

**JSS Academy of Higher Education & Research**

( Deemed to be University )

Re-Accredited "A+" Grade by NAAC

Sri Shivarathreeshwara Nagara Mysuru - 570015, Karnataka

Faculty of Life Sciences

# Syllabus

**B.Sc. ENVIRONMENTAL SCIENCE**  
As Per National Education Policy 2020  
Under the CBCS Pattern  
Implementation Year 2021-22 onwards

**BSc**



# Syllabus

## **B.Sc Environmental Science** **As per NEP 2020**

**Under the CBCS Pattern**



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## B.Sc Environmental Science

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## **B.Sc Environmental Science**

### **Program Overview**

<b>Name of the Degree Program</b>	<b>: B.Sc., (Hons.)</b>
<b>Discipline Core</b>	<b>: Environmental Science</b>
<b>Total Credits for the Program</b>	<b>: B.Sc., Basic - 136 credits</b> <b>B.Sc., Hons. - 176credits</b>

**Year of implementation** : 2021-22

### **Programme Objectives**

- To create and disseminate knowledge to the students about environmental problems at local, regional, and global scale.
- To provide practical training on modern instrumentation and analytical techniques for environmental analyses.
- To sensitize students towards environmental concerns, issues, and impacts of climate change and related mitigation strategies.
- To make the students to apply their knowledge for efficient environmental decision-making, management, and sustainable development.
- Provide students with technical and analytical skills that enable them to find employment in federal and state resource agencies, consulting firms, community-based education, and industrial firms tasked with environmental compliance.

### **Programme Outcomes**

- Students will possess the intellectual flexibility necessary to view environmental questions from multiple perspectives, prepared to alter their understanding as they learn new ways of understanding.
- Students will solve problems systematically, creatively, and reflexively, ready to assemble knowledge and formulate strategy.
- When encountering environmental problems students will assess necessary scientific concepts and data, consider likely social dynamics, and establish integral cultural contexts.
- When faced with questions that lie beyond their current knowledge base, students will actively research data, concepts, histories, and narratives necessary for adequate consideration of the issue.
- Students will communicate with precision, effective art, and sound rhetoric in

writing, in speech, and in digital media.

- Reflecting upon their internalized values system, students will continue to evolve an individual vision of harmonious and sustainable interaction among humans as well as between humans and the rest of the natural world.

**Program Specific Outcomes:**

- Understand the basic concepts of Environments and its components along with their interactions through study of Ecology, Biodiversity, Environmental Chemistry, and Environmental Microbiology
- Understand the different kinds of Pollutions and their sources through study of Climate and Air Pollution Studies, Hazardous Waste & Environmental Toxicology and Soil Pollution and different laws about pollution
- Analyze and determine pollution using Environmental Analytical Techniques, Biostatistics and Computational Techniques.
- Understand different technologies like biotechnology, water, and Wastewater treatment technology to find the solutions and their applications in abatement of Pollution and other environmental problems.
- Understand the disaster management and industrial safety.
- Determine the environmental impact due to different developmental projects and find solution to eliminate these impacts.
- Understand the policies governing resources and the environment and identify social dimensions (stakeholders, interests, trade-offs, synergies, ethical principles) to consider in the development of management plans.
- Through Project work, student can identify a particular environmental problem, review the literature for finding the gaps, develop research methodology, collect data, and carry out data analysis and interpretation for finding a suitable solution and acquire the ability to write the research findings in the form of structured thesis and communicate the research results through oral or poster presentations.
- Developing critical thinking for shaping strategies (scientific, social, economic, and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
- Adopting sustainability as a practice in life, society, and industry. Students will have

mastered foundational knowledge enabling them to make sound life decisions as well as enter a career in an environmental profession or graduate school.

**Eligibility**

Candidates who have passed the 10+2 Examination / Equivalent Examination with at least 40% marks.

**Pedagogy:**

The general pedagogy to be followed for theory and practicals are as under.

1. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counselling, Remedial Coaching.
2. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation, and Innovative methods.
3. Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level 3.

**Assessment:****Weightage for assessments (in percentage)**

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	30%	70%
Practical	30%	70%
Projects	30%	70%

Curriculum Structure for the Undergraduate Degree Program  
B. Sc., (Basic / Hons.) in Environmental Science.

Semester	Core Subjects (Credits) L T P	Discipline Specific/ Open Elective Subjects (Credits) L T P	Language L T P	Skill Enhancement Courses (SEC) / Ability Enhancement Courses (AEC) L T P	Value Based / Activity Based L T P	Total Credits
I	<b>DSC 01 –</b> Introduction to Environmental Science (5) 3+0+2  <b>DSC 02-</b> Elements of Ecology and Ecosystems (5) 3+0+2	<b>OEC 1 –</b> Environmental Issues (3) 3+0+0	<b>L 1 -</b> English (3) 3+0+0  <b>L 2 -</b> English / Kannada / French (3) 3+0+0	<b>SEC 01 -</b> Digital Fluency (3) 3+0+0	Value Based Course (VBC) 01 - Health & Wellness (2) 2+0+0	24
II	<b>DSC 03 –</b> Natural Resources & Management (5) 3+0+2  <b>DSC 04 –</b> Environmental Pollution & Health (5) 3+0+2	<b>OEC 2 –</b> Wildlife Science (3) 3+0+0	<b>L 1 –</b> English (3) 3+0+0  <b>L 2 -</b> English / Kannada/ French (3) 3+0+0	<b>AECC 01 –</b> Environmental Studies (3) 3+0+0	Activity Based Course (ABC) 01: Environmental Awareness/ Education Programs (2) 0+0+2	24
Exit Option Certificate in Environmental Science						48 Credits
III	<b>DSC 05 –</b> Biodiversity Conservation & Management (5) 3+0+2  <b>DSC 06 –</b> Energy & Environment (5) 3+0+2	<b>OEC 3 -</b> Ecotourism (3) 3+0+0	<b>L 1 -</b> English (3) 3+0+0  <b>L 2 -</b> English / Kannada / French (3) 3+0+0	<b>AECC 02 –</b> Indian Constitution (2) 2+0+0  <b>SEC 02 –</b> Artificial Intelligence (2) 2+0+0	-	23
IV	<b>DSC 07 –</b> Introduction to	<b>OE C 04 –</b> Sustainable Development	<b>L 1 –</b> English (3) 3+0+0	<b>SEC 03 –</b> Cyber Security (2)	Activity Based Course (ABC) 02 - Industrial Visit/	23



	Environmental Microbiology (5) 3+0+2  <b>DSC 08 – Environmental Earth Science</b> (5) 3+0+2	(3) 3+0+0	<b>L 2 -</b> English / Kannada / French (3) 3+0+0	2+0+0	Training (Report + Viva Voce) (2) 0+0+2	
<b>Exit Option                                          Diploma in Environmental Science                                          94 Credits</b>						
<b>Semester</b>	<b>Core Subjects (Credits) L T P</b>	<b>Discipline Specific/ Open Elective Subjects (Credits) L T P</b>	<b>Skill Enhancement (SEC) / Ability Enhancement Courses (AEC) L T P</b>	<b>Value Based / Activity Based L T P</b>	<b>Total Credits</b>	
V	<b>DSC 09 – Eco-toxicology</b> (5) 3+0+2 <b>DSC 10 – Environmental Monitoring &amp; Techniques</b> (5) 3+0+2 <b>DSC 11 Eco restoration &amp; Development - (4)</b> 3+0+1	<b>DSE 01a -</b> Hydrology (3) 3+0+0 <b>OR</b> <b>DSE 01b.</b> Atmospheric Science (3) 3+0+0	<b>SEC 04 – Data Modeling</b> (3) 3+0+0	Value Based Course <b>(VBC) 02 – Ethics &amp; Self Awareness</b> (2) 2+0+0	22	
VI	<b>DSC 12 – Environmental Disaster Management</b> (5) 3+0+2  <b>DSC 13 – Solid Waste Management</b> (5) 3+0+2  <b>DSC 14 – Wildlife Management &amp; Conservation</b> (4) 3+0+1	<b>DSE 02a -</b> Integrated Water Resource Management (3) 3+0+0 <b>OR</b> <b>DSE 02b -</b> Carbon Sequestration & management (3) 3+0+0	<b>SEC 05 – Professional / Societal Communication</b> (3) 3+0+0	-	20	
<b>Exit Option                                          B.Sc., in Environmental Science                                          Credits                                          136</b>						
VII	<b>DSC 15 - Evolution Biology</b> (5) 3+0+2  <b>DSC 16 - Environmental Biology</b> (5) 3+0+2  <b>DSC 17 – Environmental Chemistry</b> (5) 3+0+2	<b>DSE 03a -</b> Water Supply & Sanitation <b>OR</b> <b>DSE 03b -</b> Environment & Global Economy (3) 3+0+0 <b>AND</b> <b>DSE 03c.</b> Principles of Research Methodology (3)	-	-	21	
VIII	<b>DSC 18 – Environmental Economics &amp; Management</b> (5) 3+0+2	<b>DSE 04a -</b> Water, Energy & Food Nexus (3) 3+0+0	-	-	19	

	<b>DSC 19</b> – Environmental Impact Assessment (5) 3+0+2	<b>OR</b> <b>DSE 04b</b> - Climate Change & Management (3) 3+0+0 <b>AND</b> <b>DSE 05a</b> - Research Project (6) <b>(OR)</b> <b>DSE 05b</b> - Bioremediation & Techniques (3) 3+0+0 <b>AND</b> <b>DSE 05c</b> - Bioenergy Technologies (3) 3+0+0			
<b>Award of B.Sc., (Hons) in Environmental Science</b>					<b>176 Credits</b>

Curriculum Structure for the Undergraduate Degree Program  
B.Sc., (Hons) in Environmental Science

SEMESTER I								
Sl. No.	Study Component and Code	Title of the Paper	Hours of Instruction/ Week	Examination				Total Credits
				Duration in Hrs	CIA	Theory/ Practical Exam	Max. Marks	
1	DSC 01	Introduction to Environmental Science	3	3	30	70	100	3
2	Practical 01	Introduction to Environmental Science	4	3	15	35	50	2
3	DSC 02	Elements of Ecology and Ecosystems	3	3	30	70	100	3
4	Practical 02	Elements of Ecology and Ecosystems	4	3	15	35	50	2
5	OEC 01	Environmental Issues	3	3	30	70	100	3
6	Language 1	Part-I English I	3	3	30	70	100	3
7	Language 2	Part II English I/Kannada I/French I	3	3	30	70	100	3
8	SEC 01	Digital Fluency	3	3	30	70	100	3
9	VBC 01	Health & Wellness	2	2	-	50	50	2
	Total Marks and Credits						750	24
SEMESTER II								
1	DSC 03	Natural Resources & Management	3	3	30	70	100	3
2	Practical 03	Natural Resources & Management	4	3	15	35	50	2
3	DSC 04	Environmental Pollution & Health	3	3	30	70	100	3
4	Practical 04	Environmental Pollution & Health	4	3	15	35	50	2
5	OEC 2	Wildlife Science	3	3	30	70	100	3
6	Language 1	Part-I English II	3	3	30	70	100	3
7	Language 2	Part II English II/Kannada II/French II	3	3	30	70	100	3
8	AECC 01	Environmental Studies	3	3	30	70	100	3
9	ABC 01	Environmental Awareness/ Education Programs	2	2	-	50	50	2
	Total Marks and Credits						750	24

SEMESTER III								
Sl. No.	Study Component and Code	Title of the Paper	Hours of Instruction/ Week	Examination				Total Credit
				Duration in Hrs	CIA	Theory/ Practical Exam	Max. Marks	
1	DSC 05	Biodiversity Conservation & Management	3	3	30	70	100	3
2	Practical 05	Biodiversity Conservation & Management	4	3	15	35	50	2
3	DSC 06	Energy & Environment	3	3	30	70	100	3
4	Practical 06	Energy & Environment	4	3	15	35	50	2
5	OEC 03	Ecotourism	3	3	30	70	100	3
6	Language 1	Part-I English III	3	3	30	70	100	3
7	Language 2	Part II English III/Kannada III/French III	3	3	30	70	100	3
8	AECC 02	Indian Constitution	2	2	-	50	50	2
9	SEC 02	Artificial Intelligence	2	2	-	50	50	2
	Total Marks and Credits						700	23
SEMESTER IV								
1	DSC 07	Introduction to Environmental Microbiology	3	3	30	70	100	3
2	Practical 07	Introduction to Environmental Microbiology	4	3	15	35	50	2
3	DSC 08	Environmental Earth Science	3	3	30	70	100	3
4	Practical 08	Environmental Earth Science	4	3	15	35	50	2
5	OEC 04	Sustainable Development	3	3	30	70	100	3
6	Language 1	Part-I English III	3	3	30	70	100	3
7	Language 2	Part II English IV/Kannada IV/French IV	3	3	30	70	100	3
8	SEC 03	Cyber Security	2	2	-	50	50	2
9	ABC 02	Industrial Visit/ Training (Report+ Viva Voce)	2	2	-	50	50	2
	Total Marks and Credits						700	23

SEMESTER V								
Sl. No.	Study Component and Code	Title of the Paper	Hours of Instruction/ Week	Examination				Total Credit
				Duration in Hrs	CIA	Theory/ Practical Exam	Max. Marks	
1	DSC 09	Eco-toxicology	3	3	30	70	100	3
2	Practical 09	Eco-toxicology	4	3	15	35	50	2
3	DSC 10	Environmental Monitoring & Techniques	3	3	30	70	100	3
4	Practical 10	Environmental Monitoring & Techniques	4	3	15	35	50	2
5	DSC 11	Eco restoration & Development	3	3	30	70	100	3
6	Practical 11	Eco restoration & Development	2	2	15	35	50	1
7	DSE 01a (OR) DSE 01b	Hydrology (OR) Atmospheric Science	3	3	30	70	100	3
8	SEC 04	Data Modeling	3	3	30	70	100	3
9	VBC 02	Ethics & Self Awareness	2	2	-	50	50	2
	Total Marks and Credits						700	22
SEMESTER VI								
1	DSC 12	Environmental Disaster Management	3	3	30	70	100	3
2	Practical 12	Environmental Disaster Management	4	3	15	35	50	2
3	DSC 13	Solid Waste Management	3	3	30	70	100	3
4	Practical 13	Solid Waste Management	4	3	15	35	50	2
5	DSC 14	Wildlife Management & Conservation	3	3	30	70	100	3
6	Practical 14	Wildlife Management & Conservation	2	2	15	35	50	1
7	ES DSE 02a (OR) ES DSE 02b	Integrated Water Resource Management (OR) Carbon Sequestration & management	3	3	30	70	100	3
8	SEC 05	Professional / Societal Communication	3	3	30	70	100	3
	Total Marks and Credits						650	20

SEMESTER VII								
Sl. No .	Study Component and Code	Title of the Paper	Hours of Instruct ion/ Week	Examination				Total Credit
				Duration in Hrs	CIA	Theory/ Practical Exam	Max. Marks	
1	DSC 15	Evolution Biology	3	3	30	70	100	3
2	Practical 15	Evolution Biology	4	3	15	35	50	2
3	DSC 16	Environmental Biology	3	3	30	70	100	3
4	Practical 16	Environmental Biology	4	3	15	35	50	2
5	DSC 17	Environmental Chemistry	3	3	30	70	100	3
6	Practical 17	Environmental Chemistry	4	3	15	35	50	2
7	DSE 03a OR DSE 03b	Water Supply & Sanitation OR Environment & Global Economy	3	3	30	70	100	3
8	DSE 03c	Principles of Research Methodology	3	3	30	70	100	3
	Total Marks and Credits						650	21
SEMESTER VIII								
1	DSC 18	Environmental Economics & Management	3	3	30	70	100	3
2	Practical 18	Environmental Economics & Management	4	3	15	35	50	2
3	DSC 19	Environmental Impact Assessment	3	3	30	70	100	3
4	Practical 19	Environmental Impact Assessment	4	3	15	35	50	2
5	DSE 04a (OR) DSE 04b	Water, Energy & Food Nexus (OR) Climate Change & Management	3	3	30	70	100	3
6	DSE 05a (OR) DSE 05b and DSE 05c	5a Research Project (OR) 5b Bioremediation & Techniques and 5c Bioenergy Technologies	6	3	60	140	200	6
			3	3	30	70	100	
			3	3	30	70	100	
	Total Marks and Credits						600	19

**Abbreviations:** DSC – Discipline Specific Core; DSE – Discipline Specific Elective; OEC – Open Elective Course; AECC – Ability Enhancement Compulsory Course; SEC – Skill Enhancement Course; VBC – Value Based Course; ABC – Activity Based Course.

# Students may choose any one elective course among the choice offered, specific to the discipline.

\*Project Proposal, Presentations, Teamwork and Professional Ethics, Industrial/Institutional Visits etc.

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## **Semester One**

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## DSC 01 - Introduction to Environmental Science

L	T	P	C
3	0	2	5

### Course Objectives:

- To have knowledge about the basics of environmental science.
- To know about the environmental interactions.
- To create awareness about the various environmental aspects.

### Course Outcomes:

1. At the end, the students will be able to know about the fundamental concepts.
2. They will acquire knowledge about the various environmental processes.
3. They will learn about the ethical perspective of environmental aspects
4. They will learn about the importance of environmental education.

### Theory

**Unit I: Basics of Environmental Sciences** - Definition, Scope, importance and elements of Environmental Science. Structure of Environment-Biological levels of organization, concept of ecology, population, community, Climatic factors - Solar Radiations, Temperature, Water and Precipitation

**Unit II: Environmental Segments** - Definition-Importance- Interaction and salient features of Atmosphere-composition and properties of the atmosphere - Hydrosphere- hydrological cycle – distribution, water budget – Lithosphere - structure and composition, soil types, soil profile, soil erosion – Biosphere – composition, importance and distribution.

**Unit III: Environmental Ethics** - Basic Concepts-History and importance of environmental ethics- Libertarian View- Ecological view- Conservation view- Eco-spirituality- Theology and the Environment- theories of the environmental ethics.

**Unit IV: Environmental Education** - Basic Concepts- Scope-Need-Importance - Goals- Principles of Environmental Education-Types of Environmental Education- formal and non-formal environmental education. People and environment.

## **Practical 01 - Introduction to Environmental Science**

### Part A

1. Introduction to lab techniques (Procedure and practices).
2. Determination of pH in given Sample.
3. Determination of EC in given sample.
4. Soil Moisture.
5. Soil Organic Content.
6. Permeability.
7. Porosity.
8. Suspended Solids in water.
9. Symbiotic association
10. Study on Rocks

### Part B

1. Soil Sampling techniques
2. Soil Profile
3. Characteristics of Population
4. Species Interactions
5. Ecological Niche

### Part C

Spotter (chosen from the portion)

### **References:**

1. George L Clarck (1956), Elements of Ecology, John Wiley & Son Inc. New York.
2. Michael Boylan (2013), Environmental Ethics, 2nd Edition.
3. Dr Y.K Singh (2006), Environmental Science, New Age International (P) Ltd., Publishers.
4. S.V.S Rana, (2009), Essentials of Ecology and Environmental Science, Fourth edition

## DSC 02 - Elements of Ecology & Ecosystems

### Course Objectives:

- To convey the principles of ecology
- Provide examples from ecological studies
- Illustrate the application of ecological principles to the management of ecosystems.

