भारतीय प्रौद्योगिकी संस्थान कानपुर
INDIAN INSTITUTE OF TECHNOLOGY KANPUR
P.O.: IIT Kanpur, 208 016, Uttar Pradesh, India
ACADEMIC SECTION : UNDERGRADUATE OFFICE

Prof. Sagar Chakraborty
Chairperson, SUGC

No. A(U)/New _Course/2025/UG/14 /1022
December 9, 2025

OFFICE MEMORANDUM

The SUGC, in its meeting 2025-26/3rd, approved the proposal of the Physics (PHY) and Humanities and Social Sciences (HSS) departments to offer a new course as detailed below:

Sl. No.	Course No.	Credits (L-T-P-A)	Course Title	Course Type
1.	PHY211	11 [3-1-0-0]	Thermal Physics	REGULAR
2.	ENG409	9 [3-0-0-0]	Indian Grammatical Traditions	REGULAR

The copy of the course proposals is enclosed for reference.

Sagar Chakraborty

Copy to:

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

Indian Institute of Technology Kanpur

Proposal for a New Course

1. <u>Course No</u>: A **200 level (specifically PHY210, if available)** number requested.
2. *Course Title*: **Thermal Physics**
3. <u>No. of Lectures per week</u>: 3 (L), Tutorial: 1 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A),

   <u>Credits (3*L+2*T+P+A)</u>: 11   <u>Duration of Course</u>: Full Semester
4. <u>Proposing Department/IDP</u> : Physics

   <u>Other Departments/IDPs which may be interested in the proposed course</u>: All Departments/IDPs

   <u>Other faculty members interested in teaching the course</u>: All Physics Faculty Members
5. <u>Proposing Instructor</u>: DUGC (PHY)
6. Course Description:

A) <u>Objectives</u>: This present course is an extended version of the previous modular Thermal Physics course (PHY210M) and includes an introduction to microscopic thermal physics in the larger version. This course is designed to offer a first course of thermal physics to undergraduate physics students. The first half of the course will be dedicated to the systematic development of thermodynamics from a physicist's perspective whereas the second half is mainly dedicated to the introduction of microscopic understanding of the same in the framework of kinetic theory. The course offers an avenue towards advanced topics like non-equilibrium thermodynamics, statistical mechanics, soft matter physics etc. An attempt to present entropy in the general context of multiplicity and information theory is also included.

B) <u>Contents</u>: (for 38 lectures)

1. Introduction to Thermodynamics (2 lectures)

- Macroscopic systems: isolated, closed and open

- Extensive and intensive variables

- Adiabatic vs diathermic walls

- Thermal equilibrium, zeroth law of thermodynamics

2. First Law of Thermodynamics (4 lectures)

- Concept of heat and work

- State functions, internal energy

- Thermodynamic processes (isochoric, isobaric, isothermal, adiabatic)

- Differential form of the first law of thermodynamics

- Cp-Cv relations, compressibility, expansion, real systems

3. Reversibility and Heat Engines (5 lectures)

- Reversible vs irreversible processes

- Heat engines and refrigerators

- Carnot cycle, Otto, Diesel, Stirling engines

4. Second Law and Entropy (5 lectures)

- Kelvin-Planck and Clausius statements – their equivalence
- Clausius theorem and inequality
- Entropy as a state function, T-S diagrams

5. Thermodynamic Potentials and Irreversible Processes (5 lectures)

- Internal energy, enthalpy, Helmholtz and Gibbs free energies; Maxwell relations
- TdS equations, internal energy expressions
- Thermodynamics of radiation
- Joule-Thomson cooling, free expansion
- Free energies and equilibria

6. Phase Transitions (5 lectures)

- First and second order transitions
- Clapeyron and Ehrenfest equations
- Gibbs phase rule, critical phenomena
- Chemical potential, open systems, Gibbs-Duhem relations

7. Concept of Entropy in Statistical Framework (2 lectures)

- Entropy as multiplicity
- Entropy in quantum mechanics, black holes, and information

8. Kinetic Theory of Gases (5 lectures)

- Ideal gas assumptions
- Maxwell-Boltzmann distribution
- Mean, rms, most probable speeds
- Degrees of freedom, specific heats

9. Collisions and Transport (5 lectures)

- Collisions, mean free path
- Viscosity, conductivity, diffusivity
- Brownian motion (Einstein-Langevin), limits of kinetic theory

C) Pre-requisites: None.

