Tutorial Manual

For

Environmental Science, Sustainability and Renewable Energy (BE04000101)

B.E. Semester 4

Directorate of Technical Education, Gandhinagar, Gujarat

College Name :

Certificate

This is to certify that Mr./Ms. _____ _____ Enrollment No. _____ of B.E. Semester 4, _____ Engineering of this Institute (028) has satisfactorily completed the Tutorial work for the subject **Environmental Science, Sustainability and Renewable Energy (BE04000101)** for the academic year 202__-2__.

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Preface

Main motto of any laboratory/practical/field work is for enhancing required skills as well as creating ability amongst students to solve real time problem by developing relevant competencies in psychomotor domain. By keeping in view, GTU has designed competency focused outcome-based curriculum for engineering degree programs where sufficient weightage is given to practical work.

The awareness of environmental issues is spreading rapidly and has gained importance on a global scale, leading to better prospects for systematic studies in Environmental Science, Sustainability, and Renewable Energy. Over the last decade, a significant number of undergraduate and postgraduate courses in Environmental Science and Sustainability have been introduced in most universities in India. In addition, the University Grants Commission (UGC) has made Environmental Studies a mandatory component of the syllabus for all basic degree programs in the country.

Most newly introduced undergraduate courses in Environmental Science–related subjects include tutorial sessions. This laboratory manual enables students to familiarize themselves with the relevant topics in advance of the actual practical sessions, thereby generating interest and providing a basic understanding prior to performance. This, in turn, enhances the attainment of predetermined learning outcomes among students. The manual is designed to serve as a comprehensive reference.

The primary objective of this tutorial manual is to enhance students' skills and abilities to analyze and solve real-time environmental problems through the development of relevant technical and professional competencies. In line with the Gujarat Technological University (GTU) competency-focused, outcome-based curriculum, this manual acts as a structured learning tool to cultivate industry-relevant skills that are often challenging to achieve through conventional classroom instruction alone.

This course is designed to develop environmental awareness and foster sustainable thinking by addressing key environmental issues such as pollution control, waste management, sustainability, climate change, and the growing need for renewable energy. Students will acquire a sound understanding of the scientific principles underlying environmental degradation, the fundamentals and applications of sustainability and renewable energy technologies, and the role of engineering solutions in mitigating environmental challenges in a sustainable and responsible manner.

Utmost care has been taken while preparing this question book however always there is chances of improvement. Therefore, we welcome constructive suggestions for improvement and removal of errors if any.

Course Outcomes (COs):

CO-1 Highlight the importance of environmental sciences.

CO-2 Identify the types of pollution in society along with their sources, causes, effects & Mitigation.

CO-3 Explain the generation, impacts, and management of various types of wastes and describe the causes and effects of acid rain and ozone layer depletion.

CO-4 Describe the concepts of sustainability, climate change phenomena and green building principles.

CO-5 Recognize the role of Renewable Energy in sustainable development.

Sr. No.	Name of Tutorial	CO1	CO2	CO3	CO4	CO5
1.	**Introduction to Environment**	√				
2.	**Environmental Pollution**					
2.A	Water Pollution		√			
2.B	Air Pollution		√			
2.C	Noise Pollution		√			
2.D	Land Pollution		√			
2.E	Solid Waste			√		
2.F	Bio-medical Waste			√		
2.G	E-waste			√		
2.H	Acid Rain, Depletion of Ozone layer			√		
3.	**Sustainability**					
3.A	Definition, scope				√	
3.B	Sustainable development & Circular economy, SDGs				√	
3.C	Climate Change				√	
3.D	Green Building				√	
3.E	Concept of 4R's				√	
4.	**Renewable Energy**					
4.A	Conventional Vs Renewable Energy					√
4.B	Green Hydrogen					√

Index

(Progressive Assessment Sheet)

Sr. No.	*Assignments*	*Page No.*	*Date of performance*	*Date of submission*	*Assessment Marks*	*Sign. of Teacher with date*	*Remarks*
1.	**Introduction to Environment**						
2.	**Environmental Pollution**						
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3.D	Green Building						
3.E	Concept of 4R's						
4.	**Renewable Energy**						
4.A	Conventional Vs Renewable Energy						
4.B	Green Hydrogen						
Total							

Tutorial 1: Introduction to Environment and Environmental Science

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion / Poster or Infographic Preparation on following topics :

- Scope of Environmental Science.
- Components of environment and its relationship
- Environmental Degradation related case study
- Importance of environmental education.

Relevant CO: CO1

Objectives:

- To make individuals aware of the issue and understand the reasons behind environmental degradation.
- To encourage individuals to seek out knowledge about the environment and all of its components.
- To develop a sense of responsibility and perspective necessary for progressive actions towards the environment.

Tutorial 2: Water Pollution

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion/ Poster or Infographic Preparation on following topics:

- water pollution : Sources and its effects on Environment
- Different water quality standards (for India)
- Physical water quality parameters : Its sources, Effects and Permissible Limits
- Chemical water quality parameters : Its sources, Effects and Permissible Limits
- Eutrophication : Sources and its effects on Environment
- Case study on River water pollution and role of government for its prevention

Relevant CO: CO2

Objectives:

- To identify the sources of water pollution.
- To prohibit the discharge of toxic pollutants in quantities that might adversely affect the environment.
- To implement programs for the control of water pollution.

