18BSP604					Fundamentals of Atmospheric Sciences and Climate Change					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	0	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To introduce all atmospheric phenomena and their impacts on the Climate
- To integrate specific atmospheric processes such as clouds and aerosols into a multidisciplinary analysis of the Earth
- To overview the basic characteristics of remote sensing imagery and its applications
- To appreciate the role of atmospheric models for large scale weather and climate predictions

UNIT 1 FUNDAMENTALS OF ATMOSPHERIC PHYSICS 12 Hrs.

Nature and composition of the atmosphere, temperature gradient in the atmosphere, heating earth surface and atmosphere, Solar Radiation, Humidity, Processes that lift air, environmental lapse rate, Atmospheric stability, air pressure and winds, air pollution, global warming, climate change: global and regional, seasons in India.

UNIT 2 CLOUD PHYSICS AND AEROSOLS 18 Hrs.

Basic laws of thermodynamics and their applications in atmosphere, tropospheric aerosols: source, sink and transport, primary and secondary effects of aerosols, Nucleation and condensation, microphysics of warm and clod clouds, Thunderstorm Electrification, Clausius-Clapeyron equation, microphysics of warm and cold clouds, properties of aerosols in the atmosphere, radiative forcing of atmospheric constituents, Artificial Modification of Clouds and Precipitation, plume dispersion and atmospheric stability.

UNIT 3 REMOTE SENSING OF THE ATMOSPHERE 12 Hrs.

Fundamentals of remote sensing, Electromagnetic spectrum: laws and applications in the atmosphere, Energy interaction in the atmosphere. Active and passive remote sensors, different platforms of remote sensing, Sources of errors, data handling, satellite spectroscopy, applications of remote sensing in synoptic scale meteorology and climate change studies, space borne LIDARs, Earth Observation Satellite systems.

UNIT 4 FUNDAMENTALS OF ATMOSPHERIC MODELING 18 Hrs.

Equation of state, Continuity equations, Thermodynamic energy equation, momentum equation in Cartesian and spherical Coordinates, Hydrostatic and non-hydrostatic models, Altitude coordinate, Pressure coordinate, Boundary layer and surface processes, numerical solutions to partial differential equations, Numerical Weather Prediction, Significance of atmospheric modeling in monitoring climate change.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Identify the various processes taking place in the atmosphere such as solar radiation, humidity, precipitation, condensation, nucleation etc.

CO2 – Determine the effects due the imbalance of the atmospheric processes such as global warming, air pollution, climate change etc.

CO3 – Apply the microphysics of clouds formation, precipitation, pressure gradient in studying atmosphere changes through remote sensing.

CO4 - Describe various atmosphere instrumentations such as LIDARS, satellite sensors and remote sensing image acquisition methods.

CO5 – Generate equation of motion and continuity for the atmospheric modelling.

CO6 – Analyze the Numerical weather prediction in monitoring of climate change.

TEXT/REFERENCE BOOKS

1. Fundamentals of Atmospheric Modeling by Mark Z. Jacobson (Cambridge University Press, 2005).
2. The Physics of Atmospheres by John Houghton (Cambridge University Press, 2002).
3. The Atmosphere: An Introduction to Meteorology by Frederick K. Lutgens and Edward J. Tarbuck (Pearson, Eleventh edition).
4. Atmospheric Science: Principles, Processes and Applications by Smith Paul (Syrawood Publishing House, 2007).
5. Atmospheric Chemistry and Physics by Seinfeld and Pandis (Wiley Publications, 2012).
6. An introduction to atmospheric radiation by K. N. Liou, Academic press, San Diego.
7. Satellite Meteorology: An Introduction by Stanley Q Kidder and Thomas H. Vonder Haar, Academic Press.
8. Remote Sensing of Atmosphere by J. T. Houghton, F. W. Taylor and C. D. Rodgers, Cambridge Univ. Press, 1984.
9. An introduction to atmospheric physics, David G. Andrews, , Cambridge University press.