

Sant Gadge Baba Amravati University, Amravati

*Scheme of Teaching, Learning & Examination
Leading to the Degree in Bachelor of Science in the Programme*

Environmental Science

In the Faculty of Science and Technology

(Three Years-Six Semester Degree Programme- (C.B.C.S.)

B.Sc. Part III

Semester V and Semester VI

Session 2024 –2025

Sant Gadge Baba Amravati University, Amravati

Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science in the Faculty of Science and Technology (Three Years-Six Semester Degree Programme-C.B.C.S.) (B.Sc. Part III) Semester V

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of-Exam Hours	Examination & Evaluation					Minimum Passing	
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks		
			L	T	P	Total	T/T	Practical	Total		Theory +MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	DSC-V: Pollution Control Technology	DSC-5S	6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
		DSC Lab-/Pr-5S			6	6		2.25	2.25	04			25	25	50	25	P
2	Mini-Project/Hands-on Training/Workshop/DIY related to Environmental Science		-	--	6	6	-	2.25	2.25	2	Internal Assessment by college/institute/department				50	25	P
3	Open Elective Course (OEC) GIC: EVS (5S)- Energy and Environment (Optional)	EVS/GIC -5S					75 hrs (during session) optional to extracurricular and co-curricular activities 1 Cr.										
4	Internship/Apprenticeship/Field Work/Work Experience						150 Hours cumulatively from Sem II to Sem V resulting into earning of 5 Credits (Minimum 120 Hours mandatory resulting into earning of 4 Credits)										

L: Lecture, T: Tutorial, P: Practical, DIY: Do It Yourself activity

Notes :

1. Internship/Apprenticeship/Field Work/Work Experience is Mandatory. It can be carried out cumulatively from Semester I to Semester V for a duration of 150 Hours resulting into earning of 5 Credits (Minimum 120 Hours resulting into earning of 4 Credits is mandatory for every student). Internship /Apprenticeship/Field Work / Work Experience will be conducted after I semester till Vth semester in vacations for minimum 120 hrs, cumulatively entailing 4 Credits. It's credits and grades will be reflected in final semester VI credit grade report.
2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- P
3. If DSC (excluding Mathematics) is Physics, then 2 Tutorial be added.
4. There shall be Skill Enhancement Module (SEM) in each course of DSC and DSE
5. OEC (Optional) can be studied during semester I to V, Its credits and grades will be reflected in final semester VI credit grade report. OEC may be opted from Sem I to Sem V. It is comprised of GIC, Skill Course and MOOC (through SWAYAM)
6. Minimum 10% of the total credits of the UG (Bachelor's Degree) programme, that is, at least 12 credits are mandatory to be earned by all the students from Ancillary Credit Courses as mentioned in Table A (SGBAU, Direction No. 76/2022, Date 06/10/2022)
7. Extra-curricular and co-curricular activities: Maximum 5 Credits may be earned through Extra-curricular and co-curricular activities, which will be an option to OEC (maximum 75 hours and 5 credits), so that students performing in such activities shall be given exemption from undertaking

Code of the Course/Subject	Title of the Course/Subject	(Number of Periods per week)
EVS(5S)/ Environmental Science	Pollution Control Technology	6

Course Outcomes:

- 1. CO1: Understand Types of air pollution control Pollution Technologies used in for Indoor and Ambient air pollution control.**
Upon completion of this course, students will be able to describe and explain the fundamental principles of specific technologies their processes applications and limitations to control Environmental Pollution.
- 2. CO2: Analyze pollutant for their identification and quantification.**
Students will be able to analyze year, water and soil for identification of pollutant and degree of pollution for their further control.
- 3. CO3: Apply Knowledge to identify which treatment is required to removal of specific pollutants.**
Learners will apply their knowledge physico-chemical properties and nature of pollutant for required unit process for its removal.
- 4. CO4: Identifies types of solid waste, their characteristic and its management.**
Students will categorize the solid waste and its composition for its further treatment and disposal.
- 5. CO5: Acquire knowledge of sources composition and control of automobile exhaust.**
Student will identify sources air pollutant releases from vehicles, and apply knowledge locally to minimize vehicular emissions.
- 6. CO6: Select Design pollution control methodology.**
Student will be competent in design and select to handle pollution control processes related to type, degree of pollution for its minimization and control.

Curriculum

Unit	Content	Lecture req
Unit-I	<p>General approche of air pollution :</p> <p>1.1 Sampling-Ambient and indoor, techniques.</p> <p>1.2 Anal tical Methods of analyses of Nitrogène di- oxide, Sulfur dioxide, Respirable Suspended Particulate Matter (RSPM) and Setttable Particulate Matter</p> <p>1.3 Air quality standards, émission standards given by CPCB and BIS.</p> <p>1.4 Integrated approches of air pollution control : City planning, zoning,</p> <p>1.5 Source correction Methods- By changing Raw material, technology replacement and Control at the source. National and International steps to control green house gases.</p>	12
Unit-II	<p>Air Pollution control Techniques.</p> <p>2.1 Particulate Control Devices (Dry) : Gravitational settling chambers, cyclone separators, Fabric filters; Electrostatic Precipitators.</p> <p>2.2 Wet collectors devices : scrubbers, Packed bed tower, Ventury Scrubber.</p> <p>2.3 Flaring, thermal incinération, catalytic oxydation.</p> <p>2.4 Control of other gaseous pollutants : Odor, Volatile Organic Compounds (VOCs), Oxides of Sulphur and Oxides of Nitrogen emissions.</p> <p>2.5 Control of automobile exhausts emissions. : Use of after burners, catalytic converters, engine modifications ; tuning, importance of good maintenance and Driving habits. Alternative fuels.</p>	14
Unit-III	<p>Waste Water Treatment Processes:</p> <p>3.1 Sewage water – Sources and Charactristics , need of treatment , Types waste water treatment</p> <p>3.2 Primary / Physical Traetment- Screening, grit chamber, aeration, oil and grease removal, sedimentation, coagulation, flocculation.</p> <p>3.3 Secondary / Biological Treatment Processes–Activated sludge process, trickling filter, UASB (upflow anaerobic sludge blanket).</p>	14

