

**Scheme of Teaching, Learning & Examination leading to the Degree in Master of Science in the Programme
Environmental Science (Two year- Four Semester Degree Programme- C.B.C.S.)
(M.Sc. Part II) Semester III**

S. No.	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	L/T	Practical	Total		Theory+ MCQ External	Theory Internal	Internal	External		Marks	Grade
1	DSC-IX Terrestrial Pollution	EVS - 301	4	-	-	4	4	-	4	4	80	20	-	-	100	40	P
2	DSC-X Remote Sensing GIS & Computer Applications	EVS-302	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
3	DSE- I Environmental Impact Assessment & Audit.	EVS-303	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
4	DSE -II Pollution Control Technology	EVS-304	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
5	Lab- 5 Practical Based on DSC IX & X	EVSL-301&302 PR- V	-	-	6	6	-	3	3	*	-	-	-	100	100	50	P
6	Lab- 6 Practical Based on DSE I & DSE- II	EVSL-303&304 PR-VI	-	-	6	6	-	3	3	*	-	-	-	100	100	50	P
7	# Internship/ Field Work/ Work Experience@																
8	Open elective/ GIC/ Open skill/ MOOC* Landscape Design and management	OEC I	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
Total						28			26						600		

L: Lecture, T: Tutorial, P: Practical

Student may complete their Internship/ Field Work/ Work experience in First or Second or Third semester of Master of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

Note: Internship/ Apprenticeship/ Field Work Experience (during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 Credits for learning of 90hours. Its credits and grades will be reflected in final semester IV credit grade report.

-OEC (Optional) can be studied during semester I to IV

**Scheme of Teaching, Learning & Examination leading to the Degree in Master of Science in the Programme
Environmental Science (Two year- Four Semester Degree Programme- C.B.C.S.)
(M.Sc. Part II) Semester IV**

S. No.	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	L/T	Practical	Total		Theory+ MCQ External	Theory Internal	Internal	External		Marks	Grade
1	DSC-XI Environmental Toxicology and Hazardous Waste Management	EVS 401	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
2	DSC-XII Industrial Hygiene And Safety	EVS 402	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
3	DSC -XIII Environmental Policies and Legislation	EVS 403	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
4	SEC Nature, Conservation And environmental Management	EVS 404	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
5	Lab- 7 Practical Based on DSC XI, XII, XIII & SEC-I	EVSL-401,402,403,&404 PR-VII	-	-	6	6	-	3	3	*	-	-	-	100	100	50	P
6	Lab-8 Practical Based on Project	PR-VIII	-	-	6	6	-	3	3	*	-	-	-	100	100	50	P
7	# Internship/ Field Work/ Work Experience @																
8	Open elective/ GIC/ Open skill/ MOOC* Post-Harvest Technology for medicinal and Aromatic Plants	OEC	4	-	-	4	4	-	4	3	80	20	-	-	100	40	P
Total						28			26						600		

L: Lecture, T: Tutorial, P: Practical

Student may complete their Internship/ Field Work/ Work experience in First or Second or Third semester of Master of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

Note: Internship/ Apprenticeship/ Field Work Experience (during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 Credits for learning of 90hours. Its credits and grades will be reflected in final semester IV credit grade report.

-**OEC** (Optional) can be studied during semester I to IV.

Sant Gadge Baba Amravati, University, Amravati.
Faculty of Science and Technology
Programme – M.Sc. II (Environmental Science) CBCS

Syllabus prescribed for-

PG Programme

Programme :

M.Sc. Environmental Science

SEMESTER-III

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods /weeks
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EVS – 301

TERRESTRIAL POLLUTION

04

Course Outcomes

Upon completion of this Course successfully, students would be able to

1. Classify types and composition of solid wastes.
2. Aware about methods of transportation of solid waste in urban area.
3. Identify health hazards of typical solid waste.
4. Understand major industries as source of pollution.
5. Manage type of treatment and disposal to be provided to specific solid waste.

Unit	Content
Unit -I	Composition and Sources of solid waste: Ashes, residues, slag, grit, debris, dirt, masonry, garbage, rubbish, trash, dead animals, abandoned vehicles, industrial waste, agro-waste, sewage treatment residues. Urban and rural, agricultural and industrial, demolition, textile, paper and allied products, chemical and agro-chemical, and hospitals.
Unit-II	Collection, transportation and characterization of solid wastes: Waste storage devices, , collection equipment, alley, curb, backyard, block and curbside collections, transportation equipment, transfer station, long distance transports, processing of solid wastes for disposal, general properties, physical, chemical and biological properties of solid wastes, Bulkiness, combustibility, solubility.
Unit - III	Effects of solid wastes: Effects of mining and transportation activities, odor nuisance and occupational hazards, health hazards, social and aesthetic impacts of terrestrial pollution, interaction of terrestrial pollution with air and water pollution, agricultural land and their effects on environment,
Unit - IV	Pollution from production methods: Environmental effects of nuclear, thermal and hydel power production methods pollution from oil, coal, wood and agro-residues burning, food and chemical manufacturing industries, agro industries, fertilizers and pesticides, petroleum production, acid plants.
Unit - V	Management of solid wastes: Physical methods such as open dumping, sanitary landfill, ocean dumping, incineration, chemical methods such as

	pyrolysis, biological methods such as composting and vermi-composting, management of hazardous wastes, modern trends in solid waste management, recycling of waste materials, waste minimization technology.
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Recommended Books:

1. Principles of Environmental toxicology: -Ian C. Shaw and John Chadwick, Taylor and Francies
2. Environmental Toxicology and Chemistry: -Donald G. Crosfy 1998
3. Text book of modern Toxicology: - David A. Wright and Pamela Welbourn Cambridge University Press 2002. Ernest Hodgson and Patricia E. Levi Appleton and Lange Stamford etc U.S.A. 1995.
4. Basic Toxicology: - Frank C. Lu, Homisphere publishing Corporation, New York, Washington 1993.
5. Essentials of Toxicology: - Loomis TA, Lea Fabiger.
6. Toxicology: -Hayes.
7. Principles of toxicology: -Cassarett and Doulls.
8. Environmental Engineering: - M.Narayanrao.
9. Solid Waste Management in developing countries: -A. D. Bhide
10. Integrated Solid Waste Management:-George Tehbanoglous Theisen and Vigil.
11. Guide lines for setting up operating facility:-Hazardous waste management CPCB Manual, 1998.1. A. D. Bhide and B.B. Sundersen, Solid Waste Management in Developed Countries, INSDOC, New Delhi (1983)
12. Environmental Pollution and Toxicology: -S.P.Ray, Chaudhari, D.S. Gupta.
13. Environmental Engineering designing approach: -Arcadia P. Sincero Gregoria A. Sincero Prentice hall of India Pvt. Limited.
14. Encyclopedia of Environmental control technology (9 Vols. Set):- Paul N. Cheremisinoff Technip Book International.
15. Principal of Environmental Toxicology: -Ian C.Shaw & John Chadwick; Taylor and Frances
16. Environmental Toxicology and Chemistry. :- Donald G. Crosty 1998
17. Environmental Toxicology: - David A. Wright & Pamela Welbourn Cambridge University Press 2002.
18. Text book of modern toxi.:- Ernest Hodgson & Patricia E. Levi Appleton & Cange stamfend etc U.S.A 1995.
19. Basic Toxicology: - Frack C. Lu, Homisphere publishing Cerporation, New York, Washington 1993.

Syllabus prescribed for-

PG Programme

Programme :

M.Sc. Environmental Science

SEMESTER-III

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods/weeks
EVS -302	REMOTE SENSING, GIS AND COMPUTER APPLICATIONS	04

Course Outcomes

Upon completion of this Course successfully, students would be able to

1. Understand basics of Remote Sensing technique.
2. Apply to determine land cover and land use pattern.
3. Explain interactions of EMR to various layers in atmosphere.
4. Understand types, characteristics and platforms in remote sensing.
5. Interpret the aerial photographs.
6. Acquire basic knowledge of computer.
7. Describe Geographical Information System.

Unit	Content
Unit -I	Introduction to remote sensing: Definition, Historical perspective, Electromagnetic radiations(EMR), EMR spectrum, Radiation laws, Black body and real body radiation, Hemispheric reflectance, Transmittance, Absorbance,. Application of remote sensing in environmental studies: Land use / land cover; Wastelands; Forest, Forest fires; Water resources, Disasters; Wildlife habitat, Vegetation
Unit-II	Interaction of electro magnetic radiation (EMR) and remote sensing: With earth surface: reflection, transmission, spectral signatures. With the atmosphere: scattering, absorption, refraction, Types of remote sensing, Characteristics of remote sensing, Platforms and orbits: ground based, air borne, space borne Orbits: geostationary satellites and polar-orbiting satellites Sensors: MSS and TM scanners in landsat series, HRV scanners in spot series, LISS,
Unit - III	Aerial photography: Definition, Photogrammetry, Flight lines of vertical aerial photography, Types of aerial photography, Types of films, , Aerial photo interpretation. Applications of Remote Sensing: , , Geologic and Soil Mapping, Agricultural applications, Forestry applications, , Water Resource applications, Urban and Regional Planning application, Wetland Mapping, ,.
Unit - IV	Computer and statistical applications: History, characteristics and classification of computers, Application of computers;, Main parts of PC, , Basic elements and tools of statistical analysis, probability, Chi-square test, Arithmetic, geometric and harmonic means; Linear equations, Tests of hypothesis and significance.

Unit - V	Geographical information system (GIS): GIS: definition, capabilities and advantages, History of GIS, Objectives of GIS, Elements of GIS, Data model: Raster and vector data model, Data structures: relational, hierarchical and network data structures, Use of GIS in environmental management Components of GIS, GIS Workflow, GIS Categories, Levels/ Scales of Measurements.
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Recommended Books:

1. Principles of Remote Sensing: A.N. Patel and S. Singh, Scientific Publishers (India), Jodhpur (1999).
2. Remote Sensing of the Environment: J. R. Jensen, Pearson Education Inc, Delhi(2003).
3. Remote Sensing for Environment and Forest Management: A. Mehrotra and R.K. Suri, Indus Publishing Co., New Delhi (1994).
5. Remote Sensing for Large Wildfires: E. Chuvieco, Springer, New York (1999).
6. Introduction to Geographic Information System: Chang, Kangtang, Tata McGraw Hill, New Delhi (2002).
7. Geographic Information System: R. Ram Mohan Rao and A. Sharieff, Rawat Publication, New Delhi, (2002).
8. Textbook of Remote sensing and GIS (Third edition, 2006) by M. Anji Reddy BS Publication, Hyderabad
9. Fundamentals of remote sensing (Second edition, 2005) by George Joseph Universities press (India) Private Ltd., Hyderabad.
10. Remote sensing and image interpretation (Fifth edition, 2007) by Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chapman Wiley India publication, New Delhi .
11. Remote sensing of the environment (2000) John R. Jensen, Dorling Kindersley India Pvt. Ltd,
12. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991

Syllabus prescribed for-
Programme :
SEMESTER-III

PG Programme
M.Sc. Environmental Science

Code of the Course/Subject Periods\ week-	Title of the Course/Subject	Total number of
EVSL- 301 -302	Practical Based EVS 301 & 302 TERRESTRIAL POLLUTION & EMOTE SENSING GIS & COMPUTER APPLICATIONS	06

Expt.	Content
A. Experiments based on Terrestrial pollution:	
1	To Estimate the effect of Exhaust gases on chlorophyll content in different plants.
2	Analysis of Physical Parameters of Solid Waste.
3	Analysis of Chemical characteristics of Solid Waste
4	To compare chemical characteristics of soil by rapid tests.
5	Study on physical characteristics of soil.
6	Determination of organic matter by Walkley and Black method from soil.
B. Experiments based on Computer and Statistical Applications :	
1	Basic Program for standard deviations.
2	Basic Program for BOD/ COD/Hardness
3	Use of Excel program for data manipulations, functions and formulae, chart & graphs.
4	Use of MS-Word for creating document, tables, and graphs
C. Experiments based on G.I.S. :	
1	Interpretation of aerial photographs.
2	Use of GIS software for Environmental Studies.
3	Determination of height of the object in aerial photographs.
4	Interpretation of Satellite Images
5	Analysis of aerial photographs by using stereoscope
6	Indexing of Topo sheet.
7	To study the conventional signs and symbols from Toposheet.
8	Interpretation of Topo sheet.
9	To study of conventional signs and symbols from weather map.
10	Interpretation of weather map

Course Outcomes:

Upon completion of this Course successfully, students would be able to

1. Analyse solid waste for their properties.
2. Determine degree of contamination of soil.
3. Demonstrate programme on BOD/COD water parameters.
4. Interpret satellite imageries / aerial photographs.

Sant Gadge Baba Amravati University Practical Examination

External Practical V -Distribution of Marks (Duration - 6 Hrs) (Total Marks- 80+20=100)

Q.1 Any one Experiment based on terrestrial pollution.	20 Marks.
Q.2. Any one minor Experiment based on terrestrial pollution.	15 Marks.
Q.3 Any one Experiment based on Computer and Statistical Applications.	15 Marks
Q.4 Any one major Experiment based on Geographical Information systems.	20 marks
Q.5 Any one minor Experiment based on Geographical Information systems.	10 marks

Total – 80 Marks

Internal Practical – Distribution of Marks

1. Practical record	10 Marks
2. Attendance / Sincerity	05 Marks
3. Viva-voce	05 Marks

Total Marks - 20 Marks

Syllabus prescribed for-

PG Programme

Programme:

M.Sc. Environmental Science

SEMESTER-III

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods/week
EVS-303	ENVIRONMENTAL IMPACT ASSESSMENT AND AUDIT	04

Course Outcomes

Upon completion of this Course successfully, students would be able to

1. Understand concept of Environmental Impact Assessment and Statement.
2. Formulate EIA Reports.
3. Explain methodologies used in Environmental Impact Assessment.
4. Understand components, impact, advantages of EIA.
5. Explain Environmental Auditing.
6. Perform auditing methodology & prepare audit reports.

Unit	Content
Unit -I	Environmental impact assessment (EIA): Definition of EIA and EIS, , Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines- 1994 (Notification of Government of India).
Unit-II	Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible;); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.
Unit - III	Components of EIA: Environmental Setting; Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socioeconomic, air water, soil and noise environment. Public participation in EIA: Decision making, Public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.
Unit - IV	Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc., eco – labeling eco-marks, ecotourism, eco-feminism, Eco-regulation, eco-accountability, green management, green products, green claims, eco wars.
Unit - V	Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing; Designing and implementation of audit tools – pre audit activities – on site activities – post audit activities –

	Environmental statement – benefits of environmental audit – EA scenario in India – submission of Environmental Audit report in MoEF format.
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Recommended Books:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).
4. Environmental Impact Assessment & Management: Daya Publishing House, New Delhi (1998).
5. Using Environmental Management system to improve profits: B. Pearson, BFP Little and M. J. Brierley, Graham & Thotrman, Kluwer Academic Publisher Group, London (1992).
6. A monograph on Environmental Audit: The Institute of cost and works Accounts of India, New Delhi (1994)
7. Handbook of Environmental Impact Assessment (Vol. I): Judith Petts, Blackwell Science, USA (1999).
8. Handbook of Environmental Impact Assessment (Vol. II): Judith Petts, Blackwell Science, USA (1999).
9. Environmental Impact Assessment: A. Eillpin.
10. Environmental Impact Assessment and Management: H. Kumar (1998).
11. Environmental Impact Assessment of Tehri Dam: V. Govardhan.
12. Practical guide to Environmental Impact Assessment: Belly Bowers and Marriott (1977).
13. Environmental Impact Assessment: A. K. Shrivastava APH Publication 2003.
14. Law of Intellectual Property: Dr. S. R. Mysani Asia Law House (2nd Edition) Law Book Sellers, Publishers and Distributors Hyderabad.
15. Environmental Impact Assessment, L. W. Canter, McGraw Hill publication, New Delhi.
16. Proceedings Indo-US workshop on environment impact analysis and assessment (1980) NEERI, Nagpur.
17. Environment & Social impact assessment, Vlcany, F., Bronsetin DA (1995), John Wiley & Sons, New York.
18. EIA – A Biography. B. D. Clark, B. D. Bissel, P. Watheam.
19. Second world congress on engineering and environment 1985, Institution of engineers.