L	T	P	C
3	0	2	5

### Course Outcomes:

After successful completion of the course, students will be able to

1. The physical aspects of the environment.
2. Relationships between organisms and their environment.
3. The structure and function of ecosystems.
4. Human influences on the global environment.

### Theory

**Unit I: Introduction to ecosystem** - Definition, scope and basic principles of ecology, hierarchical group of ecology, components (biotic and abiotic – light, wind and temperature and fire), food chain, food web, trophic levels, ecosystem pyramids, ecosystem services, types of ecosystems- terrestrial (forest, grassland, and desert) and aquatic (pond, river, estuary and marine).

**Unit-II: Ecosystems and nutrient cycling** - Energy flow and its models, energy efficiencies, homeostasis, ecological productivity (primary and secondary), nutrient cycling, biogeochemical cycles: importance (water, oxygen, carbon, nitrogen, phosphorus, and Sulphur), impact of man on nutrient cycles.

**Unit-III: Population ecology** - Density, natality, mortality, carrying capacity, age structure, population growth curve, regulation of population, density dependent and density independent factors, seasonal population fluctuation. distribution, dispersion, population interactions: competition, parasitism, predator-prey interactions, protooperation, commensalisms and mutualism.

**Unit-IV: Community Ecology** - Composition, qualitative and quantitative characters of community; methods of studying vegetation, stratification of plant and animal communities, life forms of plants and animals, succession: types, process and examples of succession, ecotones: concept of edge effect, ecological niche; r and k strategies, ecological indicators, and keystone species.

**Practical 02 - Elements of Ecology & Ecosystems**

1. To construct ecological pyramids of population sizes in the ecosystem.
2. Determination of Chlorophyll content from plant species.
3. Determination of Harvest method from plant species.
4. Analyze the vegetation by quadrat method.
5. Diversity Measure: Shannon Wiener and Simpson Index.
6. Listing of indicator species in a Forest, Ecosystem
7. Identification Techniques for wild fauna
8. Diversity Measure of Birds fauna in different habitat conditions.
9. Listing of Threatened and Endangered Fauna in a Forest Ecosystem
10. Prepare a map of the campus

**References:**

1. Groom. B. & Jenkins. M. 2000. Global Biodiversity: Earth's Living Resources in the 21<sup>st</sup> Century. World Conservation Press, Cambridge, UK.
2. Chapman, J.L. and Reiss M.J. 2005. Ecology Principles and Applications, Cambridge University Press, London.
3. E.P. Odum and G. W. Barrett 2005. Fundamentals of Ecology, Thomson Asia Pvt. Ltd., Singapore.
4. S.V.S. Rana 2005. Essentials of Ecology and Environmental Sciences, Prentice Hall of India, New Delhi.
5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications.

## OEC 01 – Environmental Issues

L	T	P	C
3	0	0	3

### Course Objectives:

- Describe the need and major of environmental global and regional issues
- Identify the core components of environmental issues
- Analyze current environmental issues and evaluate potential solutions

### Course Outcomes:

After successful completion of the course, students will be able to

1. To provide students with the knowledge and skills necessary to enable them to solve problems
2. Relate the features of human populations to different types of environmental degradation
3. Recognize the impact of globalization on the environment.

## Theory

**Unit I: Global environmental issues** - Greenhouse effect – causes and associated hazards, ozone layer depletion – causes and associated hazards, acid rain, climate change, sea level rise, forest fire and deforestation, human population growth. environmental problems associated with urbanization, modernization of agriculture.

**Unit II - Regional environmental issues** - Solid waste sources, generation, composition, disposal, and management. human intervention on wetlands and eutrophication and reclamation of wetlands. Development - induced displacement, resettlement, and rehabilitation. Discussion on project affected people (PAPs). Desertification and reclamation of degraded land. Vehicular pollution and urban heat islands.

**Unit III: Environmental management** - Rainwater harvesting, sustainable farming, green buildings, carbon sequestration, Ramsar sites in India. ecotechnology, JNN solar mission, eco-marks, swachh bharat abhiyan, national mission for a 'Green India' and people biodiversity register.

**Unit IV: Community participation** - Environmental movements (appiko movement, chipko movement, narmada bachao andolan), sacred groves, corporate responsibility movement; environmental groups and movements, role played by NGOs and individuals, environmental education and awareness, environmental ethics, philosophy of 'greed versus need'.

**References:**

1. Kemp D.D. 1990. Global Environmental Issues, A Climatological approach, Routledge, London.
2. Disaster Management: A disaster Manager's Handbook, ADB Publications, 1991.
3. Gopal Bhargava 1992. Environmental Challenges and Ecological Disasters, Mittal Publication, New Delhi.
4. Khitoliya, R.K. (2004) Environmental Pollution: Management and Control for Sustainable Development.
5. Santra, S. (2001) Environmental Science. New Central Book Agency (Pvt) Ltd., Kolkotta

## Language 1- Part I English I

L	T	P	C
3	0	0	3

### Course Objectives:

- Improve and enhance the communication skills of the learners.
- Improve speech pronunciation, grammar, and vocabulary.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Have better language, communication, and pronunciation skills.
2. Have enhanced their vocabulary since they would have learnt about root words, synonyms, antonyms, phobias, and manias.
3. Use the Language Lab by Senako Software to improve their vocabulary. The Language Lab is equipped with exercises for language learning. The Voice Pronounce guides the students to improve their pronunciation through instant feedback and visual indication of what sounds and words to improve on.

### Unit-I: Grammar – I

1. Correct Use of Nouns
2. Correct Use of Pronouns
3. Reading Comprehension Passage

### Unit-II: Grammar – II

1. The rules and sequence of tenses
2. Types of sentences: Simple, Compound and Complex sentences, clauses, phrases, adjuncts and gerunds
3. Subject Verb Agreement

### Unit-III: Vocabulary

1. Roots A to F
2. Synonyms and Antonyms
3. Phobias and Manias

### Unit-IV: Essay

Excerpts from APJ Abdul Kalam's "Wings of Fire "

### References:

- 1.S.C Gupta (2021) English Grammar and Composition by Arihant Publishers
- 2.S. P. Bakshi (2021) Objective General English by Arihant Publishers

## Language 2 – Part II English I

L	T	P	C
3	0	0	3

### Course Objectives:

- Improve and enhance the literary skills of the learners.
- Develops language skills such as reading, writing, speaking, and listening.
- Help the students to grasp the ideas of the writer.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Express their thoughts, ideas, feelings, and observations.
2. Develop philosophical, historical and a critical perspective in their writings.

### **Unit-I: British Poetry**

1. “When in Disgrace” by Shakespeare
2. “Spring” by Christina Rossetti

### **Unit-II: Post-Colonial Literature**

1. “The Night of the Scorpion” by Nissim Ezekiel
2. “I Am Not That Woman” by Kishwar Naheed

### **Unit-III: Contemporary and British Literature**

1. “The Kanda Man-eater” by Jim Corbett
2. “A Man Who Had No Eyes” by MacKinlay Kantor
3. “A Child’s Story” by Charles Dickens

### **Unit-IV: Indian English Literature**

“The Education System in India” by Dr. V. Shashi Kumar

### **References:**

1. Jim Corbett (1944) The Man – Eaters of Kumaon by Oxford University Press.
2. Charles Dickens (2013) Children’s Stories published by Bottom of The Hill Publishing.



L	T	P	C
3	0	0	3

ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಅಕ್ಯಾಡಮಿ ಮೈಸೂರು

ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು.

ಬಿಎಸ್ಸಿ ಮೊದಲನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ - ೧

ಅಧ್ಯಯನದ ಉದ್ದೇಶ

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ನಾಡು ನುಡಿಯ ಬಗ್ಗೆ ಅಭಿಮಾನ ಮೂಡಿಸುವುದು
- ಭಾಷೆಯ ಅಭಿವ್ಯಕ್ತಿಗೆ ಅವಕಾಶ ಕಲ್ಪಿಸುವುದು
- ನವೋದಯ ಕಾಲಘಟ್ಟದ ಕವಿಗಳ ಬಗ್ಗೆ ಬೆಳಕು ಚೆಲ್ಲುವುದು
- ಭೂಮಿ ಕುರಿತ ಕವಿಗಳು ಹಾಗೂ ಲೇಖಕರ ಸೃಜನಶೀಲ ಬರವಣಿಗೆಯ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ಆಡಳಿತ ಭಾಷೆಯ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು

ಅಧ್ಯಯನದ ಫಲಿತಗಳು

- ವಿದ್ಯಾರ್ಥಿಗಳು ನಾಡು ನುಡಿಯ ಬಗ್ಗೆ ಅಭಿಮಾನ ಬೆಳೆಸಿಕೊಳ್ಳುವರು
- ಭಾಷೆಯ ಅಭಿವ್ಯಕ್ತಿಗೆ ಅವಕಾಶ ಪಡೆದುಕೊಳ್ಳುವರು
- ನವೋದಯ ಕಾಲಘಟ್ಟದ ಕವಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು
- ಭೂಮಿಯ ಬಗೆಗಿನ ಕವಿಗಳು ಹಾಗೂ ಲೇಖಕರ ಸೃಜನಶೀಲ ಬರವಣಿಗೆಯ ಬಗ್ಗೆ ಅರಿತುಕೊಳ್ಳುವರು
- ಆಡಳಿತ ಭಾಷೆಯ ಬಗ್ಗೆ ಜ್ಞಾನ ಪಡೆದುಕೊಳ್ಳುವರು

ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಅಕ್ಯಾಡಮಿ ಮೈಸೂರು

ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು. ಬಿಎಸ್ಸಿ ಮೊದಲನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ-೧

ಘಟಕ - ೧, ನಾಡು-ನುಡಿ-ಚಿಂತನೆ

- ೧) ನಾಡು, ನುಡಿ , ಸಂಸ್ಕೃತಿ : ಶ್ರೀ ವಿಜಯನ ಕವಿರಾಜಮಾರ್ಗ  
೨) ಕಾಣಿಕೆ : ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ  
೩) ರತ್ನನ ಪದಗೂಳ್ : ಜಿ.ಪಿ.ರಾಜರತ್ನಂ  
೪) ಕಟ್ಟುವೆವು ನಾವು : ಎಂ ಗೋಪಾಲ ಕೃಷ್ಣ ಅಡಿಗ

ಘಟಕ - ೨ , ಭೂಮಿ

- ೧) ಬೆಳಗಾಗಿ ನಾನೆದ್ದು ಯಾರ್ಯಾರ ನೆನೆಯಾಲಿ : ಜನಪದ  
೨) ಭೂಮಿ ತಾಯಿಯ ಚೊಚ್ಚಲ ಮಗ : ದ.ರಾ. ಬೇಂದ್ರೆ  
೩) ಕುಂಕುಮ ಭೂಮಿ : ಕೆ.ಎಸ್ ನರಸಿಂಹಸ್ವಾಮಿ  
೪) ಅವ್ವ : ಪಿ.ಲಂಕೇಶ

ಘಟಕ - ೩, ವೈಜ್ಞಾನಿಕ ಮನೋಧರ್ಮ

- ೧) ಧನ್ವಂತರಿ ಚಿಕಿತ್ಸೆ : ಕುವೆಂಪು  
೨) ವಂಡೂರಿನ ಹವಳದ ದಂಡೆಗಳು : ಕೆ.ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ  
೩) ನಿಸರ್ಗದ ನಿಗೂಢ ಕುರಿಂಜಿಲೋಕ : ನಾಗೇಶ ಹೆಗಡೆ

ಘಟಕ - ೪, ಭಾಷಾ ಭಾಗ

- ೧) ಪತ್ರ ವ್ಯವಹಾರ, ಸಾಮಾನ್ಯ ಪತ್ರ, ಮನವಿ ಪತ್ರ  
೨) ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ  
೩) ಆಡಳಿತ ಭಾಷೆಯ ಸ್ವರೂಪ ಮತ್ತು ಲಕ್ಷಣ

ಹೆಚ್ಚಿನ ಓದಿಗಾಗಿ : ಕವಿರಾಜ ಮಾರ್ಗ- ಶ್ರೀ ವಿಜಯ,

ಕುವೆಂಪು ಕೃತಿ ವಿಮರ್ಶೆ- ಪ್ರೊ.ಅರವಿಂದ ಮಾಲಗತ್ತಿ

ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ- ಎಚ್.ಎಂ ಚನ್ನಯ್ಯ

ಆಡಳಿತ ಕನ್ನಡ - ಎಚ್‌ಎಸ್‌ಕೆ

## Language 2 – Part II French I

L	T	P	C
3	0	0	3

### Course Objectives

- The course aims at making the learner to understand and use familiar day-to-day expressions and very basic phrases in French.
- The learners are taught to introduce themselves and others, ask and answer questions about personal details in French.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Improve the listening and speaking skills by listening to audio lessons.
2. Read, comprehend, and analyze a wide range of texts such as small paragraphs and comprehension in French.

### Theory

#### Unit 1

1. Greet people
2. Talk about yourself

#### Unit 2

1. Talk about where you live

#### Unit 3

1. Talk about your family members

#### Unit 4

1. Talk about your likes and dislikes

### References:

1. Stahl Christian (2018) 100 French Short Stories for Beginners Learn French with Stories Including Audiobook published by Lulu.com.
2. S. Singh Kajal Chawla Toujours Francais:-French Volume -0 ,language Learning Books for beginners, Easy French Step-by-Step Learning method: -Educational book published by Souvenir Publishers Pvt Ltd.

L	T	P	C
3	0	0	3

## **SEC 01 – Digital Fluency**

### **Course Objectives:**

- To introduce students to the realm of technology.
- To impart knowledge regarding the benefits of digitization.
- To help students gain digital literacy.

### **Course Outcomes:**

After successful completion of the course, students will be able to

1. Have an intelligent conversation on the key concepts and applications of Artificial Intelligence, Big Data Analytics, Internet of Things, Cloud Computing and Cybersecurity.
2. Develop holistically by learning essential skills such as problem-solving, design thinking and teamwork.

### **Theory**

**Unit-I: Emerging Technologies** – Overview of emerging Technologies – Artificial Intelligence (AI), Machine Learning, Deep Learning. Database Management for Data Science, Big Data Analytics. Internet of Things (IoT) and Industrial Internet of Things (IIoT). Cloud computing and its service models. Introduction to Cyber Security and Types of cyber-attack.

**Unit-II: Applications of Emerging Technologies** – Artificial Intelligence (AI), Big Data Analytics, Internet of Things, Cloud Computing, Cyber Security.

**UNIT III: Essential skills beyond Technology:** Safe usage of the internet, Creative Problem solving & Critical Thinking, Innovation and Design Thinking, Use of tools in enhancing skills.

### **References:**

1. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers.

## VBC 01 – Health & Wellness

L	T	P	C
2	0	0	2

### Course Objectives:

- To introduce the concept of health, food, nutrition and diet and their role in malnutrition, communicable and non-communicable diseases.
- Relationship between of yoga and Ayurveda.
- The psychology, various emotions, and behavioral aspects.

### Course Outcomes:

At the end of the course, students would be able to understand the

1. Need of food, nutrition, diet and causes of malnutrition and various disease conditions.
2. Gains knowledge of yoga and ayurveda their health benefits.
3. Psychology, various personalities, and their effect on concentration.

## Theory

### Unit I

Definition of health, food, nutrients, nutrition, diet, RDA (ICMR & WHO), Balanced Diet, malnutrition. Exercise & fitness. Incidence of Nutritional problems, signs, symptoms and treatment- Protein Energy Malnutrition, Micronutrient deficiencies (Vit-A, Iron, Iodine and Zinc)- Causes & consequences of malnutrition. Intervention programs: Mid-Day Meal Programme, NIPPCD Fortification and enrichment of foods, NIN, ICMR, WHO, FAO.

### Unit - II

Communicable Diseases causes and prevention -cholera, polio, measles, HIV. Impact of NCDs on public health. Non-communicable diseases causes and prevention: Obesity, Diabetes mellitus, hypertension, CVD, Cancer, Osteoporosis

### Unit - III

Yoga and health science- Introduction to Yoga; Objective of Yoga; Concept of Mind according to Yoga; Importance of Yoga & Misconceptions of Yoga. Ayurveda- Principles; Dosha theory. Interrelation between Yoga and Ayurveda. Herbal remedies and Nutraceuticals.

### Unit - IV

Psychology, emotion, personality, motivation, cognition, cognitive learning, memory, forgetting and Artificial Intelligence - definitions and types. Understanding basic behavioral aspects- attention and concentration.

**References:**

1. Vinodini Reddy., Pralhad Raj, Gowrinath Sastry J, Kashinath, K.C. (1993), Nutrition Trends in India, NIN, Hyderabad.
2. Park and park (1995), Textbook of preventive and social medicine, Banarsidas published by Jabalpu.
3. Jellifee, D.D and Pathes (1989), Assessment of Nutritional status of community, WHO, Geneva.
4. Baron RA and Misra G, (2014), Psychology, Fifth Edition, New Delhi, By Pearson education.
5. Yoga Health by Dr H R Nagendra & Dr R Nagarathna.

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## **Semester Two**

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## DSC 03 – Natural Resources and Management

L	T	P	C
3	0	2	5

### Course Objectives:

- Student study about the various types of natural resources.
- Student can understand the various energy resources.
- The course also covers biological resources, water resources and sustainable development.

### Course Outcomes:

1. At the end of the course, student have a clear understanding on the various natural resources.
2. Student can differentiate various energy resources.
3. Students have a clear understanding on methodology in the effective management.
4. Student also come across various agencies and treaties behind the resources management.

### Theory

**Unit I: Basic concepts of Energy Resources:** Role in human civilization, World energy scenario, Renewable and non-renewable sources of energy. Non-Renewable Energy Resources: Fossil fuels and their reserves, nuclear energy, types, uses and effects. Energy utilization and its effects on environment, Energy crisis, Renewable energy: Hydropower, Solar energy, geothermal, tidal and wind energy, biomass energy, biohydrogen.

**Unit-II: Biological and soil resources:** Types and uses of biological resources, Forest resources and conservation in India, Wildlife conservation efforts in India, Project tiger, soil and Mineral resources: mineral resources in India, types of soil, soil erosion. Soil conservation techniques. Types of land use, Land conservation strategies

**Unit-III: Water resources:** Types and uses of water resources, Methods of enhancing fresh water supply, Watershed management & its importance, Sustainable management of water resources- agriculture, industry, and urbanization.

**Unit IV: Food Resources:** Basic of human nutrition, types of nutritive constituents, food crops

of India, current food crisis, hunger index, problems associated with food resources, recent developments in food resources- golden rice and single cell proteins, sustainable and green technology.

### **Practical 03 – Natural Resources and Management**

1. Identification of various energy resources.
2. Demonstration of Solar cell
3. Production of Biodiesel.
4. Identification of various minerals and soils
5. Understanding the various Properties of soil.
6. Identification of different food constituents

### **References:**

1. Lodish H. F. (Editor) Berk A., Matsudaira P., Kaiser C. A., Krieger M., Scott M. P., Zipursky S. L., Darnell J. Molecular Cell Biology. W. H. Freeman and Co., Publishers.
2. Singh, J.S., Singh, S.P. and Gupta, S.R. 2016. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
3. Donahue R.L. and Miller R.W. 2014. Soils in Our Environment, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Morgen, M.D. Morgen J.M. and Wiersima J.H. 2014, Environmental Science: Managing Physical and Biological Resources Wm C Brown Publishers London.
5. Tyler Miller Jr. G. 2015. Living in the Environment. Wadsworth Publishing Company, Belmont California.
6. Botkin, D.B and Keller E.A., 2015, Environmental Studies: The earth as a living plant. Charles E. Merrill, Publishing Co. London.

## DSC 04 – Environmental Pollution & Health

L	T	P	C
3	0	2	5

### Course Objectives:

- To understand about air, water and soil pollution
- Students will learn about Climate change, health, and environment.
- Students will learn about the various kinds of pollution that occur in the environment

### Course Outcomes:

After successful completion of the course, students will be able to

1. Through this course, the students learn the importance of environment and methods to minimize the pollution.
2. This course prepares the students to be responsible citizens.
3. At the end of the course, the students will have an understanding on the pollution measures.
4. The students will have the basic knowledge in understanding the Climate change and health.

### Theory

**Unit-I: Air pollution-** sources of air pollution, Primary and secondary air pollutants, Origin and effects of SO<sub>x</sub>, NO<sub>x</sub>, CO<sub>x</sub>, CFC, Hydrocarbon, Photochemical smog, Acid rain, Ozone layer depletion, effects of air pollution control of air pollution- catalytic converter, settling chambers, scrubber, electrostatic precipitators and cyclonic separators.

**Unit-II: Soil and noise pollution** - Cause and types of soil pollution, Effects of soil pollution, Pesticides in soil environment and their effects, Biological magnification, mining and environmental problems, Cause and types of noise pollution, Effects of noise pollution, control and abatement measures of Soil and Noise pollution.

**Unit-III: Water and thermal pollution-** Sources, types and effects of water pollution, marine pollution, ground water pollution, Sources, types and effects of thermal pollution, advanced techniques and methods in Water and thermal pollution

control.

**Unit-IV: Health and environment-** effect of pollutants on human health- heavy metals (Mercury, Lead, Cadmium, and Arsenic), pesticides, climate change and human health, Radiation effect on human health. Effects of pollutants on ecosystem (flora and fauna).

**Practical 04 – Environmental Pollution & Health**

1. Identifying the sources of pollution in water obtained from different sources.
2. Measurement of photo density flux by Luxmeter.
3. Measurement of noise pollution
4. Studies on indicators of air pollution
5. Determination of CO<sub>2</sub> in the atmosphere by volumetric method.
6. Determination of SO<sub>2</sub> in different areas
7. Basic radioactive measurement procedures by using GM counter.
8. Field visit to assess air and noise pollution.
9. Study of primary and secondary abatement methods.
10. Physico-chemical properties of polluted soils.

**References:**

1. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
2. Sodhi G.S. 2015, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.
3. Khopkar, S.M. 2014. Environmental Pollution Analysis, Wiley Eastern Limited New York.
- 4 Rao M.N. and H.V.N. Rao, 2012: Air Pollution, Tata McGraw Hill Publishing Co. Ltd., NewDelhi.

## OEC 02 – Wildlife Science

### Course Objectives:

L	T	P	C
3	0	0	3

- Status of the wildlife Diversity, value, and drivers of its loss.
- Relationships between organisms through interactions.
- Current efforts to conserve wildlife on global, national, and local scales.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Cite the scientific evidence for biodiversity change in the modern era and detail the contemporary causes of diversity loss.
2. Understand the ecological, social, and economic impacts of diversity loss
3. Apply management principles and tools that are used to conserve diversity.

## Theory

**Unit I: Introduction to wildlife** - Wildlife diversity - Genetic, species and ecosystem, alpha, beta, and gamma. Values of wildlife – consumptive use, optional, productive, social. Bio-wealth, endemism, significance of the endemism, Hot spots of wildlife. IUCN categories - endangered, vulnerable, rare and extinct species

**Unit II: Wildlife ecology** - Natalty, mortality, density, population growth curve, age structure, Density dependent and density independent factors; carrying capacity; regulation of population. Seasonal population of fluctuation, distribution, and dispersion. Population interactions - competition, parasitism, predation, proto cooperation, commensalisms and mutualism.

**Unit III: Wildlife issues** - Causes of wildlife depletion, man-wildlife conflicts, wildlife corridors, wildlife trade and regulations, ecological consequences of reduction in wildlife, deforestation and its impact, wildlife in Karnataka, brief account of endangered fauna of India.

**Unit IV: Wildlife conservation** - Ex- situ (zoological and aquaria) & in-situ (National Park, Sanctuaries and Biosphere Reserves) conservation. Single species-based conservation programmes (e.g., Tiger; Elephant,), Captive breeding, Women in conservation (e.g., Bishnois). Wildlife Protection Act, 1972. afforestation, social forestry, agroforestry, and joint forest management.

**References:**

- 1.Saharia, V.B. 1982 Wildlife in India, Nataraj Publishers, Dehra Dun
- 2.Seshadri, B.1986 India's Wildlife reserves, Sterling Pub's Pvt. Ltd., New Delhi
- 3.Giles, R.H. Jr. (Ed) 1984. Wildlife Management Techniques 3rd edition. The wildlife Society, Washington. D.C. Nataraj Publishers,Dehradun. India
- 4.Dasman, Rf. 1964, Wildlife Biology. John and Wiley and sons Newyork. Pp231.
5. Robinson, Wl. and Eric, G. Bolen, 1984. Wildlife Ecology and Management Mac Millan Publishing Co, Ny. Pp 478.

## Language 1 – Part I English II

L	T	P	C
3	0	0	3

### Course Objectives:

- Understand and apply the purpose of adjectives, adverbs, and prepositions.
- Apply the rules of reported speech in dialogue writing.
- Bring life to the words and enhance creativity in writing by using figures of speech like alliteration, metaphor, and simile.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Correct errors in sentences by applying rules of adjectives, adverbs, and prepositions.
2. Reveal the tone and moods of the characters and improve writing of dialogues by applying the rules of Reported Speech.
3. Use figurative language to elicit emotion, help readers form mental images and draw readers into the work.

### Theory

#### Unit-I: Grammar

1. Correct Use of Adjectives
2. Reported Speech
3. Correct Use of Adverbs
4. Correct Use of Prepositions
5. Formal Letters (Resume and Cover letter) and Writing Emails
6. Reading Comprehension Passage

#### Unit-II: Vocabulary – I

1. Roots: G to L
2. Figures of Speech: Alliteration, Metaphor, Simile

#### Unit-III: Vocabulary – II

1. Prefixes and Suffixes

## 2. New Words in English

### **Unit-IV: Essay: Indian English Literature**

Swami Vivekananda's Address at Parliament of Religions in Chicago

#### **References:**

1. Lewis Norman (2016) Word Power Made Easy, published by Goyal Publishers & Distributors Pvt. Ltd.
2. Raymond Murphy (2009) Grammar in Use Intermediate Student's Book with answers: Self-study Reference and Practice for Students of North American English, published by Bookswagonn.
3. Raymond Murphy (2013) English Grammar In Use: A Self Study Reference And Practice Book Intermediate Learners Book published by Cambridge University Press.



## Language 2 – Part II English II

L	T	P	C
3	0	0	3

### Course Objectives:

- Learn and appreciate different literatures like Indian English, British and American literature.
- Learn to appreciate the importance of moral and ethical values in life through study of literature.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Critically analyze the aftereffects of Industrial Revolution in Britain, especially the prevalence of child labor, through the poem “The Chimney Sweepers” by William Blake.
2. Know about the importance of nature. Nature is the best teacher who can teach humans about what is evil and what is good through the poem “The Tables Turned” by William Wordsworth.
3. Learn that every person must understand his/her own abilities and talents and not be fooled by a critic who may not have the best intentions through the poem “The Frog and the Nightingale” by Vikram Seth.

### Theory

#### Unit-I: Poetry from the Romantic period

1. “The Chimney Sweepers” by William Blake
2. “The Tables Turned” by William Wordsworth

#### Unit-II: Indian English Poetry

1. “The Frog and the Nightingale” by Vikram Seth
2. “Battle with Death”, Translating Atal Bihari Vajpayee’s Hindi poem “Maut Se Thann Gayi”.

#### Unit-III: British and American Prose

1. “The Mammon and The Archer” by O’Henry

2. "The Tell-Tale Heart" by Edgar Allan Poe
3. "The Case for The Defence" by Graham Greene

**Unit-IV: Drama Translation Works**

"Yama's Defeat" by Kuvempu translated from Kannada to English by Dr. C. Naganna

**References:**

1. Vajpayee Atal Bihari 21 poems by Atal Bihari Vajpayee, translated by Pavan K Verma published by Penguin Books India Pvt Ltd.
2. Henry O '100 Selected Stories published by Vasani Book Depot.
3. Edgar Allan Poe (2019) The Tell-Tale Heart published by Blurb.
4. Thomson Sharada's Savitri published by Word catcher Publishing.

L	T	P	C	
3	0	0	3	

ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಅಕ್ಯಾಡಮಿ, ಮೈಸೂರು

ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು

ಬಿಎಸ್ಸಿ ಎರಡನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ - 9

ಅಧ್ಯಯನದ ಉದ್ದೇಶ

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕುವೆಂಪು ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ವಚನಗಾರ್ತಿಯರ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು
- ವಚನಗಾರರ ಬಗ್ಗೆ ಬೆಳಕು ಚೆಲ್ಲುವುದು
- ಪರಿಸರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ಪ್ರಬಂಧ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು

ಅಧ್ಯಯನದ ಫಲಿತಗಳು

- ವಿದ್ಯಾರ್ಥಿಗಳು ಕುವೆಂಪು ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ವಿಸ್ತಾರವಾದ ತಿಳುವಳಿಕೆ ಹೊಂದುವರು
- ವಚನಗಾರ್ತಿಯರ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು
- ವಚನಗಾರರ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ಜ್ಞಾನ ಪಡೆದುಕೊಳ್ಳುವರು
- ಪರಿಸರದ ಬಗ್ಗೆ ಅರಿತುಕೊಳ್ಳುವರು
- ಪ್ರಬಂಧ ಸಾಹಿತ್ಯವನ್ನು ಗ್ರಹಿಸಿಕೊಳ್ಳುವರು.

**ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಅಕ್ಯಾಡಮಿ, ಮೈಸೂರು**  
**ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು. ಬಿಎಸ್ಸಿ ಎರಡನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)**

**ಸಾಹಿತ್ಯ ಸಿಂಚನ -೨**

**ಘಟಕ - ೧, ಜೀವನ ಕಲೆ**

೧) ಜಲಗಾರ : ಕುವೆಂಪು

**ಘಟಕ - ೨, ಕನಸು**

೧) ಅಕ್ಕ ಕೇಳವ್ವ ನಾನೊಂದು ಕನಸು ಕಂಡೆ : ಅಕ್ಕ ಮಹಾದೇವಿ

೨) ಶವದ ಮನೆ : ಚದುರಂಗ

೩) ರಂಗಣ್ಣನ ಕನಸಿನ ದಿನಗಳು : ಎಸ್.ವಿ ರಂಗಣ್ಣ

**ಘಟಕ- ೩, ಮಳೆ**

೧) ಮುಕ್ಕಣ್ಣ ಮಳೆ ಕರುಣಿಸೋ : ಜನಪದ ಕಾವ್ಯ

೨) ತೆಂಕಣಗಾಳಿಯಾಟ : ಪಂಜೆ ಮಂಗೇಶರಾಯರು

೩) ಅಮೆಜಾನ್ ಮಳೆಕಾಡಿಗೆ ಅಗ್ನಿ ಪರೀಕ್ಷೆ : ಟಿ. ಆರ್ ಅನಂತರಾಮು

**ಘಟಕ -೪, ಭಾಷಾ ಭಾಗ**

೧) ಗಾದೆ, ಸ್ವರೂಪ ಲಕ್ಷಣ

೨) ಪ್ರಬಂಧ, ಸ್ವರೂಪ ಲಕ್ಷಣ

೩) ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರ, ಅಧಿಕೃತ, ಅರೆ ಅಧಿಕೃತ ಪತ್ರಗಳು

**ಹೆಚ್ಚಿನ ಓದಿಗಾಗಿ :**

ಕುವೆಂಪು ಸಂಚಯ - ಡಾ.ಪ್ರಧಾನ್ ಗುರುದತ್ತ

ಕನ್ನಡದ ಅತ್ಯುತ್ತಮ ಸಣ್ಣ ಕತೆಗಳು - ನರಸಿಂಹ ಮೂರ್ತಿ

ಆಡಳಿತ ಕನ್ನಡ - ಡಾ. ಮುರಿಗೆಪ್ಪ

## Language 2 – Part II French II

L	T	P	C
3	0	0	3

### Course Objectives:

- The students are taught to interact in a simple way provided the other person talks slowly and clearly and is prepared to help.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Gain an appreciation and understanding of the diversity of the Francophone world within the broader framework of multicultural communities and global perspectives.
2. Comprehend and respond with grammatical accuracy to spoken and written French as well as demonstrate cultural awareness.

### Theory

#### Unit 1

1. Engage in a simple buy-and-sell situation

#### Unit 2

1. Ask about the day, the time and the date
2. Accept and refuse

#### Unit 3

1. Read simple notices, posters and catalogues

#### Unit 4

1. Fill in a simple form
2. Write a simple postcard

### References:

1. Verma Rashmi (2020) French Made Easy published by Goodwill Publishing House
2. Kendris Christopher (2011) Barron's Foreign Language Guides - 501 French Verbs (with CD) published by Goyal Publishers & Distributors Pvt. Ltd.

## AECC 01 - Environmental Studies

L	T	P	C
3	0	0	3

### Course Objectives:

- To identify and solve the environmental problems.
- To avoid environmental pollution & global problems.
- To create awareness among the people about protection of environment

### Course Outcomes:

After successful completion of the course, students will be able to

1. Get the knowledge about the different types of resources like land, water, mineral and energy.
2. Gain the knowledge about the different types of pollutions and their control technologies.
3. Get the information about ecosystem and about its functions like Food chain, Ecological pyramids etc.

### Theory

**Unit I: Introduction to environmental studies** - Multidisciplinary nature of environmental studies; Scope and importance of environmental studies, Ecosystems, Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, rivers, oceans). Natural Resources: Renewable and Non-renewable Resource, Land resources and land use change; Land degradation, soil erosion and desertification. Water: Use and over- exploitation of surface and ground water, conflicts over water (international & inter- state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources.

**Unit-II: Biodiversity and Conservation** - Levels of biological diversity : genetic, species and ecosystem diversity; values of biodiversity Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots, 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.

**Unit-III: Environmental Pollution & Policies** - Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks, Solid waste management, Climate change, global warming, ozone layer depletion, acid rain, 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).

**Unit-IV: 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 landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Field work activities (Study of simple ecosystems).

**References:**

1. Textbook of Environmental studies for undergraduate courses by Erach Bharucha.
2. Deswal, S. and Deswal, A. 2005. A Basic Course in Environmental Studies. Dhanpat Rai & Co ltd., Delhi.
3. Singh, N. and Sontakke, N.A. 2002. On Climatic fluctuations and Environment changes on Indo-Gangetic Plains, India.
4. Deswal, S. and Deswal, A., 2003, Energy, ecology, Environment and Society, Dhanpat Rai&co ltd., Delhi.
5. Singh, G.B. and Sharma, B.R. 1998. Fifty Years of Natural Resource Management Research, Indian Council of Agriculture Research, New Delhi.

**ABC 01 - Environmental Awareness / Education programs**

L	T	P	C
0	0	2	2

The students are advised to take part in various environmental awareness programs/events/activities. Students are asked to complete the instructed activities. The evaluation is done based on their involvement/participation.

1. Observing Environmental Calendars
2. Participation in rallies/Jathas
3. Writing articles in newspapers
4. Promotion of Van Mahotsav program
5. Clean drive events.



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## **Semester Three**

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## DSC 05 - Biodiversity Conservation and Management

L	T	P	C
3	0	2	5

### Course Objectives:

- To know about global biodiversity concepts and issues.
- To know about the various forms of biodiversity
- To know about the various methods of conservation of biodiversity.

### Course Outcomes:

1. The students will learn about the basics concept about biodiversity and its types and various conventions.
2. They will learn about the various class of microbial diversity and its economic and environmental significance.
3. They will learn about the plant diversity groups.
4. They will learn about the various conservative strategies of biodiversity.

### Theory

**Unit I: Biodiversity** - Basic concepts, Types of biodiversity- species concepts-Biological and phylogenetic species concept, speciation, and species extinction. Importance of biodiversity- Taxonomic classification of plants and animals- Biodiversity conventions- Socio-cultural aspects of biodiversity.

**Unit II: Microorganisms** - General Characteristics, habitat and economic importance of Chemoautotrophs, Bacteria, Fungi and Algae, Microbial toxins in environment- types of microbial toxins- Bacterial Diseases of man-Types-causes-effects and control measures.

**Unit III: Diversity of insects, fishes, birds and its environmental significance** - Pollination and seed dispersal, General characteristics, habitat, environmental and economic importance of Bryophytes- Pteridophytes-Angiosperms. Lichens as ecological indicators. Importance and conservation of tropical regions- wetlands- mangroves- coral reefs.

**Unit IV: Global Biodiversity Conservation** - Endemism and hotspots, The Critical Role of Hotspots, Biological diversity and future climate, Factors for decline of biological diversity,

Approaches for conservation of biological diversity, Protection of wild flora, fauna and natural habitats, Ex-situ and In- situ conservation- Threatened and endangered species.

### **Practical 05 - Biodiversity Conservation and Management**

#### **Part A**

1. Carbonates and bicarbonates in soil
2. Moisture factor in plants material
3. Soil texture by field method
4. Seed germination test
5. Total organic carbon.
6. Saponification of oils
7. Wind velocity by anemometer
8. Microbial Toxins
9. Herbarium
10. Study of bird diversity
11. Field visit
12. Soil classification using Munsell color chart

#### **Part B:**

1. Threatened Endangered and extinct
2. Native and endemic species Seed bank
3. Insitu and excite conservation
4. Classification of Rock and mineral
5. Renewable energy.
6. Identification of biological specimens and economic importance

#### **Part C:**

Spotters (chosen from the portion)

**References:**

1. Chandel, K.P.S., Shukla, G. And Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
2. Zachos, Frank E.; Habel, Jan Christian (2011) Biodiversity Hotspots, Distribution and Protection of Conservation Priority Areas, Springer.
3. Council of Scientific and Industrial Research (1986). The Useful Plants of India Publication and Information Directorate, CSIR, New Delhi.
4. Nair, M.N.B. et. al. (Eds.) (1998). Sustainable Management of Non-wood Forest Products. Faculty of Forestry, University Putra. Malaysia. 434 004 PM Serdang, Selangor, Malaysia.
5. Soule, M.E. (ed.) (1986). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts

## DSC 06 - Energy and Environment

L	T	P	C
3	0	0	3

### Course Objectives:

- This course aims to provide students with a broad understanding of the existing energy resources.
- Students can discuss the issues related to energy and the environment.
- Students get a broad idea of challenges and possible paths to sustainable energy generation and use.

### Course Outcomes:

1. By the end of the course student have a broad idea of energy related issues.
2. Students can identify the gaps of energy sector and relation towards sustainable use
3. Students will have a clear picture of energy related issues and policies related to it.

### Theory

**Unit-I: Energy, Demand and Energy resources** - Defining energy; forms and importance; fossil fuels, advent of nuclear energy, global energy resources; renewable and non-renewable resources: distribution and availability; future technologies for capturing and integrating these resources into our energy infrastructure; energy- use scenarios in rural and urban setups; energy conservation. Energy demand and use in domestic, industrial, agriculture and transportation sector, energy subsidies and environmental costs.

**Unit-II: Energy, environment, and society** - Nature, scope and analysis of local and global impacts of energy use on the environment; fossil fuel burning and related issues of air pollution, greenhouse effect, global warming and urban heat island effect; nuclear energy and related issues such as radioactive waste, spent fuel; social inequalities related to energy production, distribution, and use.

**Unit-III: Energy, ecology and the environment** - Energy production as driver of environmental change; energy production, transformation and utilization associated environmental impacts (nuclear accidents, construction of dams, environmental pollution); energy over-consumption and its impact on the environment, economy, and global change.

**Unit-IV: Politics of energy policy and our energy future** - Political choices in energy policy globally and in the Indian context; domestic and international energy policy; energy diplomacy and bilateral ties of India with her neighbors. Current and future energy use patterns in the world and in India; alternative sources as green energy (biofuels, wind energy, solar energy, geothermal energy; ocean energy; nuclear energy); need for energy efficiency; energy conservation and sustainability.

#### **Practical 06 - Energy and Environment**

1. Identification of Various energy setups.
2. Identification of various fossil fuels.
3. Identification and sources of Greenhouse gases.
4. Estimation of carbon dioxide and ammonia by spectroscopic method.

#### **References**

1. Elliott, D. 1997. Sustainable Technology. Energy, Society and Environment (Chapter 3). New York, Routledge Press.
2. McKibben, B. 2012. Global Warming's Terrifying New Math, Rolling Stone Magazine.
3. Craig, J.R., Vaughan, D.J., Skinner, B.J. 1996. Resources of the Earth: Origin, use, and environmental impact (2nd edition). Prentice Hall, New Jersey.
4. Rowlands, I.H. 2009. Renewable Electricity: The Prospects for Innovation and Integration in Provincial Policies in Debora L. Van Nijnatten and Robert Boardman (eds), Canadian Environmental Policy and Politics: Prospects for Leadership and Innovation, Third Edition. Oxford University Press, pp. 167-82.
5. Oliver, J. 2013. Dispelling the Myths about Canada's Energy Future, Policy: Canadian Politics and Public Policy, June-July.

### OEC 03 - Ecotourism

L	T	P	C
3	0	0	3

#### Course Objectives:

- This course introduces the students to the basics of tourism.
- Course clears idea of importance of various types of tourism.
- Course give introduction to various ecotourist sites and their importance.
- Course clears the various impact of tourism and proper management practices.

#### Course Outcomes:

1. At the end of the course, the student will be able to apply these learning to practical use.
2. Student can identify the areas of tourist importance and improve
3. Student can practice ecofriendly approach in development of tourist sites.
4. Student can also support NGOs and other agencies in improving ecotourism.

**Unit – I: Tourism** - Concepts, Definition and Historical development of tourism. Distinction between Tourist-Traveler-Visitor-Excursionist. Types and Forms of Tourism; Tourist system Nature, characteristic. Components of tourism and its characteristics.

**Unit – II: Tourism and impacts** - Domestic tourism: features, pattern of growth, profile. International tourism: Generating and Destination regions. Pattern of growth and Profile. Positive and Negative Impacts of Tourism: Socio - cultural, Economic, Environmental and Political. Factors affecting ecotourism impacts, Ecotourism as a tool for sustainable development.

**Unit – III: Ecotourism** - History and Definition of Ecotourism, Soft Tourism, Principles of Ecotourism, Facts and Critical Issues, Stakeholders of Ecotourism, Ecotourism Economy and Activities, Ecotourism and Sustainable Tourism, Tourism and Biodiversity. Role Of National and International Agencies, The International Ecotourist society (TIES).

**Unit – IV: Places of interest of ecotourism** - Wildlife Sanctuaries (Bharatpur Bird Sanctuary, Biligiri Rangaswamy Temple), National Parks (Jim Corbett Tiger Reserve, Kanha NP, Kaziranga NP, Gir NP,) and Biosphere reserves in India (Nilgiri BR, Sundarbans BR,



Seshachalam Hills BR). Hill Stations: Study of Hill Station attractions and their environs with case studies of Mussoorie, Nainital, Munnar and Ooty. Beaches: Beaches in Goa, Kerala, Orissa. Islands: Andaman Nicobar & Lakshadweep islands.

**References:**

1. Bhatia. Tourism Development, 2000, New Delhi, India
2. Seth: Tourism Management, 2000, Pune, India
3. Kaul: Dynamics of Tourism, 1999, New Delhi, India.
4. Mill and Morrison – The Tourism system an Introductory Text (2000)) Prentice Hall
5. Cooper, Fletcher, Tourism, Principles and practices (1999) Pitman

## Language1 – Part I English III

L	T	P	C
3	0	0	3

### Course Objectives:

- Learn the importance of Superfluous Expressions otherwise known as redundant or unnecessary expressions.
- Learn to use Active and Passive Voice in speech and writing and understand them

### Course Outcomes:

After successful completion of the course, students will be able to

1. Add variety to their writing using conjunctions and articles so that they can be used to create sentences with different styles and meanings.
2. Add flexibility in their language by proper use of Active and Passive voice.
3. Successfully remove redundant and superfluous expressions in their speech and writing.
4. Express nuances in meaning by using modal auxiliary verbs.

### Theory

#### Unit-I: Grammar

1. Correct use of Conjunctions
2. Correct use of Articles
3. Superfluous Expressions and commonly mispronounced words in English
4. Active and Passive Voice
5. Modal Auxiliaries
6. Reading Comprehension Passage

#### Unit-II: Vocabulary

1. Roots: M to R
2. Homonyms, homophones and homographs
3. Figures of Speech: Hyperbole, Euphemism, Onomatopoeia, Personification
4. Foreign expressions

**Unit-III: Creative Writing**

1. Paragraph writing
2. Précis Writing

**Unit-IV: Essay**

Sardar Vallabhi Bhai Patel's letter to Nehru after drafting the Constitution.

**References:**

1. Sudhir S Padhye (2017) English Grammar and Writing Skills published by Notion Press
2. S.P Bakshi, Richa Sharma (2017) Descriptive English published by Arihant Publication

## Language 2 – Part II English III

L	T	P	C
3	0	0	3

### Course Objectives:

- Critically analyze American, Anglo American, Neoclassical and Victorian Poetry.
- Learn about the importance of historical fiction and diary entries.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Think and ponder about the plight of not only Jewish refugees but refugees all over the world and raise broader questions about isolation, loneliness, and exile.
2. Understand and appreciate the revolutionary and patriotic spirit of Bhagat Singh's last three years (1929-31) in Lahore's Central Jail, through Bhagat Singh's jail diary.
3. Learn about several life changing lessons like revengeful instinct can only lead to one's doom and not to give up on life despite all hurdles.

### Theory

#### Unit-I: American and Anglo-American Poetry

1. "The Road Not Taken" by Robert Frost
2. "Refugee Blues" by W H Auden

#### Unit-II: Neoclassical and Victorian Poetry

1. "On His Blindness" by John Milton
2. "The Last Duchess" by Robert Browning

#### Unit-III: Drama, Historical Fiction and Diary Entries

1. "The Proposal" by Anton Chekov
2. "Remember the Roses" by Avery Taylor
3. Bhagat Singh's jail diary

“The Mahabharatha”

**References:**

1. Chekhov Anton (2017) The Very Best of Anton Chekov - Short Stories published by Embassy Books.
2. Sandhu Yadvinder Singh (2020) Bhagat Singh's Jail Diary published by Prabhat Prakashan.
3. Frost Robert (1993) The Road Not Taken and Other Selected Poems published by Wilder Publications.

L	T	P	C
3	0	0	3

ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಆಯಾಸ ಮೈಸೂರು

ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು

ಬಿಎಸ್ಸಿ ಮೂರನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ – ೩

ಅಧ್ಯಯನದ ಉದ್ದೇಶ

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಜನಪದ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಒಲವು ಮೂಡಿಸುವುದು
- ಪ್ರವಾಸ ಸಾಹಿತ್ಯದ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು
- ವೈಚಾರಿಕತೆಯ ಪ್ರಸ್ತುತತೆಯ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ಶಿವರಾಮ ಕಾರಂತರ ಬದುಕು ಬರವಣಿಗೆಯ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ಓದಿಗೆ ಅನುವು ಮಾಡಿಕೊಡುವುದು
- ಲೇಖನ ಚಿಹ್ನೆಗಳ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು.

ಅಧ್ಯಯನದ ಫಲಿತಗಳು

- ವಿದ್ಯಾರ್ಥಿಗಳು ಜನಪದ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಒಲವು ಹೊಂದುವರು
- ಪ್ರವಾಸ ಸಾಹಿತ್ಯದ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು
- ವೈಚಾರಿಕತೆಯ ಪ್ರಸ್ತುತತೆಯ ಬಗ್ಗೆ ವಿಸ್ತಾರ ಜ್ಞಾನ ಪಡೆಯುವರು
- ಶಿವರಾಮ ಕಾರಂತರ ಬದುಕು ಬರಹದ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ಜ್ಞಾನ ಪಡೆವರು
- ಲೇಖನ ಚಿಹ್ನೆಗಳ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು

ಜೆಎಸ್‌ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಆಕ್ಯಾಡಮಿ ಮೈಸೂರು  
ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು. ಬಿಎಸ್ಸಿ ಮೂರನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ - ೩

ಘಟಕ - ೧, ಮಾನವೀಯತೆ

- ೧) ಸತ್ಯ ಶರಣೆ ಸಂಕಮ್ : ಡಾ. ಪಿ.ಕೆ. ರಾಜಶೇಖರ  
೨) ಚಂದ್ರಮತಿಯ ಪ್ರಲಾಪ : ರಾಘವಾಂಕ  
೩) ಅಮ್ಮ ಹೇಳಿದ ಎಂಟು ಸುಳ್ಳುಗಳು : ಮಣಿಕಾಂತ್ ಎ.ಆರ್

ಘಟಕ - ೨, ಪ್ರವಾಸ ಸಾಹಿತ್ಯ

- ೧) ನನ್ನ ಗ್ರಹಿಕೆಯ ನೇಪಾಳ : ನಾಗತಿಹಳ್ಳಿ ಚಂದ್ರಶೇಖರ್

ಘಟಕ - ೩, ವಿಚಾರ ಕ್ರಾಂತಿ

- ೧) ಕತ್ತೆ ಮತ್ತು ಧರ್ಮ : ಡಾ. ಸಿದ್ದಲಿಂಗಯ್ಯ  
೨) ವೈಚಾರಿಕತೆ : ಎಚ್. ನರಸಿಂಹಯ್ಯ  
೩) ನಮ್ಮ ಅಳತೆಯನ್ನು ಮೀರಲಾರದ ದೇವರು : ಡಾ.ಕೆ. ಶಿವರಾಮ ಕಾರಂತ

ಘಟಕ - ೪, ಭಾಷಾ ಭಾಗ

- ೧) ಸುತ್ತೋಲೆ  
೨) ಕಡತ (ಪೈಲುಗಳು) ಕಛೇರಿ ಟಿಪ್ಪಣಿಗಳು  
೩) ಲೇಖನ ಚಿಹ್ನೆಗಳು

ಹೆಚ್ಚಿನ ಓದಿಗಾಗಿ : ಹೊನ್ನಾರು ಜನಪದ ಗೀತೆಗಳು - ಡಾ. ಪಿ.ಕೆ. ರಾಜಶೇಖರ

ಅಮ್ಮ ಹೇಳಿದ ಎಂಟು ಸುಳ್ಳುಗಳು : ಮಣಿಕಾಂತ್ ಎ.ಆರ್

ತೆರೆದ ಮನ - ಡಾ. ಎಚ್ ನರಸಿಂಹಯ್ಯ

ಆಡಳಿತ ಕನ್ನಡ - ಎಚ್‌ಎಸ್‌ಕೆ

L	T	P	C
3	0	0	3

**Course Objectives:**

- This course aims to enable the learn to understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment).

**Course Outcomes:**

After successful completion of the course, students will be able to

1. Understand sentences and frequently used expressions related to areas of most immediate relevance (e.g., local geography, employment, accommodation, health and illness);
2. Understand short, simple texts, incl. letters and everyday material (e.g., advertisement, menus, magazine articles, hotel webpages) related to areas of most immediate relevance (e.g., local geography, employment, holidays, consulting a doctor);
3. Communicate verbally in simple and routine tasks requiring simple and direct exchange of information on familiar and routine matters (e.g., asking where places are, finding your way around, visiting the doctor, renting an apartment).

**Theory**

**Unit 1**

1. Talk about yourself, your educational background, your job, your family, your neighborhood
2. Talk about your hobbies and daily activities

**Unit 2**

1. Ask for goods in a shop where goods are displayed
2. Order a meal in a restaurant if dishes are either displayed or illustrated on the menu

**Unit 3**

1. Book a hotel room (face to face)
2. Ask for basic services in a post office or bank

**Unit 4**

1. Indicate the nature of a medical problem to a doctor



2. Make inquiries about a journey at a travel agency

**References:**

1.Makowski Francois (1995) Beginners French Made Easy with CD published by  
Goyal Publishers & Distributors Pvt. Ltd.

2.Cantel J B (1860) The Pronunciation of French Made Easy published byNabu Press

L	T	P	C
2	0	0	2

**Course Objectives:**

- The course aims to imbue students with the process of constitutional making and its formulations. Further, it is offered with the objective to acquaint students to have the basic understanding of the constitution of India.

**Unit I: Constitution – Structure and Principles**

- Meaning and importance of Constitution
- Making of Indian Constitution
- Salient features of the Constitution

**Unit II: Fundamental Rights and Directive Principles**

- Fundamental Rights
- Fundamental Duties
- Directive Principles

**Unit III: The Union Government**

- President of India – Election & Powers
- Prime Minister and Council of Ministers
- Lok Sabha – Composition and Powers
- Rajya Sabha - Composition and Powers

**Reference:**

- 1) Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
- 2) M. V. Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)
- 3) J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)
- 4) Constitution of India (Full Text), India. Gov. in., National Portal of India, [https://www.india.gov.in/sites/upload\\_files/npi/files/coi\\_part\\_full.pdf](https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf)
- 5) Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; Lexis Nexis Butterworths Wadhawa, 2015.
- 6) Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015.

**SEC 02 – Artificial Intelligence**

L	T	P	C
2	0	0	2

**Course Objectives:****Course Outcomes:**

After successful completion of the course, students will be able to

**Curriculum awaited from GoK**



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## **Semester Four**

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## DSC 07 – Introduction to Environmental Microbiology

L	T	P	C
3	0	2	5

### Course Objectives:

- This is an interdisciplinary course that focuses on the application of microbiology in environmental remediation.
- Students will learn the major principles of environmental microbiology and the relationship of microbes to environmental processes and other living organisms.
- Students will demonstrate proper scientific procedure to identify various type of environmental microbes.

### Course outcomes:

After successful completion of the course, students will be able to

1. Students will be able to understand the basic concepts of microbiology
2. Students will be able to classify the different class of micro-organisms
3. Students will be able to explain microbial growth & metabolism
4. Students will be able to understand the different types of water borne diseases.

### Theory

**Unit I: Fundamentals of Microbiology** - Classification of microorganisms, Cell – definition, structure, genetic material, cell size, cell theory, classification of cell – Prokaryotic & Eukaryotic, Nucleic acid – RNA (types & protein synthesis), DNA (double helix bond), Plasmids, mutations, genetic recombination's, Recombinant DNA technology – introduction, construction & application in environmental field.

**Unit II: Brief Survey of Microbial Groups** - Bacteria- Size, shape & structure, classification of bacteria, Unusual Types of Bacteria (Sheathed Bacteria, Stalked Bacteria, Budding Bacteria, Gliding Bacteria, Bdellovibrio, Actinomycetes, Cyanobacteria) Archaea, Eukaryotes: Fungi, algae, protozoa and virus – size, shape & structure, major groups viron, virus Replication, Detection and enumeration.

**Unit III: Microbial Metabolism and Growth** - Enzymes – definition, characteristics, types of enzymes, enzyme substrate complex, Enzyme Kinetics, Effect of Inhibitors on Enzyme Activity, Metabolism: catabolism, anabolism, photosynthesis, Microbial Growth Curve & Kinetics: Batch

Cultures, continuous culture, physical and chemical factors affecting microbial growth, Measurement of Microbial Biomass.

**Unit IV: Role of Microorganisms in Biogeochemical Cycles** - nitrogen cycle, phosphorus cycle, sulfur cycle, Water related vector borne diseases, Opportunistic Bacterial Pathogens, Antibiotic-Resistant Bacteria, Viral Pathogens- Hepatitis, Viral Gastroenteritis, Protozoan Parasites- Cyclospora, Entamoeba histolytica, Naegleria.