	<p>3.4 Advance / Chemical Treatment Process - Neutralization, chemical precipitation, adsorption, demineralization.</p> <p>3.5 Sludge- Origin, nature, type, characteristics, treatment and disposal.</p>	
Unit–IV	<p>Solid Waste Management.</p> <p>4.1 Management of municipal solid wastes (MSW): Sources, composition and characteristics.</p> <p>4.2 MSW Collection, Transportation and Treatment methods ; Open-dumping and sanitary landfills. Reduction, reuse and recycling of materials.</p> <p>4.3 Optional technologies for processing of MSW : Incinération, gasification, pyrolysis</p> <p>4.4 Hazardous wastes : Sources and characteristics. Safe storage, transport. Treatment of hazardous waste- Stabilisation. Disposal of hazardous wastes.</p> <p>4.5 Radioactive waste : sources, classification, health and safety aspects. Management of radioactive wastes.</p>	12
Unit–V	<p>Biomédical and Radioactive Waste Trématent</p> <p>3.1 Biomédical - Introduction, concept, sources and classification,</p> <p>3.2 Trématent and disposal (Recycle, composting and Incinération).</p> <p>3.3 Radioactive waste- Handling, storage ..</p> <p>3.4 treatment and disposal</p> <p>3.5 Case Studies: Nuclear Power Disaster.</p>	12
Unit - VI	<p>Industrial Health and Safety</p> <p>6.1 Characteristics of explosives, Flammables, toxic substances and Précautions during handling and storage and transportation.</p> <p>6.2 Health Safety : Respiratory Personal Protective Equipment (RPPE) ; types and avantages.</p> <p>6.3 Non- Respiratory Personal Protective Equipment (NRPPE). Sélections, use care and maintenance of non Respiratory protective Equipment. NRPPE : Head protection, ear protection, face and eye protection, hand protection, foot protection and body protection.</p> <p>6.4 Fire Safety : types of fire, and fire Extenguishers.</p> <p>6.5 Occupational health and Diseases.</p>	14

A. AIR POLLUTION

CO's

After completion of this course successfully, the students would be able to-

1. Sample ambient air pollutant: gaseous and Particulate matter (PM)
2. Acquire skill in analysis of major air pollutants; NO₂ SP₂, Setttable/ Suspended and Respirable Suspended Particulate Matter (SPM & RSPM).
3. Differentiate primary and secondary air pollutants.

Content-

1.1 Air Pollutant Sampling.

1.2 Secondary metabolites-

Concept and application of Alkaloids, Phenolics, saponins and Flavonoids.

Activities-

1. Standardization / setting of air sampling equipment.
2. Measurement of SPM/RSPM of ambient air.
3. Measurement of Setttable PM by manual method.
4. Sampling of NO₂ & SO₂
5. Quantitative analysis of selected air pollutants.
6. Submission of Report on Air Pollutant monitoring.

B. Water Pollution

CO's

After completion of this course successfully, the students would be able to-

1. Identifies degree of water Pollution.
2. Suggests, required water treatment process to be applied.

Content-

2.1 Identification of types of water Pollution.

2.2. Assessment of degree of pollution.

2.3 Characteristics of determined water pollution in polluted water.

Activities-

1. Sampling of Polluted water for different analysis.
2. Storage, transportation and preservation of sampled water.
3. Its quality analysis for suggestion of further treatment.
4. Submission of report with photographic evidence.

C. SOLID WASTE MANAGEMENT-

CO's

After completion of this course successfully, the students would be able to-

1. Categorize solid waste and its composition.
2. Demonstrate type of need of treatment to solid waste.

Content-

3.1-Municipal / Domestic Solid Waste characteristics.

3.2. Commercial / Industrial Solid Waste characteristics.

3.3 Biomedical Solid Waste characteristics.

3.3. Treatment processes.

Activities

1. Asses components of solid waste.
2. Measurement of generated quantity of Solid Waste on daily basis.
3. Study of Solid Waste Treatment and disposal method applied.
4. Submission of report

D. FIRE SAFETY-

CO's

After completion of this course successfully, the students would be able to-

1. Categorize solid waste and its composition.
2. Demonstrate type of need of treatment to solid waste.

Content-

- 4.1-Types of fires.
- 4.2- Causes of fires.
- 4.3-Acquire knowledge Of types of fire Extinguishers.
- 4.4- Handling of fire extinguishers.

Activities

1. To identify fire prone area.
2. Study of causes of fires.
3. Study of categories of different fire extinguishers.
4. Hands on training on fire extinguishers.
5. Submission of report

Textbooks and Reference Books

1. Environnemental Sciences- Jackson and Jackson
2. Environnemental Sciences- Tucker (1990)
3. Introduction to Environnemental Chemistry– A. K. De
4. Pollution control in process industries–S.P. Mahajan. Tata McGraw Hill pub. New Delhi
5. Water and Waste water technology–M. J. Hammer, John Wiley A & sons, New York 1986.
6. Introduction to waste water trématent process–R. S. Ramalho.
7. Current practices in Environnemental Engineering. (Vol.I&II) Alam Singh and U. S. Sharma. International Book Traders, Delhi-1997.
8. Basic environnemental technology: Jerry; A. Nathanson.
9. Hand book of environnemental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
10. Environnement and Health –Anthonyl. Rowland & Paul Cooper, 3rd edition -1989.
11. Air quality management by Stern, A.C.(Ed)1974.
12. Air pollution theory by Crawford.
13. Land pollution, causes and control by Harrusson and Laxon.
14. Soil and water conservation engineering by Schwab, S. D. Frevert, R.K. Edminster, T. W. and Barns, John Willey and sons.
15. Standard Methods for the Examination of water and waste water (1984) APHA,
16. Environnemental Sciences-Jackson and Jackson
17. Environnemental Sciences- Tuckeer (1990)
18. Introduction to Environnemental Chemistry– A. K. De
19. Pollution control in process industries– S. P. Mahajan. Tata McGraw Hill pub. New Delhi
20. Water and Waste water technology–M. J. Hammer, John WileyA & sons, New York 1986.
21. Introduction to waste water trématent process– R. S. Ramalho.
22. Current practices in Environnemental Engineering. (Vol. I & II) Alam Singh and U. S. Sharma. International Book Traders, Delhi-1997.
23. Basic environnemental technology: Jerry; A. Nathanson.
24. Hand book of environnemental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
25. Environnement and Health –Anthony I. Rowland & Paul Cooper, 3rd edition -1989.
26. Air quality management by Stern, A. C.(Ed)1974.
27. Air pollution theory by Crawford.
28. Land pollution, causes and control by Harrusson and Laxon.
29. Soil and water conservation engineering by Schwab, S. D. Frevert, R. K. Edminster, T. W. and Barns, John Willey and sons.

Sant Gadge Baba Amravati University, Amravati Syllabus Prescribed
for Three Year UG Programme
B.Sc. Part III Semester-V

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/hands-on/Activity)	(No. Of Periods/Week)
EVS (5S) / Environmental Science	Pollution Control Technology	02

COs

By the end of the Lab/Practical Course, generally students would be able to:

- 1) Understand and the types and their sources of released pollutants.
- 2) Acquire the skill of sampling and analysis of pollutant.
- 3) Explain pollution control technologies used in in Industries.
- 4) Demonstrates Industrial safety measures and fire safety.

* LIST OF PRACTICAL/LABORATORY EXPERIMENTS/ACTIVITIES ETC.

Air Pollution (Any Five)

- 1) Préparation of Wind rose Diagram of an area.
- 2) Détermination of NO_x in an ambient air.
- 3) Détermination of SO₂ in an ambient air.
- 4) Comparative détermination of CO₂ in the atmosphère by volumétrie method.
- 5) Mesurément of Smoke Density.
- 6) Détermination of Respirable Suspended Particulate Matter (RSPM).
- 7) Détermination of Setttable Particulate Matter by Fix Paper method.
- 8) Calibration of Air Sampler.

II. Water Pollution (Any five)

1. Détermination of Chemical Oxygène Demand value for industrial waste effluent.
2. Estimation of Mixed Liquor Suspended Solids (MLSS) in Activated sludge.
3. Estimation of organic matter from soil/sludge.
4. Préparation of Material Safety Data Sheet for laboratory chemicals.
5. Détermination of Energy content in biomass (Bomb Calorimetry).
6. Estimation of Na⁺ and K⁺ in water/effluent samples using Flame Photometer

Sant Gadge Baba Amravati University, Amravati Practical Examination (Environmental
Science), Semester V– (CBCS New)
Practical–I Pollution Control Technology

Sr. No.	Internal Practical Examination	Marks-25
1	Attendance (Entire Semester)	05
2	Performance and Participations in conduct of the practical for Entire Semester.	09
3	Activity participation and Report: Academic/Institute/Industrial/Field visit or any report activity related to the subject	03
4	Practical Record Book	05
5	Internal Viva-Voce	03

Sant Gadge Baba Amravati University, Amravati Practical Examination (Environmental
Science), External Viva-Voce

SEMESTERV– (CBCS New) Practical: Pollution Control Technology
Time–4 Hours Max Marks-25

Sr.No.	External Practical Examination	Marks-25
1	Air Pollution	10
2	Water Pollution - Major	05
3	Water Pollution – Minor	03
4	Sludge	03
5	External Viva-Voce	04

Code of the Course/Subject	Title of the Course/Subject	(Number of Periods per week)
EVS/GIC 5S	Energy and Environment	6

