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|---|---|---|---|
| **Course title:** Geoinformatics for atmosphere | | | |
| **Course code:** NRG 184 | **No. of credits:** 3 | **L-T-P:** 15-15-30 | **Learning hours:** 45 |
| **Pre-requisite course code and title (if any):** Prior knowledge of remote sensing and image processing | | | |
| **Department:** Department of Natural and Applied Sciences | | | |
| **Course coordinator(s):** Dr Ayushi Vijhani | | **Course instructor(s):** | |
| **Contact details:** | | | |
| **Course type**: Elective | | **Course offered in:** Semester 3 | |

**Course description**

The analysis of satellite measurements is critical in weather, climate studies, air quality etc. and transforming these observations into information is a current challenge in the developing world. This course deals with study of earth's atmosphere using data obtained from geostationary and polar orbiting satellites for meteorological and atmospheric science applications. This course will provide fundamental understanding about meteorological and atmospheric remote sensing as well as operational and future satellite missions. It will also deal with satellite image interpretation for identification of several weather phenomena, cloud types, aerosols etc. This course will further focus on various applications of satellite-derived parameters in meteorology, weather forecasting, air quality and climate monitoring.

**Course objectives**

1. To provide fundamental understanding about meteorological and atmospheric processes and its association with coupled human – environment system.
2. To provide fundamental understanding about current and future satellite missions and weather forecasting.
3. To utilize satellite-based observations to monitor the environment, meteorological processes/phenomena and air quality.

**Course content**

| Module | Topic | L | T | P |
|---|---|---|---|---|
| 1. | **Fundamentals of Meteorological and atmospheric remote sensing**<br>The objective of this module is to gain familiarity with fundamentals of meteorological and atmospheric process through remote sensing.<br>Following topics will be introduced in the module.<br>Principles of Geoinformatics in Meteorology and Atmospheric sciences, Operational and future satellite missions for aerosols, clouds and trace gases (Terra/Aqua MODIS, Calipso, Cloudsat, AURA OMI, INSAT series etc.), Atmospheric Radiative transfer | 4 | | |
| 2. | **Weather observation from space**<br>The objective of this module is to gain familiarity with satellite image interpretation for identification of various weather and atmospheric phenomena. Following topics will be introduced in the module. | 3 | 4 | |

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|---|---|---|---|---|
| | Satellite Image interpretation (Visible, IR and Water vapor), Identification of cloud type, water vapour, precipitation and atmospheric aerosols from satellite imagery | | | |
| 3. | **Application of Satellite–derived parameters in Meteorology and atmospheric sciences**<br>The objective of this module is to gain familiarity with applications of satellite derived parameters for various domains. Following topics will be introduced in the module.<br>Atmospheric aerosols, trace gases and Air quality<br>Tropical cyclones (satellite tracking of cyclones, Dvorak's technique, genesis and intensity), Cyclone warning system in India and dissemination<br>Fog phenomena<br>Atmosphere-Ocean interactions (El Nino, La Nina, ENSO, IOD (Indian Ocean Dipole)<br>Indian summer monsoon–Onset, Active/Break cycles, retreat<br>Weather Forecasting and data assimilation | 8 | 11 | |

**Lab**

| **Module** | **Topic** | **L** | **T** | **P** |
|---|---|---|---|---|
| 1. | Introduction to SBDART and OPAC | | | 2 |
| 2. | Satellite image interpretation for identifying cloud types, water vapor, atmospheric aerosols, phenomena etc. | | | 4 |
| 3. | Introduction to Grid Analysis and Display System (GrADS) | | | 9 |
| 4. | **Group project**<br>The objective of this module is to give hands on experience on tools and techniques learnt throughout the course.<br>Students will undertake a group project on relevant topics. This module will consist of requisite data download, data processing, analysis and final presentation at the end of the semester | | | 15 |
| | **Total** | **15** | **15** | **30** |

**Evaluation criteria**

- Minor test 1: Written test (at the end of teaching of modules 1 and 2) -20%
- Minor test 2: Written test (at the end of teaching of modules3) - 20%
- Major test : Written test [at the end of the semester, full syllabus] - 30%
- Final presentation of group project (at the end of the semester) - 30% Final presentation of group project will be evaluated on following basis–
  - Novelty of the work (10%)
  - Oral presentation skills and logical flow of information (10%)

Viva (10%)

**Learning outcomes**

By the end of the course, students will:

- command a critical understanding of physical principles behind meteorological and atmospheric remote sensing [Minor test 1 and Minor test 2]
- be able to interpret satellite images for various meteorological and atmospheric phenomena [Minor test 2]
- be able to interpret information from various satellite derived parameters [Major test]
- enhance their knowledge in satellite remote sensing and ready to use this to achieve their professional career goals

**Pedagogical approach**

Lectures, lab exercises, tutorials, visits

**Course Reading Materials**


1. Ahrens C.D. (1999) Meteorology today, Brooks/Cole, 6th edition.
2. Cobb A.B. (2003) Weather Observation Satellites, Rosen PublishingGroup.
3. Kelkar R.R. (2007) Satellite Meteorology, B S Publications,Hyderabad.
4. Kidder S.Q. and Vonder T.H. (1995) Satellite Meteorology–An Introduction, Haar Academic Press, New York
5. Wallace J.M and Hobbs P.V. (2006) Atmospheric Science; An introductory survey book, 2nd addition, Academic press,Elsevier


**Advanced Reading Material**

Advanced reading material will be provided to the students as and when required.

**Recommended journals for reference**

1. Advances in Meteorology
2. Atmospheric Environment
3. Climate Dynamics
4. Journal of Geophysical Research
5. Geophysical research letters

**Additional information**

**Student responsibilities:** Attendance, Feedback, discipline

**Course Reviewers**


**Dr Shailesh Kumar Kharol**

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