GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering – Semester 6
Specialization / Minor Degree in Global Citizenship Personality Development
Subject Code : 116AQ02
Subject Name : Ecology, Environment, and Sustainable Development

Type of course : Compulsory

Prerequisite : Zeal to learn the subject.

Rationale :

1. To understand ecology, pollution, and depletion of natural resources
2. To understand the renewable energy resource management.
3. To develop the understanding of global efforts for sustainable development

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	4	70	-	30	-	100

Content :

Sr. No.	Content	Total Hrs
1	**Ecology:** History and scope of ecology, the ecosystem concept: Abiotic and biotic components, Importance of conserving **biodiversity**, threats to biodiversity, Energy input in ecosystem, **Biomass**, Concept of food web, **Ecological succession**: Primary and secondary process in succession, **Nutrient cycles** on the ecosystem (carbon cycle, nitrogen cycle, sulphur cycle, phosphorus cycle), man's impact on nutrient cycles, Carbon sequestration, **Microbial ecology:** microbial nutrition and growth, environmental factors affecting growth and control of microorganisms by physical and chemical agents, microbial interactions in the environment-symbiotic, beneficial and harmful.	8
2	**Meteorology and Climate Change:** Definition of weather and climate, Elements of weather and climate: solar radiation, air temperature, atmospheric pressure, wind, humidity, clouds, precipitation and visibility; Structure of the atmosphere based on vertical temperature profile, Ionospheres, Composition of the atmosphere, ozone in the atmosphere, aerosols, carbon compounds in the atmosphere and Green House Effect **(GHE); Tropical cyclones:** cyclogenesis and movement; thunderstorms, land and sea breezes, effects of severe weather- flood, land slide, lightning etc. **Climate change**: preliminary concepts, global warming, anthropogenic causes, consequences of global warming- sea level rise, changes in rainfall pattern and amount, impact on agriculture, fisheries, industries, human comfort etc., acid rain, ozone hole.	10

3	**Environmental Pollution :** **Water Pollution**: sources and consequences, characteristics of domestic, industrial, agricultural and plastic wastes. Sewage and industrial wastewater treatment methods, case studies. **Air Pollution**: Sources and classification of air pollutants, Radioactive and thermal pollution sources and their effects on surrounding environment, natural and anthropogenic sources of pollution, **Global Implication** of air pollution (Greenhouse gases, ozone layer depletion, photochemical smog and ozone, acid rain), Air pollution control equipments, effects of air pollutants on humans, animals, plants and properties. **Noise Pollution**: Basic properties of sound waves, Measurement and analysis of sound, Noise control and abatement measures, and Environmental problems associated with noise pollution. **Soil Pollution**: Responses of plants to soil pollution, changes in soil characteristics by waste disposal, sanitary landfills, mining wastes, and human activities.	10
4	**Environmental Management and Sustainable Development :** **Solid and Hazardous Waste Management**: Source, generation characteristics, collection and transportation, waste processing and disposal: Sanitary land filling, Biocomposting (aerobic, anaerobic, vermicomposting). **Energy and Environment**: Energy resources and their exploitation, conventional and non-conventional energy sources: Fossil fuels-coal, oil and nature gas: hydroelectric power: tidal, wind, geothermal energy, Biomass: solar collectors, photovoltaics, solar ponds. Resources of energy, energy use pattern in different parts' of the world and its impact on the environment. Environmental implications of energy use **Environmental Conservation and Sustainable Development :** Water conservation: Current status of water resources, watershed management, water harvesting. Mineral conservation: Reserves and resources of world mineral supplies, Environmental effects of extracting and using mineral resources, Approaches in mineral resource management - ecological approach; economic approach; ethnological approach; integrated resource management strategies. Definition and concepts of sustainable development; Sustainable development goals; Hurdles to sustainability; Environment and economics. **Global effort for sustainable development :** Individual, Societal, NGO's, Local and International efforts and role of UNO.	14

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	**25%**	**25%**	**20%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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Note : This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books :

1. Donald Ahrens C: Essentials of Meteorology - An introduction to the atmosphere (6th Ed.); Brooks/ Cole, Canada (2011).
2. Chapman, J.L. and Reiss, M. J. 2005. Ecology Principles and Applications, Cambridge University Press, London.
3. Boyle, G., Bob Everett and J. Ramage. 2003. Energy System and Sustainability, Oxford University Press, New York.
4. Sudhakara Reddy, and B. P. Balachandra. 2006. Energy, Environment and Development, Narosa Publishing House Pvt. Ltd., New Delhi.
5. H.S. Peavy, D.R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw Hill International Edition.
6. Metcalf and Eddy, Wastewater Engineering: Treatment, disposal Reuse, Tata-McGraw Hill education (India).
7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil, McGraw Hill Publication.
8. S.K. Garg, Environmental engineering Vol. I & II, Khanna Publication.

Course Outcomes :

Sr. No.	CO statement	Marks % weightage
CO-1	Students will be able to understand the concept of Ecosystem and Environment.	10%
CO-2	Students will learn about global environmental issues/problems and take steps to solve them.	25%
CO-3	Students will develop environmental management skills from the concept of recycling, reusing and reducing.	20%
CO-4	Students will understand the potential uses of natural energy sources for global development.	25%
CO-5	Students will know the global efforts (such as UNFCC, UNCED, OECD, etc.) for the sustainable developments.	20%

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Indicative Assignments/Tutorials :

1. Energy and its flow in the ecosystem (with diagram).
2. Impacts of Global Warming across the world and steps to reduce this issue.
3. Find at least 10 interesting facts that make up the ecosystem (include the abiotic and biotic factors).
4. Enlist 10 major current environmental problems of your locality and 5 major world's biggest environmental problem.
5. Describe how human activity has impacted your ecosystem? Give 2 specific examples of the human activity and be very specific of how it has changed or affected the ecosystem.
6. Find at least one specific example of conservation or sustainability efforts that have been used in your ecosystem.

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