

Indian Institute of Technology, Kanpur Proposal for a New Course

1. Course No: SPA601
2. Course Title: Space and Astronomical Instrumentation
3. Lectures per week: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional hours: (0-2): 0 (A), Credits $(3*L+2*T+P+A)$: 9, Duration of Course: Full Semester
4. Proposing Department: Space Science & Astronomy
5. Proposing Instructor: J. S. Yadav & Pankaj Jain
6. Course Description

(A) Objectives: The course aims to introduce students to instruments and detectors used in Space Science and Astronomy. It will introduce the basic principles and techniques, such as, detector design, calibration, background, space qualification and data acquisition used in this field. It will describe the challenges faced in the Space relative to ground based instruments. It will describe some instruments, such as, the India's first space observatory; Astrosat, LAXPC instrument on-board Astrosat, Moon and Mars missions in detail.

(B) Contents (preferably in the form of 5 to 10 broad titles):

S. no.	Broad Title	Topics	No. of lectures
1.	Introduction	Historical perspective, background, basics of space observations, differences w.r.t. ground based instruments, challenges	3
2.	Space observations (what we observe)	Electromagnetic spectrum, continuous and discrete spectroscopy, Cosmic rays, solar wind, solar flares, magnetic field, Spectroscopic techniques to deduce composition and physical properties	6
3.	Particle/Photon detectors & type (focussing & non-focussing)	Interaction of charged particles and photons with matter, electromagnetic wave detectors, charged particle detectors, such as, nuclear emulsions, GM counters, proportional counters, scintillators, semiconductor detectors etc.	8
4.	Basic techniques and past instruments	Modelling background, basic techniques in detector calibration, data acquisition and space qualification, challenges faced in space observations, effect of Earth atmosphere and past space instruments	8
5.	Planetary space missions	Moon and Mars missions, Planetary mapping, meteorites and moon samples	6
6.	India's first Space observatory: AstroSat	All five instruments which include all sky monitor, SXT telescope, LAXPC, CZIT instrument and UVIT telescopes (near optical and near UV)	5
7.	LAXPC instrument	detailed description of LAXPC instrument, challenges in realizing the payload, performance in space, data	6

(C) Pre-requisites, if any: N/A

(D) Short summary for including in the Courses of Study Booklet: Basic principles of space and astronomical instrumentation and detectors, electromagnetic wave and charged particle detectors, spec-

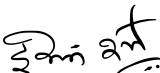
troscopy, spectroscopic techniques to deduce composition and physical properties, detector design, calibration, background, space qualification and data acquisition, detailed discussion of a few selected observatories, such as, AstroSat, Moon and Mars missions.

7. Recommended Books:

- Radiation detection and measurement, Gless F. Knoll
- High Energy Astrophysics, M. S. Longair, Volume 1 and 2

8. Any other remarks:

Dated: 23.06.2022 Proposer: Pankaj Jain

Dated: 23.06.2022 ~~DUGC~~/DPGC Convener: 

The course is approved/~~not approved~~

Chairman, SUGC/SPGC

Dated: