ADVANCED ATMOSPHERIC PHYSICS

PROF. MV SUNIL KRISHNA
Department of Physics
IIT Roorkee

INTENDED AUDIENCE : B.Tech (4th year), MSc (2nd year), MTech (1st year), Pre-PhD

INDUSTRIES APPLICABLE TO : Relevant for R & D based organizations such as ISRO, NCMRWF, IMD,DRDO.

COURSE OUTLINE :
This course attempts to impart knowledge on advanced aspects of atmospheric and space physics. Starting with the basics of inertial and non-inertial forces and various dynamical phenomenon it leads to understanding various important aspects such as atmospheric waves and instabilities. The second half of the course is devoted to the understanding of various phenomenon related to ionosphere, the coupling between solar energy and magnetosphere, single particle motion in a variety of electric and magnetic fields, formation of earth's radiation belts etc. This course can be an extension to the earlier NPTEL course: Introduction to atmospheric and space sciences.

ABOUT INSTRUCTOR :
Prof. MV Sunil Krishna carry research in the area of atmospheric and space physics. With specific interest in understanding the space weather effects on the neutral atmosphere and ionosphere by combining satellite, ground based measurements and modeling techniques. Our research group at IIT Roorkee tries to understand how intense solar prominences such as solar flares and coronal mass ejections effect the geospace in general and the mesosphere-thermosphere and ionosphere in particular.

COURSE PLAN :

Week 1**:** Atmospheric dynamics, Apparent forces, effective gravity, Coriolis force, pressure gradient force, gradient wind

Week 2**:** Thermal wind, continuity equation, perturbation theory and atmospheric waves

Week 3**:** Sound waves, gravity waves and Rossby waves, Momentum and energy transports by waves in the horizontal and the vertical

Week 4**:** Atmospheric instabilities, Atmospheric instabilities, dynamical instabilities, barotropic instability,

Week 5**:** baroclinic inertial instability, Necessary condition of barotropic and baroclinic instability.

Week 6**:** Combined barotropic and baroclinic instability. Kelvin-Helmholtz instability

Week 7**:** Ionosphere: Formation of Ionosphere, Chemical processes, Ionospheric conductivity

Week 8**:** Planetary ionospheres, Ionospheric exploration using rockets and satellites

Week 9**:** Langmuir probe, temperature measurements, airglow and aurora, radio wave propagation in the ionosphere.

Week 10**:** Magnetosphere: Earth as a magnet, solar wind, types and theory of solar wind

Week 11**:** Frozen-in magnetic field, interaction of solar wind with Earth's magnetic field and formation of magnetosphere, single particle motion in in homogeneous electric and magnetic fields

Week 12**:** Inter planetary magnetic field (IMF), geomagnetic storms, van-allen radiation belts, plasmasphere, coronal holes, CMEs, satellite observations of various plasma domains and plasma instabilities.