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| **Course Code** | **21CEO310T** | **Course Name** | **Global Warming and Climate Change** | **Course Category** | **O** | **Open elective course** | **L** | **T** | **P** | **C** |
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| **Pre-requisite Courses** | *Nil* | | **Co-requisite Courses** | *Nil* | | **Progressive Courses** | *Nil* |
| **Course Offering Department** | | ***Civil*** | | | **Data Book / Codes/Standards** | *Nil* | |

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| **Course Learning Rationale (CLR):** | | | *The purpose of learning this course is to:* |  |  | **Program Outcomes (PO)**  **(1- Low, 2 – Medium, or High-3)** | | | | | | | | | | | |
| **CLR-1:** | *Gain knowledge about the earth system* | | |  |  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **CLR-2:** | *Study the basics of climate parameters and climate change causing elements* | | |  |  | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning |
| **CLR-3:** | *Understand importance of global warming* | | |  |  |
| **CLR-4:** | *Understand different mitigation measures against global warming and their protocol* | | |  |  |
| **CLR-5:** | *Explore renewable resource usage to reduce global warming* | | |  |  |
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| **Course Outcomes (CO):** | | | *At the end of this course, learners will be able to:* | |  |
| **CO-1:** | *Apply the acquired knowledge on earth system* | | | |  | *3* | *-* | *-* | *-* | *-* | *2* | *3* | *-* | *-* | *-* | *-* | *-* |
| **CO-2:** | *Identify the climate parameters and their impact due to human activates* | | | |  | *3* | *-* | *-* | *~~-~~* | *~~-~~* | *2* | *3* | *-* | *-* | *-* | *-* | *-* |
| **CO-3:** | *Identify the climate change impact in various sector* | | | |  | *3* | *-* | *-* | *-* | *~~-~~* | *2* | *3* | *-* | *-* | *-* | *-* | *-* |
| **CO-4:** | *Interpret different protocols related to climate change* | | | |  | *3* | *-* | *-* | *-* | *~~-~~* | *2* | *3* | *-* | *-* | *-* | *-* | *-* |
| **CO-5:** | *Implement and analyze reason behind global warming, mitigation measures of climate change* | | | |  | *3* | *-* | *-* | *-* | *~~-~~* | *2* | *3* | *-* | *-* | *-* | *-* | *-* |

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| **Unit-1: EARTH’S CLIMATE SYSTEM 9 Hours**  Introduction to earth system-hydrosphere, lithosphere, cryosphere, atmosphere and biosphere. Hydrological cycle and Carbon cycle. Atmosphere and its composition, Atmospheric stability and lapse rate, Ozone layer and its functions, Ozone depletion and ozone hole, Global warming and its impacts, Greenhouse gases and greenhouse effect, El Nino and La Nina |
| **Unit-2: CLIMATE INDICES AND EXTREME EVENTS 9 Hours**  Climatology, Paleoclimatology, Indian climate system and their classification, Role of land and ocean to regulate climate, Role of ice and wind to regulate climate, causes of climate change Milankovitch theory (natural cause), Human induced climate variations, Climate Extremes-Cyclones, thunderstorms, Tornadoes, Heat waves, Sea level rising-Ice melting, temperature rising, Floods and droughts. Energy balance of the earth |
| **Unit-3: PHYSICAL EVIDENCES OF CLIMATE CHANGE 9 Hours**  Climate change impact in different sectors- Agriculture, Forestry, Fishery, Socio economic impact – tourism, Evidences of warming and change in atmosphere/ ocean circulations. Sea level changes and Shore line changes. Polar ice, Isotopes, Ice melting and Ice core analysis, glaciers loss. Energy supply: Role of energy in development of human civilization, Emissions from energy generation. Role of energy in current climate change. |
| **Unit-4: INTERNATIONAL RESPONSES TO CLIMATE CHANGE 9 Hours**  Climate change organization and programs, History of IPCC and UNFCCC, IPCC- Assessment report highlights, UNEP, Need for international protocols of climate change, Kyoto protocol, Montreal protocol, UNDP - United nations development program, Carbon credit and Clean development mechanism. |
| **Unit-5: CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES 9 Hours**  Renewable and alternative energy technologies- Biomass, Solar, Hydro, Geothermal and Wind. Clean technology, biodiesel, compost, biodegradable plastics. Concept of sustainable development, Concept of carbon sequestration. Adaptation measures- Green building technology. Public awareness - Methods and ecology, economics and ethics: the missing links. Life cycle analysis, Role environmentalist. |

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| **Learning**  **Resources** | 1. *Dash Sushil Kumar, “Climate Change –An Indian Perspective”, Cambridge University Press India Private limited 2007.* 2. *Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge,2006.* | 1. *Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.* 2. *Jan C. van Dam, Impacts of “Climate Change and Climate Variability on ydrological Regimes”, Cambridge university press ,2003.* |

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|  | **Bloom’s**  **Level of Thinking** | **Continuous Learning Assessment (CLA)**  **- By the Course Faculty** | | | | **By The CoE** | |
| **Formative**  **CLA-I Average of**  **unit test**  **(50%)** | | **Life Long\***  **Learning**  **CLA-II- Practice**  **(10%)** | | **Summative**  **Final**  **Examination**  **(40% weightage)** | |
| **Theory** | **Practice** | ***Theory*** | ***Practice*** | ***Theory*** | **Practice** |
| Level 1 | Remember | 20% | - | 20% | - | 20% | - |
| Level 2 | Understand | 20% | - | 20% | - | 20% | - |
| Level 3 | Apply | 30% | - | 30% | - | 30% | - |
| Level 4 | Analyze | 30% | - | 30% | - | 30% | - |
| Level 5 | Evaluate | - | - | - | - | - | - |
| Level 6 | Create | - | - | - | - | - | - |
|  | **Total** | 100 % | | 100 % | | 100 % | |

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| **Course Designers** | | |
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| 1. Dr. Rajkumar Samuel, Hubert Enviro-Care Systems, Chennai | 1. Dr. E. S. M Suresh, NITTTR, Taramani, Chennai. | 1. Mr. K.C.Vinu Prakash, Assistant Professor, SRMIST |
| 2. Mr. A. Abdul Rasheed, CMWSS Board | 2. Dr. G. Dhinagaran, Asst. Professor, CES, Anna University | 2. Dr. K.Prasanna, Assistant Professor, SRMIST |