Syllabus prescribed for-

PG Programme

Programme :

M.Sc. Environmental Science

SEMESTER-III

Code of the Course/Subject Periods/weeks	Title of the Course/Subject	Total number of
EVS-304	POLLUTION CONTROL TECHNOLOGY	04

Course Outcomes:

Upon completion of this Course successfully, students would be able to

1. Understand the fundamental principles of pollution control.
2. Analyse and assess pollution control technologies.
3. Propose pollution control strategies.
4. Apply knowledge of pollution control technology to real-world scenarios.
5. Demonstrate proficiency in pollution monitoring and measurement techniques.

Unit	Content
Unit -I	Air Pollution Control Methods: - Need for control methods. Particulate emission control gravitational settling chambers, cyclone separates, fabric filters, Electrostatic precipitators, wet scrubbers. Control of gaseous pollutants – So ₂ , NO _x , CO, CO ₂ PAN & Hydrocarbons modifications of operating conditions. Automobile pollution control - control at source, fuel tank, carburetor, crankcase Exhaust emissions, Indian scenario.
Unit-II	Sewage and Industrial Waste Water Treatment: - The need for waste water treatment: Primary treatment (Sewage)-screens, grit chambers and oil separation & primary sedimentation. Primary treatment (industrial waste water) – segregation, equalization, neutralization, sedimentation, flotation & Oil separation. Secondary treatment -principal of biological treatment – waste stabilization ponds – Aerated lagoon, - Activated sludge process- trickling filters. Sludge treatment and disposal, preliminary operations- sludge thicker-sludge digesters, sludge conditioning- dewatering methods – sludge drying beds, vacuum filtration – filter process, centrifugation – sludge disposal methods.
Unit - III	Advanced waste water treatment: - Removal of suspended solid, dissolved solids, nitrogen, removal of phosphorous. Adsorption-refractory organics and their treatment – Reuse and recycle of waste water. Operation, monitoring & designing of Effluent treatment plants, including - primary, secondary and tertiary treatment for the industries Viz-Sugar,

	Pulp & Paper, Dairy, Textile, Distillery, fertilizer & petrochemical industries. Concept of common effluent treatment plant (CETP) and Public owned treatment plant (POTP).
Unit - IV	Radiation and Noise Pollution Control Measures: - Types of radiations, sources of radiations, biological effects of radiations, nuclear energy scenario, The nuclear dilemma. Introduction to noise pollution. The decibel scale – physiological, psychological effects of noise – Noise measurement Noise control criteria, Equipment for noise measurement – Noise control in industries.
Unit - V	Solid Waste Management: - Need of Solid Waste management, types of solid waste, biodegradable, refractory, and inorganic, industrial solid waste, pulp and paper, sugar, thermal power station, food processing, textile, urban and agricultural. Solid waste treatment: compaction, dewatering, briquette, size reduction, Solid waste disposal methods solid waste reuse: Recycling and incineration pyrolysis, biogas generation, solid waste as a source of raw material i.e. light weight bricks from fly ash, composting etc. Management of urban solid waste.

Recommended Books:

- 1) Air Pollution :- H.C.V. Rao, 1990.
- 2) Air Pollution & Control:- P. Pratapmouli G.N. Vekatasubbayya, Divya Jyothi. Prakashan, Jodhapur 1989.
- 3) Fundamentals of Air Pollution:- 2nd Ed. Arthur C.stern Acad. Press1984.
- 4) Pollution Control in Process Industries:- S.P. Mahajan, Tata Mc.Graw Hill Publications. New Delhi.
- 5) Meterology of Air Pollution:- R.S. Scores 1990. Ellis Harhood publication.
- 6) Air Pollution :- M.N. Rao, Mc Graw Hill 1993.
- 7) Waste Water Engineering, treatment, Disposal and reuses:- Metcalf and Eddy.
- 8) Water Supply & Sanitary Engineering :- R.C. Rangwala.
- 9) Introduction to Waste Water treatment process. :- Ramalho R.S.
- 10) Environmental Engineering :- Arcadvo. P. Sincero& Gregorial A.Sincero Prentice Hall of India Pvt. Ltd.
- 11) Ecotechnology for pollution control and environmental management:- R.K. Trivedy and Arvind Kumar Enviro. Media.
- 12) Water and Waste Water Technology:- Mark J. Hammer Joh Witteyt Sons.
- 13) Waste Water Engineering :- J.R. White.
- 14) Environmental Pollution and Engineering:- C.S. Rao.
- 15) Environmental Engineering:- M. Narayanrao.
- 16) Solid Waste Management in developing Country:- A.D. Bhide.
- 17) Integrated Solid Waste Management :- George Techbanogl Theisen and VigsI
- 18) Industrial Waste Water Treatment :- M.N. Rao & A.K.Dutta. Oxford 4 IBH Publ. House 1987.
- 19) A Treatise or Rural, Muncipal and Industrial water Management:-KVSG Murali Krishna.
- 20) Sewage Disposal and Air Pollution Engineering:- S.K. Garg 1990Khanna. Publication.
- 21) Water Supply and Sanitary Engineering:- G.S. Bridie & J.S. BridesDhanpat Rai & Sons. 1993 6th Ed.
- 22) Water treatment specification:- Frank rose Mc growl Hill 1985.

Syllabus prescribed for-
Programme:
SEMESTER-III

PG Programme
M.Sc. Environmental Science

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods\ week-
EVSL- 303 & 304	Practical Based EVS 303 & 304 ENVIRONMENTAL IMPACT ASSESSMENT AND AUDIT & POLLUTION CONTROL TECHNOLOGY	06

A. Experiments based on Environmental Impact Assessment (E.I.A.)	
1	To evaluate the impact of traffic density on mix environment.
2	To study pollution potential of diary effluent.
3	To draw the flow chart for industrial effluent treatment.
4	To compare the impact of chemical pesticides vis-a-vis biopesticides on micro flora.
5	To examine the effect of chemical v/s bio fertilizers on root ramification and plant growth.
6	Impact of air pollution on photo density flax of plant leaves.
7	Evaluation of impact of refuse on soil quality
B. Experiments on Pollution Control Techniques and Analysis :	
1	To study the effluent characteristics of pulp and paper industry.
2	Analysis of textile mill effluent
3	Estimation of MLSS, MLVSS from the sewage.
4	Determination of chlorine demand for drinking water.
5	Determination of pollution load through leachate of solid waste dump
Course Outcome: Upon completion of this Course successfully, students would be able to	
<ol style="list-style-type: none"> 1. Gain the practical knowledge of environmental sample analysis. 2. Examine the impact of pollution on environment. 3. Investigate and analyze the quality of different polluted environmental samples. 4. Compare the effects of pollutants on plants and animals. 5. Understand the pollutant effluent treatment processes. 	

**Sant Gadge Baba Amravati University Practical Examination
Practical - VI**

External Practical -Distribution of Marks (Duration - 6 Hrs) (Total Marks- 80+20=100)

Distribution of Practical Marks (Duration - 6 Hrs) Total Marks: 100)

Q.1. Any one major Experiment on Environmental Impact Assessment (EIA)	25 marks
Q.2. Any one minor Experiment on Environmental Impact Assessment (EIA)	20 marks
Q.3. Any one major Experiment on Pollution Control Techniques	20 Marks
Q.4. Any one minor Experiments on PCT.	15 Marks

Total – 80 Marks

Internal Practical – Distribution of Marks

1. Practical record	10 Marks
2. Attendance / Sincerity	05 Marks
3. Viva-voce	05 Marks

Total Marks - 20 Marks

**Syllabus prescribed for-
Programme :
SEMESTER-IV**

**PG Programme
M.Sc. Environmental Science**

Code of the Course/Subject	Title of the Course/Subject	Total number of
Periods/weeks		
EVS -401	ENVIRONMENTAL TOXICOLOGY AND HAZARDOUS WASTE MANAGEMENT	04

Course Outcomes:

Upon completion of this Course successfully, students would be able to

1. demonstrate sound understanding of the concept of Environmental Chemistry and Environmental Toxicology
2. summarize the most relevant terms, principles, and methods in Environmental toxicology
3. recognize the importance of environmental changes and understand various aspects of air, soil and water chemistry
4. demonstrate sound understanding of the waste generation process and characteristics of different types of solid wastes.
5. apply recycling vis-à-vis resource recovery technologies for useful conversion of specific waste type to eco-friendly products.

Unit	Content
Unit -I	Scope and concepts of ecotoxicology and toxicology, Paracelsus's view of poison; clinical, environmental, economic toxicology; xenobiotic concentration and dose, calibration of Dose response curve, lethal, Lc50 and threshold concentration, acute, sub-acute and chronic toxicity; bioconcentration and biomagnifications, Toxicity Vs chemotherapy. Neurotoxicity, carcinogenicity, & mutagenicity.
Unit-II	Bio-assay techniques; study protocols to evaluation of toxicants. Tests for assessing carcinogenicity and muta toxicity of compounds. TLC techniques for determination of toxicants in water & vegetable samples.
Unit - III	Classification of toxicants: natural and synthetic toxins; chemicals classification and mode of action of pesticides. Recent trends in the use of pesticides. Plant toxins; Affla- toxins, ergots, pyrethroids. Heavy metal pollution caused by lead, arsenic, mercury, cadmium and chromium, their effect on human health.
Unit - IV	Hazardous waste management: Nature and scope of hazardous wastes, classification of hazardous substances and wastes, Hazardous wastes and air and water pollution control, physical forms and segregation of wastes, hazardous substances and health. Separation of waste at sources of

	generation for recovery plastic, paper, and metal etc. Need of hazardous waste management; type of wastes, biodegradable, refractory and inorganic, industrial wastes. Industrial sludge, radioactive wastes.
Unit - V	Waste treatment and disposal: - treatment and disposal of hazardous wastes, reduction, recycling and methods of wastes treatment, neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration Pyrolysis, wet-oxidation etc. landfill treatment for hazardous waste disposal & leachate management, land farming, Bioremediation.
Learning Outcomes: <ol style="list-style-type: none"> 1. Understand toxicology and associated terms. 2. Learn about everyday toxic substances. 3. Interpret a dose-response curve. 4. Acquire information about biological variation. 5. Define exposure types. 6. Familiarity with toxicity episode phases. 7. Basic understanding of risk assessment 	

Recommended Books:

1. Principles of Environmental toxicology:-Ian Chaw and John Chadwick, Taylor and Francies
2. Environmental Toxicology and Chemistry: -Donald G. Crosfy 1998
3. Text book of modern Toxicology: - David A. Wright and Pamela Welbourn Cambridge University Press 2002.Ernest Hodgson and Patricia E. levi Appleton and Lange Stamford etc. U.S.A.1995.
4. Basic Toxicology: - Frank C. Lu, Homisphere publishing Corporation, New York, Washington 1993.
5. Essentials of Toxicology: - Loomis TA, Leae Fabiger.
6. Toxicology: -Hayes.
7. Principles of toxicology: -Cassarett and Doulls.
8. Environmental Engineering: - M. Narayanrao.
9. Solid Waste Management in developing countries: -A.D. Bhide
10. Integrated Solid Waste Management: -George Tehbanoglous Theisen and Vigil.
11. Guide lines for setting up operating facility: -Hazardous waste management CPCB Manual, 1998.

Syllabus prescribed for-
Programme :
SEMESTER-IV

PG Programme
M.Sc. Environmental Science

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods/week
EVS-402	INDUSTRIAL HYGIENE AND SAFETY	04

Course Outcomes

Upon completion of this Course successfully, students would be able to

1. Describe importance of Industrial Safety.
2. do risk and hazard analysis in industry.
3. Identify specific industrial Hazards.
4. Prevent work-related injury and ill health to workers and to provide safe and healthy workplaces.
5. Promote occupational health and safety within organizations by communicating to workers and management about risks and hazards.

Unit	Content
Unit -I	<p>Industrial safety: History and development of safety movement, Need for safety, Safety legislation: Acts and rules.</p> <p>Safety policy: safety organization and responsibilities and authorities of different levels.</p> <p>Accident sequence theory, Causes of accidents, Accident prevention and control techniques.</p> <p>Plant safety inspections- Job safety Analysis and investigation of accidents, Role of safety committee and its formation, Safety awareness programme: motivation, education and training.</p>
Unit-II	<p>Risk assessment and management: Checklist procedure, Preliminary hazard analysis, What if analysis, Failure mode effect analysis, Hazard and operability (HAZOP) studies, Hazard analysis techniques: Fault tree analysis, Event tree analysis, General outline of DOW index, Risk estimation and management, Major hazard control, On-site and Offsite emergency preparedness.</p>
Unit - III	<p>Specific hazards: Identification of hazard, machine guarding, safety with hand tools/ portable power tools, Pressure vessel hazards and their control.</p> <p>Safety in material handling: hazards and safe Practices, safety with storage of materials, Electrical hazards: classification, safe work practices, Chemical hazards: laboratory safety, bulk handling of chemicals.</p> <p>Fire and explosion hazards, Fire detection, Prevention ,control, and extinguishments, Industrial layout, Industrial waste management.</p>
Unit - IV	<p>Industrial hygiene: Environmental stresses: physical, chemical, biological and ergonomic stresses, Principles of industrial hygiene, Overview of control</p>

	measures. Permissible limits. Stress, Exposures to heat, Heat balance, Effects of heat stress, Control Measures. Chemical agents , IS/UN classification, Flammables, Explosives, Water sensitive chemicals, Oxidants, Gases under pressure, Chemicals causing health hazards: irritants, asphyxiates, anesthetics, systemic poisons and carcinogens, Chronic and acute exposure, Routes of entry, , Occupational exposure limits, Engineering control measures, Principles of ventilation.
Unit - V	Occupational health: Concept of health and occupational health, Occupational and work related diseases, Levels of prevention, History of occupational health, Characteristics of occupational diseases, Essentials of occupational health service, personal protective equipment (respiratory and no respiratory)

Recommended Books:

1. Frank Lees Book on loss prevention in process industry, vol. 1 & 2.
2. Industrial safety / safety management – K.G. Mistry
3. Safety Management – Grimandi and siemens.
4. Safety supervision – Peterson
5. Eleventh edition of NSC, USA
6. IS 14489 On Safety Audit
7. Factories Act 1948
8. Environmental Protection & Law – H. V. Jadhav & V. M. Bhosale
9. Law Science & Environment – R. P. Ananad
10. Instrumental Methods of chemical analysis – Willard Merrit Dcan.
11. Analytical Spectroscopy – Chhatwal
12. Analytical Instrumentation – NEERI Publication
13. Analytical Chemistry – Kennedy
14. Instrumental Method –Sharma
15. A text Book of Quantitative Inorganic Analysis – A. L. Vogel
16. International Environmental Policy emergence and Dimension by L. K. Caldwell 1990.
17. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad(1993).
18. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999).
19. Environmental Toxicology and Chemistry: Donald G. Crosby Oxford University Press, USA (1998).
20. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd. USA (1998).
21. Principals of Environmental Toxicology: Ian C. Shaw and John Chadwick, Taylor and Francis, USA (1998).
22. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994).
23. Risk Assessment and Environmental Management: D. Kofi Asvite- Dually, John Willey & Sons, West Sussex, England (1998).
24. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004).

Syllabus prescribed for-
Programme :

PG Programme
M.Sc. Environmental Science

SEMESTER-IV

Code of the Course/Subject Periods/week	Title of the Course/Subject	Total number of
EVS -403	NATURE, CONSERVATION AND ENVIRONMENTAL MANAGEMENT	04

Course Outcomes:

After completing this course successfully, students would be able to:

1. Apply strategies for conservation of biodiversity;
2. Understand need for conservation of natural resources.
3. Demonstrate non-conventional Resources.
4. Describe Environmental System.
5. Identify Environmental problems and apply strategies to solve it.

Unit	Content
Unit -I	Biodiversity and resource conservation: Strategies for biodiversity conservation, Causes and Impacts of depletion in biodiversity; Endangered and threatened plant and animal species, Importance and need of conservation. Natural Resources: Mineral resources, Forest resources, Water resources; Environmental impact of resource exploitation, Wasteland reclamation, Wetland conservation; Watershed management, Rain water harvesting.
Unit-II	Environment Biotechnology: Vermiculture technology- Role of earthworm, process of vermin composting, applications; Bio-fertilizer technology- Definition, classification importance, prospects; Fermentation Technology- Bioreactor, pretreatment and purification, materials of the bioreactor,
Unit - III	Non-conventional energy sources and their programs in India: Biogas, Wind Mill (wind farm, Advantages and limitation, wind energy), Solar energy (SPV,ST), Geothermal energy, Nuclear energy, Hydro power (small hydal project), Tidal power
Unit - IV	ISO 14000: Definition, Standards (14001), TC-207, EMAR and EMAS, TAG. ISO 9000, ISO 14001, Relation between ISO 14001 and ISO 9000, Certification, Accreditation and Registration, Preparation for ISO 14000
Unit - V	Sustainable Development: Concepts of sustainable development; definition of sustainable development, Principles of sustainable development; barriers to sustainable development – health aspect of sustainable development; practices of sustainable development in India; Industrial and urban environmental problems in India: Industrial development – impact on resources depletion and pollution (case studies), environmental problems of urbanization.

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Recommended Books:

1. Biodiversity: K. C. Agrawal, Agro Botanical Publishers, New Delhi, India (1996),
2. Environmental Biology: S.N.Prasad, Campus Books International, New Delhi (2000),
3. Fundamentals of Biotechnology: S.S.Purohit and S.K.Mathur, Agro Botanical Publishers, New Delhi, India. (1990).
4. Environmental Biology: K. C. Agrawal, Agro Botanical Publisher, New Delhi, India. (1993).
5. Compendium of Environmental Statistics: Central Statistical Organization, Dept. of State. Ministry of Planning and Programme Implementation, Govt. of India. (1997).
6. Environment Pollution and Development: Prof. Chandra Pal, Mittal Publications, New Delhi (1999).
7. Environmental Guidelines and Standards in India: P. K. Goel and K. P. Sharma, Techno science Publications, Jaipur, (1996).
8. Global Environmental Chemistry: D. C. Parashar, C. Sharma and A
9. Mitra, Narosa Publishing House (1998).
10. Environmental Challenges and the Universities: AIN (1994).
11. Environment and Development: I. S. Grover and A. K. Thukval, Scientific Publishers, Jodhpur (1998).
12. CEE towards a green future – CEE Ahamedabad 1999.
13. Waste minimization – Prasal Modak
14. Towards an agro-ecosystem policy for India – A Damodharan
15. Environmental economics for sustainable development – Kumar

16. Ecology and economics: an approach to sustainable development – Sengupta

17. Environment, Development and sustainability – Bhaskar Nath
18. Water technology management challenges and choices – A.K

**Syllabus prescribed for-
Programme :
SEMESTER-IV**

**PG Programme
M.Sc. Environmental Science**

Code of the Course/Subject EVS-404	Title of the Course/Subject ENVIRONMENTAL POLICIES AND LEGISLATION	Total number of Periods/week 04
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Course Outcomes:

After completing this course successfully, students would be able to:

1. Describe the importance and methods of environmental education.
2. Understand and comprehend the knowledge of basic Environmental policies and legislation.
3. Understand the role of National/International NGOs and Governmental Organizations.
4. Explain basic legal terminology and legal reasoning in environmental protection.
5. Understand the judicial response to environmental issues in India.

Unit	Content
Unit -I	Environmental education programme: - Definition and background of environmental education, need and objectives of environmental education, Role of environmental education in the formal education, – role of various organization Govt. and non-Govt. sharing concerns in Env. Education
Unit-II	Environmental Education : Traditional methods of environmental education . Methods of education for sustainable development, Current problems in environmental education: Environmental education at various levels. Teachers training program. recent methods of environmental education.
Unit - III	Global environmental Controversies: Environmental movements and peoples responses; social, political and economic issues in the controversies over natural resources, silent valley, Narmada Project, Almatti dam project, Sardar Sarovar project, Tehri dam, Koyna dam, , , impact of Mathura refineries on Taj Mahal.
Unit - IV	Environmental Awareness and Conservation strategies: - Stockholm conference, Earth summit, Agenda-21 (Rio,1992) Johnsburg 2002),World commission on environment and development (WCED). World water council (WWC), World health organizations (WHO) ISI, EPHA, United Nations Environmental Programme (UNEP), International Union for conservation of Nature and Natural Resources (IVCN) World wide fund for Nature (WWF)
Unit - V	Environmental Laws: - Wild life protection Act, 1972, amended 1991. Forest (Conservation) Act, 1980, Indian forest Act (Revised) 1982, Air (Prevention and Control of Pollution) Act,1981 as amended by Act, 1987

	and rule 1982. Motor Vehicle Act, 1988. The Water (Prevention and Control of Pollution) Act, 1974 as amended up to 1988 and rules 1975. The Environ (Protection) Act, 1986 and rules 1991. Public Liability Insurance Act, 1991 Hazardous waste management and handling. Rules 1989 as amended up to 2003.
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Recommended Books:

1. Hand Book of Env. Laws, Acts, Rules, Guidelines, Compliance and Standard Vol. 1 & 2: R. K. Trivedi Environmental Edition: 1st 1996.
2. Pollution control Acts, Rules and notifications issued there under: Central Pollution Control Board April. 1995.
3. Environmental Protection and the Laws: C. N. Mehta, 1991.
4. Legal aspects of Environmental Pollution and its Management: Ed. S. M. Ali, 1992.
5. International Environmental Policy Emergence and Dimensions: by L. K. Caldwell 1990.
6. Lal's Commentaries on water, Air pollution laws along with the environmental (Protection) Act and rules 1986, 3rd Ed. 1992: Law Publisher India.
7. Universal Environment and Pollution law manual: S. K. Mohanty 1998.
8. Praes Distn. Environmental Laws in India: (Deep, Lated Edn).
9. Environmental Problems, protection and control Vol I & Vol II Ed: Arun Kumar.
10. Hand book of Env. Laws, Acts, Rules, Guidelines, Compliances and Standards VoL. 1 & 2 :- R.K. Trivedi Enviro media Edition:1st 1996
11. Pollution control Acts, Rules, and notifications issued there under: - Central Pollution Control. Board April. 1995.
12. Environmental Protection and the Law's:- C.N. Mehta, 1991.
13. Legal aspects of Environmental Pollution and its Management: - Ed.S.M. Ali, 1992.
14. International Environmental Policy Emergence and Dimensions: - by L.K. Caldwell 1990.
15. Lal's Commentaries on water, Air Pollution laws along with the environmental (Protection) Act, and rules, 1986, 3rd Ed. 1992:- Law Publisher India.
16. University Environment and pollution law manual:- S.K. Mohanty 1998.
17. Environmental Governance (the Global Challenge):- Lamont C. Hempel Affiliated East-West Press Pvt. Ltd. New Delhi.
18. Declaration of :- The stockholm conference, Rio, Rio +5 and Rio+10
19. Constitution of India [Referred articles from Part III, Part IV and Part IV A].
20. Praes Distn. Environmental laws in India :- (Deep. Deep, Lated edn.)
21. Environmental problems, protection and control Vol I and II Ed.:- Arun Kumar 1999.
22. Universal Environment pollution law Manual.:- S.K. Mohanty 1998

