Department of Environmental Biology, A.P.S. U. Rewa

P.G Two Year Course

Two YEAR P.G Program Course work and Research Work						
Year/ Semester		Courses Level	Core course	Practical Courses	Seminar Or VAC	Total Credits
First year	Sem I	400 400	CC- 11 (6 Credits) CC- 12 (6 Credits)	PC- 11 (4 Credits) PC- 12 (4 Credits)	**Seminar** (2 Credits)	22
	Sem II	400 500	CC- 21 (6 Credits) CC- 22 (6 Credits)	PC- 21 (4 Credits) PC- 22 (4 Credits)	**Value Added Course** (2 Credits)	22

Two YEAR P.G Program Option – I Only Course work						
Year/ Semester		Courses Level	Core course	Practical Courses	Seminar Or VAC	Total Credits
Second year	Sem III	500 500	CC- 31 (6 Credits) CC- 32 (6 Credits)	PC- 31 (4 Credits) PC- 32 (4 Credits)	**Seminar** (2 Credits)	22
	Sem IV	500 500	CC- 41 (6 Credits) CC- 42 (6 Credits)	PC- 41 (4 Credits) PC- 42 (4 Credits)	**Value Added Course** (2 Credits)	22

03/09/25
(Dr. Aprana Singh)

3/9/25

3/9/25

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Theory Paper: Scheme B-1 for Two Year PG Program

Program:	Class: M.Sc. I Semester	Year: 2025	Session: 2025-26
Subject: Enviromental Biology			
1	Course Code	CC11	
2	Course Title	ENVIRONMENTAL POLLUTION AND ENVIRONMENTAL CHEMISTRY	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	**This paper introduces students to the concept of environmental pollution and environmental chemistry student will be aware of the types of pollutants, sources, impacts and mitigation practices, green technology, its goals and advantages. It also highlights the potential role of green technologies in realizing the goal of sustainable development and focuses on community participation to tap the economic benefits associated with switching to green technologies.**	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	Topics	No. Of Lectures
I	**Introduction** Environmental chemistry in Rasayanashastra: Ancient Indian alchemy and its legacy,Water Purification techniques in Ancient India ; Charcoal Filtration, copper vessels, Tulsi, and Neem. Environmental Pollution basic concept, sources of environmental pollution, point and non- point sources, categories of environmental pollutants, primary and secondary pollutants, modern approaches for pollution control: concepts of clean environment. Chemistry of the atmosphere, Water and Soil	18
II	**Air Chemistry and Air pollution** Chemistry of the atmosphere and Air Pollution – gases and particles;: Definition & Sources of air pollutants (Natural sources and manmade sources), classification of pollutants, particulates & gaseous pollutants, photochemical smog, transport of air pollutants and, effect of air pollutants on vegetation, crops, human health and monuments, methods of air pollution control, air quality management concept, Air Quality index (AQI).	18

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III	**Water ,Soil Chemistry and Pollution** Chemistry of water and soil: Water chemistry: Structure and properties of water, Water Pollution : Definitions, Sources of water pollutants, effects of water pollutants on plants, animals and human health, Water pollution control strategies, Water quality parameters (Physical, Chemical, biological). Soil Chemistry: Physio chemical composition of the soil, Soil pollution, sources of soil pollution, nature of soil pollutants, impact of soil pollution on plants, animals and human health, soil pollution monitoring and control strategies: soil quality management concept.	18
IV	**Noise and Radioactive Pollution** Noise pollution: Definitions, Sources of noise, effects of noise on human health, monitoring of noise pollution management & control, noise exposure levels and standards, status of noise pollution in India, Radioactive material and sources of radioactive pollution; effect of radiation on human health; thermal pollution and its effects.	18
V	**Toxicology and Green technology**: Concept of toxins, toxicity and toxicology, Classification of toxic compounds . Green technologies Green technologies in historical and contemporary perspectives; successful green technologies: paradigm shift from 'cradle to cradle' to 'cradle to grave' green energy, green infrastructure, green economy, and, green chemistry;Green buildings Green future role of green technologies towards a sustainable future Applications of green technologies	18
Keywords/ Tags: Environmental Pollution,Air Chemistry and Air pollution,Water quality parameters,Noise pollution,Toxicology and Green technology		
Text Books, Reference Books, Other Resources		

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Suggested Readings:

1.Air pollution by Stern (Vol 1-Vol VIII)

2..Environmental chemistry: B. K. Sharma, H. Kaur (Krishna Prakashan media, Meerut)

3. Air pollution: S. K. Agarwal (A. P. H. Publishing corporation, New Delhi)

4.Environmental Science - Taylar and Miller

5..Environmental Science – Botkin and Kelter, John Wiley and Sons, New York.

9.Environmental Science – S.C. Santra

10.C.N Sawyer, P.L McCarty and G.F Parkin, Chemistry for Environmental Engineering and Science, 5th ed. Tata McGraw-Hill, 2003 .

11. Das, A. K. Environmental Chemistry with Green Chemistry, Books and allied (P) Ltd.

12. Ahluwalia, V.K. Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.

13. Sanghi, R. and Srivastava, M.M. Green chemistry: Environment Friendly Alternatives, Narosa Publishing House.

14. Paul Anastas, John C. Warner, John Warner Joint; Green Chemistry: Theory and Practice New Ed Edition; Oxford University press, USA, 2000

15.Biomass and alternate fuel systems – Thomas F. McGowan, Michael L. Brown, William S. Bulpitt, James L. Walsh Jr.. Wiley AICHE

16, Alternative fuels- S.S. Thipse – Jaico publishing

17. Hrubovcak, J., Vasavada, U. & Aldy, J. E. 1999. Green technologies for a more sustainable agriculture (No. 33721). United States Department of Agriculture, Economic Research Service.

18.Principles of Soil Science Watt K. E. F.(1973), (McGraw Hill Book Co., New Delhi

19.Ruth Ann Murph. 2022. Environmental Chemistry in theLab. ISBN 9780367438951, CRC Press.

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

3/9/25

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Practical Paper: Scheme B-1 for Two Year PG Program

Program:	Class: M.Sc. 1 Semester	Year: 2025	Session: 2025-26
Subject: **Enviromental Biology**			

1	Course Code	**PC11**	
2	Course Title		
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	**This paper introduces students to the concept of environmental pollution and environmental chemistry Students will be able to analyze the different pollutants through various instruments.Students will understand about the various toxicants present in the environment. Students will take a step forward for sustainable development with the help of green technologies.**	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P: 120 hrs

Topics	No. Of Lectures

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- Study of high-volume sampler and respirable dust sampler.
- Determination of acidity of water.
- Determination of pH and temperature of water.
- Determination of hardness of water.
- **Determination of carbon dioxide in water.**
- IDetermination of wind velocity..
- Determination of Air pollution index.
- Determination of Noise level by/Noise level meter.
- Radiation Pollution (Photographs and description)
- Write Assignment on Green technology.
- Write Assignment on Toxicology
- Water quality Monitoring
- Estimation of Nitrate in wastewater samples.
- Estimation of Phosphate in wastewater samples.
- Macro elements estimation in soils like C, N and P
- Estimation of cations in soil and water samples

*Activity- listing plants in scriptures local traditions, Preparation of Charts /discussions on Environment and Rishis, /field visit to identify plants, preparation of charts.

120

Keywords/ Tags: Radiation Pollution,Noise Level ,wind velocity.,respirable dust sample, Green technology,high-volume sampler

Text Books, Reference Books, Other Resources

3/9/25

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Suggested Readings:

1.Air pollution by Stern (Vol 1-Vol VIII)

2..Environmental chemistry: B. K. Sharma, H. Kaur (Krishna Prakashan media, Meerut)

3. Air pollution: S. K. Agarwal (A. P. H. Publishing corporation, New Delhi)

4.Environmental Science - Taylar and Miller

5..Environmental Science – Botkin and Kelter, John Wiley and Sons, New York.

9.Environmental Science – S.C. Santra

10.C.N Sawyer, P.L McCarty and G.F Parkin, Chemistry for Environmental Engineering and Science, 5th ed. Tata McGraw-Hill, 2003 .

11. Das, A. K. Environmental Chemistry with Green Chemistry, Books and allied (P) Ltd.

12. Ahluwalia, V.K. Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.

13. Sanghi, R. and Srivastava, M.M. Green chemistry: Environment Friendly Alternatives, Narosa Publishing House.

14. Paul Anastas, John C. Warner, John Warner Joint; Green Chemistry: Theory and Practice New Ed Edition; Oxford University press, USA, 2000

15.Biomass and alternate fuel systems – Thomas F. McGowan, Michael L. Brown, William S. Bulpitt, James L. Walsh Jr.. Wiley AICHE

16, Alternative fuels- S.S. Thipse – Jaico publishing

17. Hrubovcak, J., Vasavada, U. & Aldy, J. E. 1999. Green technologies for a more sustainable agriculture (No. 33721). United States Department of Agriculture, Economic Research Service.

18.Principles of Soil Science Watt K. E. F.(1973), (McGraw Hill Book Co., New Delhi

19.Ruth Ann Murph. 2022. Environmental Chemistry in theLab. ISBN 9780367438951, CRC Press.

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

Internal Assesment	Marks	External Assessment	Marks
Total			

3/9/25

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

P.G 2 Year Course

Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. I Semester	**Year: 2025**	**Session: 2025-26**
Subject: **Enviromental Biology**			
1	Course Code	**CC12**	
2	Course Title	**Population ecology**	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1. Student will able to understand the fundamental concepts and principles of Ecology 2. Student will be aware about the important fundamental concepts and principles and its conservation 3.Students will learn about the modern tools and techniques available to study and understand the nature 4. Students will learn the field techniques, data collection, mapping and analysis 5. Students will take up interdisciplinary research and teaching in Ecology	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	Topics	No. Of Lectures

3/9/25

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School of Environmental Biology
A. P. S. University, Rewa (M.P.)

I	Demographic Patterns in Ancient India, Population size, density, and distribution in the Indus Valley Civilization, Vedic period, and Mauryan Empire , Characteristics of population- distribution, and demographic parameters density, natality, mortality, survivorship curves, age distribution and age pyramids. Population growth, carrying capacity, 'r' & 'k' selection, Energy partitioning, Population fluctuations and self regulation of population, density dependent & density independent population regulation.	18
II	Population interaction– intraspecific competitions, characteristic and outcomes, Inter specific interactions- positive interaction, commensalism, mutualism and protocooperation. Negative interaction- amensalism, parasitisms, competition, predation.	18
III	Ecological genetics – Hardy Weinberg law, factors affecting gene frequencies, genetic drift and founder's effect. Population variation, environmental and genetic variation, external influence on genetic variation	18
IV	Speciation- isolation mechanisms. Allopatric and sympatric speciation, Ecology of mimicry- types and evolutionary aspects, Co-evolution of plants and animals, pair wise and diffuse coevolution.	18
V	Systems ecology – general idea, Elementary idea about ecological modeling, Concept of homeostasis, Cybernetics and feedback.	18
Keywords/ Tags: Systems ecology		
Text Books, Reference Books, Other Resources		

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Suggested Readings:

Fundamentals of Ecology: Eugene P. Odum, (Natraj Publishers, Dehradun.)
2. Environmental Biology: P. D. Sharma (Rastogi Publications, Meerut)
3. Ecology and Environment: P. D. Sharma (Rastogi Publications, Meerut)
4. Environmental Biology: M. P. Arora (Himalaya Publishing House, New Delhi)
5. Toxicology – Principles and Methods: M. A. Subramanian, MJP, Publishers, Chennai,2004
6. Environmental Biology:Principles of Ecology: P.S. Verma (S. Chand Ltd,2000)
7. General microbiology Volume I andII :C. B. Powarand H. F. Daginawala (Himalaya publishing House, Mumbai), 2002
8. Microbiology :P. D. Sharma (Rastogi publication Meerut)
9. Microbiology for Environmental Engineering :M. C. Kinnery (Tata McGraw-Hill Publishing Company Limited, New Delhi).
10. Skoog, D.A., Holler, F., Crouch, S.R., Instrumental Analysis, Cenage Learning IndiaPvt. Ltd, New Delhi,2007
11.Settle, F. Instrumental Techniques for Analytical Chemistry, Prentice-Hall, Inc.,Englewood Cliffs, NJ, (1997).
12. Popek, E. P. Sampling and analysis of environmental pollutants: a complete guide,USA: Academic (2003).
13.Lillesand, T., Kiefer, R. W., & Chipman, J. Remote sensing and image interpretation.John Wiley & Sons, (2014)

14.Handbook of Thin-Layer Chromatography, 2003. 3rd Edition; Edited By Joseph Sherma,Bernard Fried. CRC Press.

15. A Textbook of Biotechnology: R. C. Dubey, S. Chand and Company, New Delhi (2002).
16. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
17.. Friday, A & D.S. Ingram (Gen. Eds.) 1985. The Cambridge Encyclopedia of Life Sciences, Cambridge Univ. Press, Cambridge.

18.. Ecosystems of the World Series - Nos.1,2,3,4,5,6,7,8,12,13, & 14 Elsevier, Amsterdam.

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

Practical Paper: Scheme PC12 for Two Year PG Program

3/9/25

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Practical Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. I Semester	**Year: 2025**	**Session:** 2025-26
Subject: **Enviromental Biology**			
1	Course Code	**PC12**	
2	Course Title	Population ecology	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1. Student will able to understand the fundamental concepts and principles of Ecology 2. Student will be aware about the important fundamental concepts and principles 3.Students will learn about the modern tools and techniques available to study and understand the nature. 4. Students will learn the field techniques, data collection, mapping and analysis 5. Students will take up interdisciplinary research and teaching in Ecology. 6. Students will be able to understand the structure of population by various mathematical calculations. 7.Students will understand how to read the age pyramid of the population.	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P: 120 hrs

Topics	No. Of Lectures

3/9/25

Professor & Head
School of Environmental Biology
A. P. S. University, Rewa (M.P.)

1.Age Pyramids 2.Population Density 3. Population Natality 4.Population Mortality 5. Survival ship curve. **6.Methods of measuring the age of population** 7.growth forms of population 8.population Dispersion 9. r and k selection. 10.Positive and negative Interaction 11. Speciation Activity -preparation of charts and models, Quiz competition on topic related(Population ecology).	120

Keywords/ Tags: :Age Pyramids, r and k selection., Natality,Mortality

Text Books, Reference Books, Other Resources

3/5/25

Professor & Head
School of Environmental Biology
A. P. S. University, Rewa (M.P.)

Suggested Readings:

1.Fundamentals of Ecology: Eugene P. Odum, (Natraj Publishers, Dehradun.)

2. Environmental Biology: P. D. Sharma (Rastogi Publications, Meerut)
3. Ecology and Environment: P. D. Sharma (Rastogi Publications, Meerut)
4. Environmental Biology: M. P. Arora (Himalaya Publishing House, New Delhi)
5. Toxicology – Principles and Methods: M. A. Subramanian, MJP, Publishers, Chennai,2004
6. Environmental Biology:Principles of Ecology: P.S. Verma (S. Chand Ltd,2000)
7. General microbiology Volume I andII :C. B. Powarand H. F. Daginawala (Himalaya publishing House, Mumbai), 2002
8. Microbiology :P. D. Sharma (Rastogi publication Meerut)
9. Microbiology for Environmental Engineering :M. C. Kinnery (Tata McGraw-Hill Publishing Company Limited, New Delhi).
10. Skoog, D.A., Holler, F., Crouch, S.R., Instrumental Analysis, Cenage Learning IndiaPvt. Ltd, New Delhi,2007
11.Settle, F. Instrumental Techniques for Analytical Chemistry, Prentice-Hall, Inc.,Englewood Cliffs, NJ, (1997).
12. Popek, E. P. Sampling and analysis of environmental pollutants: a complete guide,USA: Academic (2003).
13.Lillesand, T., Kiefer, R. W., & Chipman, J. Remote sensing and image interpretation.John Wiley & Sons, (2014)

14.Handbook of Thin-Layer Chromatography, 2003. 3rd Edition; Edited By Joseph Sherma,Bernard Fried. CRC Press.

15. A Textbook of Biotechnology: R. C. Dubey, S. Chand and Company, New Delhi (2002).
16. Bioinformatics: Databases and Systems, by Stanley I. Letovsky

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

Internal Assesment	Marks	External Assessment	Marks
Total			

3/9/25

Professor & Head
School of Environmental Biology
A. P. S. University, Rewa (M.P.)

Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc.II Semester	**Year: 2025**	**Session:** 2025-26
Subject: Enviromental Biology			
1	Course Code	**CC21**	
2	Course Title	Environmental Biotechnology and Instrumentation Techniques	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1.Upon successful completion of this course, students will be able to understand the fundamental concepts and principles of biotechnology and Instrumentation technology. 2. Students will be aware about the important fundamental concepts, principles and of complex instrumentation techniques. 3.They will develop proficiency in the operation and maintenance of various analytical instruments, equipping them to perform accurate quantitative and qualitative analyses of environmental samples in research and professional settings. 4. Students will learn the field techniques, data collection, mapping and analysis. 5. Students will take up interdisciplinary research and teaching in biotechnology and Instrumentation techniques.	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:
Total No. Of Lectures- Tutorial- Practical (in hours per week): **L-T-P:**			

3/9/25

Professor & Head
School of Environmental Biology
A... S. University, Rewa (M.P.)

Unit	Topics	No. Of Lectures
I	Traditional Bioremediation Practices in Ancient India, Use of Natural Microorganisms for Waste Management, Traditional Fermentation Techniques. Introduction, basic of environmental biotechnology, scope of biotechnology, biotechnological approach of environmental pollution.Biotechnology for Environmental Protection: Scope of **biotechnology in pollution control, In-situ and Ex-situ bioremediation,** phytoremediation- heavy metal phytoremediation, organic phytoremediation, microbes used in pollution mitigation.	18
II	Cell structures and their functions.DNA & RNA structure, DNA Replication,Transcription and Translation (Protein synthesis), Genetic code, gene mutation, Biofertilizer technology Biodegradation of xenobiotics.	18
III	Bioinformatics: Retrieval methods for DNA sequence, Protein sequence and protein structure information; Databases – Format and Annotation :, Common sequence file formats, Annotated sequence databases – Primary Sequence databases, Protein sequence and structure databases Genome Analysis. bioinformatics tools and web services.	18
IV	Spectroscopic Techniques: Basic Principles, Instrumentation and applications of: Ultraviolet – visible (UV-VIS) Spectroscopy, Atomic Absorption spectroscopy (AAS),, Flame photometer, Chromatography Techniques: Different types of Chromatography techniques and its application.	18
V	Environmental Sample Processing and Analysis, Methods for processing and analysis of Environmental Samples-- techniques and applications Environmental sampling: Air, Water, Soil-collection, storage, preservation and analysis of samples.	18
Keywords/ Tags:		
Text Books, Reference Books, Other Resources		

3/9/25

Professor & Head
School of Environmental Biology

Suggested Readings:

. Environmental Biotechnology, M. H. Fulekar, Oxford & IBH Publishing

2. Co. Pvt. Ltd., New Delhi

3. Mohapatra. P. K., 2006, Text Book of Environmental Biotechnology. I K International.

4. Evans, G.M. and Furlong J.C. 2003. Environmental Biotechnology: Theory and

5. Application. John Wiley and Sons.

6. Thomas, J.A. and Fuchs, R. 2002. Biotechnology and Safety Assessment.

7. Academic Press.

8. Wang L.K. Hung Y.T. nad Shammas N.K.(Eds). 2006. Advanced Physicochemical Treatment Processes. Springer-Verlag New York, LLC

9. Introduction to Environmental Microbiology. Mitchell, R.1974.Prentice Hall Int.

10. Microbiology-M.J. Pelczar, E.C.S. Chan, N.R. Kreig.1996. Mc Graw Hill Books Co., New York

11. Microbiology-Fundamentals and Applications. Atlas, R.M. MacMillian Pub. Co.,New York

12. A Textbook of Biotechnology: R. C. Dubey, S. Chand & Company, New Delhi (2002).

13. Biotechnology: B.D. Singh, Kalyani Publishers.

14.Handbook of Thin-Layer Chromatography, 2003. 3rd Edition; Edited By Joseph Sherma,Bernard Fried. CRC Press.

15. A Textbook of Biotechnology: R. C. Dubey, S. Chand and Company, New Delhi (2002).
16. Bioinformatics: Databases and Systems, by Stanley I. Letovsky

Suggested Continuous Evalution Methods:
Maximum Marks:

Continous Comprehensive Evalution (CCE):		**University Exam (UE):**

3/9/25

Professor & Head
School of Environmental Biology
A. P. S. University, Rewa (M.P.)

Practical Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class: M.Sc.I I Semester**	**Year: 2025**	**Session: 2025-26**
Subject: **Enviromental Biology**			
1	Course Code	**PC21**	
2	Course Title	Environmental Biotechnology and Instrumentation Techniques	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1.Upon successful completion of this course, students will be able to understand the fundamental concepts and principles of biotechnology and Instrumentation technology. 2. Students will be aware about the important fundamental concepts, principles and of complex instrumentation techniques. 3.They will develop proficiency in the operation and maintenance of various analytical instruments, equipping them to perform accurate quantitative and qualitative analyses of environmental samples in research and professional settings. 4. Students will learn the field techniques, data collection, mapping and analysis. 5. Students will take up interdisciplinary research and teaching in biotechnology and Instrumentation techniques.	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

3/9/25

Professor & Head
School of Environmental Biology
A. P. S. University, Rewa (M.P.)

Total No. Of Lectures- Tutorial- Practical (inhours per week): L-T-P: 120 hrs	
Topics	**No. Of Lectures**
1. RNA and DNA Structure 2. DNA isolation technique 3. DNA Databases 4. Bioremediation,, Phytoremediation of heavy metal and organic compounds 5. Microbes used in pollution mitigation. 6. Biofertilizers 7. To study the principle and functioning of UV-Visible spectrophotometer. 8. Analysis of water samples with titration method 9. To Study the working principle Atomic Absorption spectroscopy (AAS) 10. Analysis of Plant sample through Spectrophotometer 11. Pigment analysis through paper chromatography. 12. Pigment analysis through Thin Layer chromatography. 13. Write Assignment on Methods of Different Types of Sample Collection (Soil,Water and Air). *Activity-traditional composting in local villages, ancient stepwells or water systems, preparation of charts and models.	120
Keywords/ Tags: DNA Databases,Bioremediation,heavy metal, Thin Layer chromatography.,paper chromatography,Biofertilizers,Atomic Absorption spectroscopy ,Phytoremediation,Spectrophotometer	
Text Books, Reference Books, Other Resources	

3/9/15

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Suggested Readings:

1. Environmental Biotechnology, M. H. Fulekar, Oxford & IBH Publishing

2. Co. Pvt. Ltd., New Delhi

3. Mohapatra. P. K., 2006, Text Book of Environmental Biotechnology. I K International.

4. Evans, G.M. and Furlong J.C. 2003. Environmental Biotechnology: Theory and

5. Application. John Wiley and Sons.

6. Thomas, J.A. and Fuchs, R. 2002. Biotechnology and Safety Assessment.Academic Press.

7 Wang L.K. Hung Y.T. nad Shammas N.K.(Eds). 2006. Advanced Physicochemical Treatment Processes. Springer-Verlag New York, LLC

8. Introduction to Environmental Microbiology. Mitchell, R.1974.Prentice Hall Int.

9. Microbiology-M.J. Pelczar, E.C.S. Chan, N.R. Kreig.1996. Mc Graw Hill Books Co., New York

10. Microbiology-Fundamentals and Applications. Atlas, R.M. MacMillian Pub. Co.,New York

11. A Textbook of Biotechnology: R. C. Dubey, S. Chand & Company, New Delhi (2002).

12. Biotechnology: B.D. Singh, Kalyani Publishers.

13.Handbook of Thin-Layer Chromatography, 2003. 3rd Edition; Edited By Joseph Sherma,Bernard Fried. CRC Press.

14. A Textbook of Biotechnology: R. C. Dubey, S. Chand and Company, New Delhi (2002).
15. Bioinformatics: Databases and Systems, by Stanley I. Letovsky

Suggested Continuous Evaluation Methods:
Maximum Marks:
Continuous Comprehensive Evaluation (CCE): **University Exam (UE):**

Internal Assesment	Marks	External Assessment	Marks
Total			

3/9/25

Professor & Head
School of Environmental Biology
A.S.S. [illegible]

Theory Paper: Scheme B-1 for Two Year PG Program				
Program:	**Class: M.Sc.II Semester**		**Year: 2025**	**Session: 2025-26**
Subject: Enviromental Biology				
1	Course Code	**CC22**		
2	Course Title	BIODIVERSITY AND CONSERVATION		
3	Course Type			
4	Pre-Requisite (if any)			
5	Course Learning Outcome (CLO)	(1) Students will understand the status of the planet's biological diversity. (2) Students will be aware about the value of biodiversity and scientific evidence for biodiversity change in the modern era and causes of biodiversity loss. (3) Students will understand the basic concepts and scientific principles of conservation and global patterns in biodiversity (4) Students will become familiar with the current efforts to conserve biodiversity on global, national and local scales. (5) Students will know the practical issues with local conservation.		
6	Credit Value	6		
7	Total Marks	Max. Marks:	Minimum Passing Marks:	

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	**Topics**	**No. Of Lectures**

3/9/25

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School of Environmental Biology
A. P. S. University, Rewa (M.P.)

I	Introducation of *Prakriti* (Nature) and its sacredness, Role of religion in promoting conservation, Worship of plants (like Tulsi, Peepal) and animals (like cow, snake), Festivals and rituals promoting environmental care,Biodiversity: Definition, importance, Concept of biodiversity, Levels of biodiversity. Species, genetic, ecosystem and Agro-biodiversity. Diversity magnitude and global accumulation of Biodiversity, biodiversity and its role in ecosystem functioning, Measures for maintaining biodiversity, Hotspots of biodiversity,	18
II	Measurement of biodiversity – Species richness & abundances, diversity indices –Shannon Wever and Simpson Index. Biodiversity and various ecosystem services; Valuationof ecosystems and species: Biodiversity prospecting and indigenous knowledge systems, community biodiversity registers. Social and ecological benefits of biodiversity, Biodiversity as bio resources – use and values (consumptive and productive use values) of biodiversity as sources of food, fodder, timber, medicinal and ornamental plants. Ramser sites in special reference to M.P.	18
III	Treat and reduction of biodiversity, Threats to biodiversity: Natural and anthropogenic Global deforestation rate- Species extinctions and Causes for extinction: habitat loss, industrialization, hunting and biol invasions; invasive species: wiser use & management. Extinction through geological time scale: mass extinction. Current extinction trends. The theory of island biogeography; ecotone and edge effect. Effect of loss of biodiversity on Ecosystem.	18

3/9/25

Professor & Head
Environmental Biology
A. P. S. University, Rewa (M.P.)

IV	Need for conservation of biodiversity, Conservation strategies: In-situ and ex-situ conservation, biodiversity hotspots conservation, latest hotspots of India and world, mega diversity countries, centers of plant diversity and endemism. India – Biospheres, National parks and Wildlife sanctuaries, Wildlife conservation projects: Tiger Project, Crocodile Conservation, GOI-UNDP Sea Turtle project.	18
V	Biodiversity conservation and international efforts- The Earth Summit, Rio declaration., global protected area network. Protected areas and functions; UNESCO biosphere reserves; IUCN conservation categories-endangered, threatened, vulnerable, Red Data Books. Regulation of biodiversity: Convention on Biological Diversity, National Biodiversity Authority, WCMC, CITES	18

Keywords/ Tags:

Text Books, Reference Books, Other Resources

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School of Environmental Biology
A. P. S. University, Rewa (M.P.)

Suggested Readings:

.1Primack, Richard B., and Anna Sher (2016). Introduction To Conservation Biology. Sinauer Associates, Incorporated, Publishers.

2. Berlatsky (2013) Biodiversity – Global Viewpoints. Gale Cengage Publishers. ISBN: 9780737769050.

3. Gary G. Mittelbach (2012) Community Ecology. Sinauer Associates, Inc.; 1 edition. ISBN: 978-0878935093.

4. 1. Burough, P.A. and McDonnel, R. 1998. Principles of Geographical Information Systems. Oxford University Press, NY.

5. Campbell, J.B. (2nd Ed), 1996. Introduction to Remote Sensing. Taylor and Francis.

6. Christopher, J. 1997. Geographical Information Systems and Computer Cartography. Longman:

7. Reeves, Robert G. 1999. Manual of Remote Sensing, (Vols. I & II). American Society of Photogrammetry and Remote Sensing, USA.

8. Rencz, A.N. (3rd Ed.) Remote Sensing for the Earth Sciences: Manual of Remote Sensing. John Wiley & Sons, Inc., New York.

9. Sabins, F. F. Jr. (2nd Ed). 1986. Remote Sensing: Principles and Interpretation. W.H. Freeman & Co.

Suggested Continuous Evalution Methods:
Maximum Marks:

Continous Comprehensive Evalution (CCE):		**University Exam (UE):**

Practical Paper: Scheme PC22 for Two Year PG Program

Practical Paper: Scheme B-1 for Two Year PG Program

Program:	**Class:** M.Sc. II Semester	**Year: 2025**	**Session:** 2025-26

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Subject: **Enviromental Biology**			
1	Course Code	**PC22**	
2	Course Title	BIODIVERSITY AND CONSERVATION	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	(1) Students will understand the status of the planet's biological diversity. (2) Students will be aware about the value of biodiversity and scientific evidence for biodiversity change in the modern era and causes of biodiversity loss. (3) Students will understand the basic concepts and scientific principles of conservation and global patterns in biodiversity. (4) Students will become familiar with the current efforts to conserve biodiversity on global, national and local scales. (5) Students will know the practical issues with local conservation.	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P: 120 hrs

Topics	**No. Of Lectures**

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1. IUCN threat categories
2. Biodiversity conservation, principles and strategies
3. Biodiversity Hotspots: in India
4. Biodiversity Hotspots: in world
5. National Parks in M.P. amd India
6. Wildlife sanctuaries in M.P, and India
7. Biosphere reserves in M.P. and India
8. Use of biodiversity: Source of food, medicine, raw material, aesthetic and cultural..
9. Measurement of Biodiversity-by-biodiversity indices.
10. Assignment on wildlife conservation projects.
11. **Assignments on Earth summit and Rio declaration.**
12. Wetlands of India.
13. Wetlands of world..
14. Ramser sites of M.P.

120

Activity- listing plants in scriptures local traditions, Preparation of Charts /discussions on Nature and Rishis, /field visit to identify plants, preparation of charts.

Keywords/ Tags:

Text Books, Reference Books, Other Resources

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Professor & Head
School of Environmental Biology

Department of Environmental Biology, A.P.S.U. Rewa (M.P.)

Value Added Courses (Syllabus)

On

Disaster Management

M.Sc. II Semester

Module -1 (3hrs.)

Concepts and definitions (Disaster, hazard, Vulnerability, Risks)

Module- 2 (3hrs.)

Differential impacts -in terms of caste, class, gender, age, location, disability, Global trends in disasters urban disasters, pandemics, climatic change

Module-3 (3hrs.)

Disaster cycle-its analysis phases, culture of safety, prevention, mitigation and preparedness, community based DRR, role and responsibilities of community

Module-4 (3hrs.)

Factors affecting Vulnerabilities, differential, impacts, impacts of development projects such as dams, embankments, changes in Land-use etc. Climate change adaptation.

Module -5 (3hrs.)

Components or Disaster Relief: Water, Food, Sanitation, Shelter, Waste management, Institutional arrangements (Mitigation and preparedness, DM Act and Policy, other related policies plans, programmes and legislation)

Practical-(Module-15hrs.)

Disaster preparedness

Dos and Do mots at individual or household levels (before, during and after a disaster), Communication.

Coordination, Cooperation during the emergencies, community based First Aid (CBFA); Community based

Disaster Management (CBDM); Mock drills (Fire, Earthquake, Campus shooting, Bomb Threat)

Disaster Risk Assessment Techniques

Risk identification: Application of Remote Sensing (RS), Geographic information system (GIS), and Global

Positioning System (GPS) in Risk Assessment

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A.P.S. University, Rewa (M.P.)

VAC (CHM/EESC) (2 Credits)

Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. III Semester	**Year: 2025**	**Session:** 2025-26
Subject: **Environmental Biology**			
1	Course Code	**CC31**	
2	Course Title	**Environmental Microbiology**	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1.Student will able to understand the fundamental concepts and principles of Microbiology 2..Students will learn about the modern tools and techniques available to study and understand microbiological techniques. 4. Students will learn the field techniques, data collection and analysis 5. Students will take up interdisciplinary research and teaching in microbiology.	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	Topics	No. Of Lectures
I	Definition and importance Of Microbes, Microbial Practices in Ancient India, Use of Neem, turmeric, and other antimicrobial plants, Introduction to Environmental Microbiology: Introduction, scope, structure of microorganisms-fungi, bacteria, virus, classification of microorganisms, role of microbes in sewage treatment (Trickling Filter, Activated sludge Process and Oxidation Pond Process). Foods and Microbes- spoilage and preservation of foods, single cell protein, microbiology of milk and milk products, causation of food toxicity, infections.Edible mushrooms,Spirulina cultivation.	18

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II	Environmental Microbial ecology: Classification of microbes Role of microbes in bio-remedial processes, Environmental factors affecting microbes, their cultivation and growth. Concept of bioindicators, bioindicators as plants, animals, bioindicators in man made environment, role of bioindicator in pollution control. Fundamentals of microbial nitrogen fixation	18
III	Microbial Methods: and Air microbiology: - Types of culture, sterilization and disinfection, techniques used for enrichment of culture, methods of pure culture, preparation, maintenance, and preservation of microbial culture. Sources and types of microorganism in air, Allergic disorder by air microflora, Collection & enumeration of air microflora	18
IV	Soil microorganism, Biogeochemical cycles with reference to microorganisms Rhizosphere, Rhizoplane, phyllosphere, phylloplane, Mycorrhiza- Ecto, Endo, Ectendomycorrhiza, VAM,Cyanobacteria, Interaction among soil organisms Neutral, positive interactions, Biological nitrogen fixation- symbiotic and non symbiotic, Mechanism of N_2 fixation.	18
V	Water microorganisms, pathogenic & non pathogenic Microbial analysis of water Water purification Brief account of Water borne diseases & preventive measures.	18

Keywords/ Tags:

Text Books, Reference Books, Other Resources

Suggested Readings:

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

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Practical Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. III Semester	**Year: 2025**	**Session:** 2025-26
Subject: **Environmental ~~science~~ BIOLOGY**			
1	Course Code	**PC31**	
2	Course Title	**Microbial Analysis and sampling techniques**	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1.Students will able to understand the fundamental concepts and principles of Microbiology 2..Students will learn about the modern tools and techniques available to study and understand microbiological techniques. 3. Students will be able to understand various methods of Media preparation. 4.Students will be able to understand the microbes present in the environment and importance of the microbes in	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:
Total No. Of Lectures- Tutorial- Practical (in hours per week): **L-T-P:** 120 hrs			

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1.Working principle of Autoclave.
2. Microbial cell counting by serial dilution technique
3. Microbial cell counting by pour plate technique.
4. Measurement of bacterial size.
5. Microbial colony counting by colony counter.
6. . Laminar air flow Air sampler
7. Alcoholic and mixed acid ferme
8. Gram positive staining method.
9. Gram negative staining method.
10. Hay infusion method.
11. Milk Microbiology.
12.Microbial Air Sampler.
13.BOD incubator.
14.. Isolation of Pure culture by Streak plate method.
15.Measurement of size of bacteria

Activity - preparation of charts, Assignment and models, Quiz competition.

120

Keywords/ Tags: Autoclave,Microbial cell,pour plate technique.

Text Books, Reference Books, Other Resources

Suggested Readings:

. General microbiology Volume I andII :C. B. Powarand H. F. Daginawala (Himalaya

publishing House, Mumbai), 2002
8. Microbiology :P. D. Sharma (Rastogi publication Meerut)
9. Microbiology for Environmental Engineering :M. C. Kinnery (Tata McGraw-Hill Publishing Company Limited, New Delhi).
10. Skoog, D.A., Holler, F., Crouch, S.R., Instrumental Analysis, Cenage Learning IndiaPvt. Ltd, New Delhi,2007
11.Settle, F. Instrumental Techniques for Analytical Chemistry, Prentice-Hall, Inc.,Englewood Cliffs, NJ, (1997).
12. Popek, E. P. Sampling and analysis of environmental pollutants: a complete guide,USA: Academic (2003).
13.Lillesand, T., Kiefer, R. W., & Chipman, J. Remote sensing and image interpretation.John Wiley & Sons, (2014)

14.Handbook of Thin-Layer Chromatography, 2003. 3rd Edition; Edited By Joseph Sherma,Bernard Fried. CRC Press.

15. A Textbook of Biotechnology: R. C. Dubey, S. Chand and Company, New Delhi (2002).
16. Bioinformatics: Databases and Systems, by Stanley I. Letovsky

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Suggested Continuous Evalution Methods: Maximum Marks: Continous Comprehensive Evalution (CCE):		University Exam (UE):	
Internal Assesment	**Marks**	**External Assessment**	**Marks**
Total			

Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. III Semester	**Year: 2025**	**Session: 2025-26**
Subject: **Environmental Science**			
1	Course Code	**CC32**	
2	Course Title	**Biostatistics-and Computer application**	
3	Course Type		
4	Pre-Requisite (if any)		

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5	Course Learning Outcome (CLO)	1.Students will get the detailed account of data collection, 2.Students will learn about various census techniques used in population study 3.Students will be able to compute the central tendencies. 4.Students will learn about the various possibilities of probable events. 5.Students will understand the analysis of variance 6.Students will able to understand the preparation of hypothesis 7.Students will get the knowledge of basics of MS office. 8.Students will understand the uses of Internet as well as the web Browsers, search engines.	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	Topics	No. Of Lectures
I	Statistics in Ancient Indian Period. Simple ratios and proportions in Ayurveda . Data Recording and Analysis in Ancient Medicine, Classification of diseases, herbs, and treatments (Charaka Samhita, Sushruta Samhita). Introduction, origin and growth of statistics, scope of statistics. Measures of central tendency, Requisites of good average, Types of Mean Methods of Computation of Mean, Mode and Median in Individual Series, Discrete Series and Grouped Series Methods of Calculation of Mode in Individual series, Discrete series and Grouped series Measures of dispersion, Introduction, Objects of measuring variation, Methods of studying variation. Computation of range and standard deviation, .	18
II	**Unit – II Probability and Hypothesis** Probability, definition and types of events in probability, Theorems on probability, Test of Hypothesis- introduction, Types of hypothesis Procedure for testing the hypothesis, Types of error during testing a hypothesis, Test of significance, student 't' test, properties and application of 't' test.	18

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III	**Correlation and Chi Square test** Types of correlation, positive and negative, simple, partial and multiple correlations, Linear and non linear correlation, Method to study correlation: Karl Pearson's correlation coefficient method, scatter diagram method. Standard error of correlation coefficient and its significance test. Chi Square Test, introduction,,Computation and use of Chi Square Test, Misuse and limitation of Chi Square Test, Analysis of variance, Assumption in analysis of variances, One way and two way classification, general idea.	18
IV	**Fundamental of Computer and Peripherals.** Introduction of Computer, Components of Computer System. **Central Processing Unit Input and Output Devices, Memory.** Concept of Hardware and Software. Features of MS word, MS Excel and MS Power Point.	18
V	**Introduction of Internet and basics of Networking** **Basic of Computer Networks** Local Area Network (LAN), Wide Area Network (WAN), Internet: Concept of Internet, Applications of Internet, Connecting to the Internet, World Wide Web (WWW), Web Browsing software, (Popular Web Browsing Software), Search Engines **Communications and Collaboration** Introduction, Objectives, Basics of E-mail, What is an Electronic Mail, Email Addressing, Using E-mails, Opening Email account, Mailbox: Inbox and Outbox, Creating and sending a new E-mail, Replying to an E-mail message, forwarding an E-mail message, Sorting and Searching, e mails.	18
Keywords/ Tags:		
Text Books, Reference Books, Other Resources		

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School of [illegible]

Suggested Readings:

1. Chakravorti S.R. and Giri N.(1997): Basis Statistics South Asian Publishers New Delhi 12/46
2. Clarke G.M. and Cooke D.(1994): A Basic Course in Statistics Arnold London.
3. Goon A.M. Gupta M.K. and Dasgupta B. (1985): Fundamental of Statistics Vol. I The World Press Private Ltd. Calcutta.
4. Goon A.M. Gupta M.K. and Dasgupta B. (1985): Fundamental of Statistics Vol. I The World Press Private Ltd. Calcutta.
5. Gupta S.C. and Kapoor V.K. (1986): Fundamental of Mathematical Statistics Sultan Chand and Sons Publishers
6. Gupta, S.C. (1999). Fundamentals of Statistics. Himalayan Pub. House Delhi.
7. Hadley G (1987). Linear Algebra; Narosa Publishing House.
8. Hoshmand, A.R.(1988).Statistical methods for Env.& Agr. Science. CRS Press, New York
9. Kartikeyan, S., Chaturvedi, R. M. Bhosale , R. M. "Comprehensive Textbook of Biostatistics and Research Methodology" Edition: 1st, Bhalani Publishing House, Parel, Mumbai 400 012, Maharashtra, India. 2016
10. Khan,I.A. & Khanum,A. (1994). Biostatistics. Ukaaz Publications, Hyderabad.
11. Leon SJ (1980). Linear Algebra with applications; Macmillan
12. RAO B.L.S.PRAKASA "ABOUT STATISTICS AS A DISCIPLINE IN INDIA" electronic journal of history of probability and statistics . vol 2. 2006.
13. Rao,P.S.S. & Richard, J.(1996). An Introduction to Biostatistics. Prentice Hall, New Delhi.
14. Reference Books: 1. Graybill FA (1983). Matrices with applications in statistics. John Wiley & Sons
15. Sukhatma, P.Iii. and Amble,Iii.N. (1976). Statistical methods for Agricultural workers : ICAR, New Delhi.

Suggested Continuous Evalution Methods:
Maximum Marks:

Continous Comprehensive Evalution (CCE):		**University Exam (UE):**

Practical Paper: Scheme B-1 for Two Year PG Program

Program:	**Class:** M.Sc.III Semester	**Year: 2025**	**Session:** 2025-26
Subject: **ENVIRONMENTAL SCIENCE**			
1	Course Code	**PC32**	
2	Course Title	Statistical computation of data, ,Computer and Internet	

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3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1. Student will able to understand the fundamental concepts of BIostatistics 2. Student will be aware about the basic application of computer, 3.Students will learn about the modern tools and techniques available to study statistical concepts. 4. Students will learn the field techniques, data collection, mapping and analysis 5. Students will get the knowledge of basics of MS office.	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P: 120 hrs

Topics	No. Of Lectures
1. preparation of frequency distribution of leaf length data. 2. Calculation of mean value of leaf length data. 3. Calculation of median value of leaf length data. 4. Calculation of mode value of leaf length data. 5. Calculation of Probability. 6. To construct the Histogram of different types of data: 7. To construct the Smooth frequency curve of different types of data: 8. To construct the frequency curve Ogive of different types of data 9. Calculation of positive and negative corelation 10. Computation of Chi square test. 11. Prepare an assignment on MS office. 12. Prepare an assignment on computer networking. 13. Prepare an assignment on electronic Mail. **Activity** - preparation of charts, Assignment and models, Quiz competition.	120

Keywords/ Tags:

Text Books, Reference Books, Other Resources

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Suggested Readings:

1.Chakravorti S.R. and Giri N.(1997): Basis Statistics South Asian Publishers New Delhi 12/46

Clarke G.M. and Cooke D.(1994): A Basic Course in Statistics Arnold London.

Goon A.M. Gupta M.K. and Dasgupta B. (1985): Fundamental of Statistics Vol. I The World Press Private Ltd. Calcutta.

Goon A.M. Gupta M.K. and Dasgupta B. (1985): Fundamental of Statistics Vol. I The World Press Private Ltd. Calcutta.

Gupta S.C. and Kapoor V.K. (1986): Fundamental of Mathematical Statistics Sultan Chand and Sons Publishers

Gupta, S.C. (1999). Fundamentals of Statistics. Himalayan Pub. House Delhi.

Hadley G (1987). Linear Algebra; Narosa Publishing House.

Hoshmand, A.R.(1988).Statistical methods for Env.& Agr. Science. CRS Press, New York

Kartikeyan, S., Chaturvedi, R. M. Bhosale , R. M. "Comprehensive Textbook of Biostatistics and Research Methodology" Edition: 1st, Bhalani Publishing House, Parel, Mumbai 400 012, Maharashtra, India. 2016

Khan,I.A. & Khanum,A. (1994). Biostatistics. Ukaaz Publications, Hyderabad.

Leon SJ (1980). Linear Algebra with applications; Macmillan

RAO B.L.S.PRAKASA "ABOUT STATISTICS AS A DISCIPLINE IN INDIA" electronic journal of history of probability and statistics . vol 2. 2006.

Rao,P.S.S. & Richard, J.(1996). An Introduction to Biostatistics. Prentice Hall, New Delhi.

Reference Books: 1. Graybill FA (1983). Matrices with applications in statistics. John Wiley & Sons

Sukhatma, P.Iii. and Amble,Iii.N. (1976). Statistical methods for Agricultural workers : ICAR, New Delhi.

Suggested Continuous Evalution Methods:

Maximum Marks:

Continous Comprehensive Evalution (CCE): **University Exam (UE):**

Internal Assesment	Marks	External Assessment	Marks
Total			

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School of Environmental Biology

INERNSHIP / APPRENTICSHIP / SEMINAR (2 CREDIT)

Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. IV Semester	**Year: 2025**	**Session: 2025-26**
Subject: **Environmental Biology**			
1	Course Code	**CC41**	
2	Course Title	**Waste Utilization and Management for Energy Production**	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1. Students will .Understand the waste and waste utilization 2. Students will be able to apply the knowledge about the operations of Waste to Energy Plants. 3. Students will be able to analyze the various aspects of Waste to Energy Management Systems. 4. Students will be Carry out Techno-economic feasibility for Waste to Energy Plants. 5. Students will usethe knowledge in planning and operations of Waste to Energy plants..	
6	Credit Value	6	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

Total No. Of Lectures- Tutorial- Practical (inhours per week):
L-T-P:

Unit	Topics	No. Of Lectures

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I	**Introduction of Waste management** • Introducation Ancient Indian Waste Management Practices, • Bioenergy in Ancient Times, • Charcoal and plant-based fuel in ancient cooking, • Role of ancient practices in today's sustainable energy production. • The Principles of Waste Management and Waste Utilization. • Waste Management Hierarchy and 7R Principle of waste management • Waste as a Resource and Alternate Energy source.	18
II	**Waste Sources & Characterization** ▪ Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. ▪ Classification of waste – agro based, alga,forest residues, domestic waste, industrial waste (hazardous and non-hazardous). ▪ Characterization of waste for energy utilization. ▪ Waste Selection criteria.	18
III	**Technologies for Waste to Energy Conversion** ▪ Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation, Introduction of microbial fuel cell. ▪ Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification, Solvolysis of wood. ▪ Environmental benefits of Biochemical and Thermo-chemical conversion. Conversion of wastes to fuel resources for other useful energy applications. .	18

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IV	**Waste to Energy Options** ▪ Landfill gas, collection and recovery. ▪ Refuse Derived Fuel (RDF) – fluff, Briquettes, Energy pellets. ▪ Utilization and advantages of briquetting, ▪ Alternate Fuel Resource (AFR) –production and use in Cement plants, Thermal power plants and Industrial boilers. ▪ Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery. ▪ Energy Recovery from wastes and optimization of its use, ▪ E- Waste Recycling of e-waste: impact of hazardous e-waste in India	18
V	**Waste collection and transportation** Centralized and Decentralized Waste to Energy Plants ▪ Waste activities – collection, segregation, transportation and storage requirements. ▪ Location and Siting of 'Waste to Energy' plants. ▪ Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. ▪ Waste To Energy & Environmental Implications ▪ Environmental standards for Waste to Energy Plant operations and gas clean-up. ▪ Savings on non-renewable fuel resources. General idea of Carbon Credits: Carbon foot print and carbon credits transfer.	18
Keywords/ Tags:		
Text Books, Reference Books, Other Resources		

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School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Suggested Readings:

