Indian Institute of Technology Kanpur

COURSES OF STUDY

2026





Indian Institute of Technology Kanpur
KANPUR-208016

Department of Cognitive Science

MS-R in Cognitive Science

	MS by research (Course Template)			
Courses	**Semester 1**	**Semester 2**	**Semester 3**	**Semester 4**
	CGS600 [9 credits]	CGS698A	Research credits	Research credits
	CGS601 [11 credits]	CGS613 (Modular 1st Half)		
	CGS602 [11 credits]	CGS612 (Modular 2nd Half)		
	CGS610 (Modular 1st half) [5 credits]	Elective 1		
	CGS611 (Modular 2nd half)- [5 credits]	Elective 2		
	CGS700 (Seminar Course)- [0 credits]			

MTech in Cognitive Science

	MTech (Cognitive Systems)- Course Template			
Courses	**Semester 1**	**Semester 2**	**Semester 3**	**Semester 4**
	CGS601 [11 credits]	CGS786	Research credits	Research credits
	CGS602 [11 credits]	CGS616		
	CGS610 (Modular 1st half) [5 credits]	Elective 2		
	CGS611 (Modular 2nd half)- [5 credits]	Elective 3		
	CGS700 (Seminar Course)- [0 credits]			
	Elective I			

UG Minor in Cognitive Science

	CgS Minor degree (Template)	
	Odd-Semester	**Even Semester**
Courses	CGS401	CGS402
	Elective	

Course Number	Course Name	L-T-P-D	Credits	Brief Description
CGS401	Introduction to Cognitive science	3-0-0-0	9	The objective of the course is to spark curiosity of students about the fascinating world of Cognitive Science and introduce them to what studying mind looks like. The course investigates some important debates in the field of cognitive science, organizational principles of human mind.
CGS402	Applied cognitive Science	3-0-0-0	9	The course offers a whirlwind tour of applications of principles understood in cognitive science in the design or study of different products and systems in the world. We discuss how cognitive science principles can be applied in the fields of marketing, advertising, cyberspace, UX design, HCI, BCI etc.
CGS600	Computational tools for Cognitive Science	3-0-2-0	11	The objective of this course is to equip students to be able to program the design, experimentation and analysis of sophisticated cognitive science studies independently, and to be able to implement and fit simple cognitive models to behavioural data. The course will be taught primarily in python. Students who succeed in this course will be able to code independently, without having to rely on third party libraries.
CGS601	Foundations of Cognitive Science	3-0-0-0	9	To introduce students with the fundamentals of cognitive science, i.e., the study of the mind! The course begins with the origins of the field and goes on to familiarize students with its interdisciplinary perspectives on how the mind is organized and processes information. The course covers symbolic representational views as well as approaches like situated/ embodied cognition and Bayesian cognitive science. The course covers some phenomena that

				includes perception, attention, memory and decision making.
CGS602	Basic statistics data analysis & inference	3-0-2-0	11	The course will introduce fundamental concepts in statistics beginning with topics like the philosophy of science, laws of probability, random variables & probability distributions, hypothesis testing, t-test, F-test, chi-square test, ANOVA, correlation and regression etc. Tutorials will help expose students to ways of testing hypotheses and interpreting results on real or fake datasets using R programming language.
CGS609	Cognitive Neuroscience	3-0-0-0	9	The primary goal behind this course is to acquaint students with the fundamentals of cognitive neuroscience - a discipline centred on the question of how the brain enables the mind. The course is not set out to cover the entire breadth of topics in exhaustive detail but aims to: 1. introduce students to the fascinating literature that paved the way to the current understanding of how the brain enables diverse cognitive functions. 2. equip students with the basic skills required to scrutinize evidence from a diverse set of complementary approaches and critically evaluate current research in the field.
CGS610 (modular)	Experiment design and analysis	3-0-0-0	5	By the end of the module student should be able to (a) read an experimental paper and understand the theoretical research question, critically evaluate validity of the method in answering the question. (b) Be able to present empirical work both orally as well as in form of written report. (c) should be able to understand how choice of stimuli and response method can influence an experiment.

CGS611 (modular)	Basics of psychophysics	3-0-0-0	5	By the end of the course student should be able to design, understand and implement psychophysical experiments using classical and adaptive procedures using python/R. The student should be able to generate the controlled stimuli and analyse psychophysical data properly.
CGS612 (modular)	Eye-tracking and VR as tools in Cognitive Science	3-0-0-0	5	By the end of the course students should be able to a) design, implement and analyze eye-tracker based experiments b) design, implement, and analyze experiments in VR environment. Students should be able to understand the kind of cognitive problems that can be investigated using VR. Students should also gain some idea of designing experiments on Unity framework and collect data from different sensors.
CGS613 (modular)	Basics of EEG	3-0-0-0	5	By the end of the module student is expected to understand and appreciate the principles of EEG data processing, artifact detection and subtraction, time and spectral ways of analysing EEG data, finding their cortical sources and connections, through programming MATLAB/python interface and hands-on EEG sessions. The student would be expected to be able to design an ERP experiment and analyze ERP data.

CGS616	Human Centered Computing	3-0-0-0	9	This course offers a hands-on introduction to human-facing computing: reviewing both current techniques and open problems. The course comprises four modules, each one built around a hands-on mini-project that students will work on, individually or in groups – theory and empirical methods will be introduced to the extent that they help the students with their projects. The course will begin with addressing topics relevant to currently mature technologies (search), transition to address currently active (recommender systems) and inchoate (affective computing) research areas and finally touch upon the common core of AI research that is the theoretical frontier in human-facing computing (building realistic goal-directed agents).
CGS621	Introduction to psycholinguistics	3-0-0-0	9	The objective of this course will be to introduce the students to the basics of psycholinguistics. The course will start with a brief discussion about the evolution of language, proceed through basic linguistic principles and move on to a detailed study of language acquisition, production and comprehension. Towards the later, part of the course we will try to integrate the role and importance of language in overall cognition, by attending to its overlap with other mental functions like attention, perception, memory, language and problem solving.
CGS622	Cognitive Science of multilingualism	3-0-0-0	9	The course is aimed at introducing students to the cognitive consequences of knowing two or more than two languages. It will introduce students to the linguistic issues, psychological issues, neuroscience & impact of bilingualism on the organization of other cognitive functions as well.

CGS641	Topics in translational neuroscience	3-0-0-0	9	This course aims to provide insights into cognitive, behavioral, and neural system-level dynamics for explaining behavior and their dysfunctions and discuss intervention strategies. The course will navigate through 1) understanding the fundamentals and the principles that govern the cognitive system and behavioral function of interest, then 2) explore a few test cases where simulated manipulations can help explain and intervene in disordered patients.
CGS646	Topics in agent based models in cognitive and behavioural science	3-0-0-0	9	This course will explore how agent-based models can be a possible way to theorize about complex cognitive and/or social behaviour that is seen in human or animal societies. The kinds of phenomena of interest include: concepts: how they form and are shared; language: its emergence and acquisition; cooperation and its impact on groups; rational behaviour: impact of different levels of rationality and protocols especially in economic decision making; and similar other kinds of behaviour. It is very hard (or in some cases impossible) to study these kinds of phenomena under controlled lab conditions with human or animal subjects. So, the only option is to build models. While different types of models are possible this course chooses agent-based models to study such phenomena.
CGS651	Logic and Cognitive Science	3-0-0-0	9	The goal of the course is to discuss the role of formal logic as a conceptual tool in cognitive science. Generally, logic and its 'laws' are characterized as being 'domain-independent'. However it is clear that there cannot be one 'global' formal system of logic that applies to all domains of reasoning: for instance, there are domains where it makes no sense to apply classical 2-valued logic. Different syntactic and semantic choices may be appropriate for different domains, resulting in the use of different formal systems of logics.

CGS671A	Neural Basis of Learning and Memory	3-0-0-0	9	The objective of the course is to familiarize students with the cognitive processes of learning and memory, the neural mechanisms that drive these processes as well as disorders of learning and memory. The focus of the course will be on recent advancement in the field and how the processes have been experimentally investigated using multiple methodologies.
CGS690	Social behavior and the brain: an introduction to social neuroscience	3-0-0-0	9	As this course is mainly designed as a PG Course, the focus will be on in-class discussions through not-only the subject mattered covered from the textbooks; but also, through contemporary journal articles about relevant topics. Apart from a mid-semester and end-semester examinations, a large part of the evolution will be based on class-room assignments. At the end of the course, group-presentations will be planned for students in groups and will be evaluated as part of course-requirements.
CGS698A	Mind: philosophical investigations	3-0-0-0	9	The objective of the course is to enable the student to understand the important philosophical positions in understanding mind. The questions discussed will include: What is the nature of mind? How is the mind related to the brain? What is consciousness? How can we be certain that others have minds and conscious experiences? Can a computer have a mind or consciousness? How do we study the mind? At the end of the course, the student is expected to understand the strengths and weaknesses of different positions. The student is also expected to understand the philosophical implications of the scientific studies discussed in the curriculum and the implications of different positions for conducting scientific studies.
CGS698C	Bayesian models & data analysis	3-0-0-0	9	This course will study the Bayesian analogues for traditional data analysis and modelling. It will also cover

				computational techniques often used in Bayesian data analysis and modelling. Topics Covered: Fundamentals of the Bayesian approach, Parameter estimation, Bayesian analogues of t-test, regression, ANoVA, power analysis. Model selection, Bayesian computation. Case studies.
CGS698D	Neurobiology of affect & motivation	3-0-0-0	9	This course aims to guide students as they take a deep dive into the cognitive neuroscience literature on emotions, pleasure, pain, uncertainty and effort in decision-making as well as affect & motivation disorders. Students will review selected papers and use class discussions to flesh out their own ideas for further research. As a primer for any real-world workplace setting, a fair amount of focus will be laid on working together as a team, improving communication skills by way of oral presentations & written reports. By the end of the course, students will be aware of classic studies and current research trends in the field, how to critically evaluate and interpret results etc.
CGS698E	Topics in Visual Perception	3-0-0-0	9	The course looks at visual perception with the lens of cognitive science of visual perception primarily based on Marr's tri-level approach. With help of perceptual constancy, the course tries to understand the process of visual perception and how it interacts with other cognitive processes such as attention, action, etc.

CGS652	Consciousness	3-0-0-0	9	The student is expected to understand and distinguish between philosophical approaches (focusing mostly on contemporary approaches) to consciousness. The students should be able to understand the phenomena to be explained and understand the methodological issues in studying consciousness. Knowledge of experiments on various aspects of consciousness including the relationship between consciousness and other mental processes as well as neural mechanisms that underlie consciousness. The course will focus on psychophysical, neural and computational studies on consciousness. The course will be a seminar course and will involve discussing journal articles in some detail.
CGS700	Seminar in Cognitive Science	0-0-0-0	0	To familiarize the PG students with the current themes and progress as presented by their colleagues.By the end of the course learn best practices in oral presentation and preparation for talks.
CGS702	Project	0-0-0-0	9	A research project in cognitive science under the supervision of a faculty member.
CGS786	Computational Cognitive Science	3-0-0-0	9	To what degree functions of the mind can be reproduced or simulated by a computer is a question that has become volubly prominent in recent years. It is often posed for public consumption as a matter of ends – when will computer performance surpass human performance on interesting challenges. From a scientific standpoint, it is more useful to ask this question from the standpoint of means – what physical and informational resources do biological organisms have available to respond adaptively to situations they encounter in the world? This is the question that computational cognitive scientists seek to answer. Such research frequently starts from parametric characterizations

				of empirical behavior. Theorists then develop computational models of the phenomenon that capture the quantitative relationship between these parameters and various experimental conditions. A good empirical fit permits further questions of biological and epistemic plausibility to be asked of the model. Models that pass these quasi-philosophical checks graduate to the status of theories. These accounts are, inevitably, challenged as incomplete or erroneous by further iterations of experiments and models. The cycle of research in cognitive science, therefore, encompasses, in order of the workflow presented above, neuroscience and psychology, statistics, computer science, and philosophy. This course is meant to introduce students interested in the computational aspects of cognitive science a relatively comprehensive overview of the discipline.
CGS410	Language in the Mind and Machines	3-0-0-0	9	***Objectives*** Humans possess an amazingly complex communication system that allows them to transmit any message using a linear stream of auditory/visual symbols in real time. We know this system as language. How did human language evolve? How does it work in the mind? **Language in the Mind and Machines** is an introductory course on the study of language from a cognitive perspective. The course is designed to expose students to fundamental questions in language science, e.g., how language came into existence, how it evolved, and how is it processed in the mind and machines, and provide them with a set of tools and methods to investigate these questions. The students will learn fresh perspectives on language: Language as a complex adaptive system of symbols and Language as a cognitive function. The focus will be on the universals of human language, variation across languages,

				origin and evolution of language, processing of language in the mind and Large Language Models. The course will attract students from all study backgrounds to take up challenging and interesting problems in the study of language and solve them using novel mathematical and computational techniques. This course will have a considerable focus on regular hands-on assignments which would target interesting open problems in language science and will end with a course project to be done using Python/R. **The course is targeted at all engineering and science disciplines who wish to understand language and solve some outstanding research problems in the study of language and the mind**