Tutorial 3: Air Pollution

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion/ Poster or Infographic Preparation on following topics :

- Air Pollution : sources and effects of air pollution on human health, plants and property.
- Air pollutants : Its classification, sources and effects of each
- Ambient Air Quality Standards
- Collection of Ambient Air Quality (For given city/location of different month of given year ,its comparision with standards)

Relevant CO: CO2

Objectives:

- To identify the sources of Air pollution.
- To discuss the effects of air pollution on human health, plants, animals and materials.
- To classify different air pollutants.

Tutorial 4: Noise Pollution and Land Pollution

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion/ Poster or Infographic Preparation on following topics :

- Noise Pollution : Effects of noise pollution on human health
- Land pollution : Sources and its effect on Environment
- Control of noise pollution
- Indian standards of Noise

Relevant CO: CO2

Objectives:

- To identify the sources of noise pollution and land pollution.
- To differentiate sound and noise.
- To use noise measuring instrument. (sound level meter)

Tutorial 5: Solid Waste- Generation and Management

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion / Hands on exercise / Poster or Infographic Preparation on following topics:

- Different types and sources of solid waste.
- Causes and effects of solid waste pollution.
- Methods for solid waste disposal.
- Collection of solid waste generation data (sources/types) of given city from solid waste management department/website and its comparison with other city.
- Current Solid waste Management practices of given city.

Relevant CO: CO3

Objectives:

- To reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste.
- To reduce adverse effects of waste on human health and environment.

Tutorial 6: Bio-medical Waste: Generation and Management

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion/ Survey and Questionnaire-based Study/ Poster or Infographic on following topics :

- Sources of bio-medical waste with its characteristics.
- Methods for treatment of bio-medical waste.

- Collection of different types of Bio medical waste generation data of given hospital .

Relevant CO: CO3

Objectives:

- To classify bio-medical waste.
- To differentiate infectious and non-infectious bio-medical waste.
- To identify sources of bio-medica waste.

Tutorial 7: E-Waste Generation and Management

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion / Poster or Infographic Preparation on following topics:

- Sources and types of e-waste
- Environmental and health impacts of improper disposal of e-waste
- Collection of different types of e- waste generation data of given institute/organization.

Relevant CO: CO3

Objectives:

- To classify e-waste.
- To understand the environmental and health impact of improper disposal of e-waste.
- To identify sources of e-waste.

Tutorial 8: Global Environmental Issues

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion / Debate / Data Collection and Interpretation of following topics :

- Major global Environmental issues : Causes & effects
- Acid rain : chemistry, causes and effects
- Ozone depletion : causes and effects
- Global Warming : causes and effects
- Carbon footprints

Relevant CO: CO3

Objectives:

- To creat the awareness about global environmental problems
- To Impart basic knowledge about the environment and its allied problems.
- To understand acid rain, ozone depletion, and climate change.
- To develop an attitude of concern for the environment.

Tutorial 9: Basic Concept of Sustainability

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ MCQ Quiz/ Case Study Analysis and Discussion/ Comparative Study (Traditional vs Sustainable practices) on following topics :

- Sustainable Development Goals
- Concept of Sustainability with reference to Environment
- Concept of circular economy

Relevant CO: CO4

Objectives:

- To understand sustainability and sustainable development.
- To study Sustainable Development Goals and circular economy.

Tutorial 10: Basic Concept of Green Building

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ Individual Seminar/ MCQ Quiz/ Case Study Analysis and Discussion / Data Collection and Interpretation on following topics:

- Green Building : fundamental principles & objectives
- Role of following organization with reference to Green Building:
  (1) LEED(2) IGBC (3) GRIHA (4) TERI

Relevant CO: CO4

Objectives:

- To encourage and promote green building practices performance and energy which promote the health and well-being of residents and occupant.
- To reduce energy use by increasing energy efficiency and conservation.

Tutorial 11: Concept of 4R ((Reduce, Reuse, Recycle, Recover)

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ Individual Seminar/ MCQ Quiz/ Case Study Analysis and Discussion / Hands on exercise on following topics:

- Principles of 4Rs
- Concept of 4R : For effective solid waste management system
- Reuse/ Recycle concept for effective Agricultural waste management
- Reuse/ Recycle concept for effective construction waste management

Relevant CO: CO4

Objectives:

- To understand the concept and principles of 4R.
- To reduce consumption at the source.
- To reuse goods as much as possible to extend their life cycle.
- To minimize waste generation and promote sustainable waste management practices.

Tutorial 12: Renewable Energy

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ Individual Seminar/ MCQ Quiz/ Case Study Analysis and Discussion on following topics :

- Conventional and renewable energy sources
- Renewable energy : Types and its generation
- Wind Energy : Generation, advantages and disadvantages
- Solar Energy : Generation, advantages and disadvantages
- Geo-thermal Energy : Generation, advantages and disadvantages
- Data collection of Wind Energy and Solar Energy generation plants capacity and actual generation (for India)

Relevant CO: CO5

Objectives:

- To understand the need for renewable energy.
- To differentiate between conventional and renewable energy sources.
- To study the principles, advantages and limitations of renewable energy sources.
- To recognize the role of renewable energy in sustainable development.

Tutorial 13: Green Hydrogen

Mode of activity:

Individual or Group Presentation / Interactive Quiz/ Individual Seminar/ MCQ Quiz/ Case Study Analysis and Discussion on following topics :

- Methods of green hydrogen production.
- Advantages and challenges associated with green hydrogen.
- Major applications of green hydrogen

Relevant CO: CO5

Objectives:

- To understand the concept of green hydrogen.
- To study hydrogen production using renewable energy sources.
- To learn about storage, transportation and applications of green hydrogen.
- To recognize the role of green hydrogen in future clean energy systems.

Environmental Science, Sustainability and Renewable Energy

(Subject Code: BE04000101)

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