#### **Practical 07 – Introduction to Environmental Microbiology**

1. Introduction to environmental microbiology lab – do & don'ts.
2. Study of Microscope
3. Sterilization
4. Preparation of Culture Media
5. Isolation of microorganisms from soil Sample.
6. Simple Staining.
7. Negative Staining.
8. Gram Staining.
9. Isolation of algae specimen from water sample.
10. Pour Plate Techniques.
11. Streak Plate Techniques.
12. Spread Plate Techniques.
13. Lux meter

#### **References:**

1. Gabriel Bitton, Wastewater Microbiology (3rd Edn), 2015, A John Wiley & Sons, Inc., Publication, (ISBN 0-471-65071-4).
2. Pelczar, Jr, M.J., Chan, E.C.S., Krieg, R.Noel., and Pelczar Merna Foss, Microbiology; 5th Edn., Tata McGraw Hill Publishing Company Limited, New Delhi 2016.
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.C. and Painter, P.R., General Microbiology, MacMillan Edn., Ltd., London, 2014.
4. Pichai, R. and Govindan, V.S., Edn., Biological processes in pollution control, Anna University, Madras, 2015.
5. P D Sharma, Environmental Microbiology, 1st Edition, 2017, Rastogi Publications.



## DSC 08 – Environmental Earth Science

### Course Objectives:

L	T	P	C
3	0	2	5

- To about the evolution and history of the earth.
- To know about the formation of earth materials like rocks and minerals.
- To know about the various surface processes.

### Course Outcomes:

1. The students will learn about the formation of earth and various materials.
2. They will learn about the rocks and minerals formations.
3. They will learn about the various processes responsible for the soil formation.
4. They will learn about the basic concepts about the oceans.

### Theory

**Unit I: Earth as planet** - Evolution of earth - classification of earth's interior (Crust, Mantle and core)- Earth Materials- Gross composition and physical properties of important minerals; properties, classification and processes responsible for mineral concentrations.

**Unit II: Basics of Petrology** - Modes of magma formation. Physical properties of magma- temperature, viscosity, density and volatile content-Formation of Rocks- Rock cycle, types, classification and properties of rocks- Igneous, Sedimentary, Metamorphic rocks.

**Unit III: Surface features and Processes** - weathering, erosion, transportation and deposition of Earth's material; formation of soil, Classification of soil, energy balance of the Earth's surface processes; important physiographic features and major river basins in India.

**Unit IV: Oceans and Atmosphere** - Elementary ideas about weather systems, Climates of India, Indian Monsoon, Hypsography of the continents and ocean floor: continental shelf, slope, rise and abyssal plains, Physical and chemical properties of sea water-Ocean currents, waves and tides.

## **Practical 08 – Environmental Earth Science**

### Part - A

1. Familiarization with meteorological instruments and their use
2. Presentation and interpretation of wind data (wind rose)
3. Studies of selective igneous rocks.
4. Study of metamorphic rocks.
5. Study of sedimentary rocks
6. Study of geological maps and drawing of sections across geological structures
7. Use of survey instruments - theodolite, dumpy level and plane table.
8. Field study to a local environmentally important area

### Part - B

1. Study folds in rocks
2. Study of Faults in rocks.
3. Physical properties minerals.
4. Study of ocean relief features.
5. River basins of India.

### Part - C

Spotters from theory.

### **References:**

1. Earth Science & The Environment (4 th Edition) (2007): Thomson & Truck, Thomson Learning Inc.
2. Environmental Geology (1987): K. S. Valdiya; Tata McGraw-Hill
3. Atmospheric Science – An introductory survey (1977): J. M. Wallace and P. V. Hobbs; Academic Press
4. Earth Science (Revised Edition) (2005): Maria Chona Sulti- Branganza, Phillipine copyright, Rex Book Store, Inc.
5. The Basics of Earth Sciences (2003): Robert E. Krebs, Greenwood Press.

## OEC 04 – Sustainable Development

L	T	P	C
3	0	0	3

### Course Objectives:

- Students will learn about the concepts of Sustainable Development
- They learn about sustainable agriculture practices.
- Students will learn about the sustainable earth economy

### Course Outcomes:

After successful completion of the course, students will be able to

1. Through this course, the students learn the importance of sustainable agriculture practices
2. The students will have the basic knowledge in understanding the influence of sustainable development processes on preparation, planning and policy implementation.
3. At the end of the course, the students will have an understanding the ethics and sustainability
4. The students will have understood the effective management strategies of the sustainability issues.

### Theory

**Unit-I: Sustainable Development** - Definition and concepts of sustainable development – Brundtland Commission - sustainable agriculture, Economic and Ecologic aspects of sustainable development, sustainable forests and forestry, sustainable fisheries, sustainable earth economy, environmental worldviews, ethics and sustainability.

**Unit-II: Sustainable management** - Components of Sustainability, Complexity of growth and equity, principles and practices, Sustainable management of resources, effective management strategies of the sustainability issues, United Nations Sustainable development goals (SDGs) and UNEP.

**Unit-III: Sustainable Development and International Contribution** - International Summits, Conventions, Agreements, Transboundary issues, Action plan

for implementing sustainable development, Global Sustainable Development, Moral obligations and Operational guidelines, sustainable development processes on preparation and planning.

**Unit-IV: Sustainable Development Systems on socio-economic aspect** - Socio-economic policies for sustainable development, Strategies for implementing eco-development programs, Economic growth, Sustainable development through trade, Economic growth, Carrying Capacity, Public participation.

**References:**

1. Martha Honey 1999. Ecotourism and sustainable development, Island Press, Washington DC
2. Martin Mow forth and Ian Munt 1998. Tourism and sustainability, Routledge, U.K
3. Robert U Ayres, Paul M Weaver. Eco restructuring: Implications for sustainable development. IN-05457.
4. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.
5. R.B. Jain. Environmental Stewardship and Sustainable Development IN-04021.
6. The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New Society Publishers, 2005.
7. Mays, L.W. 2006. Water Resources Sustainability. The McGraw-Hill Publications

## Language 1 – Part I English IV

### Course Objectives:

- Know the importance of CV Writing to showcase skills, education and work history.
- Build confidence and fluency, assess progress, and put learning into action by enacting role plays.
- Boost conversational English skills by using idioms and proverbs.

L	T	P	C
3	0	0	3

### Course Outcomes:

After successful completion of the course, students will be able to

1. Express certain ideas or opinions and improve creative writing by using idioms and proverbs.
2. Improve on their interview preparation skills by utilizing the tools of the Language Lab.
3. Create engaging and well-thought essays on current and relevant topics.
4. Understand that one should never be content with what is, nor consider oneself an expert which is the message of Steve Jobs' "Stay Hungry, Stay Foolish".

### Theory

#### Unit - I: Grammar

1. Report Writing (Magazine Report, News Report)
2. Preparing CV's and Facing Interviews: Do's and Don'ts.
3. Role Plays
4. Reading Comprehension Passage

#### Unit - III: Vocabulary

1. Roots: S to Z
2. Figures of speech: Pun, Oxymoron, Irony, Antithesis
3. Idioms and Proverbs
4. Phrasal Verbs

#### Unit - III: Creative Writing

1. Story Writing

## 2. Essay writing

### **Unit - IV: Essay**

“Stay Hungry Stay Foolish”, by Steve Jobs

#### **References:**

1. Hundiwala S. (2012) Facing the Corporate Interviews Useful and Time-Tested Tips for Job Interviews in Multinational Companies published by Arihant Publishers.
2. Malhotra Jyoti (2014) IELTS - Vocal Cosmetics published by V&S publisher.
3. Bell James Scott (2017) How to Write Short Stories and Use Them to Further Your Writing Career.
4. Mitra Bashu (2006) Encyclopaedia of Idioms and Proverbs published by Anmol Publications Pvt Ltd.

## Language 2 – Part II English IV

L	T	P	C
3	0	0	3

### Course Objectives:

- Learn about Modern and Post-Modern literature.
- Learn about the glory of the Vijayanagar Empire through chronicles of Paes.
- Learn about racial discrimination through African American writings.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Understand and critically appreciate the century-old conflict between the Ruling class and the Artist community through “The Burning of the Books” by Bertolt Brecht
2. Comprehend that any person who is oppressed or “caged” will always continue to “long” for freedom, knowing that if others are entitled to it, they should be entitled to it, too through Maya Angelou’s poem “I Know Why a Caged Bird Sings”.
3. Appreciate the glory of the Vijayanagar Empire through the travelogues of Paes.

### Theory

#### Unit-I: Poetry from the Modern and Post-Modern periods

1. “The Burning of the Books” by Bertolt Brecht
2. “Birches” by Robert Frost

#### Unit-II: British and African American Literature

1. “Ah, Are You Digging on My Grave?” by Thomas Hardy
2. “I Know Why a Caged Bird Sings” by Maya Angelou

#### Unit-III: Indian English Literature, Travelogues and French Prose

1. “Eidgaah” by Munshi Prem Chand
2. Chronica dos reis de Bisnaga’ (Chronicles of the Vijayanagara Empire) by Paes
3. “La Parure” or “The Necklace” by Guy de Maupassant

#### Unit IV: British Drama

“The Dear Departed” by Stanley Houghton

**References:**

1. Robert Frost (1993) The Road Not Taken, Birches, and Other Poems published by Coyote Canyon Press.
2. Munshi Prem Chand (1969) Selected Short Stories published by Maple Press.
3. Guy De Maupassant (1992) The Necklace and Other Stories published by Vishv Books Private. Ltd.
4. Stanley Houghton (2018) The Dear Departed published by Palala Press.



L	T	P	C
3	0	0	3

ಜೆ.ಎಸ್.ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಆಕ್ಯಾಡಮಿ, ಮೈಸೂರು

ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು

ಬಿಎಸ್ಸಿ ನಾಲ್ಕನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ – ೪

ಅಧ್ಯಯನದ ಉದ್ದೇಶ

- ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ದಮನಿತ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ವಚನ ಸಾಹಿತ್ಯದ ವೈಶಿಷ್ಟ್ಯಗಳ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು
- ಮಹಿಳಾ ಸಾಹಿತ್ಯದ ಪ್ರಸ್ತುತತೆಯ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು
- ಶ್ರೀ ಸಾಮಾನ್ಯರ ಬದುಕು ಬವಣೆಯ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಅನುವು ಮಾಡಿಕೊಡುವುದು
- ಕನ್ನಡ ಮತ್ತು ಗಣಕ ವಿಜ್ಞಾನದ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ತಿಳಿಸಿಕೊಡುವುದು.

ಅಧ್ಯಯನದ ಫಲಿತಗಳು

- ವಿದ್ಯಾರ್ಥಿಗಳು ದಮನಿತ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಅರಿತುಕೊಳ್ಳುವರು
- ವಚನ ಸಾಹಿತ್ಯದ ವೈಶಿಷ್ಟ್ಯಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು
- ಮಹಿಳಾ ಸಾಹಿತ್ಯದ ಪ್ರಸ್ತುತತೆಯ ಬಗ್ಗೆ ಅರಿವು ಪಡೆದುಕೊಳ್ಳುವರು
- ಶ್ರೀ ಸಾಮಾನ್ಯರ ಬದುಕು ಬವಣೆಯ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವರು
- ಕನ್ನಡ ಮತ್ತು ಗಣಕ ವಿಜ್ಞಾನದ ಪ್ರಾಮುಖ್ಯತೆಯ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ಜ್ಞಾನ ಸಂಪಾದಿಸುವರು

ಜೆ.ಎಸ್.ಎಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಆಕ್ಯಾಡಮಿ, ಮೈಸೂರು  
ಜೀವವಿಜ್ಞಾನ ಮತ್ತು ನೈಸರ್ಗಿಕ ವಿಜ್ಞಾನ ವಿಭಾಗಗಳು. ಬಿಎಸ್ಸಿ ನಾಲ್ಕನೆಯ ಚಾತುರ್ಮಾಸ (ಸೆಮಿಸ್ಟರ್)

ಸಾಹಿತ್ಯ ಸಿಂಚನ - ೪

ಘಟಕ - ೧, ದಮನಿತ ಲೋಕ

೧) ಚಂದ್ರಗಿರಿ ತೀರದಲ್ಲಿ : ಸಾರಾ ಅಬೂಬಕ್ಕರ್

ಘಟಕ - ೨, ಸಹಿಷ್ಣುತೆ

೧) ಸಹಿಷ್ಣುತೆ ಸಾರುವ ವಚನಗಳು : ಬಸವಣ್ಣ, ಮಡಿವಾಳ ಮಾಚಯ್ಯ

೨) ಕುಲ ಕುಲವೆಂದು ಹೊಡೆದಾಡದಿರಿ : ಕನಕದಾಸರು

೩) ಬುರ್ಖಾ : ಫಕೀರ್ ಮಹಮ್ಮದ್ ಕಟ್ಟಾಡಿ

ಘಟಕ -೩, ಶ್ರೀ ಸಾಮಾನ್ಯರ ಬದುಕು

೧) ಕೊನೆಯ ಗಿರಾಕಿ : ನಿರಂಜನ

೨) ವಾಣಿಯ ಸಮಸ್ಯೆ : ಕೊಡಗಿನ ಗೌರಮ್ಮ

೩) ಮಾರಿಕೊಂಡವರು : ದೇವನೂರು ಮಹಾದೇವ

ಘಟಕ - ೪, ಭಾಷಾಭಾಗ

೧) ಜಾಹೀರಾತು ಹಾಗೂ ಜಾಹೀರಾತುಗಳ ಮಾದರಿ ರಚನೆ

೨) ಕರಪತ್ರ (ಪಾಂಪ್ಲೆಟ್), ಭಿತ್ತಿ ಪತ್ರ (ಪೋಸ್ಟರ್), ಫಲಕ ಬರಹ

೩) ಕನ್ನಡ ಮತ್ತು ಗಣಕ ವಿಜ್ಞಾನ, ಕನ್ನಡ ಮತ್ತು ಅಂತರ್ಜಾಲ

ಹೆಚ್ಚಿನ ಓದಿಗಾಗಿ : ಸುಳಿ - ಸಾರಾ ಅಬೂಬಕ್ಕರ್

ಸಣ್ಣ ಕಥೆಗಳು : ಕನ್ನಡದ ನಾರಾಯಣ

ಕನಕ ದಾಸರ ಕೀರ್ತನೆಗಳು ಮತ್ತು ಮುಂಡಿಗೆಗಳ - ಪ್ರೊ. ಸುಧಾಕರ

ಆಡಳಿತ ಕನ್ನಡ - ಡಾ.ಮುರಿಗೆಪ್ಪ

## Language 2 – Part II French IV

L	T	P	C
3	0	0	3

### Course Objectives:

- Students are taught to communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters.
- Students are taught to describe in simple terms the aspects of his/her background, immediate environment and matters in areas of immediate basic need.

### Course Outcomes:

After successful completion of the course, students will be able to

1. Communicate in writing in simple and routine tasks requiring simple and direct communication of information on familiar and routine matters (e.g., applying for a job, booking a room by email, making an appointment);
2. Demonstrate knowledge and understanding of key aspects of the culture of the target language (e.g., food, festivities);
3. Use basic grammar in simple and routine tasks requiring direct communication of information on familiar and routine matters, as well as articulating personal opinions.
4. Use high frequency vocabulary related to areas of immediate relevance (e.g., personal and family information, school/work, leisure, general culture).

### Theory

#### Unit 1

1. Use public transport (buses, trains and taxis)
2. Ask your way and give directions

#### Unit 2

1. Buy tickets
2. Read notices, posters, catalogues, timetables, brochures, menus, advertisements, signs

#### Unit 3

1. Write notes and simple messages
2. Note down times, dates and places from notice boards and announcements

#### Unit 4

- 1.Note down instructions and requests such as client orders and delivery dates.
- 2.Describe events and daily activities

**References:**

1. Dr. Ramesh Chilukuri (2020) Breathe French: Learning made as easy as Breathing published by Prowess Publishing.
- 2.Beaujolie Florence (2019) French Made Easy 2 In 1 published by M & M Limitless Online Inc.

### **SEC 03 – Cyber Security**

#### **Course Objectives:**

L	T	P	C
2	0	0	2

#### **Course Outcomes:**

After successful completion of the course, students will be able to

#### **Curriculum awaited from GoK**

### **ABC 02 - Industrial Visit/Industrial Visit/internship**

L	T	P	C
0	0	2	2

#### **The following activities are incorporated in the Activity Based Course**

1. Internship
2. Hands on training
3. Work experience with NGOs
4. Work with Mentors (Inter institution/Intra institution)

After successful completion, students must present the topic and submit brief report.



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## **Semester Five**

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## DSC 09 - Eco-toxicology

L	T	P	C
3	0	2	5

### Course Objectives:

- To know about the basics of toxicology.
- To know about the metabolism of the toxic substances.
- To know about the various bioassay methods.

### Course Outcomes:

1. The students will learn about the various toxicological aspects.
2. They will learn about the various modes of action of toxic substances.
3. They will learn about the various bioassay methods of toxicity.
4. They will learn about the various carcinogenic and mutagenic substances.

### Theory

**Unit I: Basics of toxicology** - Definitions and Toxicological terms, Concept, Importance-History of Toxicology-Dose-Response Relationship, Dose-Response Curves (LD50 and LC50). Subdivisions of Toxicology- epidemiology-history- Types of Epidemiologic Studies: Advantages and Disadvantages.

**Unit II: Toxicology and safety** - Absorption and distribution of toxicants-Transfer across Membrane Barriers, Absorption, Distribution, and Elimination of Toxic Agents, Sites of Biotransformation, Biotransformation Reactions.

**Unit III: Concepts of Bioassay** - types, characteristics, importance and significance of bioassay, field based microbial bioassay for toxicity testing, Immunotoxicity, histotoxicity, cell toxicity, Biosensors and Bio-markers: Concept and approach, advantages and disadvantages. Metal Toxicity-toxicology of Selected Metals-Fe, Hg, Pb, Ar, Cr.

**Unit IV: Environmental Carcinogens and Mutagens** - Chemicals (VOC, Pesticides): DNA Damage and Mutagenesis- Human Cancer- Causes, Incidence, and Mortality Rates - Occupational Carcinogens.

## **Practical 09 - Eco-toxicology**

### Part - A

1. Estimation of protein content of biological samples
2. Pesticides residues estimation
3. Estimation of heavy metals in soil
4. Estimation heavy metals in samples of plant and animal materials,
5. Animal Bioassays: In-vitro and In-vivo
6. Bioassay test- Fish LC50
7. Micronucleus assay
8. Determination of Animal LD50
9. Probit Analysis and Graphical method.

### Part - B

1. Study on biomarkers.
2. Study on carcinogenic chemicals
3. Study on mutagenic chemicals.
4. Cell toxicity study
5. Histotoxicity tests.

### Part - C

Spotters From Syllabus

### **References:**

1. Environmental biology and Toxicology, by Sharma P.D. Rastogi and Lamporary., 1994.
2. Environmental pollution and Toxicology by Meera Asthana and Astana D.K., Alka printers, 1990.
3. Toxicology, by A.Sood, Sarup and sons New Delhi, 1999
4. Textbook of Preventive and Social Medicine, by Park J.E. and Park K., Banosidas Bharat Publishers, Jabalpur, 1985
5. Environmental Epidemiology, by Anisa Basheer, Rawat Publication Jaipur, New Delhi 1995.

## DSC 10 - Environmental Monitoring and Techniques

### Course Objectives:

- The aim of this course is to impart the knowledge of the various methodologies that are adapted for effective monitoring of environmental parameters.
- The students learn about data collection, water quality parameters, modeling in environmental sciences and application of computer technology in monitoring.

L	T	P	C
3	0	2	5

### Course Outcomes:

After successful completion of the course, students will be able to

1. Students are well versed in the various monitoring technologies for sampling environmental samples.
2. Students can handle the various analytical instruments used in laboratory
3. Students can have basic understanding towards environmental modeling.

### Theory

**Unit-I: Environment monitoring** - History and Definition, Objective and purpose of Monitoring, Function of monitoring, Types of monitoring (Source based, occupation based, target based), Techniques (Instruments, chemical analysis, biological and remote sensing) Sampling methods (for air, water and soil), Emission factors (definition, application, source of errors), Importance of sampling (sampling plan, types of sampling, statistical analysis), Importance of quality assurance of data

**Unit-II: Physical, Chemical and Microbial contaminants** - Physical contaminants – Naturally occurring particulates, Human made particulates, Mechanisms and control of particulate, Chemical contaminant: Type of contaminants, Sources of Contaminants, contaminant transport and fate, Microbial contaminants: - Environmentally transmitted pathogens, concept of indicator organisms, sample processing and storage.

**Unit-III: Instrumentation techniques** - Basic environmental techniques: Colorimeter, Flame photometry, atomic absorption Spectrophotometry, X-ray Fluorescence, Fourier Transform Infrared spectroscopy, Neutron Activation Analysis, Chromatography (HPLC),

Anodic Stripping Voltammetry. GIS and Remote sensing: Definition, scope and applications.

**UNIT-IV: Introduction to environmental system analysis** - Approaches to development of models; linear simple and multiple regression models, validation and forecasting. Models of population growth and interactions-Lotka-Volterra model, Leslie's matrix model, point source stream pollution model, box model. Gaussian plume model.

**Practical 10 - Environmental Monitoring and Techniques**

1. Analysis of Water parameters (Alkalinity, chloride, Dissolved oxygen and Chemical oxygen demand)
2. Analysis of nitrites and phosphates in water sample using Spectroscopy.
3. Analysis of sodium and potassium using Flame photometer.
4. Understanding Environmental various modelling.

**References:**

1. Botkin, D.B and Keller E.A., 2011: Environmental Studies: The earth as a living plant. Charles E. Merrill, Publishing Co. London.
2. Botkin, D.B and Keller E.A., 2011: Environmental Science; Earth as a Living Planet, John Wiley and Sons Inc., New York.
3. Manahan, S.E. 2010. Environmental Chemistry, Seventh Edition, Lewis Publishers, New York.
4. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
5. Gupta S.P. 2015, Statistical Methods, Sultan Chand and Sons, New Delhi.

## DSC 11 - Eco-restoration and Development

L	T	P	C
3	0	1	4

### Course Objectives:

- Eco-restoration course teaches students the methodology to reclaim waste land, soil conservation, green technology, environmental policy and sustainability.
- Students will have the introduction to environmental policies and legislations.
- Students are introduced with latest restoration Techniques

### Course Outcomes:

1. The students in this course understand the role of restoration processes to reclaim degraded land,
2. Students can also help soil conservation, familiarity with environmental policies at state, national and international level.

### Theory

**Unit-I: Aims and strategies of restoration** - Concepts of restoration, single vs. multiple endpoints; ecosystem reconstructions; physical, chemical, biological and biotechnological tools of restoration. Acceleration of ecological succession, reintroduction of biota.

**Unit-II: Degraded lands** - Agricultural practices and land degradation, Mining and its impact on soil quality, Conservation of degraded lands, Rehabilitation of mine soils and salt affected soils, biological reclamation techniques, Bio fertilizers, Mycorrhizae, Vermicomposting, Afforestation, Organic farming, Bioremediation restoration of lakes-case studies.

**Unit-III: Eco friendly products and practices** - Concept of green technology-Eco development and environmentally friendly products and technologies (LED, IoT, Green buildings, emission technologies), Reduction of Emission by Deforestation and forest Degradation (REDD), REDD+. Restoration and management of Coastal Zone, Coral Reef and Mangroves ecosystems.

**Unit-IV: Approaches in resource management** - Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource

management strategies; concept of sustainability science: different approach towards sustainable development and its different constituents; sustainability of society, Indian renewable energy program.

### **Practical 11 - Eco-restoration and Development**

1. Analysis of Dissolved oxygen in the given water sample.
2. Analysis of Chemical oxygen demand of water sample.
3. Analysis of Biological oxygen sample in the water sample.
4. Understanding and analysis of hazards in the laboratory.
5. Analysis and understanding of Environmental impact assessment of construction.

### **References:**

1. Tyler Miller Jr. G. 2012. Living in the Environment. Wadsworth Publishing Company, Belmont California.
2. Cunningham. W.P., 2014, Understanding Our Environmental: An Introduction W.C. Brown Publishers, Oxford.
3. Singh J.S., 2013, Restoration of degraded lands, Rastogi Publications, Meerut.
4. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi

## DSE 01a - Hydrology

L	T	P	C
3	0	0	3

### Course Objectives:

- This subject gives an introduction about the various concepts of hydrology.
- The student will learn the water resources and the types.
- The subject describes the different components of surface & ground water.
- The student will learn the various methods of water resource management.

### Course outcomes:

Upon successful completion of the course, students will be able to

1. The student will have the better understanding of various concepts involved in hydrology.
2. Understand the water resources of India.
3. Gain knowledge about groundwater resources.
4. Understand the water resource management.

## Theory

**Unit-I: Introduction:** Definition of hydrology, Importance of hydrology, Practical applications of hydrology, Global water availability, world water resources, water resources of India & Karnataka, water budget of India, Water demand – types, per capita demand – factors affecting pcd & losses & wastes, variation in demand, design periods, population forecasting methods – arithmetic, geometric, increasing, logistic curve.

**Unit-II: Hydrological Cycle:** Precipitation: forms and types of precipitation. Measurement of precipitation (recording and non-recording type), Annual rainfall in India, Evaporation: Definition, Process, factors affecting evaporation, transpiration evapo-transpiration, reducing evaporation from water bodies, Infiltration: Definition, factors affecting infiltration, infiltration capacity, Measurement of infiltration, Runoff – definition & estimation of runoff.

**Unit-III: Ground water Hydrology:** Scope and importance of ground water hydrology. Water bearing geological formations, occurrence of ground water & geological factors affecting, Zones of ground water, Darcy's law & assumptions Aquifers - Definition, Types of aquifers, properties of aquifer, springs, open well, tube wells - types, quality of ground water & surface

water, surface & ground water pollution – causes & impacts on human health.

**Unit-IV: Water resource management:** Major drainage basin of India, watershed management: concept objectives & methods, interbasin water transfer, conjunctive water use planning, water resources projects in India, wetlands – importance & conservation, Causes and measures to control water depletion, Water as a global issue – key challenges & issues, National water policy, river water dispute – case studies.

**References:**

1. S K Garg, 1999. Water Supply Engineering, Khanna Publishers, 11th Edition, Khanna Publishers.
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, 2016. Water Supply Engineering, 2nd Edition, Laxmi Publications.
3. K. Subramanya, 2017. Engineering Hydrology, 4th Edition, McGraw Hill Education.
4. Larry W. Mays, 2011. Ground and Surface Water Hydrology; 1st edition, Wiley.
5. David K. Todd & Larry W. Mays, 2011. Groundwater Hydrology, Third edition, Wiley India Pvt Ltd.



## DSE 01b – Atmospheric Science

L	T	P	C
3	0	0	3

### Course Objectives:

- The aim of the course is to introduce the student with various concepts of Atmosphere.
- Students are exposed to various atmospheric parameters and processes.
- Students are given brief introduction of cloud formation and weather and climatic interactions

### Course Outcomes:

1. Students can understand the higher concepts towards the atmosphere.
2. Students can apply this knowledge in advanced studies like GIS.
3. This course provides firm foundation for students interested in Environmental modelling.

### Theory

**Unit I: Introduction** - Importance of atmosphere, Radiative Balance and the Natural Greenhouse Effect, Major Greenhouse Gases, Vertical Motion in the Atmosphere, Atmospheric Circulation Patterns, Climate, Weather, and Storms, The Global Carbon Cycle.

**Unit II: Aerosols and Clouds** - Aerosols: size, concentration source and sink. Importance of aerosols in climate prediction. Clouds: Basic of cloud formation (Nucleation theory of water vapour condensation) Growth of Cloud droplets by collision and coalescence, type of clouds, convection clouds, cloud seeding

**Unit III: Atmospheric motions** - Coriolis Acceleration - effects of Coriolis effect (latitude), Basics of Gravity and pressure gradient forces, flow of rivers, Thermal winds. Total, local and convection derivatives.

**Unit IV: Climate** - Introduction to climatology, climatic profile, Planetary and local winds, monsoon and jet streams, type and distribution of precipitations, Climate of India.

### **References:**

1. Wallace, J. M., and P. V. Hobbs, Atmospheric Science: An Introductory Survey, 2nd edition,

Elsevier Academic Press, 2006.

2.Marshall J., and R. A. Plumb, Atmosphere Ocean and Climate Dynamics: An Introductory Text, Elsevier Academic Press, 2008.

3.Hess, L. S., Introduction to Theoretical Meteorology, Wiley Online Library.

4.Andrews, D. G., An Introduction to Atmospheric Physics, 2nd edition, Cambridge University Press, 2010.

5.Houghton, J. T., Physics of the Atmosphere, Cambridge University Press, 2002.

## SEC 04 – Data Modeling

L	T	P	C
3	0	0	3

### Course Objectives

- This subject gives an introduction about the various concepts of data analysis.
- The subject describes the different components of mathematics & statistics.
- The subject describes different statistical testing methods.

### Course Outcomes

After successful completion of the course, students will be able to

1. The student will be able to understand various sampling methods.
2. The students will be able to describe and analyze data.
3. The student will be able to explain laws of probability.
4. The student will be able to do the data hypothesis testing.

### Theory

**Unit-I: Sampling Methods** - Collection of Data, Census Method, Concept of Population, Sample, Sampling, Sample Size, Sampling Error, Advantages and Disadvantages of Sampling Method, Necessity of Sampling, Types of Sampling Methods, Types of Random Sampling Methods – SRS, Stratified Random Sampling, Systematic Random Sampling and Cluster Sampling.

**Unit-II: Data Analysis** - Data Types: Qualitative Data, Quantitative Data, Graphical Representation Methods (Histogram, Bar Charts, Pie Charts), Measures of Center Tendency (Mean, Median, Mode,) and Dispersion (Standard Deviation, Variance) Advantages and Disadvantages, Co-Efficient of Variance.

**Unit-III: Probability** - Basic Terminology, Definition of Probability, Basic Laws of Probability, Types of Probability, Additional Rule of Probability and Multiplication Rule of Probability, Probability Distribution- Bernoulli Distribution, Binomial Distribution, Poisson distribution and Normal Distribution- Simple Problems.

**Unit-IV: Analysis Hypothesis Testing** - Hypothesis, Types of Hypotheses, Level of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test, Analysis of variance (ANOVA), Regression analysis.

**References**

1. Veer Bala Rastogi, 2009. Fundamentals of Biostatistics, ANE Books.
2. S.C. Gupta and V. K. Kapoor, 2014. Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
3. S.C. Gupta, 2018. Fundamentals of Statistics, Seventh Edition, Himalaya Publishing House.
4. R. E. Parker, Introductory Statistics for Biology, 2nd Edition, Cambridge University Press.
5. Norman T. J. Bailey, 2000. Statistical Methods in Biology, 3<sup>rd</sup> edition, Cambridge University Press.

**VBC 02 – Ethics & Self Awareness**

L	T	P	C
2	0	0	2



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## **Semester Six**

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## DSC 12 - Environmental Disaster Management

L	T	P	C
3	0	2	5

### Course Objectives:

- To know about the disasters and its types.
- To know about the control and remedial measures of disasters.
- To know about the various policies about the disaster management.

### Course Outcomes:

1. The students will learn about the basics of disaster management.
2. They will learn about the control measures of disasters.
3. They will learn about the strategies of disaster management.
4. They will learn about the legislative policies on the disaster management.

### Theory

**Unit I: Introduction to Disaster** - Definition, Types and classification of Disaster-vulnerability- Hazard Classification and Related Disaster Types, Major significant disasters. Urban Disaster (Urban floods, disease outbreak, urban temperature rise and thermal inversion) and management.

**Unit II: Natural Disasters** - Earthquake, Volcanoes, Cyclones, forest fire, Floods and drought Case studies-National Disaster Management Policy, Definition of National Policy- Main features of National Policy- Arrangements for disaster Monitoring and Review.

**Unit III: Management of Disasters** - Foundation Factors, Organization, Planning, Use of Resources, Specialist Skills, Training Needs. National Development and Disaster Management Policy- Modern Concept of International Disaster Assistance, Case Studies.

**Unit IV: Prevention and mitigation of Disasters** - Approaches toward Prevention-Resources Relevant to Prevention- Guiding Principles of Mitigation, The Nature of Preparedness- Some Problem Areas in Preparedness, Maintenance of Preparedness Levels, Funding, Warning

Aspects-Precautionary Measures Prior to Disaster Impact-Resources Relevant to Preparedness Arrangements.

### **Practical 12 - Environmental Disaster Management**

#### Part - A

1. Study of Disaster management action plan.
2. Study on heat waves.
3. Study of Flood prone areas and risk management.
4. Study of Drought prone areas and its management.
5. Study of Disaster emergency kit
6. Identification of fire extinguishers and its uses.
7. Interpretation of earthquake hazard maps.

#### Part - B

1. Study on volcanoes
2. Case studies on landslides.
3. Study of Earthquake Safe Construction of Masonry Buildings In ZONE V.
4. Study of Earthquake Safe Construction of Masonry Buildings In ZONE IV

#### Part - C

Spotters From Theory

#### **References:**

1. Disaster Management in India, (2011), Ministry of Home Affairs Government of India.
2. Edward A Keller, Environmental Geology (2000), Merrill Publishing Company.
3. Edward A Keller, (2011), Introduction to Environmental Geology (4th Edition).
4. Environmental Geology (1987): K. S. Valdiya; Tata McGraw-Hill.
5. The Basics of Earth Sciences (2003): Robert E. Krebs, Greenwood Press.

## DSC 13 – Solid Waste Management

L	T	P	C
3	0	2	5

### Course Objectives:

- To understand the current scenario of solid waste generation and problem
- They learn about solid waste management.
- Students will learn about the various kinds of solid wastes

### Course Outcomes:

After successful completion of the course, students will be able to

1. Through this course the students will learn the Control of Air Pollution
2. This course prepares the students to be responsible citizens
3. At the end of the course, the students will have an understanding on the Aerobic & anaerobic composting.
4. The students will have the basic knowledge in understanding the Municipal Solid Wastes.

### Theory

**Unit-I: Introduction to Solid Waste** - Definition, Sources, Types (Municipal, Industrial, hazardous, electronic, biomedical, demolition, etc.). Composition and Properties of Municipal Solid Wastes. Socio- economic, Environment and health impacts, Important Legislations related to Municipal solid waste.

**Unit-II: Solid waste processes** - Separation, transportation, transformation, recycling (5 R's) and disposal (Sanitary landfill): Unit operations for separation and processing, size reduction, separation, density separation, Importance of scope of Integrated Solid Waste Management (ISWM).

**Unit-III: Hazardous waste** - Definition, classification, Types (Biomedical, chemical and radioactive waste) and Generation of Hazardous waste, Hazardous waste Management and handling rules and regulatory processes. Leachate Management, hazardous waste Generation rates, Collection, hazardous waste handling and separation, storage and processing at the source. Collection, transfer and transportation: Types, equipment, personnel requirements, analysis & collection system, collection routes.

**Unit-IV: Biological and chemical conversion technologies of Solid Waste-** Principles, Aerobic & anaerobic composting, and energy recovery (Waste to energy). Thermochemical processing – combustion, pyrolysis, gasification, energy recovery system, Incineration - Process, Types, Heat Recovery, Incineration Products, Air Pollution Control

**Practical 13 – Solid Waste Management**

1. Characterization of Solid Waste from various sources.
2. Waste Sampling techniques
3. Determination of organic carbon in compost
4. To Study the methods of management of biomedical waste
5. Characterization of toxicity of hazardous waste from various sources
6. Determination of inorganic phosphate in leachate samples.
7. Determination of total nitrogen in leachate.
8. Designing of secured/sanitary landfills
9. Field visit to municipal solid waste/Biomedical waste plant.
10. Physico-chemical analysis of solid wastes.

**References:**

1. Bhide and Sundaresan (2015), Solid Waste Management in Developing Countries, Indian National Scientific Documentation Centre. New Delhi.
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (2016), Environmental Engineering, McGraw Hill Publishing company, New York.
3. Sincero, A.P., and Sincero, G.A., (2018), Environmental Engineering – A Design Approach, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Sasikumar K and Krishna S. G., (2016), Solid Waste Management, PHI Learning Pvt. Ltd., New Delhi.

## DSC 14 - Wildlife Management and Conservation

### Course Objectives:

L	T	P	C
3	0	1	4

- Apply ecological concepts and principles to the management of wildlife.
- Understand ecological principles for wildlife management practices.
- Understand the policy framework, decision processes, social and political considerations that influence decisions in wildlife management.

### Course Outcomes:

Upon completion, the students will be introduced to:

1. The guiding principles and practices for wildlife management.
2. Key techniques used by wildlife biologist to gain scientific and social science data used to inform wildlife management
3. Issues concerning wildlife management and be encouraged to identify their own values in wildlife conservation.

### Theory

**Unit I: Scope and importance** - Definition of wildlife, causes of wildlife depletion; economic importance of wildlife (monetary, recreational, scientific, and ecological benefits); need for wildlife conservation; concept of home range, rare, endangered, threatened, and endemic species of India. India as a mega wildlife diversity country, bio-geographic zones.

**Unit II: Wildlife biology** - Concept of carrying capacity, sexual selection, and parental care. Benefit of living in social group, movement, and migration. Population estimation - direct count (block count, transect methods, point counts) and indirect count (call count, track and signs, pugmark). Wildlife diseases - infectious diseases (viral, bacterial, and protozoan disease), non-infectious diseases. Impact of climate change on wildlife health.

**Unit III: Wildlife conflict and management** - Wildlife trade and regulations; Wildlife corridors, Impact of conflict on humans and wildlife. Reasons for conflicts, identification of damages caused by wild animals, animal damage control techniques - biological, chemical, and mechanical, case studies - elephant and tiger. translocation of wild animals –methods, and applications.