**PRACTICAL VII: LABORATORY EXERCISE BASED ON
PAPER EVS-401 & EVS-402**

Syllabus prescribed for-

PG Programme

Programme :

M.Sc. Environmental Science

SEMESTER-III

Code of the Course/Subject	Title of the Course/Subject	Total number of Periods\
EVSL-VII	Practical Based 401, 402, 403 & 404	week- 06
	1- ENVIRONMENTAL TOXICOLOGY AND HAZARDOUS WASTE MANAGEMENT, 2- INDUSTRIAL HYGIENE AND SAFETY. 3. NATURE, CONSERVATION AND ENVIRONMENTAL MANAGEMENT. 4- ENVIRONMENTAL POLICIES AND LEGISLATION	

A. Experiments on Environmental Toxicology :/ environmental education	
	Effects of radiation on Microbial genetic system.
	Designing of protocols to evaluate pollutants toxicity.
	To study absorption and accumulation of heavy metals by aquatic flora.
	Study of Bio-accumulation of pesticides in aquatic fauna.
	To collect the data of natural resources from local area.
	To collect the data of practices for waste management from your local area.
	To collect the data of environmental education awareness among the local people.
	Case study of daily waste collection practices in house hold.
	Collection and assessment of leaflets of pesticides, toxicity point of view.
	TLC techniques for determination of toxicants in water & vegetable samples.
B. Experiments on Industrial Hygiene and Safety :	
	To determine the ambient air quality in Industrial belt.
	Study of noise and dust pollution in flour mills.
	Design of settling tank.
	Design of Aeration tank.
	To study Environmental Status of Thermal Power Plant.
	Construction of wind rose and study of wind profiles
	Study of Categories of Fire Extinguishers.
	Find out the flash point of inflammable liquid.
C. Experiments on Natural Resource Management:	
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	(1) Identification and observation of Hot spot (Water Scarcity Area)
	2) Study of a forestation programme of social forestry.
	(3) To study the water shade management practices from local area.
	(4) To study the water harvesting practices from local area and prepare flow chart
Learning Outcomes	
<ol style="list-style-type: none"> 1. Evaluate pollution toxicity. 2. Formulate protocol for toxicity evaluation. 3. Performs monitoring of ambient air quality. 4. Performs to survey for environmental literacy. 5. Identify hazards at workplace. 6. Apply knowledge to control industrial accidents and hazards. 	

**Sant Gadge Baba Amravati University Practical Examination
Practical - VII**

Distribution of Practical Marks (Duration - 6 Hrs) (Marks 80+20= 100)

External Practical-

Q.1) One major experiment on Environmental Toxicology/ Environmental education.	20 Marks
Q.2) One minor Experiment on Environmental Toxicology/ Environmental education	15 Marks
Q.3) Experiments on Industrial Hygiene and Safety	20 Marks
Q.4) Experiment of Natural Resource Management	25 Marks

Total – 80 Marks

Internal Practical – Distribution of Marks

1. Practical record	10 Marks
2. Attendance / Sincerity	05 Marks
3. Viva-voce	05 Marks

Total Marks - 20 Marks

**Sant Gadge Baba Amravati University Practical Examination
PRACTICAL VIII: PROJECT Total marks – 100.**

The students are expected to study the local environmental problems related to the following aspects during their Project work.

- a. Urban Environmental Problems.
- b. Quality of water resources.
- c. Watershed management
- d. Biodiversity study and its conservation
- e. Quality of soil parameters.
- f. Ecotourism
- g. Wildlife management.
- f. Bioremediation.
- g. Health effects of pollution.
- h. Environmental and socio-economic impacts of various human activities.
- i. Environmental health, hygiene and sanitation.
- j. Environmental microbiology.
- k. Environmental Pollution

Or Based on all eight papers of the M.Sc. Environmental Science.

COURSE CODES:

SEMESTER-IV		
1	Terrestrial Pollution	EVS-301
2	Remote Sensing GIS & Computer Applications	EVS-302
3	Practical Based on EVSL-V	PR—V (on 301&302)
4	Environmental Impact Assessment & Audit.	EVS-303
5	Pollution Control Technology	EVS-304
6	Practical Based on EVSL-VI	PR-VI (On 303 & 304)
SEMESTER-IV		
1	Environmental Toxicology and Hazardous Waste Management	EVS-401
2	Industrial Hygiene and Safety	EVS-402
3	Environmental Policies and Legislation	EVS-403
4	Nature, Conservation And environmental Management	EVS-404
5	Practical Based on EVSL- VII	PR- VII (On 401, 402, 403 & 404)
6	Based on any aspect covered in M.Sc. syllabus.	PR-VIII (Project)