Course Objectives:	<ol style="list-style-type: none"> Learn types and availability of Energy resources & interaction of energy utilization with environment. Explain types & availability of energy resources. Describes renewable energy resources. Identify impact of energy utilization on environment. Adapt strategies to conserve energy. 	
Course Outcomes:	<p>After the completion of the course, student can –</p> <p>CO-1: Identifies weather energy resource is renewable or nonrenewable.</p> <p>CO-2: Demonstrates the non-conventional energy resources.</p> <p>CO-3: Identifies impact of utilization of energy on environment.</p> <p>CO-4: Compare availability, utility and implications of renewable and nonrenewable energy resources.</p> <p>CO-5: Critique the effectiveness of different conservation strategies for energy.</p> <p>CO-6: Justifies utility of energy resource among the its types.</p>	
Unit System	Contents	Workload Allotted (Hrs)
Unit-I	<ol style="list-style-type: none"> 1.1: Energy: Forms and Importance 1.2: Global Energy Resources, Renewable and Non-renewable Resources. 1.3: Nonrenewable Energy Resources: Classification, Physico-Chemical Characteristics 1.4: Energy Content of: Fossil Fuels, Coal, Petroleum and Natural Gas. 1.5: Distribution and Availability of Energy Resources 	12
Unit-II	<ol style="list-style-type: none"> 2.1 Principles of renewable energy; energy and sustainable development, fundamentals and social implications. 2.2. Worldwide renewable energy availability, 2.3. Renewable energy availability in India, 2.4. Brief descriptions on solar energy, wind energy, 2.5. Tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy 	12
Unit-III	<p>Renewable Energy Sources</p> <ol style="list-style-type: none"> 3.1: Principle and Generation of Solar Energy (photo-Voltaic) 3.2: Solar Water Heating System & Solar Ponds 3.3: Wind Energy, Geothermal Energy, Tidal Energy, OTEC 3.4: Energy from Biomass, Biofuels 3.5: Advantages and Disadvantages 	12
Unit-IV	<ol style="list-style-type: none"> 4.1 Biomass Energy: Introduction; 4.2 Photosynthesis Process; Biofuels; 4.3 Biomass Resources; Biomass conversion technologies-fixed dome; 4.4 Urban waste to energy conversion; 4.5 Biomass gasification (Downdraft) . 	12
Unit-V	<ol style="list-style-type: none"> 5.1. Green Energy: Introduction, 5.2. Fuel cells: Classification of fuel cells – H₂; Operating principles, 5.3. Zero energy Concepts. Benefits of hydrogen energy, 5.4 Hydrogen production technologies (electrolysis method only), hydrogen energy storage, 5.5 Applications of hydrogen energy, problem associated with hydrogen energy 	12
Unit-VI	<p>Future Aspects of Energy Use and Energy Conservation</p> <ol style="list-style-type: none"> 6.1: Current and Future Energy use Patterns in the World and in India 6.2. Evolution of Energy Use Over Time 6.3: Need for Energy Efficiency; Energy Conservation and Sustainability 6.4: Action Strategies for Sustainable Energy Management from a Future Perspective. 6.5 Energy Over-Consumption and its Impact on the Environment, Economy, and Global Change 	12

References:

1. Text Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) 1. Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2. Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication.Solarenergy, SubhasPSukhatme, TataMcGrawHill, 2ndEdition,1996. 16-2-2023 4

Reference Books:

1. Principles of Energy conversion, A. W. Culp Jr.,, McGraw Hill, 1996
2. Non-Convention EnergyResources, Shobh Nath Singh, Pearson, 2018

Sant Gadge Baba Amravati University, Amravati

Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science in the Faculty of Science and Technology (Three years- Six Semester Degree Programme- C.B.C.S.) (B.Sc. Part III) Semester VI

Sr.	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	T/T	Practical	Total		Theory + MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	DSE-I: Environmental Management and Conservation OR DSE-II: Global Climatic Issues	EVS-6S	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Lab-DSE-I: Environmental Management and Conservation OR DSE-II: Global Climatic Issues	EVS-6S PR	-	-	6	6	-	2.25	2.25	04			25	25	50	25	P
	Mini-Project/Hands-on Training/Workshop/DIY related Environmental Science				6	6	-	2.25	2.25	02	Internal Assessment by college/institute/department				50	25	P
	EVS 6S (GIC-5) (Optional) AI in Environmental Science	EVS 6S GIC-5	1														

L: Lecture, T: Tutorial, P: Practical, DIY: Do It Yourself activity

Notes:

1. Internship/Apprenticeship/Field Work/Work Experience is Mandatory. It can be carried out cumulatively from Semester I to Semester V for a duration of 150 Hours resulting into earning of 5 Credits (Minimum 120 Hours resulting into earning of 4 Credits is mandatory for every student). Internship /Apprenticeship/Field Work / Work Experience will be conducted after I semester till Vth semester in vacations for minimum 120 hrs, cumulatively entailing 4 Credits. It's credits and grades will be reflected in final semester VI credit grade report.
2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- P
3. If DSC (excluding Mathematics) is Physics, then 2 Tutorial be added.
4. There shall be Skill Enhancement Module (SEM) in each course of DSC and DSE
5. OEC (Optional) can be studied during semester I to V, Its credits and grades will be reflected in final semester VI credit grade report. OEC may be opted from Sem I to Sem V. It is comprised of GIC, Skill Course and MOOC (through SWAYAM)
6. DSE (DISCIPLINE/DEPARTMENT SPECIFIC ELECTIVE): A BASKET CONTAINING AT LEAST TWO COURSES/SUBJECTS SHALL BE PROVIDED, SO THAT STUDENT HAS A CHOICE FOR THE SELECTION.
7. Minimum 10% of the total credits of the UG (Bachelor's Degree) programme, that is, at least 12 credits are mandatory to be earned by all the students from Ancillary Credit Courses as mentioned in Table A (SGBAU, Direction No. 76/2022 ,Date 06/10/2022)
8. Extra-curricular and co-curricular activities: Maximum 5 Credits may be earned through Extra-curricular and co-curricular activities, which will be an option to OEC (maximum 75 hours and 5 credits), so that students performing in such activities shall be given exemption from undertaking OEC.

Sant Gadge Baba Amravati University, Amravati Syllabus
Prescribed for Three-Year UG Programme Programme: B.Sc.
III Semester-VI (CBCS)

Code of the Course/Subject	Title of the Course/Subject	Total Number of Periods/week
EVS(6S)/ Environmental Science	Environmental Management and Conservation	06

Course Outcomes:

1. CO 1: Understand the various fundamental management aspects for environment.
2. CO2: Acquire knowledge of strategies, tools and techniques like Environmental Impact Assessment, Environmental Audit, Remote Sensing, and Geographical Information System adapted to conserve environment
3. CO 3: Understand concept importance and types of Environmental Education.
4. CO4: Aware about rules and regulations and organizations related to Environmental Conservation.
5. Apply statistical knowledge and skill to environment related data for analyze data further decision making.

Curriculum

Unit	Detail Description/Content	Periods require
Unit-I:	<p>Environnemental Education :</p> <p>1.1 Définition, Need, Principles and objectives of environnemental éducation,</p> <p>1.2 Types of environnement éducation (Formal & Non Formal), stages of environnement éducation, current status of environnement éducation in India.</p> <p>1.3 Environmental Education & Awareness : Concept of environmental awareness, methods of environnemental awareness, rôle of environnemental éducation in awareness programmes,</p> <p>1.4 Rôle of NGO's in environmental éducation; environnemental awareness thorough mass media.</p>	12
Unit-II:	<p>Environmental Geology ;</p> <p>2.1 Mining : Types of mining, issues related with mining management, stratégies for conservation of minerals.</p> <p>2.2 Land Use Pattern, land dégradation and land management.</p> <p>2.3 Wetland- Definition, characteristics, importance, threates and its Conservation.</p> <p>2.4 Mangrove Forest : Définition, characteristics, biodiversité, importance, occurrence threates and its conservation,</p> <p>2.5 Westland ; Introduction, Causes and control measures.</p>	12
Unit-III:	<p>Wild Life Management –</p> <p>3.1 Wild life as a ressource, threats to Wild life. Indian Board for Wild life (IBWL).</p> <p>3.2 WWF, Wild life institutes in India. Wild life poaching. Wild Life Protection Act, 1972, Environnemental Protection Act, 1986.</p> <p>3.3 Biodiversity Conservation : Need of conservation ; National policy and goals;</p> <p>3.4 Methods of biodiversity conservation - in situ conservation (sanctuaires, National parks and biosphère reserve); ex-situ conservation (zoo, botanical gardens)</p> <p>3.5 C onventionon biological diversity (CBD), Biodiversity Act 2002.</p>	12
Unit-IV:	<p>Role of National and International Organizations in Environmental Protection :</p> <p>4.1 IUCN, UNEP, Man and Biosphère Programme (M.B.P.),</p> <p>4.2 Central and State Pollution Control Board. Ministry of Environnement and Forest (MOEF).</p> <p>4.3 Environmental Impact Assessment- Concept, scope and objectives,</p> <p>4.4 EIS, Public participation in EIA, avantages and désavantages of Public Participation.</p> <p>4.5 Environmental Statement Report : Introduction and Importance.</p>	12
Unit-V:	<p>Environmental Audit :</p> <p>5.1 Definition, propose, avantages, général approach to environmental audit.</p> <p>5.2 Introduction to Remote Sensing : Components, elements, types and applications.</p> <p>5.3 Satellite Images and Aerial photography, types and its interprétation.</p> <p>5.4 Geographical Information System (Concept and Avantages).</p> <p>5.5 Concepts of sustainability its types. Sustainable development, Principles.</p>	12
Unit-VI:	<p>Statistics:</p> <p>6.1 Introduction of statistics, biostatistics, Data : its types, tabulation of data, types of tables</p> <p>6.2 Représentation of Data diagrammatic représentation and graphical représentation of data.</p> <p>6.3 Statistical Methods: Mean, mode, median,</p> <p>6.4 Standard deviation, regression analysis.</p>	12

Sant Gadge Baba Amravati University, Amravati
Syllabus Prescribed for Three Year UG Programme:
B.Sc. III Semester VI

Code of the Course/Subject	Title of the Course/Subject	No. of Periods/week	EVS
(6S)/Environmental Science	Practical	2	

1.		<p>A) Experiments on Biodiversity :</p> <ol style="list-style-type: none"> 1. Détermination of Shannon Weiner Species diversity index to terrestrial animal communities. 2. Determination of Margalef diversity index to terrestriell animal communities. 3. Determination of Kothe’s Species Deficit index to aquatic organisms. 4. Photographic submission of flora and fauna.
2.		<p>B) Experiments on Environmental Management :</p> <ol style="list-style-type: none"> 1. Characterization of Wasteland soil. 2. Characterization of Wasteland water. 3. Characterization of wetland sediments. 4. Visit to near by mine/quarry 5. Survey of Environmental literacy in near by community. <p>C) Experiments on Environmental Management :</p> <ol style="list-style-type: none"> 1) Characterization of wasteland soil. 2) Characterization of wetland water. 3) Characterization of wetland sediments. 4) Visit to near by mine/quarry 5) Survey of Environmental literacy in near by community. <p>D) Experiments on Environmental Management :</p> <ol style="list-style-type: none"> 1. Characterization of wasteland soil. 2. Characterization of wetland water. 3. Characterization of wetland sediments. 4. Visit to near by mine/quarry 5. Survey of Environmental literacy in near by community. <p>E) EXPERIMENTS ON EIA:</p> <ol style="list-style-type: none"> 1. Evaluation of impact of refuse son soil quality. 2. Impact of air pollutants on plants leaves. 3. To examine the Effects biofertilizers versus chemical fertilizers on root ramification and plant growth. 4. To evaluate the impact of traffic density on environment.

A. Environment Education

CO's

After completion of this course successfully, the students would be able to-

1. Explain concept of Environment Education.
2. Learns need and importance of Environment Education.
3. Apply tools and mode of Environmental Education for effective awareness in the society and schools, where it is needed.

Contents-

Formal Environment Education.

Non – formal Environment Education.

Activities: (Field)

1. To assess Environment Education programme arranged by Governmental and Non – Governmental agencies in your local area; Society, Schools and Colleges.
2. To conduct Environmental Literacy Survey in neighborhood areas.
3. To conduct Environmental Awareness Programme.

B. Environmental Geology

CO's

After completion of this course successfully, the students would be able to-

1. Understand fundamental concept of Environmental Geology.
2. Acquire skill of to deal with local Environmental Geology related issues.

Contents- (Field Activities)

1. To study Local stone, soil, and boulders (murum) quarries and its impact on environment.
2. To study effect of sand mining on local nala's and rivers.
3. To identify and study local Land Use Pattern.
4. To study neighborhood Wetland for its Bio-geo-ecological study and local threats to its.

C. Wild Life Management

CO's

After completion of this course successfully, the students would be able to-

1. Aware about legal rules regulations for Conservation of Wild life.
2. Explain National Institutions working for Wild life Conservation.
3. Understand the concept of Biodiversity , its importance , conservation.

Contents:

Activities- (Field Activities)

1. Assessment of Local Biodiversity; Forest, aquatic, Soil/Litter etc.
2. To identify local threats to biodiversity.
3. Study of conservation strategies adapted for conservation of biodiversity.

D. Environmental Impact Assessment, Environmental Audit and Remote Sensing.

CO's

After completion of this course successfully, the students would be able to-

1. Understand the fundamental concept of Environmental Impact Assessment (EIA), Environmental Audit, Environmental Statement.
2. Acquire skill to Conducts Environmental Audit.
3. Demonstrates remote sensing and interpretation of aerial photographs.

Activities:

1. Identify post impact of local developmental Project on local Environment .
2. Prediction of impact of ongoing project on Environment.
3. To conduct Environmental Audit.
4. To conduct Green Audit
5. Interpretation of Satellite imageries / Aerial Photographs.

Reference Books:

- 1) Environmental economics for sustainable development– Kumar
- 2) Ecology and economics: an approach to sustainable development –Sengupta
- 3) Environment, Development and sustainability–Bhaskarnath
- 4) Water technology management challenges and choices – A.K. Barua. Biodiversity and environment – S. K. Agarwal
- 5) The Biological Diversity Act. 2002 and Biological Diversity rules 2004– National Biodiversity Authority India. 475,9th South cross street, Kalpalocwar Nagar, Neelangarai, Chennai – 600041.
- 6) Biodiversity measurement and estimation–D.L.Hawks
- 7) Biodiversity conservation–Global agreements and national concerns. RAMSAR sites CBD, Quarantine, Regulation, National Forestry policy, Biodiversity Act, Wild life protection Act.
- 8) Environmental Problems and Solutions by Asthana D. K.
- 9) Environmental Management by G. N. Pande
- 10) Pollution Management in Industries by R. K. Trivedi.
- 11) Indian Economy in International Perspective, 1994: Gaur K. D, Meshram P. J. Shashidharan K. L. ed. Sarup and Sons publishers Ansari Road, DaryaGanj New Delhi.
1. Environmental Economics, 2001: Madhu Raj ; Sarup and sons publishers, NewDelhi.
2. Environment & Social Issues, 2000: Sunit, Gupta Sarup and Sons Publishers, New Delhi.
3. Global Environment: Current Status, 2000: Sunit, Gupta Sarup and Sons Publishers, New Delhi.
4. Environmental economics for sustainable development account in gandvaluation 2001: Some issue in modeling Kumar (Pushpam).
5. Environmental Crisis and Management: Sunit, Gupta Sarupand Sons Publishers, New Delhi.
6. Ecology & economics: An approach to sustainable development and sustainability: Bhaskar Naath, Luc Hens, David Pimental.
7. Environmental Remote sensing By: Saumitra Mukharajee.
- 19 Hand Book of Env. Laws, Acts, Rules, Guidelines, Compliance and Standard Vol. 1 & 2: R. K. Trivedy Environmental Edition:1st1996.
20. Pollution control Acts, Rules and notifications issued the reunder: Central Pollution Control Board April. 1995.
21. Environmental Protection and the Laws: C. N. Mehta,1991.
22. Legal aspects of Environmental Pollution and its Management: Ed. S. M. Ali, 1992.
23. International Environmental Policy Emergence and Dimensions: by L. K. Caldwell 1990.
24. Lal's Commente vison water, Air pollution laws along with the environmental (Protection) Act and rules1986, 3rd Rd. 1992: Law Publisher India.
- 25 Environmental Problems, protection and control Vol I &Vol II Ed:Arun Kumar.
- 26 Remote Sensing and Image Interpretation:-Tomas M. Lilles and Ralph W. Keifer john Wiley and sons Inc. New Yark.
27. Introduction to Remote sensing:-James B. Campbell, Tylor and Franeis Ltd. London.
28. Fundamentals of GISN:- Michael N. Demers..
29. Remote Sensing application in appliedgeo sciences:-Sumitra Mukherjee, Milton Book Company.
30. Environmental Geography:- H. M Saxena, Milton Book Company.
31. Principles of Photogeology:-Singh.
32. Principles of Remote Sensing:-Currain.
33. Fundamentals of Photogeology:-S. N. Pandey.
34. Environmental Impact Assessment, L.W. Canter, McGraw Hill publication, New Delhi.
35. Proceedings Indo-US workshop on environment impact analysis and assessment (1980) NEERI, Nagpur.
36. Environment& Social impact assessment, Vlcany, F., Bronsetin DA (1995), John Wiley & Sons, New York.
37. EIA–A Biography. B. D. Clark, B. D. Bissel, P. Watheam

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION/ Lab-6 Environmental Management and Conservation Internal Practical examination		
Sr. No	Evaluation Criteria	Max. Marks: 25
1	Attendance/Active participation in Lab sessions, Regularity	5
2	Performance and Participations in conduct of the practical for Entire Semester.	5
3	Activity participation and Report: Field visit or any report activity .	5
4	Practical Record Book	5
5	Internal Viva-Voce	5

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION/ Lab-6 Environmental Management and Conservation External Practical examination TIME: 4 hours		
Sr. No	Evaluation Criteria	Max. Marks: 25
1	Any one experiment on Biodiversity conservation.	7
2	Any one experiment on GIS or Remote sensing.	7
3	Any one experiment on EIA / Environmental	7
4	Internal Viva-Voce	4
Total		25

Code of the Course/Subject	Title of the Course/Subject	(Number of Periods per week)
EVS/DSE -II (5S)/Environmental Science	Global Climate Issues	6

Course Objectives:	1. To know concept of Climate Change. 2. Understand the mechanism of Green House Effect. 3. To know effects associated with Climate Change, 4. Understand Climatic phenomena.	
Course Outcomes:	After the completion of the course, student can – CO1: Understand Earth’s past climate system. CO2: Aware about Energy balance on the surface of earth. CO3: Explain mechanism of greenhouse effect and causes of global warming. CO4: Identify causes of global warming and climate change. CO5: Involve and helps to mitigate climate change. CO6: Explain causes of global warming, as well as emission trends and driving forces that are responsible for fossil fuel emissions and deforestation. CO7: Understand anthropogenic climate change and its causes. CO8: Identify technological options to reduce emissions, their barriers and costs and co-benefits. CO9: Explain the understanding of climate mitigation in difference disciplines and the discipline's contribution to climate mitigation.	
Unit System	Contents	Workload Allotted (Hrs)
Unit-I	1.1: General Overview, -Why the Earth is a Nice Place to Live. 1.2: The Radiative Balance 1.3: The Earths Natural Greenhouse Effect 1.4: Green House Effect, An Overview- Mechanism. 1.5: Greenhouse Gases: 1.6: Sources of greenhouse gases, natural and anthropogenic	12
Unit-II	2.1: CO2 Emissions -Human Emissions of CO2, -How Much Carbon in the Ground, 2.2: Different Concerns of Rich and Poor Countries. 2.3: The Earths Carbon Reservoirs 2.4: Carbon Cycling: The Physical Carbon Pump, -The Biological Carbon Pump, 2.5: The Marine Carbon Cycle, - 2.6: The Terrestrial Carbon Cycle.	12
Unit-III	3.1: Introduction to Global warming 3.2; Past Trend of global warming. 3.3: Present trend of global warming. 3.4: Causes of global warming 3.5 Dynamics of global warming 3.6 Control measures.	12
Unit-IV	4.1: Climate and Weather. 4.2: The Earth’s Climate Machine. 4.3: Global Wind Systems 4.4: Weather and global climate 4.5: Climate Change- Concept. 4.6: Earth’s past climate	12
Unit-V	5.1: Natural causes of climate change. 5.2: Anthropogenic causes of climate change. 5.3: Present trend of climate change 5.4: Effect of climate change on- Weather. 5.5: Effect of climate change on- Water Resources 5.6: Global effects.	12
Unit-VI	6.1: Effect of climate change on- Agriculture 6.2: Effect of climate change on- Glaciers 6.3: Effect of climate change on- Sea level. 6.4: Major climatic phenomenon- El Nino-La Nina 6.5: Measures to control to Climate change 6.6: Problems of Climate Change in India	12
References:		
1. Krishnan, R., Sanjay, J., Gnanaseelan, C., Mujumdar, M., Kulkarni, A., & Chakraborty, S. (2020). <i>Assessment of climate change over the Indian region: a report of the ministry of earth sciences (MOES), government of India</i> (p. 226). Springer Nature.		

	<ol style="list-style-type: none"> 2. Pathak, H., Aggarwal, P. K., & Singh, S. D. (2012). Climate change impact, adaptation and mitigation in agriculture: methodology for assessment and applications. <i>Indian Agricultural Research Institute, New Delhi</i>, 302. 3. Khare, N. (Ed.). (2022). <i>Climate Change in the Arctic: An Indian Perspective</i>. CRC Press. 4. Ghosh, A. (2018). <i>The great derangement: Climate change and the unthinkable</i>. Penguin UK. 5. McNeeley, S. M. (2017). Sustainable climate change adaptation in Indian country. <i>Weather, Climate, and Society</i>, 9(3), 393-404. 6. Chapman, L. (2007). Transport and climate change: a review. <i>Journal of transport geography</i>, 15(5), 354-367. 7. Bernes, C. (2003). <i>A warmer world: the greenhouse effect and climate change</i>. Swedish Environmental Protection Agency (SEPA). 8. Physical geography by Savendra Singh 9. Physical Geology by P.K. Mukherji 10. Environmental Geography by Savendra Singh 11. Climatology: Atmosphere By- K. Siddharth (Kitab Mahal)
<p>Model Questions:</p>	<p>Short Type (At least 8):</p> <ol style="list-style-type: none"> 1. What is Green House Effect? 2. Give the names of greenhouse gases, 3. What is the difference between natural greenhouse effect? 4. Give the sources of greenhouse gases. 5. Which are the sinks for atmospheric CO₂? 6. What is climate change? 7. Give any two-climate change induced effects on earth. 8. What is global warming?
	<p>Long Type (At least 4):</p> <ol style="list-style-type: none"> 1. Explain mechanism of greenhouse effect. 2. What is the difference between natural and human induced green house effect? 3. Discuss concept and mechanism of climate change. 4. Discuss El Nino and La Nina.
	<p>MCQs for Internal Assessment (At least 8)</p> <ol style="list-style-type: none"> 1. ----- gas has comparatively most terrestrial radiation absorbing potential. a- CO₂, b-CH₄, c-N₂O, d-CFCS 2. The heat radiations reflected by earth to space are----- radiations. a- Infra-red b- Terrestrial, c- UV, d- Visible. 3. ----- gas is major component of Green House Gas. a- CH₄, b- CO₂, c- N₂O, d- CFCS 4. Concept of Green House is used ----- production in cold countries. a- Agricultural, b- Industrial, c- fishery, d- aquaculture. 5. ----- is the major sink of CO₂. a-Soil. b- forest, c-forest, d- Oceans. 6. El Nini phenomena occurs in ----- ocean. a-Indian, b- Atlantic, Pacific, d- Antarctic. 7. In India El Nini phenomena directly affects----- a- rainfall, b- atmospheric temperature, c- agricultural production, fishery. 8. The greenhouse gas used in cooling systems is-----. a- CFC, b- CH₄, c-N₂O, d- H₂O vapors.

Semester III: EVS/DSE -II Lab Course

Semester	Course Code	Course Name	Teaching Hours/week
I	: EVS/DSE Lab Course-1	Lab/Pr-Global Climatic Issues	4

Course Outcomes:	CO-1. Determine Carbon content in a major sink CO ₂ in soil. CO-2. Evaluate present weather trend. CO-3. Measures present weather parameters. CO-4. Handle, standardize and maintain the meteorological equipment. CO-5. Perform interpretation of local weather and climatic conditions. Identify types of rocks and minerals.	
	A) Experiments on water analysis	Incorporation of Pedagogies
1.	Determination of soil Carbon Content.	Sampling, Analysis, Field work comparative study, Assignment, project work.
2.	Measurement of humidity and relative humidity	
3.	Measurement of light intensity	
4.	Monitoring wind speed and direction	
5.	Monitoring wind speed and direction	
6.	Measurement of rain fall	
7.	Study of Local Climate	
8.	Comparative study of Local Temperature and Rainfall Data and variations in it.	
	D) Field Practical Based Activity / Assignments	
1	Visit to local Weather Station	
2	Study of world-wide climate change projects/ Measures	

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXTERNAL EXAMINATION B.Sc. III (Environmental Science), SEMESTER – VI			
DSE Lab/Pt- External		Max Marks: 25	Time: 4 Hrs
Question No.	Exercise	Marks	
1.	Two Experiment based weather parameters.	10	
2.	Experiments on Soil analysis	10	
5.	Viva Voce	5	

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INTERNAL		
S. No.	Assessment Criteria	Marks
1.	Record/ Assignments	7
2.	Attendance	6
3.	Participation in Activity/ Field visit- Submission of Report	6
5.	Student Overall Performance	6
Total		25