D) Short summary for including in the Courses of Study Booklet: Introduction to Thermodynamics, First Law of Thermodynamics, Reversibility and Heat Engines, Second Law and Entropy, Thermodynamic Potentials and

Irreversible Processes, Phase Transitions, Concept of Entropy in Statistical Framework, Kinetic Theory of Gases, Collisions and Transport.

7. <u>Recommended books:</u>
   - M. Zemansky & R. Dittman, Heat and Thermodynamics
   - C. Kittel & H. Kroemer, Thermal Physics
   - Enrico Fermi, Thermodynamics
   - H. B. Callen, Thermodynamics and an Introduction to Thermostatistics
   - M. Saha & B. N. Srivastava, A Treatise on Heat

Dated: 06 November 2025; Proposer: DUGC, PHY

Dated: 06 November 2025; DUGC Convener (PHY):_____

The course is approved / not approved

Chairperson, SUGC

Dated: 2/12/25

Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: **ENG 4XX**
2. Course Title: Indian Grammatical Traditions
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): 9

4. Duration of Course: **Full Semester**
5. Proposing Department/IDP : **Humanities and Social Sciences**

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

   Other faculty members interested in teaching the proposed course:

   Proposing Instructor(s): **Chinmay Dharurkar**

6.   Course Description:

This course is designed for undergraduate students to provide an overview of the significant ideas in Indian grammatical traditions. The primary focus of the course is to highlight the distinct grammatical thought of India basing on the texts from the Vedic, Classical Sanskrit, Prakrits, medieval Indian grammars to the grammars of modern Indian languages. The course introduces the Vedic corpus relevant to the grammatical thought: the *Prātiśākhya*s, *Śikṣā*s, *Nirukta*, *Vyākaraṇa*, and other pre-Pāṇinian grammarians. The course lays special emphasis on the selected ideas from Pāṇinian Grammar: Aṣṭādhyāyī by introducing the basics of the grammar through actual interpretation and translation of few sūtras. The course offers an outline of the Pāṇinian tradition: the *Trimuni*, and the philosophical issues, linguistic debates in Bhartṛhari, other *śāstra* traditions. The course goes on to trace the influence of Pāṇinian grammar on other Sanskrit grammars, Prakrit grammars, and later (medieval and modern) grammars of Indic and Dravidian langauges too. It is in this sense a course in intellectual history of Indian grammatical thought. The course briefly discusses the influence the Indian grammatical tradition exerted on early Modern Linguistics through some selected common concerns like: prescriptivism vs. descriptivism, form vs. function, variationism, basic units of linguistic analysis: phoneme (*varṇa, akṣara*), morpheme (*prakṛti-pratyaya*), zero (the *it*-zero in Pāṇini) etc. The course familiarises students with the diverse linguistic-grammatical heritage of India, making cases for both its unity and plurality.

A) Objectives:

- To introduce students to the major texts and thinkers in the Indian grammatical tradition, from the Vedic period to modern grammars, and to provide an overview of their distinctive contributions.
- To develop a basic working familiarity with selected ideas and techniques of Pāṇini's Aṣṭādhyāyī, including practical interpretation of sūtras and understanding their relevance in broader linguistic debates.
- To trace the intellectual history and influence of Indian grammatical thought—its role

in shaping later Sanskrit, Prakrit, and modern Indic/Dravidian grammars, as well as its resonance with themes in modern linguistics.

- To cultivate critical appreciation of the plurality and continuity in India's linguistic-grammatical heritage.

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

Sl. No	Broad Title	Topic	No. of lectures
1.	The Vedic corpus relevant to language and grammar	Outline of the Vedic literature, oracy in the tradition, veda and loka, sacredness, *nityatā* and *apauraṣeytā*: extent and critique, the *Prātiśākhya*s, the six *Vedāṅga*s: *Śīkṣā, Vyākaraṇa, Nirukta, Kalpa, Jyotīṣa, Chandas;* Linguistic analysis assumed in *Padapāṭha, Aindra* grammar	3
2	Pre-Pāṇinian grammarians	Śākaṭāyana (radical derivationism) vs. Gārgya (givenness of some words, *autpattikatva*), the different ideas, objectives of the pre-Pāṇinian grammarians.	2
3	Pāṇini and the *Pāṇinīya*s	The Pāṇinian texts: Aṣṭādhyāyī (sūtrapāṭha), gaṇapāṭha, dhātupāṭha. The trimuni tradition: Pāṇini, Kātyāyana (vārttikas) and Patañjali (Mahābhāṣya). The commentatorial literatrue and the tradition: some commnetaries and their significance.	5
4	Pāṇini's texts and their structure	The metalanguage, brevity, techniques of brevity: the anubandha system, ittva, sūtra-syntax; the six types of sūtras with instances, sūtra-ordering, the overall structure of Aṣṭādhyāyī.	5
5.	Pāṇini's ideas through specific sūtras	Ancient Indian Phonetics: the Māheśvarasūtras, prtyāhāras, the idea of *it* elision, concrete instances from sandhi-sūtras, the extent of the idea of *pratyāhāra* – the verbal and the nominal suffixes, the Prakṛti-pratyaya vibhāga, the morphosyntax of Sanskrit through Pāṇinian sūtras, the meanining conditions as a semantic component.	5
6.	Philosophy of language through Pāṇinian tradition	Bhartṛhari's philosophy of language in Vākyapadīya, the idea of *sphoṭa*, the grammatico-philosophical issues in linguistic analysis: semnatics the verbal tense and modal system in Kauṇḍabhaṭṭa's lakārārthanirṇaya,	5
7.	Non-Pāṇinian grammars	Sarvavarman (Kāṇṭhāṅga/Katantra), Candragomin (*Cāndra Vyākaraṇa*), Devanandin (*Jainendra Vyākaraṇa*), Śakaṭāyana, Bhoja (*Sarasvatī-Kaṇṭhā-Bharaṇa*), Hemacandra (*Siddha-hemacandra*) Prakrit grammars: Prākṛtaprakāśa — by Vararuci (traditionally identified with Kātyāyana, though this is debated), Prākṛtalakṣaṇa — by Markandeya (date uncertain, medieval), Siddha-Hemacandra (Śabdānuśāsana) portions on Prakrit and Apabhraṁśa — by Hemacandra (12th c., Jain polymath), Prākṛtasarvasva — by Namisādhu (around 11th–12th c.)	5

2

		Ancient Tamil Grammar: Tolkappiyam, its comparison with Pāṇini's grammar. Kannada: Kavirājamārga, Telugu: Āndhraśabdacintāmaṇi,	
8.	Sociolinguistic issues	Socio-historical contexts of the grammars: The shifting centres of *āryāvarta*: from Sindhu to Ganga, the dynamics of Sanskrit and Prakrits in ancient and early medieval, society through Nāṭyaśāstra, epics and Purāṇas Sacredness, nityatā, degenerative sense of history, the idea of sādhuśabda, veda-loka, Pāṇini as a variationist: *vā, vibhāṣā, anyatarasyām*, the sociohistorical contexts of Sanskrit grammars and the grammarians, contextualising Patañjali's *vyākaraṇa-prayojana*s, the place of Sanskrit alongside Prakrits.	4
9.	Vyākaraṇśāstra in conversation with other śāstras (mainly Nyāya and Mimāṁsā) and disciplines: NLP, Modern Linguistics	Conceptual Foundations: Shared concern: *śabda* (word), *artha* (meaning), *vākya* (sentence), Vyākaraṇa's view of language as autonomous vs. Nyāya/Mīmāṁsā's view of language as an instrument for cognition and dharma. Adaptive reuse: concepts across śāstras Modern Linguistics: comparing concepts like morpheme, phoenme, zero etc. NLP/Computational Linguistics and Pāṇini: Simulation of Aṣṭādhyāyī, takeaways for computational Linguistics	5
		Total	**39**

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

D) Short summary for including in the Courses of Study Booklet
ENG1XX This undergraduate course surveys major ideas in Indian grammatical traditions, from the Vedic corpus and pre-Pāṇinian grammarians to classical Sanskrit, Prakrit, and modern language grammars. Special emphasis is placed on Pāṇini's *Aṣṭādhyāyī*, with hands-on interpretation of selected sūtras, the Trimuni tradition, and linguistic debates in Bhartṛhari and other śāstras. The course traces Pāṇini's influence on later Sanskrit, Prakrit, and Dravidian grammars, framing grammar as intellectual history. It also highlights resonances with early modern linguistics on issues like prescriptivism vs. descriptivism, form vs. function, and basic linguistic units. Students gain familiarity with India's diverse yet interconnected grammatical heritage.

Selected Readings

Abhyankar, K.V. (1985) *Fundamentals of Sanskrit Grammar*. Pune: Sanskrit Vidya Parisanstha.

Abhyankar, K.V. [1977 (1986, 2012)] *A Dictionary of Sanskrit Grammar*. Baroda: Oriental Institute.

Abhyankar V. M. (1942-1954) (Tr.) *Mahābhāṣya of Patañjali* [Marathi Translation] 7 volumes. Pune: DE Society.

Allen, W. S. (1953). *Phonetics in Ancient India*. London & New York: Oxford University Press.

Balbir, N. (2017). Extended grammars: From Sanskrit to Middle Indo-Aryan with reference to verb-description. *Histoire Épistémologie Langage, 39*(2), 21–44. https://doi.org/10.1051/hel/2017390202

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Bharati, A., Chaitanya, V., & Sangal, R. (1995). *Natural language processing: A Paninian perspective*. New Delhi: Prentice-Hall of India.

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Cowell, E. B. (Ed. & Trans.). (1868). *The Prakrita-prakasa, or The Prakrit grammar of Vararuchi: With the commentary (Manorama) of Bhamaha*. London: Trübner.

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Freschi, E., & Maas, P. A. (Eds.). (2017). *Adaptive reuse: Aspects of creativity in South Asian cultural history* (Abhandlungen für die Kunde des Morgenlandes, Bd. 101). Wiesbaden: Harrassowitz Verlag.

Houben, J. [(1999) 2001] 'Meaning statements' in Panini's grammar: on the purpose and context

of the Astadhyayi. *Studien zur Indologie und Iranistik 22*, 23-54.

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Jha, S. (Ed.). (1957). *A comparative grammar of the Prakrit languages* (R. Pischel, Author). Delhi: Motilal Banarsidass. (Original work published 1900)

Joshi, S.D. (1967a) 'Adjectives and Substantives as a Single Class in the "Parts of Speech"'. *Journal of the University of Poona, Humanities section* 25:19-30.

Joshi, S. D. (1967b) *The Sphoṭanirṇaya of Kauṇḍa Bhaṭṭa* (PCASS Class C No. 2). Poona: University of Poona.

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Joshi, S.D. and J.A.F. Roodbergen (1991-2007) *The Aṣṭādhyāyī of Pāṇini*(thirteen volumes). New Delhi: Sahitya Akademi.

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Kiparsky, P. (1979). *Pāṇini as a variationist*. Pune: The Poona University Press and MIT Press.

Nitti-Dolci, L. (1972). *The Prakrit grammarians* (English Trans. Prabhakar Jha). Delhi: Motilal Banarsidass. (Original work published 1938).

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Subrahmanyam, P. S. 2011. "The Prakrit Grammatians: Historical Linguists of Ancient India." *Indian Linguistics* 72: 230–242.

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Online resources:

1. https://ashtadhyayi.com/
2. https://www.linguindic.com/
3. https://sanskritlibrary.org/derivation.html, also overall https://sanskritlibrary.org/index.html
4. https://blogs.ubc.ca/ubcsanskrit/tools/
5. https://tdil-dc.in/index.php?option=com_vertical&parentid=84&lang=en
6. https://sanskrit.uohyd.ac.in/scl/
7. https://www.cfilt.iitb.ac.in/wordnet/webswn/english_version.php

7. Any other remarks: ----none----

Dated: __18/10/2025__   Proposer: ___Chinmay Dharurkar___
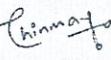
Dated: __18/10/2025__ DUGC/~~DPGC~~ Convener: ___R. Bhoumik___
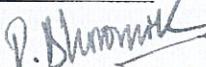
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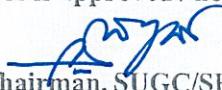
Chairman, SUGC/SPGC

Dated: ___9/12/25___