1. Banwari Lal and Patwardhan Wealth from Waste: Trends and Technologies, TERI Press.
2. Blackman, W.C. 2001. Basic Hazardous Waste Management. CRC Press.
3. CPCB Guidelines for Co-processing in Cement/Power/Steel Industry
4. EL-Halwagi, M.M., "Biogas Technology- Transfer and Diffusion", Elsevier Applied Science.
5. E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011"
6. Gazette Notification on Waste Management Rules 2016.
7. Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons.
8. Harker, J.H. and Backhusrt, J.R., "Fuel and Energy", Academic Press Inc.
9. Industrial and Urban Waste Management in India, TERI Press.
10. Mondal, P. and Dalai, A.K. eds., 2017. *Sustainable Utilization of Natural Resources*. CRC Press.
11. Mukhopadhyay S.N, Fundamentals of waste and Environmental Engineering, TERI Press.
12. Report of the task Force on Waste to Energy, Niti Ayog (Formerly Planning Commission) 2014. Municipal Solid Waste Management Manual, CPHEEO, 2016
13. Rogoff, M.J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store.
14. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), "Biomass Conversion Processes for Energy and Fuels", New York, Plenum Press, 1981
15. Waste-to-Energy in Austria – White Book – Figures, Data Facts, 2nd edition , May 2010
16. Young G.C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons.
17. Shah, Kanti L., Basics of Solid & Hazardous Waste Management Technology, PrinticeHall, 2000

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

Practical Paper: Scheme B-1 for Two Year PG Program

Program:	**Class:** M.Sc.IV Semester	**Year:** 2025	**Session:** 2025-26
Subject: **ENVIRONMENTAL [redacted] BIOLOGY**			
1	Course Code	**PC41**	
2	Course Title	Statistical computation of data, ,Computer and Internet	
3	Course Type		

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Theory Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc. IV Semester	**Year: 2025**	**Session: 2025-26**
Subject: **Environmental Biology**			
1	Course Code	**CC42**	
2	Course Title	**Environment Resources and monitoring techniques**	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	Students will understand the important resources and monitoring techniques To Explain Various stages of the EIA process in India. To Provide knowledgeone various aspects of Environment Impact Assessment Methodologies and apply them on developmental activities. ToexplaintheoutlinesofEMP. To Explain The Procedure On Environmental Audit. To Provide An Overview Of Environmental Legislation. Toreviewafew EIA reports. To make students understand the fundamental principles, sensors characteristics and applications of different types of remote sensing. To introduce students the importance of spatial mapping and modeling in GIS for natural resources management.	
6	Credit Value	6	

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IV	EIA Methodologies Different EIA Methods- (Rapid, Comprehensive, Adhoc, Checklist, Matrix, Network, Environmental Media Quality Index and Overlay Methods). Impacts of Development Activities on Environmental Components: Deforestation -Causes, Effects and Control Measures, Guidelines for Preparation Of EnvironmentalImpact Statement.	18
V	Remote Sensing: types of Remote Sensing, Electromagnetic spectrum;, satellite and Sensors, , Application of remote sensing GIS and GPS and its role in environmental conservation.,Application of GIS.	18

Keywords/ Tags:

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Raizer, V (2017) Advances in Passive Microwave Remote Sensing of Oceans 1st Edition CRC Press
2. Solimini, D., (2016) Understanding Earth Observation: The Electromagnetic Foundation of
3. Remote Sensing (Remote Sensing and Digital Image Processing) 1st Edition, Springer;
4. Estes J. E., and Senger, L.W. (1973), Remote Sensing Techniques for Environmental
5. Analysis, John Wiley and Sons New York.
6. Fischer, and Nijkamp, P (1993). Geographic Information Systems Spatial Modeling
7. and Policy Evaluation, Springer Verlag.
8. Fundamentals of Ecology: Eugene P. Odum, (Natraj Publishers, Dehradun.)
9. Environmental Biology: P. D. Sharma (Rastogi Publications, Meerut)
10. Ecology and Environment: P. D. Sharma (Rastogi Publications, Meerut)
11. Environmental Biology: M. P. Arora (Himalaya Publishing House, New Delhi)
12. Toxicology – Principles and Methods: M. A. Subramanian, MJP,
13. Publishers, Chennai,2004
14. Environmental Biology:Principles of Ecology: P.S. Verma (S. Chand Ltd,2000)

Suggested Continuous Evalution Methods:
Maximum Marks:
Continous Comprehensive Evalution (CCE): **University Exam (UE):**

3/9/25

Professor & Head
School of Environmental Biology
A.P.S. University, Rewa (M.P.)

Practical Paper: Scheme C12 for Two Year PG Program		

Practical Paper: Scheme B-1 for Two Year PG Program			
Program:	**Class:** M.Sc.IV Semester	**Year: 2025**	**Session:** 2025-26
Subject: **ENVIRONMENTAL [redacted] BIOLOGY**			
1	Course Code	**PC42**	
2	Course Title	Environmental Resources ,Remote sensing and GIS	
3	Course Type		
4	Pre-Requisite (if any)		
5	Course Learning Outcome (CLO)	1. Students will understand the important resources and monitoring techniques 2. To Explain Various stages of the EIA process in India. 3. To Provide knowledgeone various aspects of Environment Impact Assessment Methodologies and apply them on developmental activities. 4. ToexplaintheoutlinesofEMP. 5.To Explain The Procedure On Environmental Audit. 6. To Provide An Overview Of Environmental Legislation. 7.Toreviewafew EIA reports.	
6	Credit Value	4	
7	Total Marks	Max. Marks:	Minimum Passing Marks:

3/9/25

Professor & Head
Department of Environmental Biology
R.B.S. University, Agra (U.P.)

Department of Environmental Biology, A.P.S.U. Rewa (M.P.)

Value Added Courses (Syllabus)

On

Mushroom Cultivation

M.Sc. IV Semester

Course 1: Mushroom Cultivation

Unit 1

(3 hrs.)

Introduction: General history, edible mushrooms and poisonous mushrooms. Common Indian mushrooms, nutritional values, medicinal values and advantages. Systematic position, morphology, distribution and structure of various species of mushrooms.

Unit 2

(3 hrs.)

Cultivation: Paddy straw mushrooms-substrate, spawn making. Methods: Bed method, polythene bag, field cultivation. Oyster mushroom cultivation-substrate, spawning, Pre- treatment of substrate.

Unit 3

(3 hrs.)

Maintenance of mushroom diseases-common pests, disease prevention and control measures. Processing-Blanching, steeping, sun drying, Canning, pickling, freeze drying. Storage-short term and long-term storage

Unit 4

(3 hrs.)

Production level, economic return, foreign exchange from mushroom. Cultivating countries and international trade. Mushroom based products.

Unit 5

(3 hrs.)

Practical approaches: Cropping, Harvesting, Packaging-Spawning, substrate preparation, Pasteurization, Incubation, colonization, Pinning, Harvesting.

Laboratory work (15 hrs.)

Mushroom culture

Spawn production and spawning

Making and casing beds

Growing conditions for mushrooms

Pests, diseases and growing mushrooms outside

Harvesting, storing and using mushrooms

Marketing of mushrooms and special assignment

03/09/25

Professor & Head
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