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भारतीय प्रौद्योगिकी संस्थान कानपुर
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

P.O.: IIT Kanpur, 208 016, Uttar Pradesh, India

ACADEMIC SECTION : UNDERGRADUATE OFFICE

Prof. Shashank Shekhar
Chairperson, SUGC

No. A(U)/New _Course/2025/UG/10/968
October 01, 2025

OFFICE MEMORANDUM

The SUGC, in its meeting 2025-26/1st, approved the proposal of the Space Planetary Astronomical Sciences and Engineering (SPASE) department to offer following new courses as detailed below:

Sl. No.	Course No.	Curse Credits	Course Title	Course Type
1.	SPA404	3-0-0-0 [9]	Introduction to Space Technology	REGULAR
2.	SPA405M	3-0-0-0 [5]	Space Economics, Law, Policy, and Benefits	MODULAR

The copy of the course proposals is enclosed for reference.

Shashank Shekhar

Copy to:

1. Dean, Academic Affairs
2. Associate Dean, Academic Affairs
3. All SUGC members
4. Heads of All Departments
5. OARS Section

SPA404

Indian Institute of Technology, Kanpur

Proposal for a New Course for Undergraduate studies

1. Course No: 4XX
2. Course Title: **Introduction to Space Technology**
3. Per Week Lectures: 3(L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours[0-2]:2 (A), Credits (3*L+2*T+P+A): 9, Duration of Course: Full Semester

4. Proposing Department/IDP : Space, Planetary & Astronomical Sciences & Engineering (SPASE)

   Other Departments/IDPs which may be interested in the proposed course:

   Other faculty members interested in teaching the proposed course:

5. Proposing Instructor(s): Soumyabrata Chakrabarty and Pankaj Jain

6. Course Description:

   A. Objectives: The objective of this course is to introduce the students from interdisciplinary Engineering streams to various topics of Space Technology which are imperative for the design, development, operation, and application of a spacecraft system.

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

S No.	Broad Title	Topics	No. of lectures
1	Introduction	Recapitulation of the basic concepts related to Earth's atmosphere, ionosphere, spacecraft orbits, earth's radiation belts etc.	2
2	Basics of launch vehicle design & Missiles	Injection into orbit with a conventional launcher, transfer phase, Hohmann transfer orbit, geosynchronous transfer orbit, positioning phase, different types of launchers: basic principles, specific impulse, rocket equation, Indian launch vehicles; elements of SLV, ASLV, PSLV, GSLV, SSLV, RLV.	5
3	Guidance, Navigation & Control (GNC)	The fundamental concepts of GNC systems for spacecraft, Analysis of spacecraft trajectories and attitude, design and evaluation of control laws for stability and performance, familiarization with sensors and actuators used in GNC systems, practical aspects of implementation in space missions	4
4	Fundamentals of mission trajectory design	Coordinate reference frames, space flight mechanics and attitude dynamics, Attitude parameterization (direction cosine matrix, Euler axis and angles, quaternions, Euler angles), attitude rates, attitude determination, Euler equation and attitude dynamics	3
5	Different segments of an artificial satellite	Space segments, power system, attitude and orbit control system, station keeping, thermal control, TT&C subsystem, payloads, propulsion system; earth segments; receive-only home TV systems, transmit-receive earth stations, large earth stations.	4

- Kadam, N. V., Practical Design of Flight Control Systems for Launch Vehicles and Missiles, Allied Publishers, 2009
- Wiesel, W. E., Spacecraft Dynamics, 2nd ed, McGraw-Hill 1997
- Noton, M., Spacecraft Navigation and Guidance, Springer 1998
- Charles Elachi, Jakob van Zyl, 'Introduction to the Physics and Techniques of Remote Sensing' John Wiley & Sons, Inc., Hoboken, New Jersey, 2006.
- Fawwaz t. Ulaby Richard K. Moore Adrian k. Fung 'Microwave Remote Sensing: Active and passive', Vol. 1, Artech House, 1981
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Reference Books:

