

Proposal for a new modular course

1. **Modular Course No:** SPA 6xx ~~627M~~ 627M
2. **Modular Course Name:** Introduction to fluid mechanics in space
3. **Class strategy:** Lectures per week: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional hours: (0-2): 0 (A), Duration of Course: half semester, Module credit: 5 (3-0-0-0)
4. **Proposing department:** SPASE
5. **Proposing Instructor:** Kartick Sarkar, Ishan Sharma
6. **Course Description:**

A. Objective: Fluid mechanics is used to describe the flows in a range of systems, starting from planetary atmosphere and the interior of stars to the flow of matter in the largest scale of the universe. This course intends to teach basics of the fluid mechanics and its applications to different astrophysical/geophysical systems.

B. Content:

i. **Basics of Fluids (3-4 L):** Fluid equations (in a rotating frame), concepts of Maxwell-Boltzmann distribution, equations of state in gas and radiation, concepts of viscosity and conduction

ii. **Fluid properties (2-3L):** Steady flow, vorticity (in planetary atmosphere), Reynolds number, Rossby number, hydrostatic equilibrium (planetary atmosphere, stellar atmosphere, adiabatic lapse rate), sound waves

iii. **Applications to geophysical system (4L):** Solar heating; global wind patterns: jet streams, Hadley circulation; shallow water approximation; geostrophic balance; Thermal wind; Taylor-Proudman theorem; sub- & super-geostrophic balance; cyclostrophic balance; potential vorticity; planetary waves

iv. **MHD (3L):** MHD equations and simple applications (flux freezing etc, magnetic pressure, alfvén velocity)

v. **Applications to astrophysical systems (4L):** Supersonic flow (nozzle flow), stellar wind, Parker's spiral, accretion disk

vi. **Instabilities (3L):** Rayleigh-Taylor (example in a supernova remnants), Kelvin-Helmholtz, convection (examples in stellar interior and planetary mantles), Jeans instability (example in star formation)

vii. **If time permits:** shocks and geo-dynamo

C. Prerequisites: None

D. Short summary for including in the course study booklet: Basics of fluid mechanics, Magneto-hydrodynamics, applications to astrophysical and geophysical systems.

7. Books and references:

1. *The Physics of Fluids and Plasmas:* Arnab Rai Choudhuri
2. *Atmospheric and Oceanic fluid dynamics:* G. K. Vallis
3. *Geophysical Fluid Dynamics:* J. Pedlosky

SSA

INDIAN INSTITUTE OF TECHNOLOGY KANPUR
POSTGRADUATE OFFICE

SCOM
28/8/24

No. A(P)/IITK/course approval/
August 27, 2024

The Convener, DPGC
Departments of SPASE
IIT Kanpur

I am directed to communicate the concurrence of the SPGC (2023-24) in its 11th meeting held on 01/08/2024 for the approval of new PG course proposal. After detailed discussion the following courses were approved.

Course No	Title	Credits	Instructor	SPGC Decision
SPA627M	Introduction to fluid mechanics in space	3-0-0-0-(5)	Dr. Kartick Sarkar Dr. Ishan Sharma	Approved
SPA628M	Introduction to Planetary Remote Sensing from Space Missions	3-0-0-0-(5)	DPGC Convener, SPASE	Approved
SPA629M	Introduction to Geology: Measuring the Heartbeat of a Planetary Body	3-0-0-0-(5)	DPGC Convener, SPASE	Approved



Assistant Registrar
Academic Affairs



CC: OARS (DOAA Office) For necessary action

MINUTES
FOR THE 11th MEETING OF THE SENATE POSTGRADUATE COMMITTEE (2023-24) TO
BE HELD ON August 1, 2024 (Thursday) AT 03:00 P.M.

Over Zoom (online)

Members present:

Prof(s): P M Mohite (AE), Vishal Agarwal (CHE), Chinmoy Kolay (CE), Abheejeet Mohapatra (EE), T H Syed (ES), Sukumar Vellakkal in place of Vasudha Jain (ECO), Feroz Hassn (HSS), Amit Shukla (DoMS), Malay Das in place of Santanu De (ME), Sudhanshu S Singh (MSE), Sudhansu Shekhar in place of Subhajit Dutta (MATH), Sharvari Nadkarni (SPASE), Laltu Chandra (SEE), Sagar Chakrabarty (PHY) (SPASE)

Members Absent: Prof(s), Suresh Kumar (BSBE), Ark Verma (CGS), Ashis Kumar Patra (CHM), J Ramkumar (DES), Shilpi Gupta(PSE), Piyush Rai (CSE), Sri Sivakumar (MSP), Pankaj Wahi (NET)

Student representative:

Shivam Nigam (19112264), Harsha Prasad (21106270), Nachiket (18102278)

Item requiring SPGC Approval:

a) Conversion from MSR/MTech to PhD Program:

S.No	Roll No	Name	Dept	Prog	Supervisor and DPGC Recommendation	SPGC Recommendation /Decision
01-	231180016	Sivani Biswal	BSBE	MTech	Recommended	Recommended
02-	231230006	Mo Zaid	ES	MTech	Recommended	Recommended

*Students has completed course and CPI requirement as per clause 4.6 of PG Manual

b) New course approval:-

course No	Title	Credits	Instructor	SPGC Recommendation /Decision
SPA627M	Introduction to fluid mechanics in space	3-0-0-0-(5)	Dr. Kartick Sarkar Dr. Ishan Sharma	Approved
SPA628M	Introduction to Planetary Remote Sensing from Space Missions	3-0-0-0-(5)	DPGC Convener, SPASE	Approved
SPA629M	Introduction to Geology: Measuring the Heartbeat of a Planetary Body	3-0-0-0-(5)	DPGC Convener, SPASE	Approved

Items requiring SPGC recommendation for Senate considerations:

a) Conversion of Programme Full Time to Part Time

S.No	Roll No	Name	Dept	Prog	Supervisor and DPGC Recommendation	SPGC Recommendation /Decision
1	19101268	Shiv Kumar	AE	PhD	Recommended	Recommended
2	21104030	Gedala Sai Praveen	EE	MTech	Recommended	Recommended

b) Termination (under clause 8.6)

S.No	Name	Roll No	Dept.	Prog.
01	Harshita Gupta	22127266	ECO	PhD

Sr.No. 1 Three times comprehensive exam failed.

Abheejeet Mohapatra
13/8/24