**Unit IV: Wildlife conservation** - Ex- situ (zoological and aquaria) & in-situ (National Park, Sanctuaries, Biosphere Reserves) conservation. Sick animal refuges in protected areas. Single species-based conservation programmes (e.g., Tiger; Elephant and Lion), Captive breeding, Women in conservation (e.g., Bishnois). Wildlife Protection Act, 1972, afforestation, social forestry, agroforestry, joint forest management; Anti-poaching operations, Convention on protection of wild Flora & Fauna (CITES).

**Practical 14 - Wildlife Management and Conservation**

1. Study of wildlife diseases.
2. Study of Joint Forest Management.
3. Study of Social forestry.
4. Study of biodiversity hot spots.
5. Wild animal population estimation.

**References:**

1. Fryxell, J.M., A.R.E. Sinclair, and G. Caughley. 2014. Wildlife Ecology, Conservation and Management. Wiley Inc.
2. Krausman, P.R., and J.W. Cain. 2013. Wildlife Management and Conservation. John Hopkins
3. Robinson W L and Eric G Bolen. 2002. Wildlife Ecology and Management, Maxmillan Publishing Company, New York.
4. Rodgers WA. 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.
6. Saharia VB. (1982). Wildlife of India, Natraj Publishers, Dehra Dun.

## DSE 02a - Integrated Water Resource management

L	T	P	C
3	0	0	3

### Course Objectives

- The students learn about precipitation, ground water hydrology.
- They learn about water resource management and rain harvesting techniques.
- Students will learn about the concept of Integrated water resources management (IWRM)

### Course Outcomes:

Upon successful completion of this course, the student will be able to

1. By the end of the course, the student is well versed in the understanding of ground water resources and its management
2. The students will have the basic knowledge in understanding the flood control
3. At the end of the course, the students will have an understanding on the concept of Integrated water resources management
4. The students will have the basic knowledge in understanding the ground water hydrology

### Theory

**Unit-I: Integrated water resources management-** concept of Integrated water resources management (IWRM) within the broader context of development – Examining the key elements of IWRM process, Economic view of water issues: economic characteristics of water good and services, Demand and supply management.

**Unit-II: Water for food production-** ‘blue’ versus ‘green’ water debate, international and national law in water management, Private sector involvement in water resources management (PPP): objectives, options, processes, experiences through case studies, Links between PPP and IWRM, Agricultural catchment management and pollution remediation techniques.

**Unit-III: Water Resources-** Introduction of water resources, Types (Renewable and non- renewable water resources) Concept and objectives of water resources, Exploitable water resources, Concept of irrigation, development of irrigation in India, Benefits of irrigation, irrigation systems: minor and major, medium and minor irrigation projects, impact of irrigation on environment.

**Unit-IV: Urban Water Resource Management-** Concept of Urban eco-system – Urban Water Resources – Major problems –objectives and limitations of Storm water management – Storm water policies – Feasibility consideration, Storm water management practices ( Structural and Non-structural Management measures) – Water Harvesting and Conservation (Design of Small Water Harvesting Structures), Watershed Management, Urban surface runoff models, Quality models.

**References:**

1. Water Resources (2010): Shimon C Anisfeld, Island Press.
2. Water resource Engineering: Principle & Practice (2009): Satya N Challa Murthy, New Age International Publisher.
3. Principles of Water Resources: History, Development, Management, and Policy (3<sup>rd</sup> Edition) (2010): Thomas V Cech, John Wiley and Sons, Inc.
4. Hydrology & Water Resource Engineering (2014): S. K. Garg, Khanna Publishers, Delhi.



## DSE 02b - Carbon Sequestration and Management

L	T	P	C
3	0	0	3

### Course Objectives:

- To understand the natural and anthropogenic carbon cycles
- To understand the carbon emissions and consequences
- To understand the carbon sequestration technologies

**Course Outcomes:** After successful completion of the course, students will be able to

1. The students learn the various sources of C1 compounds emission
2. The students can appreciate carbon emissions problems
3. The students are familiarizing with various carbon sequestration technologies
4. The students are familiarizing with carbon emission and management policies

### Theory

**Unit-I: Introduction** - Natural and anthropogenic carbon emission, C1 compounds and greenhouse gases & global warming. Sources and sinks of greenhouse gases, global carbon inventory, carbon footprint and audit, global carbon emission trends and historical perspective

**Unit-II: Carbon capture** - Storage technologies and methods for the mitigation, remediation, and storage of industrial CO<sub>2</sub> emissions, Methods of carbon capture in industrial settings, Biological and geological carbon sequestration, CO<sub>2</sub> Capture using Ionic Liquids.

**Unit-III: Current trends in CO<sub>2</sub> Capture and advantages:** photocatalysis, electrocatalysis, artificial photosynthesis, absorption, adsorption and Membrane-Based Separation Processes, New approaches to capturing CO<sub>2</sub> from ambient air

**Unit-IV: Carbon emission and policies** - carbon emission trading, market-based cap-and-trade system, Technology and innovation subsidies, Performance Standards, Public Funding for Innovation, Procurement Policies, International Agreements

**References:**

1. Amitava Bandyopadhyay, Carbon Capture and Storage CO<sub>2</sub> Management Technologies, Apple Academic Press, 2021
2. David A. N. UssiriRattan Lal, Carbon Sequestration for Climate Change Mitigation and Adaptation, Springer International Publishing AG, 2017
3. Zhou, Shelley W.W. Contains practical examples and carbon management models, Springer International Publishing, 2020
4. Subhas Sikdar, Frank Princiotta, Advances in Carbon Management Technologies Carbon Removal, Renewable and Nuclear Energy, Volume 1, CRC Press, 2020
5. Stephen A. Rackley, Carbon Capture and Storage (II Edition), 2017, Elsevier publication

## **SEC 05 – Professional/Societal Communication**

### **Course Objectives:**

L	T	P	C
3	0	0	3

### **Course Outcomes:**

After successful completion of the course, students will be able to

**Curriculum awaited from GoK**



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## **Semester Seven**

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## DSC 15 - Evolution Biology

L	T	P	C
3	0	2	5

### Course Objectives:

- This subject provides comprehensive overview of concept of evolution.
- The students explore the salient features of various theories of evolution.
- The student will develop comprehensive knowledge regarding various variation in evolution.

### Course Outcomes:

After successful completion of the course, students will be able to

1. The student will have a better understanding of the evolution.
2. The student will have a better understanding of origin of life.
3. The student will have a better understanding of theories of organic evolution.
4. The student will have a better understanding of the different evolutionary processes that shape biodiversity.

### Theory

**Unit-I: Introduction** - Facts of evolution, evolution compared with ancient history, significance of evolutionary biology, pre & post Darwin period, modern synthesis period, paleontological evidence – significance of fossils, imperfections of fossil record, conclusion drawn from fossils.

**Unit-II: Origin of Life** - Special creation theory, theory of spontaneous generation, theory of chemical evolution, Miller experiments, origin & evolution of RNA, evolution of eukaryotes, Mendelian genetics – gene pool, gene frequency, types of selection - directional, stabilizing, disruptive, sexual selection, group & kin selection, population genetics and evolution - speciation, molecular evolution.

**Unit-III: Theories of Organic Evolution** - Theory of Lamarckism, neo-Lamarckism, Theory of natural selection, Darwin Wallace theory of natural selection, neo - Darwinism, Modern

synthetic theory, Weismann's germ plasm theory, mutation theory, advantages of mutation theory, objections to mutation theory.

**Unit-IV: Isolation & Speciation** - Types of isolation – time, distance, geographical, reproductive, Types of isolating mechanisms – habitat, seasonal, behavioral, ethological, mechanical, genetics of isolating mechanism, origin of isolation, Speciation – nature, mode, instantaneous, gradual, allopatric, sympatric, differences between allopatric & sympatric, quantum speciation, differences in speciation between plants & animals.

#### **Practical 15 - Evolution Biology**

1. Darwin theory of evolution.
2. Study of paleontological evidence.
3. Miller Experiment.
4. Mendelian Punnett square simple problems.
5. Mendelian Punnett square for monohybrid cross.
6. Mendelian Punnett square for incomplete dominance.
7. Mendelian Punnett square for multiple alleles.
8. Mendelian Punnett square for codominance.
9. Isolation Types & Mechanism.
10. Speciation.

#### **References:**

1. P S Verma, V K Agarwal, 2006. Cell biology, Genetics, Molecular ecology, Evolution and Ecology, S. Chand & company Ltd., first edition.
2. Fatik Baran Mandal, 2015. Introduction to Evolutionary Biology, Oxford & IBH Publishing Co Pvt. Ltd.
3. Rastogi, 2019. Organic Evolution (Evolutionary Biology), Kedarnath ramnath publisher.
4. Surya Prakash Mishra, 2018. A Textbook of Cell Biology Genetics And Evolution, Kalyani Publishers.
5. Arumugam, R.P. Meyyan, M.G. Ragunathan, 2018. Genetics Evolution and Biostatistics, Saras Publication.



## DSC 16 - Environmental Biology

L	T	P	C
3	0	2	5

### Course Objectives:

- Students are expected to have the advanced learning of environmental techniques.
- Microbiological treatment of wastewater,
- Bioremediation and biodegradation of xenobiotics.

### Course Outcomes:

By the end of this course students should be able to:

1. Describe and comprehend the fundamental concepts of environmental microbiology
2. To learn about biodegradation and bioremediation process.
3. To learn about microbial treatment of wastewater
4. Assess the costs/benefits of conservation vs. remediation or technological solutions.

## Theory

**Unit I: Microbial interface** - Interactions among microorganisms: parasitism, predation, amensalism, competition, commensalism, and mutualism. Microbial interactions with plant, animal, and human being. Microbial-Higher plant associations (Mycorrhiza, Rhizobium - Legume association), De-nitrification.

**Unit II: Applied microbiology** - Concept of biofertilizers, Concept of biopesticides, Microbial degradation of pesticides, Microbial enhanced oil recovery, Microorganisms as bio-indicators (lichens as air pollution indicators), Bio-mining (copper extraction), Microbial fuel cells, Biosurfactants and Biofilters.

**Unit III: Environmental biotechnology** - Biotechnology and environmental management, Bioremediation, In situ and Ex situ bioremediation, advantages and disadvantages. Bioremediation of ground water pollution. Phyto-remediation of soil metals, degradation of xenobiotics by microbes, Phytotechnology in wastewater treatment.

**Unit IV: Environmental reclamation** - Bio-composting - Aerobic composting methods such

as Windrow, Static pile and In-vessel methods for composting, Vermi-technology - Biology of Earthworm, type, species, and preparation. Use of microbes in improving soil fertility, Microbial treatment of oil pollution- Bio-scrubbers, and Bio-beds.

### **Practical 16 - Environmental Biology**

1. Sterilization techniques.
2. Culture media preparations.
3. Isolation techniques: serial dilution, plating.
4. Identification of bacteria and fungi: physiological and biochemical.
5. Staining – Simple and Gram's.
6. Microscopic counting of microbes using hemocytometer.
7. Measurement of microbes using ocular and stage micrometer.
8. Estimation of coliform bacteria in water by MPN method.

### **References:**

1. Paul Edmonds (1978): Microbiology: An Environmental Perspective. Mac Millan Publishing Co. Inc. New York.
2. Dart R. K. and Stretton R.J. (1980): Microbiological aspects of Pollution Control. Elsevier Scientific Publishing Company, New York.
3. Atlas R.M. and Bartha R. (1981): Microbial Ecology Fundamentals and Applications. Addison Wesley Publishing Company, Massachusetts.
4. Alexander M. (1977): Introduction to Soil Microbiology 2nd Ed., John Wiley and Sons, New York.
5. Higgins I.J. and Bunns R.G. (1975): The Chemistry of Microbiology of Pollution. Academic Press, New York.

## DSC 17 – Environmental Chemistry

L	T	P	C
3	0	2	5

### Course Objectives:

- To provide the fundamental knowledge concerning the chemical-physical characteristics of the environmental components
- To illustrate the important chemical processes in the environment.
- To understand the basic chemistry concepts to address environmental problems

### Course Outcomes:

After successful completion of the course, students will be able to

1. The students are acquiring knowledge concerning the chemical-physical characteristics of air, water and soil
2. The students can understand the chemical processes and chemical mechanisms of interactions in an environment
3. The students can apply basic chemical concepts to analyze and solve different environmental problems
4. The students can analyze the various chemical-based problems and environmental phenomena.

### Theory

**Unit-I: Essential chemical concepts** - atoms, elements, radicals; states of matter, elemental and chemical bonding, stoichiometry and chemical thermodynamics, gas law, chemical reactions (order of reaction), mass balance, classification of organic compounds, contaminants of emerging concerns

**Unit-II: Atmospheric chemistry** - formation of earth atmosphere, structure and chemical composition of atmosphere (gases, particles, ions and radicals), chemical processes for formation of inorganic and organic particulate matters, thermochemical & photochemical reactions of oxygen and ozone, NO<sub>x</sub>, SO<sub>x</sub>, photochemical smog, green house gases and global warming, ozone depletion

**Unit-III: Water chemistry** - properties of water (unusual properties-solvent properties of water, cohesion and adhesion, surface tension (capillary action), specific heat, heat of vaporization, density), hydrogen bonding in water and importance in biological systems, solubility of gases in water, marine water chemistry

**Unit-IV: Soil chemistry** - constituents and properties of soils, colloids and soil solution, sorption and ion exchange processes in the soil, adsorption of contaminants in soil: adsorption isotherms and models, redox properties of soil, soil pH and acidity in soil, transport processes and importance in the soil.

#### **Practical 17 – Environmental Chemistry**

1. Qualitative and quantitative estimation of greenhouse gases in air samples
2. Qualitative and quantitative estimation of water quality parameters pH
3. TDS
4. Hardness DO
5. Alkalinity Conductivity
6. Stoichiometry and calculations
7. Qualitative and quantitative estimation of soil quality parameters pH
8. Conductivity Porosity
9. Organic and inorganic compositions

#### **References:**

1. A. K. De, Environmental Chemistry (5th Edition) (2003): New Age International
2. B K Sharma, Environmental Chemistry (11th Edition) (2007): Krishna Prakshan media.
3. Gay W vanlon & Stephen Jduffy, Environmental Chemistry (3rd Edition) (2011): OUP Oxford Publication.
4. Colin &Michael Cann, W.H, Environmental Chemistry (5rd Edition) (2012): Freeman Publication.

## DSE 03a - Water Supply & Sanitation

L	T	P	C
3	0	0	3

### Course Objectives:

- The students will learn about the microbes and chemical agents in spread of disease through water bodies
- They learn about Human health impact of chemical agents
- Students will learn about the Water Safety in Distribution Systems

### Course Outcomes:

After

successful completion of the course, students will be able to

1. At the end of the course, the students have a clear understanding on the role of water bodies in spreading diseases through microorganisms and chemical agents.
2. The students will have the basic knowledge in understanding the Drinking-water Quality standards
3. At the end of the course, the students will have an understanding the Disinfection process
4. The students will have the basic knowledge in understanding the Risk assessment in water distribution systems

### Theory

**Unit-I: Introduction to Water supply and Sanitation-** Rural and Urban water supply systems, Types and classification of water supply systems, Need for a protected water supply, investigation and selection of water sources, protection of well waters, Disinfection of well water, Rural and Urban Sanitation, concept of Eco-sanitation.

**Unit-II: Water borne diseases and chemical agents-** Waterborne diseases caused by pathogenic microorganisms, Epidemiology: Amoebiasis, Cryptosporidiosis, Giardiasis, Microsporidiosis, Schistosomiasis, Dracunculiasis, Fasciolopsiasis, Ascariasis, Botulism, Cholera, E. coli Infection, M. marinum infection, Salmonellosis, Typhoid fever, SARS, Hepatitis A, Polyomavirus infection. Trace elements (fluoride, lead, cadmium and mercury), Acrylamide, Benzene, dichloroethane, vinyl chloride, Pesticides (Organophosphates, Carbamates, Paraquat and Endosulfan) and disease Epidemiology, Fate, Transport and

effects of Contaminants.

**Unit-III: Water Safety in Distribution Systems-** Definition and Types of Distribution System, Components of Water Transmission, hazard Identification (Physical, Chemical and Biological hazards), hazardous events (Physical integrity, Hydraulic integrity and Water quality integrity, Disinfection by-products, Chemicals from pipe materials and fittings, Water treatment chemicals, Water quality integrity.

**Unit-IV: Risk Assessment-** Assess the risks, Semi-quantitative risk assessment, Quantitative microbial risk assessment, Validate control measures, Drinking-water Quality standards and Guidelines, Standard operating and management procedures, surveillance, audits and inspections, Capacity building.

**References:**

1. Water Safety in Distribution Systems, WHO, Geneva, Switzerland.
2. WHO (2001) Sustainable Development and Healthy Environments. Sanitation on Ships. Compendium of outbreaks of foodborne and waterborne disease and Legionnaires' disease associated with ships, 1970-2000.
3. Water borne Diseases - Epidemiology & Ecology (1997): Paul R Hunter, Wiley and Sons Ltd.
4. Microbiology of Water Borne Diseases – Microbiological aspects and risks (2014): Steven L. Percival, Marylynn V. Yates, David Williams, Rachel Chalmers, Nicholas Gray, Elsevier Ltd.
5. Water Borne Pathogens (2Edition) AWWA Manual 2006

## DSE 03b – Environment & Global Economy

L	T	P	C
3	0	0	3

### Course Objectives:

- To give knowledge about the role of economic issues for environment and development problems
- To stimulate critical thinking and scientific, ethical, and philosophical analysis of different views within the environment and developmental arena.
- To understand the global economic system and environmental components

### Course Outcomes:

1. The students can understand the dynamic relation of environment, economic and developmental nexus
2. The students can critically think on environmental problems and economic development
3. The students are familiarizing with global economic system and environmental processes in interdisciplinary perspective
4. The students are familiarizing with national and international policies in connection to sustainable economic practices

### Theory

**Unit I: Introduction** - Measure development, poverty and welfare in connection with environmental quality and resource availability, corporation's role and societal responsibility in sustainable economic development and environmental conservation, the relation between economic growth and the environment and the influence of the consumer society.

**Unit II: Economic growth and Environment** - global economic system and its institutions, actors and trends from an transdisciplinary perspective, environment and sustainability challenge, Relationship between economic growth and the environment, Decoupling production from environmental damage,

**Unit III: Sustaining economic growth in the long term** - The case for economic growth,

Natural capital and sustainable economic growth, global trade and environment, green economy and sustainable development, Global Trends of GDP and sustainable developmental goals

**Unit IV: Global policies** - The role of environmental policy, Rationale for environmental policy, Range of available policy instruments, Infrastructure investment to manage environmental risks, The economic impacts of environmental policy, Investment and innovation, Productivity and competitiveness, Economic growth

**References:**

1. Alfred Greiner and Willi Semmler, The Global Environment, Natural Resources, and Economic Growth, oxford university press, 2008
2. Soubbotina, Tatyana P, Beyond economic growth: an introduction to sustainable development (English). WBI learning resources series Washington, D.C.: World Bank Group, 2004
3. Judith A. Cherni, Economic growth versus the environment, Palgrave Macmillan UK, 2002
4. World Economic Situation and Prospects, United Nations publication, Sales No. E.19.II.C.1), 2021.



## ES - DSE 3c. – Principles of Research Methodology

L	T	P	C
3	0	0	3

### Course Objectives:

- To introduce the students to research and help them to understand the importance of scientific research
- To enlighten the student with research methodology for their research dissertation and career
- To provide the knowledge of research design, methods, methodology, publications, scientific reports, and research proposals

### Course Outcomes:

After successful completion of the course, students will be able to

1. Understand the real meaning of research and its importance
2. Gain insight into identification of lacunae in already existing research findings and formulation of hypotheses
3. Possess knowledge on research methodology, methods, analyses, and interpretation of scientific data
4. Gain knowledge of scientific reports, publications, and research proposal

### Theory

**Unit I: Introduction to Research:** Meaning, objective, motivation, significance of research; Review of literature; identifying the gaps in research and formulating hypothesis. Types of research; research approaches; research process; criteria for good research. Research methods versus methodology, scope, and significance of research methodology.

**Unit II: Research problem and research design:** Identification and selection of research problem; necessity of defining a problem; techniques involved in defining the problem; need for research design; different research designs; basic principles of experimental design; important experimental designs.

**Unit IV: Analyses, interpretation, and report:** Analyses and interpretation of results obtained; techniques of interpretation; precautions in interpretation; significance of report writing, layout of research report; types of reports; presentation of research work- oral and poster; writing a research paper; precautions for writing research report. Plagiarism.

**Unit III: Publication and research proposal:** Manuscript writing; types of publications, components of publication, authorship issues. Writing research proposal; Characteristics of a proposal; content and organization of a research proposal; strengths and weaknesses in proposal seeking funding. Citations, bibliography, references; recording and indexing, classification of references.

**References:**

1. Mishra, Dr. Shanti Bhushan & Alok, Dr. Shashi. (2017). Handbook of Research Methodology.
2. Phyllis G. Supino and Jeffrey S. Borer. Principles of Research Methodology: A Guide for Clinical Investigators. Springer Science+Business Media, LLC 2012. eBook ISBN 978-1-4614-3360-6.
3. CR Kothari. Research Methodology- Methods and Techniques. 2<sup>nd</sup> revised edition. 2004. New Age International Publishers. ISBN (13) : 978-81-224-2488-1.

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## **Semester Eight**

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## DSC 18 – Environmental Economics & Management

L	T	P	C
3	0	2	5

### Course Objectives:

- To provide a comprehensive introduction to interactions between the natural environment and the human economy.
- To provide advance knowledge on the ecosystem-services and challenges arising due to externalities and economic activities.
- To develop the skills needed by environmental managers to tackle environmental issues at local, regional, and global levels.

### Course Outcomes:

1. The students can discuss on environmental issues in relation to the theory of externalities, public goods, and welfare
2. The students can realize the importance and influence of environment on the economic development
3. The students can illustrate and examine economic principles concerning the pollution, economic activities, and the environmental policies
4. The students can analyze and adopting sustainable environmental management strategies to solve environmental problems.

### Theory

**Unit I: Introduction** - Environmental economics and principles; cost-benefits analysis; instrument for environmental control: regulatory policy, economic incentives (price rationing, quality rationing, liability rule), externalities, biophysical limits to economic growth: the Malthusian, neoclassical, ecological economic perspectives, law of diminishing returns, carrying capacity, net present value, circular economy and importance.

**Unit II: Environmental management fundamentals and goals** - approaches to environmental management; sustainable development, environmental management challenges, environmentalism, and green movement, social aspects of resource use and total economic value, environmental ethics, global environmental problems and economics, environmental accounts, environmental trade, and importance.

**Unit III: Environmental management systems** - Environmental system principles: polluter pays principle, user pays principle (or resource pricing principle), precautionary principle, subsidiary principle, intergenerational equity principle; tools: standards, monitoring, modeling, eco-auditing, and management strategies; different environmental management systems; perspectives of environmental management policy in India, ISO systems & certification procedure

**Unit IV: Environmental management approaches in business** - industrial ecology, ecological engineering, Pigouvian taxes, green marketing, consumer protection bodies, eco-labeling, total quality management, covenants, life-cycle assessment, green-washing, green energy and technology, international law and sovereignty issues, international conferences (Stockholm) and agreements; participatory environmental management: education and awareness, facilitators, international bodies, and NGOs

**Practical 18 – Environmental Economics & Management**

1. Cost-benefit analysis
2. Law of diminishing returns and problems
3. Carrying capacity
4. Net present value.
5. Designing of environmental management approaches to solve the environmental problems
6. Eco-auditing and problem solving
7. Life-cycle assessment
8. Environmental standards and monitoring practices

**References:**

1. Charles D Kolstad, Environmental Economics (2nd edition), Oxford Press, 2010
2. Roger Perman, YueMa, Michael Common, David Maddison, James McGilvray, Addison Natural Resources & Environmental Economics (4th Edition) Wiley & Sons, 2011
3. Uberoi, N K Environmental Management, New Delhi Publ. Excel Books, 2020
4. Phillip Mc Cann, Modern Urban and Regional Economics, Oxford publication, 2019

## DSC 19 – Environmental Impact Assessment

L	T	P	C
3	0	2	5

### Course Objectives:

- Identify the need to assess and evaluate the impact on environment.
- Major principles of environmental impact assessment
- Understand the different steps within environmental impact assessment

### Course Outcomes:

After learning the course, the students should be able to:

1. Demonstrate the understanding of concept of Sustainable Development and justify the methods of achieving it.
2. Appreciate the importance of EIA as an integral part of planning process.
3. Apply the different methodologies to predict and assess the impacts of project on various aspects of environment.
4. Enumerate the role of public participation in environmental decision-making process.
5. Characterize the environmental attributes.

### Theory

**Unit I: Introduction to EIA** - Principles of EIA, History of EIA, Evolution of EIA in India, Environmental Impact Statement, Institutional framework and EIA, Legal framework for EIA, Environmental clearance procedure in India, Role of various actors in the EIA process, Comparison between EIA of 2006 and 1994, the drawback/limitations of EIA.

**Unit II: EIA process** - EIA notifications, Screening, Scoping, Terms of Reference, Baseline data – air, water, soil and socioeconomic. Prediction, Impact assessment, Mitigation, EIA methodologies – Checklists, Matrix/matrices, Networks, Overlays, The Battelle Environmental Evaluation System, Public hearing.

**Unit III: EIA management** - Capacity building in EIA, Trends in EIA, Air quality monitoring, Environmental monitoring - Monitoring types, Environmental Management Plan - Scope and Organization, Environmental audit – Features, Benefits, Process, Report. Environmental Risk Assessment (ERA).

**Unit IV: EIA case studies** - 1. Highways, 2. River valleys, 3. Power plants, 4. Mining projects, 5. Irrigation activities, 6. Ports, 7. Airports and 8. Chemical industry, etc.,

**Practical19 – Environmental Impact Assessment**

1. Preparation of Activity-processes Flow diagrams.
2. Preparation/drafting of EIA Report (Chemical Industry, hydropower station).
3. Case study Analysis of Environmental Audit of a major industry.
4. Preparation of Environmental Impact Statement.
5. Application of Matrices Method.
6. Cost-benefit Analysis for Resource Allocations: Transportation Method.
7. Visit to understand Institutional arrangements and functioning of PCB.
8. Visit to understand the Environmental Management system of an Industry.
9. Visit and report submission on eco-development society activity
10. Socio-economic Questionnaire Survey in minimum five villages

**References:**

1. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill, New York, USA.
2. Barrow, C.J. 2000. Social Impact Assessment: An Introduction. Oxford University Press.
3. Glasson, J., Therivel, R., Chadwick, A. 1994. Introduction to Environmental Impact Assessment. London, Research Press, UK.
4. Judith, P. 1999. Handbook of Environmental Impact Assessment. Blackwell Science.
5. D. P. Lawrence (2003) Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley and Sons, New Delhi.



## DSE 04a - Water, Energy and Food Nexus

L	T	P	C
3	0	0	3

### Course Objectives:

- To understand the dynamic interaction of water into food and energy sectors
- To acquire advance knowledge on impact and relationship of important environmental components.
- To understand the dynamic relationship of water, energy and food production for sustainable environmental conservation

### Course Outcomes:

After successful completion of the course, students will be able to

1. The students can understand the dynamic relation of environment and other systems
2. The students can critically think on water conservations in the perspective of energy and agricultural sectors
3. The students are familiarizing with various system nexus processes in an ecosystem
4. The students are capable of analyzing the various challenges in nexus between water, food and energy sectors

### Theory

**Unit-I: Introduction** - water, energy and food nexus, challenges for the nexus between water, food, energy and ecosystem, cross-sector linkages and processes within the environmental systems and dynamic interactions, system thinking in connection with solving socio-economic and ecological problems.

**Unit-II: Energy Systems** - global energy systems and sources, politics and policies of energy, Evaluating market and non-market impacts of energy development, Energy nexus (biophysical and engineering elements), Biophysical and Systems Engineering Approaches, case studies

**Unit-III: Water Systems** - Biophysical elements of water systems, water policy

in India and international, role of water in important domain nexus, Decision-making at the intersection of water and health, Social and behavioral sciences, role of citizen science, Biophysical and Systems Engineering Approaches, case studies

**Unit-IV: Food Systems** - Biophysical elements of food systems at multiple scales, Industrialization of the agri-food system: Ecological and social consequences, Food at water, energy and food nexus, Governance and policy, Challenges and Opportunities in Interdisciplinary Analyses

**References:**

1. Subramanian Senthilkannan Muthu, The Water–Energy–Food Nexus- Concept and Assessments, Springer, Singapore, 2021
2. Aiko Endo, Tomohiro Oh, The Water-Energy-Food Nexus Human-Environmental Security in the Asia-Pacific Ring of Fire, Springer, Singapore, 2018
3. Vishnu Prasad Pandey, Anil Kumar Anal, P. Abdul Salam, Sangam Shrestha, Water-Energy- Food Nexus: Principles and Practices: 229 (Geophysical Monograph Series), American Geophysical Union, 2019

## DSE 04b - Climate Change and Management

L	T	P	C
3	0	0	3

### Course Objectives:

- Students are introduced with climate aspects in global scenario
- Students are exposed to various modes and mechanisms of climate and influence of greenhouse gas.
- Students can understand global framework and methods to reduce ill effects of control of climate change

### Course Outcomes:

After successful completion of the course, students will be able to

1. In this course, the students' study about climate change and current impacts of climate change.
2. The course also covers aspects of climate parameters, environmental quality and associated issues in the context of impact of climate change.
3. At the end of the course, the students have a clear understanding on the climate change causes, impacts and mitigation strategies including global problems associated.

### Theory

**Unit-I: Elements Related to Climate Change** - Greenhouse gases (GHGs); Greenhouse effect; Total GHG emissions by energy sector – industrial, commercial, transportation, residential, Impacts – air quality, water vapour, green space – Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise.

**Unit-II: Impacts of Climate Change** - Effects of Climate Changes on living beings – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas.

**Unit-III: Mitigating Climate Change** - IPCC Technical Guidelines for Assessing

Climate Change Impact and Adaptation -Identifying adaptation options – designing and implementing adaptation measures – surface albedo environment reflective roofing and reflective paving enhancement of evapotranspiration – tree planting program – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration Techniques.

**Unit-IV: Importance of Carbon Credits** - Carbon Footprint and Carbon Offset, Carbon Tax, International Carbon Pricing Initiative, Carbon Credit in India and Developed Countries, Carbon Audit-ISO 14064, Latest developments in carbon crediting, Kyoto Convention, COPs, Copenhagen Convention and Paris Convention

**References:**

1. Hardy, J.T. 2003. Climate Change: Causes, Effects and Solutions. John Wiley & Sons.
2. Harvey, D. 2000. Climate and Global Climate Change. Prentice Hall.
3. Gillespie, A. 2006. Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations. Martinus Nijhoff Publishers.
4. Manahan, S.E. 2010. Environmental Chemistry. CRC Press, Taylor and Francis Group.
5. Maslin, M. 2014. Climate Change: A Very Short Introduction. Oxford Publications.

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## **05a - RESEARCH PROJECT OR**

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## DSE 05b - Bioremediation Techniques

L	T	P	C
3	0	0	3

### Course Objectives:

- To Understand the Composting of Organic Waste
- They learn about Vermicomposting techniques.
- Students will learn about the various kinds of bio pesticides

### Course Outcomes:

After successful completion of the course, students will be able to

1. Through this course, the students learn the important application of biological waste gas Purification
2. The students will have the basic knowledge in understanding the Eco-friendly products
3. At the end of the course, the students will have an understanding the bioremediation process
4. The students will have the basic knowledge in Treatment of toxic wastes

### Theory

**Unit-I: Introduction to Bioremediation** - Concept and Types of bioremediation Advantages and disadvantages of bioremediation, importance of bio-stimulation, Types and application of bioaugmentation Current remediation practices, benefits of bioremediation, Composting of Organic Waste, Commercial Applications of biological waste gas Purification.

**Unit-II: Bioremediation using naturally occurring microorganism** - Strategies of microbial degradation and bioremediation, Environmental effects on microbial degradation; mineralization v/s partial degradation; factors affecting microbial activity Removal of spilled oil and grease deposits (Use of oleophilic fertilizers, Use of a mixture of bacterial strains, Use of genetically engineered microbes).

**Unit-III: Reducing environment Impact of agricultural practices** - Weed control

and herbicides, Pest control and biopesticides, Eco-friendly strategy to check soil borne diseases: Importance of soil solarization, Advantages and disadvantages of Biofertilizers, Biosensor to detect environmental pollutants (In situ bioremediation of both soil and groundwater contamination).

**Unit-IV: Bioremediation of contaminated soil** - Bioremediation of organic and inorganic pollutants, Bioremediation of contaminated surface waters (pits, ponds and lagoons), Treatment of toxic wastes before they reach environment, Conservation of soil city wastes, SPCI's strategy on bio treatment.

**References:**

1. A Textbook of Biotechnology, R.C.Dubey, S.Chand Co ltd.
2. Biotechnology and Genomics, P.K.Gupta, Rastogi Publications
3. Environmental Biotechnology-Theory and Applications, Gareth M.Evans and Judith Furlong, WILEY.
4. Environmental Biotechnology, Bimal Bhattacharya and Rintu Banerjee, Oxford University Press



## DSE 05c - Bio-energy Technologies

L	T	P	C
3	0	0	3

### Course Objectives:

- Students are introduced to the importance of biomass in the energy sector.
- Students are introduced to various mechanisms of producing biofuels.
- Students are also exposed to waste management and energy generations.

### Course Outcomes:

After successful completion of the course, students will be able to

1. This course highlights biomass, biogas, pyrolysis, and waste characteristics.
2. By the end of the course the student understands biogas production from waste, characteristics of biomass fuel and importance of biodiesel.

### Theory

**Unit-I: Introduction to Biomass energy** - Biomass definition, photosynthesis and biomass, biomass types, composition, and analysis of biomass (heating value, ultimate and proximate analyses). Modes of biomass utilization for energy, biomass conversion processes, sewage sludge and its utilization.

**Unit-II: Biogas** - Biogas production, types of substrates, operational Problems, biogas process, types of biogas plants, use of biogas and digestate, advantages and limitations of biogas. Ethanol production processes, biodiesel Preparation and its applications.

**Unit-III: Thermochemical techniques of Biomass** - Biomass combustion systems and wood stoves, Densification and its techniques, Pyrolysis, Slow and fast pyrolysis, Biomass gasification, Type of Gasifiers, fluidized bed combustion systems, application of biomass combustion system.

**Unit-IV: Waste to Energy** - Waste and its characteristics, waste generation, composition, collection, separation, treatment and storage, Environmental and health impacts of waste, solid waste management, waste disposal methods: sanitary landfill, incineration, composting, policy, and economics of waste. Energy from sewage treatment.

**References:**

1. Gerhard Knothe, Jon Van Gerpen and Jurgen Krahl (2005), The Biodiesel Handbook.
2. Bioenergy Options for a Cleaner Environment: in Developed and Developing (2004) : Ralph E.H. Sims, Elsevier.
3. Sustainable Bioenergy Production - An Integrated Approach (2013) : Hans Ruppert, Martin Kappas, Jens , Springer.
4. Anaerobic Biotechnology for Bioenergy Production Principles and Applications (2011): Samir Khanal, Wiley Publishing.
5. Bioenergy Economy: A Methodological Study on Bioenergy-Based Therapies (2010): Farzad Goli, Xilbris Corporation.
6. Bioenergy: Opportunities and Challenges (2015): R. Navanietha Krishnaraj, Jong- Sung Yu, CRC Press.

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## **Question Paper Pattern**

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**MODEL QUESTION PAPER**

**QP CODE:**

**JSS Academy of Higher Education & Research, Mysuru**  
(Deemed to be University)

**First Semester BSc (Life sciences) Examination - Year**  
**Branch**

**Subject:**

*Note: Draw neat, labeled diagrams wherever necessary.*

*Your answers should be specific to the questions asked.*

**Time: 02 Hours**

**Max Marks: 50**

**I. LONG ESSAYS (Answer any TWO of the following)**

**2x10=20**  
**Marks**

- 1.
- 2.
- 3.

**II. SHORT ESSAYS (Answer any FIVE of the following)**

**5x4=20**  
**Marks**

- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**III. SHORT ANSWERS (Answer all the following)**

**5x2=10**  
**Marks**

- 11.
- 12.
- 13.
- 14.
- 15.

\*\*\*\*\*

**MODEL QUESTION PAPER**

**QP CODE:**

**JSS Academy of Higher Education & Research, Mysuru**  
(Deemed to be University)

**First Semester BSc (Life sciences) Examination - Year**  
**Branch**

**Subject:**

*Note: Draw neat, labeled diagrams wherever necessary.*  
*Your answers should be specific to the questions asked.*

**Time: 03 Hours**

**Max Marks: 70**

**I. LONG ESSAYS (Answer any TWO of the following)**

**2x15=30**  
**Marks**

- 1.
- 2.
- 3.

**II. SHORT ESSAYS (Answer any FIVE of the following)**

**5x6=30**  
**Marks**

- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

**III. SHORT ANSWERS (Answer all the following)**

**5x2=10**  
**Marks**

- 11.
- 12.
- 13.
- 14.
- 15.

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