- Iain H. Woodhouse, 'Introduction to Microwave Remote Sensing', CRC Press, Taylor & Francis Group, 2006.
- Alan C. Tribble, 'The Space Environment: Implications for Spacecraft Design', Princeton University Press, Princeton New Jersey, 2003.
- Gerard Maral, Michel Bousquet, 'Satellite Communications Systems, Systems, Techniques and Technology' John Wiley & Sons Ltd, 2009

8. Any other remarks:

S. B. Chakrabarty Pankaj Jain

Dated:05.08.2025 Proposer: Soumyabrata Chakrabarty and Pankaj Jain

Dated: 30-09-2025 DUGC/DPGC Convener:

The course is approved / not approved

Chairman, SUGC/~~SPGC~~

Dated:

SPA405M

Indian Institute of Technology, Kanpur

Proposal for a New Course for Undergraduate studies

1. Course No: SPA4XX
2. Course Title: Space Economics, Law, Policy, and Benefits
3. Per Week Lectures: 3(L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours[0-2]:0 (A), Credits (3*L+2*T+P+A): 5, Duration of Course: 6 weeks
4. Proposing Department/IDP : Space, Planetary & Astronomical Sciences & Engineering (SPASE)

   Other Departments/IDPs which may be interested in the proposed course:

   Other faculty members interested in teaching the proposed course:
5. Proposing Instructor(s): Abhay Gupta, Pankaj Jain/Soumyabrata Chakrabarty
6. Course Description:

   A. Objectives:

   By the end of this course, students will:

   - Understand the fundamentals of the global and Indian space economy, emerging markets, and commercialization models.
   - Analyze the legal and regulatory frameworks that govern space activities—both internationally and nationally.
   - Explore space policy as a strategic and developmental tool—national security, scientific research, disaster management, and digital infrastructure.
   - Evaluate socio-economic and environmental benefits of space programs, especially in emerging economies like India.
   - Apply interdisciplinary thinking to emerging space challenges such as space traffic management, debris mitigation, PPPs in satellite constellations, and lunar economy.

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

S No.	Module	Topics	No of Lectures
1	Foundations of Space Economy	Evolution of the global space economy; commercial vs. public space programs; new space race; Indian space ecosystem; case studies from SpaceX, ISRO, Pixxel, Skyroot, Piersight and other Indian startup companies.	2

- "Space Law: A Treatise" – Francis Lyall and Paul Larsen

Supplementary / Reference Material:

- ISRO, IN-SPACe and NSIL policy documents (Indian Space Policy 2023, IN-SPACe Technical Centre resources, Earth Observation Consultation Paper 2023)EO-Aug01-93Glimpses-Indian-Space-I...IN-SPACe-Technical-Cent...
- OECD Reports on the Space Economy
- World Economic Forum reports on Space for Sustainability and Satellite Services
- NASA Economic Impact Reports
- Academic papers on SSA, ADR, and debris mitigation

8. Any other remarks:

As part of the course assessment, students will complete a short essay or project that applies the concepts learned to real-world space scenarios. Options include:

- Writing a policy brief or analytical essay on a topical issue (e.g., regulating private spaceports, India's lunar ambitions, space traffic management frameworks).
- Preparing a business case or commercialization model for a space technology or service (e.g., EO-based crop insurance, satellite IoT platform, debris removal startup).
- Mapping the socio-economic impact of a space mission using data from sources like ISRO, NASA, or UN SDG indicators.
- Designing a foresight scenario for India's space economy in 2040.

Students may work individually or in teams, and are encouraged to draw from engineering, policy, economic, or entrepreneurial perspectives depending on their academic background.

Dated:05-08-2025. Proposer: Abhay Gupta

Dated: 30-09-2025 DUGC/DPGC Convener:

The course is approved / not approved

Chairman, SUGC/~~SPGC~~

Dated: