental sustainability, corporate governance and their applications to environmental sciences. Students would be encouraged to go beyond the classroom and conduct active action-research, research projects, technology based learning and internships in industry/ private/government/manufacturing and service sectors based on suitability. Lectures and classroom sessions are accompanied with on-field visits, industrial visits, seminars, laboratory experiments and in-plant training. Educational visits are an integral part of teaching Environmental Science. These interventions are compulsory and essential aspects of the curriculum. There are optional subject that can be chosen by the students as per their desire and their professional choices.

It is hoped that a student with a four years B.Sc. Environmental Science (Hons.) degree, after having the rigor of the courses outlined here, will feel adequately equipped to meet the challenges of career development. At the same time, there is sufficient content for those who wish to continue academic life at the University beyond the under-graduate level. Due care has been taken to maintain necessary academic wholesomeness and depth in the course contentsothatthelearningoutcomesfromthesecourseswillleadtointellectualgrowthofastudent.Then eedforaBasic/Hons.courseinEnvironmentalSciencesisnecessitatedbyourcountry's requirement and also the acceptability of the subject by young students from the view point of career opportunity. There is a demand for the subject in our country and as Educationists we have a societal obligation tomeetsuch aspiration of the youths. It is equally expected that Environmental Science graduates will significantly contribute to the vision of 'Zero Defect, Zero Effect 'policy initiative of Government of India.

The course curriculum presented in the following table confirms to the general Guidelines ofNEP-2020scheme, semester schedule, evaluation criteria

And course credit structure of B.Sc. Environmental Science (Basic/Hons.) Programme, like all other undergraduate courses shall comprise of 184 credits spread over Thirty Seven (37) papers to be completed in four years/eight semesters.

Sem	Theory	Practicals	OpenElectives	Vocational Course	Internships	Discipline Specific Electives	ResearchMethodology	Project	Total Papers
I	1(4)	1(2)	1(3)	-	-	-	-	-	3
II	1(4)	1(2)	1(3)	-	-	-	-	-	3
III	1(4)	1(2)	1(3)	-	-	-	-	-	3
IV	1(4)	1(2)	1(3)	-	-	-	-	-	3
V	2(6)	2(4)	-	1(3)	-	-	-	-	5
VI	2(6)	2(4)	-	1(3)	1(2)	-	-	-	6
VII	3(9)	2(4)	-	-	-	2(6)	1(3)	-	8
VIII	3(9)	1(2)	-	-	-	1(3)	-	1(6)	6
Total Papers	14	11	4	3	1	3	1	1	37

#Numbersinparenthesisindicatecredits-amountingtoatotalof107credits

In addition to the subject of Environmental Science (details provided in the above table), another core paper with a similar credit pattern is to be chosen by the student.

Irrespective of the two core paper chosen, every under-graduate student needs to take-up 2 Ability Enhancement Compulsory Courses (AECC), 2 languages, 4 Skill basedcoursesand8Valuedbasedcourses.

A candidate with a minimum qualification of M**.Sc. in Environmental Science subject only** is qualified to teach B.Sc. (Basic/Hons.) Environmental Science at under-graduate level in all the Universities, Deemed Universities Autonomous Institution, Government, Aided and Private Colleges in the State of

Karnataka.PreferencemaybegiventocandidateswithUGC-NET/K-SET/Ph.DinEnvironmentalSciencefollowingthegovernmentdirectives.

Further, the existing number of UGC-NET Fellowships in the field of Environmental Sciences is highly inadequate; it is advisable to increase the number of Fellowships in this area.

An Environmental Science programme at the under-graduate level will be successful only when independent Departments of Environmental Sciences are established at under-graduate colleges. It is important to avoid existing problems of co-ordination in teaching carried outthroughparticipatoryapproach.NEP-2020EnvironmentalScienceSubjectExpertCommitteeurgesUniversities/Collegestotakenecessarysteps inthisdirection.

EXITOPTIONSANDCREDITREQUIREMENTS

Progressive Certificate in Science, Diploma in Science, Bachelor of Science Degree or Bachelor of Science Degree with Honors in Environmental Science is awarded at the completion of every progressive year.

Exit with	Credit requirements
CERTIFICATE IN SCIENCE at the successful completion of First year (Two Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	50credits
DIPLOMA IN SCIENCE at the successful completion of Second year (Four Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	100credits
BACHELOR OF SCIENCE DEGREE at the successful completion of Three year (Six Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	142credits
BACHELOR OF SCIENCE DEGREE WITH HONOURS IN ENVIRONMENTAL SCIENCE at the successful completion of Four year (Eight Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	184credits

A student will be allowed to enter/re-enter only at the ODD semester and can only exit after EVEN semester. Re-entry at various as lateral entrants in academic programmes based on the above mentioned earned credits and proficiency test records. The validity of the earned credit will be for a maximum period of seven years or as specified by the Academic Bank of Credits (ABC).Emphasis is given on Continuous Internal Assessment (CIA) with Higher order thinking skills (40%:60% - 40% CIA and 60% End Semester Examination)for theory course and50%:50%-End Semester Examination and CIA for Laboratory work, Field works, Project, Internship and Educational visits.

MODELCURRICULUM

Name of the Degree Programme: B.Sc.**(Basic/Hons.)**

Discipline Core: **Environmental Science**

Total Credits for the Programme: **184**

Starting year of implementation:**2021-22**

Programme Outcomes:

By the End of the Programme the students will be able to develop:

1. Disciplinary knowledge in fields related to Environmental Science
2. Systemic and critical thinking with reference to environment-people-economic-development attributes
3. Problem identification skills and sustainable solution provisioning
4. Analytical reasoning and appropriate interpretation skills
5. Self-directed learning efficiencies leading to a productive lifelong learning process
6. Research-related skills such as review of literature, design of experiments, statistical competence, report writing and pre parentage specific communication packages
7. Cooperation/Teamwork
8. Reflective thinking
9. Multidisciplinary competence catering to environmental sustainability

Assessment:

Weight age for assessments (in percentage)

Type of Course	Formative Assessment/IA	Summative Assessment
Theory	**40**	**60**
Practical	**25**	**25**
Project/Experiential Learning (Internship etc.)	**Report=50** - Relevance of the topic=05 - Robustness of literature review=10 - Appropriateness of Methodology=10 - Results, Discussion and Interpretation=20 - Referencing and citation=05	**Viva-voce=50** - Presentations kills=25 - Question answer=25

PROPOSED CURRICULUM STRUCTURE FOR UNDERGRADUATE ENVIRONMENTAL SCIENCE DEGREE PROGRAMME

II B. Model Programme structure for Bachelor of Science (Basic/Hons.)With practical's with TWO major SUBJECT

SEMESTER	DISCIPLINECORE (DSC) (Credits)(L+T+P)	DISCIPLINE SPECIFICELECTIVE(DSE) /OPENELECTIVE(OE) (Credits)(L+T+P)	ABILITY ENHANCEMENTCOMPULSORY COURSE (AECC)(L+T+P)		SKILL ENHANCEMENTCOURSE(SEC)			TOTAL CREDITS
					SKILLBASED (Credits)(L+T+P)	VALUEBASED(credits) (L+T+P)		
I	Env.ScienceA1(4+2)Other Core B1(4+2)	OpenElective-1(3)	L1-1(3) L2-1(3) (4 hours each)	Environmental Studies (2)	SEC-1DigitalFluency(2) (1+0+2)	Physical Education for fitness(1) (0+0+2)	Health &Wellness(1) (0+0+2)	25
II	Env.ScienceA2(4+2)Other Core B2(4+2)	OpenElective-2(3)	L1-2(3), L2-2(3), (4 hours each)			Physical Education – Yoga (1)(0+0+2)	NCC/NSS/R&R (S&G)/Cultural(1) (0+0+1)	25
Exit option with Certificate in Science (50credits)								
III	Env.ScienceA3(4+2)Other Core B3(4+2)	OpenElective-3(3)	L1-3(3) L2-3(3) (4 hours each)	-	SEC-2: Artificial Intelligence (2) (1+0+2)	Physical Education – Sports (1)(0+0+2)	NCC/NSS/R&R (S&G)/Cultural(1) (0+0+1)	25
IV	Env.ScienceA4(4+2)Other Core B4(4+2)	OpenElective-4(3)	L1-4(3) L2-4(3) (4 hours each)	Constitution of India(2)	-	Physical Education – Games (1)(0+0+2)	NCC/NSS/R&R (S&G)/Cultural(1) (0+0+1)	25
ExitoptionwithDiplomainScience(100credits)ORChooseanyoneofthecoresubjectsasMajorand other as Minor								

V	Env. Science A5 (3+2)Env.ScienceA6(3+2) Other CoreB5(3+2)	Vocationalcourse-1(3)	-	-	SEC-3:SEC Such as Cyber Security(2) (1+0+2)	-	-	**20**
VI	Env. Science A7 (3+2)Env.ScienceA8(3+2) Other CoreB6(3+2)	Vocationalcourse-2(3) Internship(2)	-	-	SEC-4: Professional communication (2)	-	-	**22**
Exit option with Bachelor of Science, B.Sc. Degree in Environmental Science(142credits) OR continue studies with Major in the fourth year								
VII	Env. Science A9(3+2) Env.Science A10(3+2)Env. ScienceA11(3)	Env.ScienceElective-1(3) Env.ScienceElective-2(3) Research Methodology(3)	-	-	-	-	-	**22**
VIII	Env. Science A12 (3+2) Env.ScienceA13(3)Env. ScienceA14(3)	Env.ScienceElective-3(3)Research project (6)*	-	-	-	-	**-**	**20**
Award of Bachelor of Science Honors Degree, B.Sc.(Hons.) Degree in Environmental Science (184credits)								

Note:*L+T+P=Lecturing in Theory+Tutorial+Practicals.

*In lieu of the research project, two additional elective papers/ Internship maybe offered Numbers in the parenthesis refer to credits.

CURRICULUMSTRUCTUREFORTHEUNDERGRADUATEDEGREEPROGRAMME-B.Sc.(BASIC/HONS.)

Total Credits for the Programme: **184**

Starting year of implementation: **2021-2022**

Name of the Degree Programme: **B.Sc.(Basic/Hons.)**

Discipline/Subject: **Environmental Science**

Programme Articulation Matrix

Semester	Title /Name of the course	Programme outcomes that the course addresses(notmorethan3percourse)	Pre-requisite course(s)	Pedagogy	Assessment
1	**ENDSC 101-DIVISIONSOFENVIRONMENT(4)**	Have developedknowledgeandunderstandingoftheDivisionsofth eEnvironmentandabletoappreciatetheholisticrelationship betweenthem.	PU Corequivalent in Science subjects	Theory and course projects	Continuous Internal Assessment (Formative assessment)-40%. End Semester Examination (Summative assessment)-60%
	ENDSC102-WATERQUALITYANALYSIS(2)	Be able to analyze the vital physicochemical parameters of water, interpret and suggest suitable Treatment methods.		Hands-on-training	
	ENDSE OE 101-ENVIRONMENTALCONSERVATIONMOVEMENTS(3) OR ENDSE OE102 - ENVIRONMENTALPOLLUTI	Be able to get an introductory account of the Chosen open elective paper and use the acquired knowledge in decision making and hence add to quality of life.		Theory, case studies and self-study	

	ON(3)				

Semester	Title /Name of the course	Programme outcomes that the course addresses (not more than 3per course)	Pre-requisite course(s)	Pedagogy	Assessment
2	**ENDSC 201ECOLOGY-THEORYANDPRACTICE(4)**	Have developed sound knowledge of Basic and Applied Ecology.	-	Theory, case Studies and course projects	Continuous Internal Assessment (Formative assessment)-40%. End Semester Examination (Summative assessment)-60%
	ENDSC 202-ECOLOGICALANALYSIS (2)	Be able to Identify and Enumerate Planktons, Estimatet he Primary Productivity of an Aquatic Ecosystem, study The characteristics of a Biotic Community; Be able to Compute Carbon Sequestration of trees.		Hands-on-training	
	ENDSE 201 OE-CLIMATECHANGEANDITSIMPLICATIONS(3) OR ENDSE 201 OE-ENVIRONMENT ANDPUBLICHEALTHINCONTEMPORARYSOCIETY(3)	Be able to get an introductory account of the chosen open elective paper and use the acquired knowledge in decision making and hence add to quality of life.		Theory, Case studies and self-study	

Exit option with Certificatein Science (50credits)

Job opportunities for the Exitoption with Certificate

- Sampling Assistant in wastewater treatment plants
- Analytical Assistant/Intern analyst in water testing laboratories
- Laboratory instructor in educational in situations
- Field Technician in mobile environmental laboratories
- Field Technician in Research institutions/NGOs involved in environmental monitoring/carbon credit establishment/productivity studies.
- Sampling and execution assistant in environmental auditing
- Garden/nursery Supervisor/Entrepreneurship
- NGOs/Consultancy firms
- Self-employment

Semester	Title /Nameofthecourse	Programme outcomes that the courseaddresses(notmorethan3percourse)	Pre-requisite course(s)	Pedagogy	Assessment
3	**ENDSC 301–NATURALB RESOURCES AND MANAGEMENT(4)**	Have developed a sound knowledge andunderstandingofNaturalResourcesandApplicationof variousmanagementpractices.	Certificate in Science with EnvironmentalScienceasasubjectandatotalcreditscoreof50	Theory, case studies and problem solving methods	ContinuousInternalAssessment(Formativeassessment)-40%. EndSemesterExamination(Summativeassessment)-60%
	ENDSC 302– MINERALOGY,PETROLOGY,ENERGYRESOURCESANDMEDICINALPLANTS (2)	BeabletoIdentifyMajorRockformingMineralsandRocks. Learnbasicskillsofmappingandcartography.		Hands-on-trainingandfieldstudies	
	ENDSE 301 OE– WOMENANDENVIRONMENT(3) OR ENDSE 302OE– ENVIRONMENTALDISASTERSANDMANAGEMENT(3)	Beabletogetanintroductoryaccountofthe chosenopenelectivepaperandusetheacquiredknowledge in decision making and hence add toqualityoflife.		Theory,Casestudiesand Self-study	

Semester	Title /Nameofthe course	Programme outcomes that the courseaddresses(notmorethan3percourse)	Pre-requisite course(s)	Pedagogy	Assessment
4	**ENDSC 401- BIODIVERSITY,WILDLIFEANDCONSERVATION (4)**	Havedevelopedanunderstandingof theBiodiversityresources,statusofwildlife,thepressuresfacedbywildlifeareasandcultivateaninsightintothe conservationpractices.	'	Theory,casestudiesandfieldstudies	ContinuousInternalAssessment(Formativeassessment)-40%. EndSemesterExamination(Summativeassessment)-60%
	ENDSC 402- BIODIVERSITYASSESSMENTANDECOSYSTEMSERVICES(2)	Beabletoanalysethe behavior oflocalweatherpatternsby monitoringmeteorologicalparameters.Developwindand pollutionroses;analyseclimatemapsandmake interpretations. Beabletoexecutesamplinganddatacollectionskillswithreferencetobiodiversityandwildlife. Willhaveanexposuretowildlifemonitoring techniquessuchasquadrats,linetransectsandmark-release-recapture methods.		Datahandling andHands-on-training	
	ENDSE 401 OE- ENVIRONMENT ANDSUSTAINABLEAGRICULTURE(3) **OR** **ENDSE 402 OE- INITIATIVESFORENVIRONMENTALMANAGEMENT(3)**	Beabletogetanintroductoryaccountofthe chosenopenelectivepaperandusetheacquiredknowledge in decision making and hence add toqualityoflife.		Theory,CasestudiesandSelf-study	
ExitoptionwithDiplomainScience(100credits) ORChooseanyone ofthecoresubjectsasMajorandotherasMinor					
JobopportunitiesfortheExitoption withDiplomainScience					
• Procurement,processing,valueadditionandMarketingof NTFPs-Executive/Entrepreneurship • ProcurementofMedicinalPlants–Marketing/Entrepreneurship					

- Labassistantineducationalinstitutions
- WildlifeandEcotourismguides
- PublicHealth/WasteManagementAssistantsinMunicipalities
- Incineratoroperatorsinsmallestablishments
- NGOs/Consultancyfirms
- Self-employment

ExitoptionwithBachelorofScience,B.Sc.DegreeinEnvironmentalScience(142credits)orcontinuestudieswithMajorinthe Fourthyear

JobopportunitiesfortheExitoption withBachelorofScienceDegree

- AssistantsinCentral andStatePollutionControlBoards
- EnvironmentalHealthandSafetyAssistantinindustries
- OccupationalHealthandSafetyAssistantinindustries/themeparks
- PublicHealth/WasteManagementOfficersinMunicipalities
- WastewaterTreatmentPlantManagers
- Environmental/ProductionQualityAssuranceExecutive-Junior
- EnvironmentalAnalyst(Validation)
- ResearchAssistant/Staff
- R&DLabAssistant
- Watertestinglabsorchemicalsuppliers/Entrepreneurship
- LiaisonOfficer
- WatershedManagementAssistant
- Mineral/EnergyResourceExplorationAssistant
- Solarenergy/alternateenergyExecutives
- MicroirrigationExecutives
- OrganicFarmingExecutives/Entrepreneurship
- NGOs/Consultancyfirms
- TeachersinSchools
- Self-employment

AwardofBachelorofScienceHonorsDegree,B.Sc.(Hons.)DegreeinEnvironmentalScience(184credits)

JobopportunitiesfortheB.Sc.(Hons.) DegreeinEnvironmentalScience

- ScientificAssistantinResearchinstitutions
- ScientistsinCentralandState PollutionControlBoards
- EnvironmentHealthandSafetyOfficerinindustries
- EnvironmentalauditorI/AuditorII
- Environmental/ProductionQualityAssuranceOfficer
- WastewaterTreatmentPlantManagers
- SanitarylandfillandHazardousWasteHandlingExperts
- Toxicologyspecialist
- ForensicScientist
- QualityControlExecutive
- RegulatoryAffairs/LiaisonOfficer
- NGOs/Consultancyfirms
- ProjectandPlanningandDevelopmentDepartments
- WatershedManagementProfessional
- TeachersinSchools
- Self-employment

B.Sc. (Basic/Hons.) Semester3

Title of the Course: **ENDSC301- NATURAL RESOURCES AND MANAGEMENT**

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	**60**	**2**	**60**

Programme Specific Objectives	
PSO1	To develop the understanding of role of natural resources in economic and ecological development.
PSO2	To instill aknowledge ofquantifyingandevaluatingcontributionofnaturalresourcesmanagementinhumandevelopment.
PSO3	Tomotivateandinspiretoacquirecontemporaryunderstandingandskillsleadingtoissue identificationandmanagementofnaturalresources.
PSO4	To inculcatecreativityandinnovativespiritinthedomainof human-developmentandnaturalresource utilization efficiency.

Programme Outcomes	
PO1	Demonstrate competence in understanding the significance of natural resources in economic/ecological development.
PO2	Demonstratetheabilitytocarryouttheprocessofidentificationof,dataprocurementandinterpretationwithreferencetonaturalresources.
PO3	Abilitytounderstandandappreciatetheroleofquantificationofresourceusepatterninconteporary/sustainabledevelopmentparadigms.
PO4	Be able to understandthe demandsof dataanalysisandreportinginnatural resourcemanagementdomain.

Content of Theory Course3	60 Hours
Unit-1	**15**
Introduction and Definition. Functional theory of resource and dynamic theory of resource. Classification of resources-Organic and inorganic; exhaustible and inexhaustible; International, National and Individual; Ubiquitous and localized resources. Factors influencing resource availability, distribution and utilization patterns.	
Resources scarcity: types of resources scarcity-Demand-induced, supply-induced, and structural. Conservation of resources: Methods of conservation- Refuse, reduce, reuse, recycle and recovery - Methods of waste reduction. Case studies on energy and paper conservation. Natural Resources: definition, Classification of natural resources based on utility potential. Depletion trends of Natural resources.	
Unit-2	**15**
Water Resources: Sources of water and distribution pattern: Fresh water-Water budget of India-Dams: Impact on environment–Droughts and Floods: Causes and Control Strategies –Watershed Management; Rain Water Harvesting; River linking–pros and cons. Marine water–Ocean as a resource - Fisheries, aquaculture–prawns and oysters - Transportation–Shipping (people, good sand oil)and its impacts - De salination–Importance and impacts - Coastal erosion and reclamation Ground Water resources: Open wells and Bore wells–Groundwater exploitations and Recharge. Water and agriculture: Irrigated and rain-fed cultivation; Types of irrigation. Irrigation and drainage .Nutrient delivery through irrigation. Environmental implications of Conventional Agriculture–Soil degradation, surface and ground water pollution, loss of natural biodiversity, water logging and soil salinity. Hydroponics–Soil-water conservation practices in agriculture.	
Unit-3	**15**

Forest Resources: Importance of Forestry–Types of Forests of India and Karnataka–Pressures on forest areas–*encroachments, forest fires, land use change (allocation for agriculture, industry and housing*) and over utilization of forest resources (harvesting of NTFPs, overgrazing, other anthropogenic pressures). Impacts of Deforestation:-Forest Fires and their Control; Forest conservation: Sacred Groves–Chipko and Appiko Movements; Joint Forest Management; Afforestation and Deforestation (Social forestry, Agro forestry, Urban forestry), Major and Minor Forest Products; Forest based industries (Plywood, Pulp and Paper and Cottage industries). Ecotourism and its impacts.	
Captive plantations and Energy plantations Forest and wildlife conservation-Protected areas–Sanctuaries-National Parks–Biosphere Reserves.	
Unit-4	**15**
Land resources: Land-use patterns in India. Agro-climatic zones of India and Karnataka. Types of agriculture and cropping patterns. Implications of agriculture on soil –Soil erosion –causes, types, impacts, control measures. Desertification: causes, impacts and control measures. Mineral resources**:** Mining and Quarrying and their impacts; Ecological conflicts of mineral extraction; Deep sea mining and offshore oil exploration. Case studies on Coal and stone quarries. Energy Resources: Definition. Conventional, non-conventional and alternative energy resources. Energy sources and their impacts: Biomass burning (Fuel wood, Agriculture residue, Cow dung), Fossil fuels, Hyde, Geothermal, Nuclear energy; Solar (Thermal and Photovoltaic), Wind, Tidal, Microhydel. Briquettes, Wood gas, Energy from waste (Pyrolysis and Biogas), Agri-based fuels (*Biodiesel, Gasohol*), Hydrogen fuels. Cogeneration.	

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60% (60Marks)
Total	100%(100Marks)

Date CourseCo-ordinator SubjectCommitteeChairperson

Content of Practical Course 3: List of Experiments to be conducted

ENDSC 302-MINERALOGY, PETROLOGY, ENERGY RESOURCES AND MEDICINAL PLANTS

(Total Teaching Hours=52; Total Credits=2)

1. Mineralogy: Description of Minerals
2. Identification of Minerals based on their properties
3. Petrology: Description of Rocks
4. Identification of Rocks– Igneous, Sedimentary and Metamorphic
5. Introduction to Mapping- Direction, scale and conventional signs and symbols
6. Latitude & Longitude; Grid references
7. Representation of Relief
8. Study of drainage pattern and settlement pattern
9. Geo location of resources- Mineral, ore, petroleum and energy resources
10. Characteristics and delineation of water shed using toposheets
11. Identification of medicinal plants of Karnataka
12. Identification of locally available NTFP's
13. Introductiontoagroclimaticzonesof Karnataka and mapping of local agricultural diversity (District level)

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Formative Assessment – Practical Internal Assessment = 50% (25 Marks)	
Assessment Occasion/type	Weightage in Marks
End Semester Examination	50% (25 Marks)
Total	100% (50 Marks)

Nandini N.

Date Course Co-ordinator Subject Committee Chairperson

ENDSE 301 OE **:WOMEN AND ENVIRONMENT**

Number of Theory Credits	Number of lecture hours/semester
3	**42**

Content of OPEN ELECTIVE Theory Course 3	**42Hrs**
Unit-1	**14**
Ecology and Environment: Definitions, meaning and significance. Ecosystem: Structure and function. Natural resources – definition, their local availability, harvest and utility. Gender ideology, Gender inequality and gender justice in India. Women studies: Concept, Objectives of women studies. Nature and Feminine principle-basic human needs from rural and urban environment. Interaction of women with the local ecosystems for household water collection, fuel wood, fodder, medicinal plants, livestock management, food security and non-timber forest produce. Rural women: Role in agriculture sector – Soil-water conservation, chemical free food and food storage. Role in social forestry (Achieving the 5F objectives – Food, Fodder, Firewood, Fiber and Fertilizer). Conservation of indigenous species. Urban women: Role in urban climate management, lifestyle lechoices and resource conservation–water, electricity, food, fuel resources and development of conservation culture among young generation. SustainableDevelopmentGoals:GoalNo.5-Genderequality.	
Unit-2	**14**

Co-feminism: Meaning and concept, Emergence and branches of Eco- feminism, Eco-feminism in the global economy, Eco-feminist power, politics and resistance to war and violence. Women and resource scarcity: Impacts of Natural resource depletion, Climate change and environmental degradation on women. Impacts of commonly used chemicals on Women and Environment: Endocrine-disrupting chemicals (EDCs), house hold chemicals, pesticides, cosmetics, food additives, food preservatives, organic pollutants, Volatile Organic Compounds (VOC's) and indoor air pollution from cooking activities. Climate change and women's health: Vector borne diseases, poor air quality and extreme variance in climatic temperatures (*Anemia, malnutrition and food insecurity-reduced cognitive skills, poor attention span,* *Reduced working memory and poor education outcomes. Respiratory distress, cardiovascular disease, negative birth out comes and reduced mental health in*	
Children). Post-disaster impacts on women: Higher risk of physical, sexual, and domestic violence in the aftermath of disasters. Increased stress due to forced migration, mood disorders and poor economic recovery.	
Unit-3	**14**
Women response to environmental degradation: Case studies of collective empowerment – The Chipko Movement (Gaura Devi – Mahila Mangal Dal), Silent Valley Conservation Movement (Sugathakumari), Neem Patent Victory (World's First Case Against Biopiracy), Narmada Bachao Andolan (NBA). Women and Environmental Conservation: Joint Forest Management (JFM), Social Forestry, Agro forestry, Agriculture, Community nurseries and seed banks, Household Solid Waste Management, Home gardens/rooftop gardening, United Nations Clean Development Mechanism(CDM). Women empowerment through Ecotourism, Cottage industries (NTFP and forest produce processing and value addition), Eco-entrepreneurship (Handicrafts, Case studies of Desi-Charaka and Hasiru Dala). Prominent women environmentalists: Rachel Carson, Wangari Maathai, Gro Harlem Brundt land, Elinor Ostrom, Amritha Devi Bishnoi, Medha Patkar, Sunita Narain, Tulsi Gowda and Saalumarada Thimmakka.	

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60%(60Marks)
Total	100%(100Marks)

Date CourseCo-ordinator SubjectCommitteeChairperson

ENDSE 302 OE:**ENVIRONMENTAL DISASTERS AND MANAGEMENT**

Number of Theory Credits	Number of lecture hours/semester
3	**42**

Content of OPEN ELECTIVE Theory Course 3	**42Hrs**
Unit-1	**14**
Disasters: Definition, History of disasters; Components of disasters. Weather parameters: Concept, Definition, Units and measurements of Temperature, Pressure, Precipitation (Rain, snow, hail), Wind (Speed and direction) and Relative humidity. Types of disasters: Natural disasters and Man-made disasters. Natural disasters: Definitions and introduction to Earthquakes, Tropical cyclones, Cloudbursts, Floods, Drought, Land subsidence, Landslides, Mudslides, Volcanoes, Tsunami, Avalanches, Heat waves, Cold waves, Dust storms, and Locust attacks. Man-made disasters: Definitions and introduction to Gas leaks, Toxic and Hazardous wastes, Nuclear and radiation accidents, Oil spills, Forest fires, Pandemics, Weather Extremes & Climate Change and Wars. Definitions of Risk, Hazard, Exposure, Vulnerability, Response, Mitigation, Preparedness and Prevention. Mitigation and Management techniques of Disaster: Basic principles of disaster management, Disaster Management cycle, Disaster management policy. Disaster Management Authority at National, State and District levels; Roles and responsibilities of Govt. Authorities including Local Self Govt. at various levels.	
Unit-2	**14**

Natural Disasters Earthquakes - types and causes, magnitude and intensity, seismic zones of India and Karnataka. Earthquake measurements (Richter Scale) and predications. Earthquake preparedness and management. Tropical Cyclones - Types and causes. Cyclone naming. Cyclone prediction, warning, Preparedness and Management. Floods - Types and causes, Flash floods. Cloud bursts, Floods warning, Preparedness and Management. Land subsidence - Types and causes, Landslides and Mudslides and Avalanches. Land subsidence preparedness and management.	
Tsunami –types and causes. Tsunami prediction, warning, preparedness and management. Heat waves and Cold waves –Causes and effects, Warning, preparedness and management. Locust attacks–Causes and effects Preparedness and management.	
Unit-3	**14**
Man-made disasters Nuclear disaster: Chernobyl and Fukushima-Episode and effects. Exxon Valdez oil spill -Episode, effects and management. Indonesia's land and forest fires–Episode, effects and management. Bhopal Gas Tragedy-Episode, causative agent, effects and recovery. Damage and compensation. Visakhapatnam gas leak-Episode, causative agent and effects. Damage and compensation. Endosulfan disaster in Karnataka and Kerala-Episode and effects. Damage and compensation. Ennore oil spill-Episode and effects. Uttarakhandand Kerala floods- Episode, effects and management. Kodagu Landslides/Recent/Local episodes, effects and management Bandipura Forest fires/Recent/Local episodes, effects and management. Bangalore Urban floods/Recent/Local episodes, causes, effects, andmanagement. Epidemics, Pandemics and Zoo noses.	

References

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60% (60Marks)
Total	100%(100Marks)

Date CourseCo-ordinator SubjectCommitteeChairperson

B.Sc.(Basic/Hons.)Semester4

Title of the Course: **ENDSC 401-BIODIVERSITY, WILDLIFE AND CONSERVATION**

Number ofTheoryCredits	Numberoflecturehours /semester	NumberofpracticalC redits	Numberofpracticalhours/ semester
4	**60**	**2**	**60**

ProgrammeSpecificObjectives	
PSO1	Todevelopcompetencyinunderstandingbiodiversityandwildlife.
PSO2	To instillaknowledgeabout humaninteractionswithuncultivatedvarieties and developnecessaryanalyticalskillstoappreciatetheseinteractions.
PSO3	To motivateandinspire toacquirecontemporaryunderstandingandskills leadingtoissueidentificationandconservation.
PSO4	Toinculcatecreativityandinnovativespiritinidentifyingappropriateconservationtoolsandth eirtimelyimplementation.

ProgrammeOutcomes	
PO1	Demonstratecompetence in understandingtheecological, social andlegaldimensionsofbiodiversityandwildlife.
PO2	Demonstratethe ability to carry outdata collectionproceduresandanalysisin fieldconditions/laboratoriesandmakeappropriate interpretations.
PO3	Ability to understandandappreciatetherole ofbiodiversity inspecificnatural habitatsandagroecosystems.
PO4	Beabletodevelopcompetenceandacademicskillsincontributingtowardsbiodiversityandwildlif econservation.

Content of Theory Course 4	**60 Hours**
Unit-1	**15**
Biodiversity: Definition: Levels of Biodiversity-genetic diversity, species diversity and ecosystem diversity. Values of Biodiversity: Direct uses - consumptive use value, productive use value; Non-consumptive values - social value, ethical value, aesthetic value, option values and ecosystem service value. Biodiversity Hotspots: Global and Indian centers. Biogeography of India. Biodiversity profile of India: Forests and Grass lands; Wetlands and	

River in ecosystems; Marine and coastal diversity; Agro biodiversity; Urban Biodiversity; Invasive Alien species. Threats to biodiversity: Overexploitation, Habitat destruction, fragmentation, urbanization, agriculture extension, river valley projects, industrialization, deforestation, invasive species, pollution, acidification of soil and water, mining activities, desertification and climate change. Traditional Knowledge and ethics in conservation of biodiversity.	
Unit-2	**15**
Wildlife: Definition. Wildlife of India. Values of wildlife. Values of wildlife: - *Physical utility, economic/monetary value, recreational value, scientific value, ecological value, existence value.* - *Wildlife damage, human animal conflict, loss of economic productivity, wildlife diseases to man and competition effect*. Importance of wildlife: Ecological, economic, socio-cultural, investigatory, medicinal, conservation of biological diversities, importance in agriculture. Threats to wildlife: Overexploitation, habitat loss, encroachment and fragmentation, disease, pollution, invasive and exotic species, Illegal trapping and poaching, agricultural/unrestricted/overgrazing, urbanization and climate change. Endangered species – Definition, characteristics and reasons for engendering. *Species with a narrow (or single) geographic range, Species with only one or few populations, Species with a small population size, Species with a declining population size, Species hunted or harvested by people Species with lower productive ability and/orgermplasm-dispersal-ability, Species tha trequire specialized habitat and niche conditions*. Endangered species of India. Endemic species–Concept, types, characteristics, theories of endemism. Endemic Wildlife Species of India.	
Unit-3	**15**
Ecosystem Services: Concept and Definition. Regulating services: *Purification of water and air; Carbon sequestration and climate regulation; Waste decomposition and detoxification; Regulation of prey*	

populations; Pollination; Biological pest and disease control; Disturbance regulation (Flood protection). Provisioning services: Food *(crops, wild foods and spices);* Raw materials *(Timber, fuel wood, organic matter, fodder, and fertiliser);* Genetic resources *(crop improvement genes, and health care);* Biogeni cminerals; Medicina lresources *(Pharmaceuticals, chemicalmodels, and bioassay organisms)*; Energy *(Hydropower, biomass fuels)*; Ornamental resources *(Fashion, handicrafts ,jewelry, pets, worship, decoration, and souvenirs)*. Cultural services: Cultural *(Nature motisinbooks ,film, painting, folklore, national symbols, advertising); Aesthetics,* spiritual and historical *(Art, religious and heritage value);* Recreational experiences *(Ecotourism, outdoor sports and recreation);* Science and education *(Academic excursions and scientific discovery);* Therapeutic *(Eco therapy, social forestry and animal assisted therapy).* Supporting services: Nutrient cycling, Soil formation, Primary production and Habitat provision.	
Unit-4	**15**
Conservation (Biodiversity and Wildlife): Definition, need and significance .Conservations. Preservation. Conservation goals – Habitat conservation, Prevention of deforestation, Preventing species from extinction, Sustainable harvest of biological resources and climate change mitigation. Terminologies of conservation significance: Keystone species, Foundation species, Umbrella Species and Flagship species, Edge species, Critical link species, Indicator species, Priority species and Rare species. IUCN Red Listed species - Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinction the Wild and Extinct. In-situ conservation: Protected areas – Sanctuaries - National Parks – Biosphere Reserves- Project Tiger and Project Elephant; Ramadevarabetta Vulture Sanctuary. Community Conserved Areas – case studies on Black Buck, Snow leopard, Amur falcon and Sarus Crane. Ex-situ conservation: Captive breeding (Botanical gardens, zoological parks, seedbanks). Case study of *Ailuropodamelanoleuca* (Giant panda), *Ramosmaniaheterophylla*and *Madhucainsignis.* Cryopreservation, pollenstorage, tissueculture, genetic engineering,field gene banks. Case study of Indian rhinoceros and black rhinoceros. International conservation efforts - Ramsar Convention, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on the Conservation of Migratory Species of Wild Animals (CMS), Trade Records Analysis of Flora and Faunain Commerce (TRAFFIC). Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD+.	

References

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60% (60Marks)
Total	100%(100Marks)

Nandini.N.

Date CourseCo-ordinator SubjectCommitteeChairperson

Content of Practical Course 4: List of Experiments to be conductedENDSC 402-BIODIVERSITY ASSESSMENT AND ECOSYSTEM SERVICES

(Total Teaching Hours=60;Total Credits=2)

1. Documentation and assessment of tree diversity– Census method/Point-centered quarter method
2. Documentation and assessment of avian faunal diversity–Linetransect method
3. Documentation and assessment of wing edinsectfauna– Lighttrap/Stickytrap method. Documentation and assessment of Butterflies – Visual encounter
   /Photographic survey
4. Documentation and assessment of soil fauna–Pitfalltrap method
5. Documentation and assessment of crop diversity–Sampling method
6. Identification and documentation of aquatic macro flora– Visual encounter survey
7. Estimation of animal populationsize– Mark, Release and Recapture method
8. Assessment of provisional services of wetland ecosystems–Questionnaire survey method.
9. Introduction to global biodiversity databases–Global Biodiversity Information Facility (GBIF), Integrated Biodiversity Assessment Tool (IBAT-alliance)
10. Hands-on experience with biodiversity assessment software – Paleontological Statistics Software Package for Education and Data Analysis (PAST). *Note: Data from experiment No1to8can be used for analysis.*

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FormativeAssessment–PracticalInternalAssessment=50%(25Marks)	
AssessmentOccasion/type	Weightagein Marks
EndSemester Examination	50% (25Marks)
Total	100%(50Marks)

Date CourseCo-ordinator Subject Committee Chairperson

ENDSE 401OE:ENVIRONMENT AND SUSTAINABLE AGRICULTURE

Number of Theory Credits	Number of lecture hours/semester
3	**42**

Content of OPEN ELECTIVE TheoryCourse4	42 Hours
Unit-1	**14**
Environment–Definition, scope and significance. Agriculture –Definition, scope and significance. Environmental basis for agriculture and food. Agricultural patterns in India. Socio-economic pressures on agriculture. Food security and food scarcity. Types of agriculture– rain-fed cultivation and irrigation– water intensive agriculture – Reservoirs and ground water exploitation. Conventional and mechanized agriculture. Natural and Modern agriculture. Subsistence and commercial agriculture. Environmental effects of land use and landscape changes.	
Unit-2	**14**
Environmental determinants of agriculture–role of rainfall, humidity, wind, topography and edaphic factors in crop selection. Animal husbandry – Dairy and poultry – role of trans boundary species of cattle in Indian scenario. Pisiculture–Environmental effects of intensive pisiculture. Agricultural biodiversity: Crop diversity– Definition and significance. Polyculture and mono culture. Influences of green revolution on modern agricultural practices of India – Loss of agro biodiversity – Influence of trans boundary crops. Agricultural biotechnology – Genetically Modified Crops – Influence on environment. Pollination crisis. Integrated pest management.	
Unit-3	**14**
Environmental impacts of agriculture–Loss of biodiversity–soil salinity – fertilizer and pesticide pollution, Climate change and global warming. Erosion and problems of deposition in irrigation systems. Desertification. Biomagnifications – Case studies. Contemporary issues and management – Farmer distress – market mechanisms– natural farming methods/organic farming. Urban agriculture and hydroponics. Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Water shed management. Agricultural policies of	

India.	

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60% (60Marks)
Total	100%(100Marks)

Date CourseCo-ordinator SubjectCommitteeChairperson

ENDSE 402:INITIATIVES FOR ENVIRONMENTAL MANAGEMENT

Number of Theory Credits	Number of lecture hours/semester
3	**42**

ContentofOPENELECTIVETheoryCourse4	42 Hours
Unit-1	**14**
Environment: Definition and components of the environment–Atmosphere, hydrosphere, lithosphere and biosphere – Definitions and influences on human beings. Environmental issues: Natural resource overuse and depletion, pollution, lossof biodiversity, Degradation of air, water and land. Water and wastewater management: Household water demand and uses. Availability of water for household uses. Centralized supply system – Rivers. Water treatment for portable purposes. Decentralized sources – Bore wells. Sustainable use of water – Reuse and recycling, rooftop rainwater harvesting. Grey water management – Septic tanks. Energy conservation: Sources of energy – Electricity, LPG, Other petroleum fuels and feasible alternative sources (Solar heating and photovoltaic).Measures to conserve energy – LED, energy efficient electrical appliances. Bureau of Energy Efficiency standards and labeling. Domestic solid waste management: Biodegradable – Kitchen waste - Issues and management. Compositing – Composters – Bin composter, three tiers composters, pipe composting and mechanical composters. Human excreta-Issues and management. Bio-toilets, Dry/waterless toilets. Non- Biodegradable – Issues and management. Segregation – Dry, recyclables and sanitary wastes– Incinerators, Pyrolysis and sanitary landfills.	
Unit-2	**14**

Agriculture: Implications on soil water management–Fertilizer pollution – Soil salinity, Eutrophication and Bio-magnification. Pesticide pollution - DDT and Endosulphan-Integrated Pest Management (IPM), Bio-pesticides, Genetic Modified Crops (GMCs). Natural farming methods. Irrigation and drainage systems (Israel Model), Hydroponics and Aeroponics. Alternative cultivation methods: Negative impacts of food grown by conventional agriculture methods. Minimizing fertilizers and preventing chemical pesticide usage. Role of rooftop gardens and kitchen Garden sin regulating micro climate .Biofertilisers– *Rhizobium*,	

Azotobactor, *Azospirilium*, Bluegreenalgae, *Azolla*, Mycorrhizae. Livestock management: Dung and urine management – Biogas plants, Farm Yard Manure (FYM) and Vermi-composting. Human dwellings as micro climatic regimes: Variations in temperature and relative humidity in indoor and outdoor environment. Impacts of increased temperatures .Role of vegetation in micro climate regulation and Carbon capture. Green buildings and microclimate regulations.	
Unit-3	**14**
Environmental Management: Definition, need, significance and applications. Environmental Technology vs. Technology for Environment. Technological solutions for environmental degradation: Concept, advantages and limitations. Remedial actions-Waste recycling; Preventive actions – pollution prevention and Management actions - Environmental Management System (ISO14000series). Factors influencing transfer of Environmental technology - developer to technology user: Information, Research and Marketing. Factors influencing technology development: Localization, Customization and Contextualization. External factors influencing technology transfer: Laws and legislation; Administrative/Management systems; Information management; and Codes and Standards (*Eco-labeling and Green ratings*). Role of individuals in Environmental management: Resource measurements and monitoring, Ecological footprint analysis, Carbon footprint analysis, Water footprint analysis, Micro-climate monitoring And Participation in eco friendly and sustainable endeavors.	

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
AssessmentOccasion/type	WeightageinMarks
EndSemesterExamination	60% (60Marks)
Total	100%(100Marks)

Date CourseCo-ordinator SubjectCommitteeChairperson

ENVIRONMENTALSTUDIES

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

This module consists of 3 units, covering 40 lecture hours which are classroom based and 5 hours of field work intended to create awareness, enhance knowledge, develop skills and attitudes necessary to understand the Environment in its totality and enables students to participate proactively for the cause of the environment.

1. Environmental Studies (AECC) is made compulsory core module syllabus framed by UGC for all the Indian Universities/Colleges as per the directions given by the Honorable Supreme Court, which believed that, conservation of environment should be a national way of life and to be included into the education process. As suggested by NEP-2020 State Level Environmental Science Subject Expert Committee, Chairpersons of Board of Studies, Board of Examiners and subject experts it is proposed to implement the details listed in the tabular column below, **mandatorily**.

Environmental Studies(AECC)-Ability Enhancement Compulsory Course		Semester in Which the course is to be taught
Streams	B.Sc/BA/BCA/BSW/BFAandotherstreamsofHumanitiesandScience	I
	B.Com,/B.B.A/BBA(T&T)/BFTand otherstreamsofCommerceandManagement	II

2. ThispatternhelpsindistributingtheworkloadofteachersofEnvironmentalStudiesto both**landIIsemesters**enablingthedistributionofthe**teachingworkload of an institution for fullacademicyear**;ensuresdistributionofexaminationsintotwosemesters;alsoprovidescopeforafull-timeteacherofthesubject.
3. **QualificationstoteachEnvironmentalStudies(AECC):**Acandidatewithminimumqualificationsof M.Sc.inEnvironmentalSciencesubject

Onlyiseligibletoteach EnvironmentalStudies(AECC)attheundergraduatelevelinalltypesof Universities,DeemedUniversities,Autonomous Institutions,Government,Aided and Private Colleges in theStateofKarnataka.Preferencemaybegiventocandidates withUGC-NET/K-SET/Ph.D.inEnvironmentalScience.

However, when such candidate is not available, teachers of the subjects listedbelowaretobepreferredtoteach**ONLY ENVIRONMENTAL STUDIES - AECC**paperinthefollowingorder:

i. **BiologicalSciences**:
   Botany/Zoology/Microbiology/Biotechnology/LifeSciences

ii. **ChemicalSciencesandEarthSciences**:
   Chemistry/Geology/EarthSciences

TheteachersNOTELIGIBLEtoteachEnvironmentalStudies(AECC)paperare-Humanities(Economics,Geography,History,Sociology,PoliticalScience,RuralDevelopment, Philosophy and others)Commerce,Management,English&others languages,Communication, Performing Arts, FineArts, Social work, Women Studies, Psychology,HomeScience,FashionTechnology,Travel&Tourismandothersimilarsubjects.

4. **PatternofExamination**:Totalmarks–50(InternalAssessment-20marksandFinalExamination-30marks).
5. **FinalExaminationQuestionPaperPattern(Shortanswerandessaytype)**
   a. Section-A(5questionsx2marks=10marks)–5questionsoutof7
   b. Section-B(4questionsx5marks=20marks)–4questionsoutof6
6. **Durationoftheexamination**:1hour30minutes(1½hours)
7. **Teachinghoursandcredits**:3hoursofteachingperweekand2credits.

ENVIRONMENTALSTUDIES

ABILITYENHANCEMENTCOMPULSORYCOURSE(AECC)

NumberofTheoryCredits	Numberoflecturehours+fieldwork
2	**45**

ContentofENVIRONMENTALSTUDIES-AECC		45 Hours
Unit1	**Introduction to Environmental Studies:** Multidisciplinary nature of environmental studies. Scope and importance; Concept of sustainability and sustainable development. **Ecosystems:** What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Natural Resources: Renewable and Non-Renewable Resources** Land resources and land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (International & Inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	**15**
Unit2	**Biodiversity and Conservation:** Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and	**12**

	Global biodiversity hotspots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. **Environmental Pollution:** Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management, Control measures of urban and industrial waste. Pollution cases tudies.	
Unit3	**Environmental Policies and Practices:** Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife (Protection) Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal population sand rights, and human wildlife conflicts in Indian context. **Human Communities and the Environment** Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: Floods, Earthquake, Cyclones and Land slides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and	**18**

	Cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g.,CNG vehicles in Delhi). Fieldwork (5hours)	

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Subject Expert Committee Members actively participated in the preparation of proposed curriculum for four years B.Sc.(Basic/Hons.) degree in Environmental Science.

Several meetings were conducted virtually and physically with Environmental Science subject committee experts; and the proposed curriculum was approved by the Chairpersons - Board of Studies and Board of Examiners of various Universities and Colleges of Karnataka State.

NEP2020-SUBJECT EXPERT COMMITTEE-ENVIRONMENTAL SCIENCE			
Name	**Designation and address**	**Position**	**Signature**
Members Present			
Dr.N.Nandini	Professor, Department of Environmental Science, Bangalore University, Bengaluru	Chairperson	
Dr.N.S.Raju	Professor, Department of Studies in Environmental Science, University of Mysore, Mysuru	Member	
Dr.S.Suresha	Associate Professor and Head, Department of Environmental Science, Yuvaraja's College (Autonomous),University of Mysore, Mysuru	Member	
Dr.B.S.Prabhakar	Associate Professor and Head, Department of Environmental Science, St.Joseph's College (Autonomous), Bengaluru	Member	

Dr.Jayappa,M.	Special Officer, Karnataka State Higher Education Council, Government Of Karnataka	MemberConvenor	
MembersAbsent			
Dr.S.V. Krishnamurthy	Professor, Department of PG Studies and Research in Environmental Science, Kuvempu University, Shankaraghatta	Member	Absent

GOVERNMENTOFKARNATAKA

NATIONAL EDUCATION POLICY-2020(NEP-2020)

Reporton

ProposedCurricularFrameworkforAbilityEnhancementCompulsoryCourse(AECC)underNEP-2020

in

ENVIRONMENTAL STUDIES – (AECC)

Submittedto

KarnatakaStateHigherEducationCouncilGovernment ofKarnataka
Bengaluru

7thJune2022

GOVERNMENTOFKARNATAKA

NATIONAL EDUCATION POLICY-2020(NEP-2020)

Reporton

Proposed Curricular Framework for Ability EnhancementCompulsoryCourse(AECC)underNEP-2020

in

ENVIRONMENTAL STUDIES – (AECC)

Submittedby

Dr.N.Nandini **Chairperson, Subject ExpertCommittee-EnvironmentalScience,NEP-2020** Professor,Dept. ofEnvironmental Science,BangaloreUniversity,Bengaluru	**Dr. Jayappa,M.MemberConvenor,SubjectExpertCommittee-EnvironmentalScience,NEP-2020** SpecialOfficer,KarnatakaStateHigherEducationCouncil Bengaluru and Coordinator,EnvironmentalScience Committee,NEP2020

and

MembersofSubjectExpertCommittee-EnvironmentalScience

1. **Dr.N.S.Raju**,Professor,DepartmentofStudiesinEnvironmentalScience, UniversityofMysore,Mysuru.
2. **Dr.S.V.KrishnaMurthy**,Professor,DepartmentofPGStudiesandResearchinEnvironmentalScience,KuvempuUniversity,Shankaraghatta.
3. **Dr. S. Suresha**, Professor and Head, Department of Environmental Science,Yuvaraja'sCollege(Autonomous),UniversityofMysore,Mysuru.
4. **Dr.B.S.Prabhakar**,AssociateProfessorandHead,DepartmentofEnvironmentalScience,St.Joseph'sCollege(Autonomous),Bengaluru.

7thJune2022

PREFACE

Education empowers life and life systems. A holistic education paradigm will effectively focus on developing knowledge, employable skill sets, appropriate attitudes and an overall personality. A graduate is the one who acquires the following attributes and employs them to benefit societies.

- Skills of identifying a problem and factors responsible for the problem
- Acquires and appreciates problem solving skills
- Logically employs problem solving tools, spatially and temporally
- Identifies timely needs of the community and contributes to them
- Takes the community to get hercreatinganequitable ecosystem
- Works toward screating employment opportunities and work domains for different skill sets and knowledge disciplines
- Blends with various social and economic situations making life happier for the self and of the communities
- Envisages and employ svarious attitudes and skill sets for the betterment of the Nation, blending local and regional variations

Environmental Science is a domain which seamlessly connects the sciences with day-to-day societal demands. Proposing and developing a curriculum for the subject of Environmental Science is unique in many ways. Mankind is facing serious environmental issues like climate change, desertification, deforestation, pollution, solid waste generation, natural and man-made disasters.

Improving the quality of life is a process of development which includes teaching, training and instruction. A competent subject expert committee was constituted by Karnataka State Higher Education Council, Government of Karnataka to achieve these objectives. The assigned task of this committee was to design curriculum structure for both

- ✓ Under- Graduate and Post-Graduate programmes of Environmental Science
- ✓ Environmental Studies−AECC for all Under-Graduate courses

The proposed curricular frame work designed by this committee was headed by me with Eminent Educationalists in the field of Environmental Science.

NEP2020-SUBJECTEXPERTCOMMITTEE-ENVIRONMENTALSCIENCE		
Name	**Designationandaddress**	**Position**
Dr.N.Nandini	Professor Department of Environmental Science, Bangalore University Bengaluru	Chairperson
Dr.N.S.Raju	Professor Department of Studies in Environmental Science, University of Mysore, Mysuru	Member
Dr.S.V.Krishnamurthy	Professor Department of PG Studies and Research in Environmental Science, Kuvempu University Shankaraghatta	Member
Dr.S.Suresha	Professor and Head Department of Environmental Science, Yuvaraja's College (Autonomous) University of Mysore, Mysuru	Member
Dr.B.S.Prabhakar	Associate Professor and Head Department of Environmental Science, St.Joseph's College (Autonomous), Bengaluru	Member
Dr.Jayappa,M.	Special Officer Karnataka State Higher Education Council, Government of Karnataka	MemberConvenor

Our Nation's vision for higher education through National Education Policy−2020 is to transform it into a sustainable system. The Government of Karnataka is first State to launch the National Education Policy− 2020. The programme was launched virtually by Union Education Minister

Sri. Dharmendra Pradhan. **Sri. Basavaraj Bommai,** the Honorable Chief Minister of Karnataka launched the policy of digitization, research and development that could help impliment the new NEP-2020, which aims at bringing fundamental

Changes in the education system. **Dr. C. N. Ashwath Narayan**, Minister for Higher Education and Chairman for Karnataka State Higher Education Council, Government of Karnataka, initiated the implementation of the National EducationPolicy,2020(NEP-2020) in Karnataka effectively, as a first State in the country by constituting various committees comprising of Education Experts.

Prof.B.Thimme Gowda, Vice-Chairman, Karnataka State Higher Education Council, Government of Karnataka conducted several meetings with the committees constituted by Government.

The Chairpersons of Board of Studies, Board of Examiners (Environmental Science) and Subject Experts teaching under-graduate andpost-graduate courses of various Universities in the State of Karnataka, who participated actively in this processare-

Dr.N.S.Raju, Professor, Department of Studies in Environmental Science, University of Mysore, Mysuru;

Dr.B.S.Prabhakar, Associate Professor and Head, St.Joseph's College (Autonomous), Bengaluru;

Dr.J.Narayana, Professor, Department of Environmental Science, Kuvempu University, Shankaraghatta;

Dr.K.L.Prakash, Professor, Department of Environmental Science, Bengaluru University, Bengaluru;

Dr.G.V.Venkataramana, Professor and Chairman, Department of Studies in Environmental Sciences, University of Mysore, Mysuru;

Dr.S.SrikantaSwamy, Professor, Department of Environmental Science, University of Mysore, Mysuru;

Dr. Yogendra, K., Associate Professor, Department of Environmental Science, Kuvempu University, Shankaraghatta;

Dr.PrakashKariajjanavar, Assistant Professor, Department of Environmental Science, Gulbarga University, Kalaburagi;

Dr.B.C.Nagaraja, Professor and Chairman, Department of Environmental Science,

Bengaluru University, Bengaluru;

Dr.J.S.Chandrashekar, Assistant Professor and Chairman, Department of Environmental Science, Karnataka State Open University, Mysuru;

Dr.T.S.Harsha, Assistant Professor, Department of Environmental Science, Karnataka State Open University, Mysuru;

Dr.Basavarajappa,S.H., Assistant Professor, Department of Environmental Science, Kuvempu University, Shankaraghatta;

Dr.M.R.EbenezerWilson,Associate Professor ,St.Joseph's College (Autonomous), Bengaluru;

Dr.HelenRoselene, Associate Professor and Head, Department of Environmental Science, Mount Carmel College (Autonomous), Bengaluru; and

Dr.K.HarishKumar, Assistant Professor, Department of Environmental Science, Government First Grade College, Hosakote;

Dr.Kumar,M., Faculty, Department of Environmental Science, Bangalore University, Bengaluru;

Dr. AlaknandaJ. Adur, Associate Professor and Head, Department of Environmental Science, Surana College, Peenya, Bengaluru;

Sri.SachinA.Rosario, Assistant Professor, St.Joseph's College (Autonomous),Bengaluru. This work progressed under the guidance Of **Sri.L.S.Ramesh**,Special Officer, Karnataka State Higher Education Council, Government of Karnataka, initially and later steered by **Dr.Jayappa,M**., Special Officer, Karnataka State Higher Education Council, Government of Karnataka.The valuable support from subject experts **Dr.B.S.Prabhakar**, Associate Professor and Head, St. Joseph's College (Autonomous), Bengaluru and **Dr.Kumar,M**., Faculty, Department of Environmental Science, Bangalore University, Bengaluru, incompiling the report and overall editing is appreciated.

I take this opportunity to express my gratitude to the authorities of Karnataka State Higher Education Council, Government of Karnataka for giving us an opportunity to be a part of curriculum framework design and implementation of NEP-2020.

- **Prof.N.Nandini**
Chairperson

Subject Expert Committee Members actively participated in the preparation of proposed curriculum of Environmental Studies (AECC) for all the under-graduate courses in the Universities/Colleges in the state of Karnataka.

Several meetings were conducted virtually and physically with Environmental Science Subject Committee Experts; and the proposed curriculum was approved by the Chairpersons of Board of Studies and Board of Examiners of various Universities and Colleges of Karnataka State.

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MembersAbsent			
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