Course title: Basics of climate science			
Course code: NRC 131	**No. of credits**: 3	**L-T-P**: 30-15-0	**Learning hours:** 45
Pre-requisite course code and title (if any): None			
Department: Energy and Environment			
Course coordinator(s): Dr. Kamna Sachdeva		**Course instructor(s):** Dr. Kamna Sachdeva	
Contact details: kamna.sachdeva@terisas.ac.in			
Course type: Compulsory Core		**Course offered in**: Semester 1	

Course description

The aims of this course are to provide basic understanding about the climate system: its attributes, underlying processes, and the drivers of climate change. The course explores the physical processes that control sub systems of climate such as atmosphere and ocean. The course will include topics like water in atmosphere, severe storms, global warming, and energy budget to provide basic understanding about the important concepts underlying the climate-system and changes therein.

Course objectives

- To understand the essential principles of Earth's climate system and getting basic knowledge about Science behind the phenomenon of Climate Change.

Course content

Module	Topic	L	T	P
1.	Introduction to Climate Science Introduction to atmospheres: retaining the atmosphere, its vertical structure and residence time. Fundamentals of physical meteorology: perfect gas law and its atmospheric applications; Energy budget and greenhouse effect	8	4	
2.	Components of Climate Science Climate System and Interaction among components of climate system and feedback mechanisms. Water in the atmosphere; clouds and precipitation. Global climate change and Coriolis force, Coriolis force and storms.	6	4	
3.	Paleoclimatology Evidences of climate change; Ice and climate change; Isotope evidence for Climate Change; Heinrich events; Dansgaard-Oeschger events	6	4	
4.	Aerosol Science Introduction and overview of aerosols, radiative effects of aerosols: direct and indirect; scattering and absorbing behaviour of aerosols.	6	2	
5.	Climate Modeling Introduction to global and regional climate models, its applications and importance.	4	1	
	Total	**30**	**15**	**0**

Evaluation criteria

Course grades will be based on the following criteria:

- Test1: 20% (written test covering module 1)
- Test2: 20% (written test from module 2 and 3)
- Test 3: 20% (students will assessed based on assignment and presentation, detail understanding of any one meteorological instrument and its applications in climate studies will be presented by the students)
- Test 4: 40% (written test covering entire syllabus (module 1-5))

Learning outcomes

Upon completion of the course, students would be able to:

- Understand that any change /variability we are observing today is not arbitrary, everything has scientific basis (Module 1 to 5)
- Explain the workings of the climate systems and feedback mechanisms (module 1 and module 2)

Pedagogical approach

Lectures, tutorials, lab experiments and case studies

Material

Suggested Readings

Textbooks

1. Ahrens, C. Donald. Essentials of Meteorology. Brooks Cole, 2004.

Other Readings

1. Barbara J. Finlayson Pitts and James N. Pitts, Jr (2000). Chemistry of the upper and lower atmosphere- theory, experiments and applications Academic Press, San Diego
2. John H.Seinfeld and Spyros N.Pandis (2006). Atmospheric Chemistry and physics- from air pollution to climate change, John Wiley and Sons, INC
3. Potter, Thomas D (2003). Handbook of weather, climate, and water: Dynamics, climate, physical meteorology, weather systems, and measurements. John Wiley and Sons, USA

Additional information (if any)

- Research paper reading and discussions
- Symposium on latest work in the related areas

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided.

Course Reviewers

The course is reviewed by the following experts.

1. Ramesh P. Singh, Ph.D., Professor, Earth System Science and Remote Sensing, Department of Physics, Computational Science and Engineering, Schmid College of Science, Chapman University.
2. Professor Arun K. Attri, Atmospheric Chemistry and Aerosol Science Lab, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi**.**