Department of Cognitive Sciences and Psychology, School of Social and Behavioral Sciences,
Amrita Vishwa Vidyapeetham
Master of Science (MSc) in
Cognitive Sciences, Learning, and Technology (CogSci L & T) Curriculum

Course Code	Course Title	LTP	Cr		Course Code	Course Title	LTP	Cr	
	Semester I					**Semester II**			
24CLT501	Introduction to Cognitive Sciences	3 0 0	3		24CLT511	Interfaces for Learning	3 0 0	3	
24CLT502	Philosophy of Cognitive Science and Mind: An Introduction	3 0 0	3		24CLT512	Cognitive Anthropology: Cross-Cultural Perspectives	3 0 0	3	
24CLT503	Cognitive Psychology and Neuroscience - Part I	3 0 0	3		24CLT513	Cognitive Psychology and Neuroscience - Part II	3 0 0	3	
24CLT504	Introduction to Learning and Instruction	3 0 0	3			*Soft Core (options)	3 0 0	3	
24CLT505	Research Methodology I - Introduction to Research Methods	3 0 0	3		24CLT514	Research Methodology II Advanced Quantitative Data Analysis	3 0 0	3	
24CLT581	Neurophysiology and Learning Technologies Lab	0 0 1	1		24CLT599	Research Project I: From Desk to Field (with field visit)		5	
22AVP103	Mastery over Mind (MAOM)	1 0 2	2			*Amrita Values Program	1 0 0	1	
	Total		**18**			**Total**		**21**	
	Semester III					**Semester IV**			
24CLT694/ 24CLT690*	Rural field visit/ live-in Labs*	3 0 0	3		24CLT696/ 24CLT697**	Internship/Block Placement**	3 0 0	3	
24CLT695	Research Project II		7		24CLT699	Research Project III		8	
	*Soft Core (options)	3 0 0	3		24CLT698	Organizing Conference in Cognitive Science, Learning & Tech		4	
	*Soft Core (options)	3 0 0	3			Elective III	3 0 0	3	
	Elective I	3 0 0	3			Elective IV	3 0 0	3	
	Elective II	3 0 0	3						
	Total		**22**			**Total**		**21**	
				Total -82					

Specializations with Electives (can be combined with open electives)

1. User Experience					2. Optimal Cognitive Functioning and Learning Ecologies			
24CLT631	Game Design	3 0 0	3		24CLT641	Lifelong Learning and Learning Ecologies	3 0 0	3
24CLT632	User Needs for Learning Technology	3 0 0	3		24CLT642	Optimal Cognitive Functioning	3 0 0	3
24CLT633	Assessing Effectiveness of Learning Technology	3 0 0	3		24CLT643	Social Cognition, Social Neuroscience, and Technology	3 0 0	3
24CLT634	Design-Based Research	3 0 0	3					

3.Neurophysiology Tools and Learning Technologies					4. Adaptive and personalized Learning, Teaching and Technology			
24CLT651	Virtual Reality, Augmented Reality, and Haptics for Learning	3 0 0	3		24CLT661	DNA of Teaching	3 0 0	3
24CLT652	Neurophysiology Laboratory	3 0 0	3		24CLT662	Psychomotor Skill Training to Enhance Learner Performance	3 0 0	3
24CLT653	Computational Neuroscience	3 0 0	3		24CLT663	Learning Engineering	3 0 0	3
24CLT654	Neuroimaging Techniques and Cognitive Electrophysiology	3 0 0	3		24CLT664	Social Robotics	3 0 0	3
					24CLT665	Socio-Cognition and Collaborative Learning	3 0 0	3
					24CLT666	Learning Analytics and Educational Data Mining	3 0 0	3
					24CLT667	Instructional Design	3 0 0	3

Soft Core					Open Electives			
24CLT671	Natural Language Processing	3 0 0	3		24OEL531	Foundations of Artificial Intelligence	3 0 0	3
24CLT672	Deep Learning	3 0 0	3		24OEL532	Machine Learning	3 0 0	3
24CLT673	Foundation of Data Science	3 0 0	3		24OEL533	Artificial Intelligence for Robotics	3 0 0	3
24CLT674	Artificial Intelligence	3 0 0	3		24OEL534	Automation and Robotics	3 0 0	3
24CLT675	Basics of Computer Programming	3 0 0	3		24OEL535	Natural Language Processing	3 0 0	3
24CLT676	Introduction to Machine Learning Using Programming Languages	3 0 0	3		24OEL536	Deep Learning	3 0 0	3
24CLT677	Computational Intelligence	3 0 0	3		24OEL537	Machine Learning for Big Data	3 0 0	3
					24OEL538	Foundations of Corporate Social Responsibility	3 0 0	3
					24OEL539	Decision Models in Management (DMM)	3 0 0	3
					24OEL540	Individual and Group Behaviour Dynamics in Organizations (I & GBDO)	3 0 0	3
					24OEL541	Human Resource Management	3 0 0	3
					24OEL542	Talent Acquisition & Learning and Development (TA & LD)	3 0 0	3

* Students can opt for any of the soft core courses in technology from the list based on their Bachelor's qualification

**Amrita Value Programme			
22ADM502	Vedanta in day-to-day life	1-0-0	1
22AVP506	Message of Swami Vivekananda	1-0-0	1
22AVP508	Indian Arts and Literature	1-0-0	1
22AVP510	Appreciation of Kerala Mural Arts Forms	1-0-0	1
22AVP501	Message of Śrī Mātā Amritanandamayi Devi	1-0-0	1
22AVP502	Insights from the Ramayana	1-0-0	1
22AVP503	Insights from the Mahabharata	1-0-0	1
22AVP504	Insights from the Upanishads	1-0-0	1
22AVP505	Insights from Bhagavad Gita	1-0-0	1
22AVP512	Ancient Indian Science and Technology	1-0-0	1
22AVP507	Great Spiritual Teachers of India	1-0-0	1
22AVP509	Yoga and Meditation 1	1-0-0	1

Master of Science (MSc)
in
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Table of Contents

MSc in Cognitive Sciences, Learning, and Technology (CogSci & LT)

Amrita Vishwa Vidyapeetham aims to provide quality education with an emphasis on values. The university integrates scientific knowledge with spiritual understanding to benefit society and promote sustainability. Its mission is to impart 'education for life,' which includes instilling essential human values, in addition to 'education for living,' which prepares students for

professional careers. The university's primary objective is to conduct research that is driven by compassion and aimed at addressing real-world problems.

The newly established **Department of Cognitive Sciences & Psychology (CSP)** at the School of Social and Behavioural Sciences, Amrita Vishwa Vidyapeetham, adopts an interdisciplinary approach to **understanding the mind and human behavior** with the aim to nurture cognitive and psychological processes and human behavior towards individual growth as well as an **empowered and compassionate society**.

Our **upcoming MSc in Cognitive Sciences, Learning, and Technology (CSLT)** under CSP is a pioneering program that combines the disciplines of cognitive sciences with a strong emphasis **on education, skills, and technology**. This interdisciplinary program is designed to provide students with a deep understanding of cognition and behavior in the context of lifelong learning, enhanced by technological know-how, leading to socially relevant innovation and solving crucial educational challenges.

To reach our educational goals and outcomes, the MSc program integrates **interdisciplinary perspectives** ranging from computer sciences, psychology, anthropology, philosophy, learning sciences, educational sciences, and neurosciences, offering a comprehensive curriculum that includes exposure to **state-of-the-art research methods and tools**.

Under the MSc in Cognitive Sciences, Learning, and Technology, we offer **four specializations**:

1. **User Experience and Learning**
2. **Optimal Cognitive Functioning and Learning Ecologies**
3. **Adaptive and Personalized Teaching, Learning, and Skills**
4. **Neurophysiology Tools and Learning Technologies**

Integrating the strengths of our two state-of-the-art research centers **AMMACHI Labs** and **Skill Intelligences,** we offer cutting-edge programs that provide students with a multitude of opportunities to learn first-hand in an interdisciplinary environment. With our expanding industry partnerships, we aim to enhance research, practical applications, and placement opportunities to give students the chance to apply their knowledge and gain exposure to companies in their respective fields. We are committed to providing a comprehensive and immersive educational experience to help students succeed in their careers.

This **academic-lab-industry integration** prepares students for careers in research, cognitive and brain sciences (including AI), management, engineering, design, robotics, human-machine interaction, user interface optimization, and instructional design. Our students can enter different career paths in industry, global, educational, social, and government organizations.

Graduates have the opportunity to continue their education and pursue a **PhD in Cognitive Sciences and Technology at our school**.

We believe that our upcoming MSc in Cognitive Sciences, Learning, and Technology encompasses an innovative and unique curriculum that aims at equipping students with an interdisciplinary blend of theoretical knowledge and practical skills, preparing them for diverse real-world applications **to solve today's and tomorrow's education challenges, to foster equity, justice and quality education while leaving no one behind.** In this way, our program will aid in achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG No. 4, 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' and No. 3, 'Ensure healthy lives and promote well-being for all at all ages,' among other SDGs.

Program Outcomes

- PO1 Scientific knowledge and training: Gain and apply knowledge of basic and applied scientific/analytical fundamentals, leading to a deeper understanding of the interdisciplinary nature of Cognitive Sciences, Educational and Learning Sciences
- PO2 Problem analysis: Identify, formulate, review, and analyze educational challenges and problems to derive conclusions using principles of basic Cognitive Sciences, Educational Sciences and Technology.
- PO3 Using State-of-the-art tools: Create, select, and apply appropriate techniques, resources, and tools, including prediction and modelling of complex biological systems with an understanding of their limitations.
- PO4 Science communication: Communicate scientific concepts and theories effectively with peers, educators, the science community, and society at large.
- PO5 Ethics and values: Understand and practice ethical principles and commit to professional ethics, responsibilities, and norms of scientific practice.
- PO6 Individual and teamwork: Think critically and work independently as well as a member or leader in diverse teams in multidisciplinary settings.
- PO7 Science for society: Apply reasoning through contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional scientific practice.
- PO8 Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of scientific and technological changes for up-to-date research and teaching methods.
- PO9: Culturally inclusive and responsive perspectives: Culturally inclusive and responsive perspectives/ multicultural/global perspectives/fostering humanitarian perspectives, equality, diversity and inclusion.

Program Specific Outcomes (PSOs)

- PSO1: Develop an understanding of the fundamental principles of cognitive science and educational science including the interdisciplinary nature of the field.
- PSO2: Develop an understanding of the human mind, its functions, and its effects on behavior and performance.
- PSO3: Develop an understanding of the cognitive processes underlying perception, attention, memory, language, problem-solving, decision-making, and other cognitive functions.
- PSO4: Develop an understanding of the biological, psychological and sociological factors that influence cognitive processes, learning, and skill development.
- PSO5: Design and/or develop educational technology and their application to solve complex problems in teaching and learning.
- PSO6: Develop an understanding of fundamental principles of basic and applied research.
- PSO7: Design and develop educational materials (online/offline) and activities that integrate cognitive science and educational sciences.
- PSO8: Develop an understanding of the implications of cognitive science for the design of intelligent systems and the development of artificial intelligence.
- PSO9: Develop scientific, critical thinking, and meta-cognition skills
- PSO10: Establish the culture of independent learning, innovative research, and productive teamwork.

Job Perspectives

- **Neurophysiology Lab Manager**

- **Learning and Development Manager**
- **UX Designer:** UX Designers seek to make products and services easy, effective, and delightful to use.
- **HCI/UX Researcher:** HCI/UX Researchers conduct studies to explore the current challenges and look for ways to improve the user experience overall, and in particular the HCI neural network application.
- **User-Interface Optimizer**
- **Instructional Designer/Curriculum Designer:** Instructional designers create learning materials, assessments, and activities tailored to the specific needs of students, employees, and other learners. They use cognitive science and educational technology to design, develop, and evaluate instructional materials and programs. They are able to create engaging and effective learning experiences.
- **Educational Technology Consultant:** Educational technology consultants advise organizations on how to use technology to improve learning outcomes. They provide guidance on the selection, implementation, and evaluation of educational technology solutions.
- **Cognitive Engineer**
- **Learning Analytics Specialist:** Learning analytics specialists analyze data from educational programs and technologies. They use data to identify trends and patterns in learning and teaching to inform decisions about instructional design and implementation.
- **Education Software Developer:** Educational software developers create educational software applications, including AI, to design and develop systems that can interact with humans. They use a variety of methods, such as natural language processing, to create systems that can understand and respond to human input.
- **Cognitive Data Scientist:** Cognitive data scientists analyze large amounts of data to understand how people think and behave. They use a variety of methods, such as machine learning, to understand how people process information and make decisions. This informs different stakeholders in the broader area of education.
- **Cognitive Scientist:** Cognitive scientists study the mental processes of humans and animals, such as memory, perception, problem solving, and language. They use a variety of methods, such as experiments, computer simulations, and mathematical models, to understand how the brain works.
- **Educator:** specialized in technology based teaching and learning
- **Human Resource Management** : helping in organizations with knowledge management tools, re-skilling/ up-skilling and performance of employees and leadership,
- **Learning consultant:** Policy, learning and development sections of companies ect.
- **Higher Education Teaching and Learning Specialist**

Semester 1

24CLT501   **INTRODUCTION TO COGNITIVE SCIENCES**   **3 0 0 3**

Prerequisite: Good reading and writing skills in English

Summary:
This introductory course offers an overview of the interdisciplinary nature of cognitive sciences, by introducing the student to classical theories to help synthesize the pillars of cognitive sciences, which are Psychology, Anthropology, Computer sciences, Neurosciences, Philosophy and Linguistics.

Course Objectives:
1. Gaining a basic overview of the interdisciplinary nature of cognitive sciences
2. Understanding how cognitive scientists have studied various types of intelligent behavior among humans in past and present
3. Gaining an overview of classical theories in cognitive sciences
4. Understanding basic principles of cognitive processes.

Course Outcomes:

CO1: Understand the historical development and current trends in cognitive science research, including its impact on related fields.

CO2: Understanding how cognitive scientists have studied various sorts of intelligent behavior among humans in past and present

CO3: Gaining an overview of classical theories in cognitive sciences

CO4: Understanding basic principles of cognitive processes

Skills:
- Problem-solving using analogical reasoning.
- Analytical skills in interpreting mental imagery and representations.
- Understanding of the interplay between language, thought, and sensory processing.

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	X	-	-	-	-	-	-	-	-		
CO2	-	-	X	-	-	-	-	-	-		
CO3	-	X	-	-	-	-	-	-	-		
CO4	-	-	-	-	-	-	-	-	-		
CO5	X	-	-	-	-	-	-	-	-		

Syllabus:

Unit I –Overview of Cognitive Sciences as a Scientific Discipline   **9 hrs.**

- Historical roots of cognitive sciences as a scientific field
- Conceptualizations and definitions of cognitive sciences as a scientific discipline

- Overview of the six pillars of cognitive sciences: Psychology, Anthropology, Computer Sciences (including Artificial Intelligence), Neurosciences, Philosophy, and Linguistics.
- How cognitive sciences are related to learning sciences and technology

Unit II: Human Thinking and Reasoning   9 hrs.

- Overview of perspectives of cognition
- Computer simulation of human thinking
- Human reasoning
- Probabilistic models of higher-level cognition
- Relationship between language and thought

Unit III: Conceptualization, Mental Imaginary, and Representation, Knowledge and Comprehension   9 hrs.

- Analogical problem solving, the analogical paradox, gesture and analogy, conceptual metaphor
- Sensorimotor account of vision and visual consciousness
- Cognitive scripts and schemas
- Understanding language
- Artificial intelligence and cognitive models
- Implicit and explicit knowledge
- Learning and knowledge in different age stages

Unit IV – Planning, Action and Working Memory   9 hrs.

- Embodied cognition
- Situated actions
- Neural mechanisms and choices of interaction
- Cognitive load theories
- Working memories, network memory, semantic memory

Unit V: Distributed and Grounded Cognition   9 hrs.

- Distributed cognition
- Social cognition
- Cultural cognition
- Navigation
- Perceptual symbol systems

Textbooks:

Chipman, S. E. F. (2017). *The Oxford Handbook of Cognitive Science* (1st ed.). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199842193.001.0001

Frankish K, Ramsey W, eds. *The Cambridge Handbook of Cognitive Science*. Cambridge University Press; 2012.

Sawyer, R. K. (2022). *The Cambridge Handbook of the Learning Sciences* (Third edition). Cambridge University Press.

Reference Books:

The Cambridge Handbook of Cognition and Education

Hoadley, C. (2018). A short history of the learning sciences. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.), The international handbook of the learning sciences (pp. 11–23). New York, NY: Routledge.

Hutchins, E. (1995). Cognition in the wild. Cambridge, MA: MIT Press.

Rogoff, B. (1990). Apprenticeship in thinking: Cognitive development in social context. New York, NY: Oxford University Press.

Saxe, G. B. (1991). Culture and cognitive development: Studies in mathematical under- standing. Hillsdale, NJ: Erlbaum.

Scribner, S., & Cole, M. (1973). Cognitive consequences of formal and informal educa- tion. Science, 182(4112), 553–559.

Sleeman, D., & Brown, J. S. (Eds.). (1982). Intelligent tutoring systems. New York, NY: Academic Press.

Yoon, S. A., & Hmelo-Silver, C. E. (2017). What do learning scientists do? A survey of the ISLS membership. Journal of the Learning Sciences, 26(2), 167–183.

The Design of Everyday Things, by Norman, ISBN-10 # 0465050654

Interaction Design: Beyond Human-Computer Interaction, by Rogers, Sharp, and Preece, ISBN-10 # 0470665769

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT502   PHILOSOPHY OF COGNITIVE SCIENCE AND MIND : An Introduction
3 0 0 3

Prerequisite: Good reading and writing skills in English; Basic understanding of the field of cognitive and biological sciences.

Summary:
Philosophy of Cognitive Science is a rich, topical and fast-growing area of philosophy. This module will address major works, concepts and theories in the history and development of philosophy of cognitive science. The approach will be philosophically oriented, involving critical debate and close reading of assigned texts. Students will be expected to engage critically with the work and supporting discussion to develop their own voice in arguing and defending their own position on the topics covered. The course will support students to engage with some of the most critical and current debates in cognitive science by understanding the role and implications of philosophy for cognitive science and cognitive science in doing philosophy.

Course Objectives:
1. To gain a basic understanding of philosophical perspectives and approaches to conceptualising issues within cognitive science.
2. To develop a critical understanding of how philosophers engage with and debate cognitive science concepts and theories.
3. To understand how the role of philosophy has influenced and continues to challenge and develop the field of cognitive science.
4. To gain an overview of the foundational and contemporary issues within the field of cognitive science and philosophy of mind.
5. To gain an overview of current and emerging trends with theoretical and empirical work within cognitive sciences and related disciplines.

Course Outcomes:
CO1: Acquire knowledge of the critical issues and current debates in the field of cognitive science.
CO2: Understand core concepts in cognitive science and their relation to philosophical issues.
CO3: Gain information on how philosophy has historically influenced current theories within cognitive sciences.
CO4: Gain insights into how empirical research in cognitive sciences has influenced philosophical debates and thinking.
CO5: Understand how philosophical concerns, issues, and debates can inform, clarify and develop concepts and theories within the cognitive sciences, such as attention, memory and perception.

Skills:
- Gain an overview of key philosophical perspectives and concepts in cognitive science.
- Develop a deeper understanding of how philosophical and conceptual analysis has influenced concepts and theories in cognitive sciences.
- Grasp how foundational assumptions have shaped cognitive science and how they can be challenged.
- Differentiate between philosophical concepts and their application within empirical research in cognitive sciences.
- Understand how the concepualisation of mind, language and cognition has influenced empirical research in the cognitive sciences.

- Develop a basic understanding of the traditional philosophical issues that continue to challenge contemporary cognitive scientists and how empirical research has influenced philosophy.
- Demonstrate an enhanced ability to engage in critical analysis and argument through reading and group discussions.
- Demonstrate an ability to articulate their views in a systematic manner through their philosophical writing and dialogue, with a focus on clarity of idea and coherent justification.
- Demonstrate confidence in undertaking work through independent learning and taking responsibility for their learning.

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	-	-	-	-	-	-	-	-	-		
CO2	-	-	-	-	-	-	-	-	-		
CO3	-	-	-	-	-	-	-	-	-		
CO4	-	-	-	-	-	-	-	-	-		
CO5	-	-	-	-	-	-	-	-	-		

Syllabus:

- **Unit I – Introduction to Philosophy of Cognitive Science**　　　　　　**9 hrs.**
  - An introduction and review of long-standing philosophical problems and perennial questions regarding the nature of the mind addressed through a global perspective, drawing on Western and Eastern philosophies.
  - **Cognition in a Physical World**: introduces the mind-body problem and approaches to theorising the mind, including physical systems, computationalism, embodied cognition and the nature and role of mental representational. This will briefly introduce the Turing Test, the Chinese Room Argument, The Frame Problem, Connectionism, Extended and Embodied Mind and Artificial Consciousness. This is juxtaposed to Eastern philosophies, drawing on Vedanta and Taoism, where the philosophical assumptions are rooted in non-dualistic epistemology in theorising mind and body, or world.
  - **The Problems of Consciousness**: introduces the primary focus of cognitive science on cognitive capacities. The mind-body problem is related to enduring mysteries regarding consciousness. Addressing physical systems and Qualia, cognitive science is viewed from a critical perspective, and limitations are considered and debated. The Western empiricist conceptions of mind and consciousness are comparatively reviewed in light of German Idealism, Russian Psychology, Inferentialism, Advaita Vedanta and Taoism.
  - **The Nature of Thought**: introducing philosophical issues revived in cognitive science, focusing on Language and Thought, Thoughts and Concepts. These concepts are comparatively considered from both Western and Eastern philosophical perspectives, including Advaita Vedanta.
  - **Case Studies:** More Specific Mental Phenomena concerning attention, memory, and perception and recent empirical research on these topics. The remainder of the course will draw out and critically engage with the philosophical implications. These issues will be framed within wider debates and decolonial perspectives concerning the East-West philosophical divide, North-South relations and academic and biomedical hegemony. Implications for the future of cognitive science will be discussed from a global perspective addressing, diversity, decolonisation, and social justice.

- **Unit II – Cognitive Science and its Foundational Assumptions**　　　　　　**9 hrs.**
  - **Foundational Assumptions:** Critical engagement with theoretical and philosophical problems

regarding the notions of cognition, computation, representation, and consciousness. These assumptions are discussed in relation to representationalism and Cartesian dualism and critically reviewed with emerging schools of thought and Eastern non-dualist perspectives.

- **Cognitive Science and Inter-disciplinary Relations:** Critical debates on the relation between evolutionary biology and the science of cognition are discussed. Different scholars and positions on disciplinary alignments are presented and debated. These include evolutionary biology and psychology, but also AI and Neuroscience. These relations are explored in a comparative and global context of a philosophy of science as embedded within the Western Enlightenment project. Subsequent dualist epistemology and critical perspectives are explored and critically discussed.

- **Unit III – Core Concepts in Cognitive Science and Philosophical Concerns   9 hrs.**
  - **Innateness:** The historical role of innateness rooted in David Hume relating to contemporary debates concerning developmental issues is critically reviewed.
  - **Language Faculty and The Linguistic Turn:** Developmental issues are further discussed in relation to language and cognition. Starting with Noam Chomsky and to philosophical debates and developments related to language, concepts and philosophy of mind. This includes the Linguistic Turn and its relation to empiricism and philosophy of mind.
  - **The Role Of Conceptual Analysis About Mental Phenomena:** Core cognitive science concepts are discussed in relation to different disciplinary perspectives and arguments. The debates aim to consider the role and utility of cognitive science, psychology and philosophy in theorising mental phenomena in relation to consciousness, representation, and innateness. These debates are extended within a more comparative philosophical consideration related to German Idealism and its recent revival, connections to Russian psychology and Eastern theories of mind, and nondualist philosophical frameworks.

- **Unit IV – First-order Empirical Issues in Cognitive Science   9 hrs.**
  - **Theory of Mind:** Historical, philosophical theories of mind are considered (e.g. eliminativism and functionalism) and reviewed in light of empirical research and cognitive science approaches to theorising the mind (e.g. simulation theory). The discussion is extended to consider contemporary research, German Idealism and Maya theory within Advaita Vedanta.
  - **Language:** Theories of language faculty and language acquisition. The role of language and linguistics in informing non-linguistic domains of cognitive science is also addressed.
  - **Culture and Cognition:** Theories of social learning and cultural transmission and their relation to distinctive human cognitive features and science and technology.
  - **Mind, Learning and Epistemology:** Considering developments in cognitive psychology and learning theories, the emerging relations and tensions in the philosophy of mind and education are critically discussed. This debate is extended to consider Eastern philosophical perspectives, with a focus on non-dualist epistemology.

- **Unit V – Traditional Philosophical Problems and Contemporary Perspectives   9 hrs.**
  - **Rationality:** Debates in philosophy and cognitive science are directed at issues of reasoning and rationality. Consideration of Cartesian dualism and emerging alternative trends within philosophy and cognitive sciences as related to human judgments, decision-making and moral psychology. This debate considers emerging arguments within contemporary Analytic philosophy and relations to Eastern non-dualist perspectives.
  - **Artificial Intelligence and Human Consciousness:** The historical development of AI is discussed, with the Turing test and Chinese Room argument revisited. These arguments are discussed in view of contemporary developments and singularity. The future of AI is discussed in view of the debate regarding the relation of machine intelligence, the human mind and the concept of 'intelligence'. Western and Eastern conceptualisations are reviewed and critically discussed.
  - **Metaphilosophical Issues:** Drawing on the various philosophical debates, the discussion debates the role of philosophy as a methodology and implications for cognitive science as a

form of enquiry. Debates focus on empirical research and empiricist assumptions. These are discussed in view of methodological naturalism and experimental philosophy. These issues are critically discussed with a view to contemporary developments in non-dualist epistemology in Eastern philosophy.

- ▪ **Contemporary and Emerging Schools of Thought:** In concluding the module, the topics are brought back to bear on foundational philosophical issues that remain at the heart of the philosophy of cognitive science, namely, representationalism, dualism, empiricism, materialism and emerging philosophical schools of thought that challenge these assumptions, in addressing intentionality, rationality, learning and consciousness from alternative non-representational and non-dualist epistemological perspectives. These philosophical considerations draw from both Western and Eastern philosophies in discussing the future directions of Cognitive Science.

Textbooks and Papers:

Churchland, P. (1981). Eliminative materialism and the propositional attitudes. *Journal of Philosophy* 78(2): 67– 90. 10.2307/2025900

Fodor, J., Garrett, M., Walker, E., and Parkes, C. (1980). Against definitions. *Cognition* 8(3): 263–67. 10.1016/0010-0277(80)90008-6

Fodor, J., and Piattelli-Palmarini, M. (2010). *What Darwin Got Wrong.* London: Profile Books.

Grice, P. (1987). Conceptual Analysis and the Province of Philosophy. In P. Grice (1989), *Studies in the Way of Words.* Cambridge, MA: Harvard University Press.

Reference Books:

Anderson, J. (2007). *How Can the Human Mind Occur in the Physical Universe?* New York: Oxford University Press. 10.1093/acprof:oso/9780195324259.001.0001

Brandom, R. (1994). *Making It Explicit: Reasoning, Representing, and Discursive Commitment.* Cambridge, MA: Harvard University Press.

Carruthers, P. (2006). *The Architecture of the Mind: Massive Modularity and the Flexibility of Thought.* New York: Oxford University Press.

Chalmers, D. (1996). *The Conscious Mind: In Search of a Fundamental Theory.* New York: Oxford University Press. Google Scholar

Chomsky, N. (1957). *Syntactic Structures.* The Hague: Mouton.

Copeland, B. J. (ed.) (2004). *The Essential Turing.* Oxford: Oxford University Press.

Davidson, D. (1975). Thought and Talk. In D. Davidson (1984), *Inquiries into Truth and Interpretation.* Oxford: Oxford University Press.

Dummett, M. (1993). *The Seas of Language.* Oxford: Oxford University Press.

Fodor, J. (1975). *The Language of Thought.* Cambridge, MA: Harvard University Press.

Hume, D. (1777/1975). *Enquiries Concerning Human Understanding and Concerning the Principles of Morals*, edited by L. A. Selby-Bigge (3rd edition revised by P. H. Nidditch). Oxford: Oxford University Press.

Jackson, F. (1998). *From Metaphysics to Ethics: A Defence of Conceptual Analysis.* Oxford: Oxford University Press. Google Scholar

Lewis, D. (1972). Psychophysical and theoretical identifications. *Australasian Journal of Philosophy* 50: 249– 58. 10.1080/00048407212341301

Marr, D. (1982). *Vision. A Computational Investigation into the Human Representation and Processing of Visual Information.* San Francisco: W. H. Freeman.

Moore, G. E. (1966). *Lectures on Philosophy*, edited by Casimir Lewy. London: George Allen and Unwin. Nagel, T. (1974). What is it like to be a bat? *Philosophical Review* 83: 435–50. 10.2307/2183914

Newell, A. (1980). Physical symbol systems. *Cognitive Science*, 4(2): 135–83.

10.1207/s15516709cog0402_2

Newell, A., and Simon, H. (1976). Computer science as empirical inquiry: Symbols and search. *Communications of the Association for Computing Machinery* 19(3): 113–26. 10.1145/360018.360022

Pinker, S. (1997). *How the Mind Works*. New York: W. W. Norton.

Pylyshyn, Z. (1984). *Computation and Cognition. Toward a Foundation for Cognitive Science*. Cambridge, MA: MIT Press.

Richerson, P., and Boyd, R. (2005). *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago: University of Chicago Press.

Tooby, J., and Cosmides, L. (1992). The Psychological Foundations of Culture. In J. Barkow, L. Cosmides, and J. Tooby (eds.), *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. New York: Oxford University Press.

Turing, A. (1951). Can Digital Computers Think? In B. J. Copeland (ed.), *The Essential Turing*. Oxford: Oxford University Press.

Whorf, B. (1956). *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*, edited by J. Carroll. Cambridge, MA: MIT Press.

Vygotsky, L. (1986). *Thought and Language*, edited by A. Kozulin. Cambridge, MA: MIT Press.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT503   COGNITIVE PSYCHOLOGY AND NEUROSCIENCE - PART 1   3 0 0 3

Prerequisites: Good reading and writing skills in English; Basic understanding of brain anatomy and neural functioning

Course Description:
In this course, learners will gain an overview of cognitive psychology, which studies mental processes. They will explore human perception, i.e., how we perceive the world through our senses and organize our perceptions. Learners will come to understand how attention influences memory, and how memory is being constructed in the mind. Moreover, this course offers learners the opportunity to gain a deeper understanding of the relationship between brain function and cognition. At the end of the course, they should become familiar with the structure and function of the brain and nervous system. In addition, they should be able to understand the neural basis of cognitive processes, such as perception, attention, consciousness, learning, and memory. They should be able to grasp how social and biological factors impact brain development in children. They should also develop a basic understanding of the methods of cognitive neuroscience, such as brain-imaging techniques. Finally, they should gain an overview of neurocognitive disorders.

Course Objectives:
1. To develop a working knowledge of the structure and function of the brain and nervous system.
2. To understand how the human brain develops and adapts to outer circumstances.
3. To gain a basic understanding of the methods of cognitive neuroscience, such as brain-imaging techniques.
4. To gain insight into how the human mind perceives the world through the senses.
5. To gain an understanding of what attention is and what influences attention.
6. To gain an understanding of human consciousness.
7. To gain an overview of the different parts of the memory system and how we create memories.
8. To gain knowledge of the neural basis of learning and memory.
9. To gain an overview of neurological dysfunction and neurocognitive disorders.

Course Outcomes:
CO1: Understand essential concepts of neuroanatomy and brain structure and function.

CO2: Acquire knowledge of the cutting-edge technology used in cognitive neuroscience, such as functional and structural brain imaging.

CO3: Gain information on how the brain develops and what factors affect brain development.

CO4: Gain insights into theories from cognitive psychology that explain cognitive processes, such as perception, attention, consciousness, memory, and learning.

CO5: Gain insights into the neural basis of cognitive processes, such as perception, attention, consciousness, memory, and learning.

CO6: Understand different causes and types of neurological dysfunction and neurocognitive disorders and rehabilitation.

Skills:
 • Develop a deeper understanding of the relationship between brain function and cognition.
 • Differentiate between the functional divisions of the brain and gain an understanding of the workings of neurons.
 • Grasp how social and biological factors impact brain development in children and leave a lasting impact into adulthood.
 • Develop a basic understanding of the methods of cognitive neuroscience, such as brain-imaging techniques.
 • Understand cognitive psychology theories and the neural basis of cognitive processes, such as perception, attention, consciousness, memory, and learning.
 • Gain an overview of neurocognitive disorders and rehabilitation.

CO-PO Mappings

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	-	-	-	-	-	x	-	-
CO2	x	-	-	-	-	-	x	-	-
CO3	-	-	-	-	-	-	x	x	-
CO4	-	-	-	-	-	-	x	x	-
CO5	-	-	-	-	-	-	x	-	-
CO6	-	-	-	-	-	-	x	-	x

Syllabus:

Unit I – Structure and Function of the Brain and Nervous System   **9 hrs.**
- Introduction:
  - What is cognition? What is cognitive psychology? What is cognitive neuroscience?
- Methods of cognitive psychology and instruments of cognitive neuroscience (e.g., neuroimaging)
- Brain anatomy and functional divisions of the cerebral cortex
- Structure and function of neurons
- Early brain development and neuroplasticity: Influencing factors of genes, environment, and experience
  - (e.g., effects of neglect on brain development)

Unit II – Perception   **9 hrs.**
- Senses, sensation, and perception
- Anatomy of the senses in the cerebral cortex
- Perception: different types of perception, such as visual, auditory, haptic, olfactory, gustatory, somatosensory (including vestibular and proprioceptive) perception

Unit III – Attention and Consciousness   **9 hrs.**
- Attention from a cognitive psychology perspective:
  - Types: selective attention, divided attention, and sustained attention
  - Theories: early and late selection, capacity, and mental effort models
- Neural mechanisms of attention
- Consciousness: Nature, types, and function

Unit IV – Learning and Memory   **9 hrs.**
- Memory from a cognitive psychology perspective:
  - Encoding, storage and retrieval
  - Short-term forms of memory (sensory, short-term, and working memory)
  - Long-term forms of memory (explicit: episodic and semantic; implicit: procedural)
  - The constructive nature of memory
- Neural basis of learning and memory:
  - Neural networks in the human brain
  - Neurophysiology of learning and performing new skills
  - The role of the hippocampus in memory

Unit V – Neurological Dysfunction   **9hrs.**
- Neurological dysfunction and neurocognitive disorders (physiological and psychiatric)

- Neuropsychological rehabilitation

Textbooks:

Goldstein, E. B. (2015). *Cognitive psychology: Connecting mind, research, and everyday experience* (4th edition). Cengage Learning. https://aishwaryajaiswal.com/wp-content/uploads/2022/01/Cognitive-Psychology_-Connecting-Mind-Research-and-Everyday-Experience.pdf

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2014). *Cognitive neuroscience. The biology of the mind* (4th edition). Norton.

Millan, M. J., Agid, Y., Brüne, M., Bullmore, E. T., Carter, C. S., Clayton, N. S., ... & Young, L. J. (2012). Cognitive dysfunction in psychiatric disorders: Characteristics, causes and the quest for improved therapy. *Nature Reviews Drug Discovery, 11*(2), 141-168.

Reference Books:

Groome, D. (2014). *An introduction to cognitive psychology. Processes and disorders* (3rd edition). Psychology Press. http://xn--webducation-dbb.com/wp-content/uploads/2019/11/David-Groome-et-al.-An-Introduction-to-Cognitive-Psychology_-Processes-and-Disorders-Psychology-Press-Taylor-Francis-c2014.pdf

Hebb, D. O. (1949). *The organization of behavior*. Wiley.

Kandel, E. R., Schwartz, J. H., & Jessell, T. M. (2000). *Principles of neural science* (4th ed). McGraw-Hill.

Knafo-Noam, A., Daniel, E., & Benish-Weisman, M. (2024). The Development of Values in Middle Childhood: Five Maturation Criteria. *Current Directions in Psychological Science*, *33*(1), 18-26

Kok, A. (2020). *Functions of the brain. A conceptual approach to cognitive neuroscience*. Routledge.

Krebs, C., Weinberg, J., & Akesson, E. (2012). *Lippincott's illustrated reviews of neuroscience*. Wolters Kluwer.

McCandliss, B., & Toomarian, E. (2020, April 13). Putting Neuroscience in the Classroom: How the Brain Changes as We Learn. Trend Magazine, Spring 2020(5). https://pew.org/2UoSzWN

Mesulam, M.-M. (2000). *Behavioral neuroanatomy: Large-scale networks, association cortex, frontal syndromes, the limbic system, and hemispheric specialization*. Association Cortex, Frontal.

Miller, G. (2003). The cognitive revolution: A historical perspective. *Trends in Cognitive Sciences, 7,* 141–144.

Passingham, R. (2016). *Cognitive neuroscience: A very short introduction*. Oxford University Press.

Raichle, M. E. (1998). Behind the scenes of functional brain imaging: A historical and physiological perspective. *Proceedings of the National Academy of Sciences, USA, 95*, 765–772.

Shaw, P., Greenstein, D., Lerch, J., Clasen, L., Lenroot, R., Gogtay, N., Evans, A., Rapoport, J., & Giedd, J. (2006). Intellectual ability and cortical development in children and adolescents. *Nature, 440*, 676-679.

Streidter, G. (2005). Principles of brain evolution (pp. 217–53). Sunderland, MA: Sinawer.

hagard, P. (2009). Why cognitive science needs philosophy and vice versa. *Topics in Cognitive Science*, *1*(2), 237-254

Ward, J. (2020). The student's guide to cognitive neuroscience (4th edition). Routledge.

Zimmer, C. (2004). *Soul made flesh: The discovery of the brain – and how it changed the world*. New York: Free Press.

ACADEMIC PAPERS

1. Alexander, R., Aragón, O. R., Bookwala, J., Cherbuin, N., Gatt, J. M., Kahrilas, I. J., ... & Styliadis,

C. (2021). The neuroscience of positive emotions and affect: Implications for cultivating happiness and wellbeing. *Neuroscience & Biobehavioral Reviews*, *121*, 220-249

2. Barack, D. L., & Krakauer, J. W. (2021). Two views on the cognitive brain. *Nature Reviews Neuroscience, 22*(6), 359-371

3. Bayne, T., Brainard, D., Byrne, R. W., Chittka, L., Clayton, N., Heyes, C., ... & Webb, B. (2019). What is cognition?. *Current Biology, 29*(13), R608-R615.

4. Domes, G., Schulze, L., Böttger, M., Grossmann, A., Hauenstein, K., Wirtz, P. H., ... & Herpertz, S. C. (2010). The neural correlates of sex differences in emotional reactivity and emotion regulation. *Human brain mapping*, *31*(5), 758-769

5. Fox, S. E., Levitt, P., & Nelson III, C. A. (2010). How the timing and quality of early experiences influence the development of brain architecture. *Child development*, *81*(1), 28-40

6. Friedman, N. P., & Robbins, T. W. (2022). The role of prefrontal cortex in cognitive control and executive function. *Neuropsychopharmacology*, *47*(1), 72-89

7. Keunen, K., Counsell, S. J., & Benders, M. J. (2017). The emergence of functional architecture during early brain development. *Neuroimage*, *160*, 2-14

8. Koenig, J., Parzer, P., Haigis, N., Liebemann, J., Jung, T., Resch, F., & Kaess, M. (2021). Effects of acute transcutaneous vagus nerve stimulation on emotion recognition in adolescent depression. *Psychological medicine*, *51*(3), 511-520

9. Milner, B., Squire, L. R., & Kandel, E. R. (1998). Cognitive neuroscience and the study of memory. *Neuron*, *20*(3), 445-468.

10. Mussel, P., & Hewig, J. (2019). A neural perspective on when and why trait greed comes at the expense of others. *Scientific Reports*, *9*(1), 10985

11. Nelson, C. A., Fox, N. A., & Zeanah, C. H. (2023). Romania's abandoned children: The effects of early profound psychosocial deprivation on the course of human development. *Current Directions in Psychological Science*, *32*(6), 515-521

12. Paas, F., & van Merriënboer, J. J. (2020). Cognitive-load theory: Methods to manage working memory load in the learning of complex tasks. *Current Directions in Psychological Science*, *29*(4), 394-398

13. Rich, A. N., & Mattingley, J. B. (2002). Anomalous perception in synaesthesia: a cognitive neuroscience perspective. Nature Reviews Neuroscience, 3(1), 43-52.

14. Robbins, T. W. (2011). Cognition: The ultimate brain function. *Neuropsychopharmacology*, *36*(1), 1-2

15. Ryan, J. D., & Shen, K. (2020). The eyes are a window into memory. *Current Opinion in Behavioral Sciences*, *32*, 1-6

16. Schlaug, G., Norton, A., Overy, K., & Winner, E. (2005). Effects of music training on the child's brain and cognitive development. *Annals of the New York Academy of Sciences*, *1060*(1), 219-230.

17. Sturman, D. A., & Moghaddam, B. (2011). The neurobiology of adolescence: changes in brain architecture, functional dynamics, and behavioral tendencies. *Neuroscience & Biobehavioral Reviews*, *35*(8), 1704-1712

18. Vaidya, A. R., Pujara, M. S., Petrides, M., Murray, E. A., & Fellows, L. K. (2019). Lesion studies in contemporary neuroscience. *Trends in cognitive sciences*, *23*(8), 653-671

19. Vuust, P., Heggli, O. A., Friston, K. J., & Kringelbach, M. L. (2022). Music in the brain. *Nature Reviews Neuroscience*, *23*(5), 287-305.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT504   INTRODUCTION TO LEARNING AND INSTRUCTION   3 0 0 3

Prerequisite: Good reading and writing skills in English

Summary:
Learning sciences is an interdisciplinary field and based on long-established disciplinary research areas, such as anthropology, cognitive psychology, curriculum and instruction, educational psychology, and sociology. Research in the learning sciences is often situated in problems of practice that occur in a range of "learning" contexts, including formal or informal settings dedicated to schooling, workplace, or leisure/entertainment goals.This course provides an introduction to educational psychology and learning sciences, an interdisciplinary field that investigates how people learn, and how education can be improved. The course covers key theories, principles, and methods in the learning sciences, including cognitive and motivational factors that influence learning, designing effective instructions, and the role of technology in learning.

Course Objectives:

1. To gain a basic understanding of the basic concepts and theories of human learning from perspective of cognition and behavior.
2. To gain basic understanding of instruction & facilitating learning: Students will be able to understand and differentiate between various instructional models, ranging from traditional teacher-centered approaches to modern student-centered and collaborative learning strategies.
3. To gain an overview of the foundational principles to design effective learning environments
4. To gain an overview of current and emerging trends within digital learning with the outlook of AI.

Course Outcomes:

CO1: Understand and Differentiate Instructional Models:

CO2:Apply Instructional Models in Teaching Practice: Students will be prepared to apply a variety of instructional models in their teaching practice, effectively facilitating learning by adapting their teaching strategies to meet the needs and preferences of their students.

CO3: Gain information on how philosophy has historically influenced current theories within cognitive sciences.

CO4: Gain insights into how empirical research in cognitive sciences has influenced philosophical debates and thinking.

CO5: Understand how philosophical concerns issues and debates can inform, clarify and develop concepts and theories within the cognitive sciences, such as attention, memory and perception.

Skills:

- Gain an overview of key learning theories, perspectives and concepts in related to cognitive science and technology.

- Develop a deeper understanding of how learning can be facilitated and designed.
- Understand how the possibilities and limitation of digital learning as of the current state of the art.
- Demonstrate an enhanced ability to engage in critical analysis and argument through reading and group discussions.
- Demonstrate the ability to work in teams and understand multidisciplinary perspectives on Learning and Teaching.
- Demonstrate confidence in undertaking work through independent learning and taking responsibility for their learning.

CO-PO Mappings

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	**X**	-	-	-	X	-	-	-	-		
CO2	-	-	**X**	-	-	-	X	-	X		
CO3	-	**X**	-	-	-	-	-	-	-		
CO4	-	-	-	X	-	X	-	-	-		
CO5	**-**	-	-	-	-	-	-	-	X		

Syllabus:

Unit I - Foundations of Human Learning from the Perspective of Cognition   9 hrs.

Cognitive learning theories, theories of instruction, social learning theories, collaborative learning, intelligence, prior knowledge, self-regulated learning, adult learning vs learning in childhood, learning and excellence.

Unit II – Motivational and Emotional Aspects of Learning   9 hrs.

Different types of emotions and motivation in the context of learning, academic related emotions and motivation and its impact on learning, self-concept and self efficacy, social-emotional competency

Unit III – Instruction and Facilitating Learning   9 hrs.

Scaffolding, metacognition, learning in activity, learn transfer, collaborative learning, complex systems of learning, problem based learning, gamification, ICAP model

Unit IV – Technology Enhanced and Digital learning: Digital Learning and Teaching 9 hrs.

Learning in virtual environments, computer supported collaborative learning, technology-enhanced learning in different educational contexts, technology supported immersive learning

Unit V – Designing and Evaluating Learning and Learning Environments   9 hrs.

Learning Sciences, Educational Policy, Embodied Design, Measuring Learning and Change, Design research, ICAP model

Textbooks and Papers:

Alexander, P. A., Schallert, D. L., & Reynolds, R. E. (2009). What is learning anyway? A topographical perspective considered. Educational Psychologist, 44(3-4), 176–192.

Antonietti, C., Schmitz, M. L., Consoli, T., Cattaneo, A., Gonon, P., & Petko, D. (2023). Development and validation of the ICAP Technology Scale to measure how teachers integrate technology into learning activities. Computers & Education, 192, 104648.

Archambault, L., Leary, H., & Rice, K. (2022). Pillars of online pedagogy: A framework for teaching

in online learning environments. Educational Psychologist, 57(3), 178-191.

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. Educational psychologist, 49(4), 219-243.

Chi, M. T., Adams, J., Bogusch, E. B., Bruchok, C., Kang, S., Lancaster, M., ... & Yaghmourian, D. L. (2018). Translating the ICAP theory of cognitive engagement into practice. Cognitive science, 42(6), 1777-1832.

Fischer, F., Hmelo-Silver, C. E., Goldman, S. R., & Reimann, P. (Eds.). (2018). International handbook of the learning sciences. Routledge.

Fischer, F., & Opitz, A. (2022). Learning to diagnose with simulations: Examples from teacher education and medical education. Cham: Springer International Publishing.

Edwards, R. (2012). Lifelong learning: A posthuman condition? In D. Aspin, J. Chapman, K. Evans, & R. Bagnall (Eds.), Second International Handbook of Lifelong Learning (pp. 151–162). Springer.

EUCIS-LLP, European Civil Society for Europe – Lifelong Learning Platform. (2015). Manifesto for the future of learning in Europe. Brussels: EUCIS.

Fauré, E., et al. (1972). Learning to be: The world of education today and tomorrow. Paris: UNESCO.

Fischer, F., Sommerhoff, D., & Keune, A. (2023). Perspectives on learning from the learning sciences. In International Encyclopedia of Education (Fourth Edition) (pp. 44-56). Elsevier.

Greenhow, C., Graham, C. R., & Koehler, M. J. (2022). Foundations of online learning: Challenges and opportunities. Educational Psychologist, 57(3), 131-147.

Sawyer, R. K. (Ed.). (2014). The Cambridge handbook of the learning sciences. Cambridge University Press.

Slavin, R. E. (2018). Educational psychology: Theory and practice. Pearson.

Teasley, S. D. (2019). Learning analytics: Where information science and the learning sciences meet. Information and Learning Sciences, 120(1/2), 59-73.

Sawyer, R. K. (2022). An introduction to the learning sciences. The Cambridge handbook of the learning sciences, 1-24.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT505   RESEARCH METHODOLOGY I: INTRODUCTION TO RESEARCH METHODS
3 0 0 3

Prerequisite: Good reading and writing skills in English

Course Objectives:
1. To teach students a basic understanding of research methodology and its relevance for studying the human mind and brain
2. To lead students step-by-step through the different phases of the research process: identifying a researchable problem, formulating the research question, creating the research design, recruiting the sample, using research tools for data collection, analyzing and interpreting the data, and communicating the results
3. To teach students how to conduct research studies in an ethical way
4. To deepen students' critical thinking skills by using deductive logic and by thinking in a scientific way

Course Outcomes:

CO1: Understand the scientific method, as well as the role of scientific research in the field of cognitive sciences

CO2: Gain the skills to define a researchable problem and formulate a research question

CO3: Gain the ability to formulate research hypotheses in order to test theories, which include at least one independent and one dependent variable

CO4: Develop an understanding of the different research designs, including experimental designs for evaluation research, and gain the ability to recruit a sample and to apply different research tools in the field

CO5: Know how to summarize and present data as charts and frequencies in descriptive research, as well as to compare groups and find relationships between variables in inferential research

CO6: Gain the knowledge of how to conduct a research study in an ethical way

Skills:
- Scientific thinking
- Define a researchable problem and formulate a research question
- Formulate research hypotheses to test theories
- Design a research study that has high internal validity
- Recruit a random sample
- Summarize data as charts and tables
- Follow ethical guidelines while doing research

CO-PO Mappings

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	X	-	-	-
CO2	X	-	-	-	-	-	-	-	-
CO3	X	-	-	-	-	-	-	-	-
CO4	X	-	-	-	-	-	-	-	-
CO5	X	-	-	X	-	-	-	-	-
CO6	X	-	-	-	X	-	X	-	-

Syllabus:

Unit I – Scientific Method and Role of Research in Cognitive Sciences   **9 hrs.**
- Scientific research in the natural vs social sciences
- Relevance of scientific research in the field of cognitive sciences
- Features of the scientific method
- Induction vs deduction
- Quantitative, qualitative, and mixed methods research
- Code of ethics for research with human subjects

Unit II – Problem Formulation   **9 hrs.**
- Finding researchable problems
- Conducting a literature review
- Formulating the research question
- Stating the research objectives

Unit III – Theories and Variables   **9 hrs.**
- Concepts and conceptualization
- Operationalization of concepts (constructs) as variables
- Types of variables
- Nature and role of theories in social science research
- Formulation of hypotheses

Unit IV – Research Designs, Sampling, Tools   **9 hrs.**
- Units of analysis
- Research designs for quantitative and qualitative research
- Sampling methods
- Tools of data collection in quantitative research (observation methods, standardized questionnaires, rating scales, schedules) and qualitative research (unstructured/semi-structured interviews, focus group discussions, participant observation)
- Psychometric properties of quantitative research tools (validity, reliability, practicality)
- Increasing the trustworthiness of qualitative studies

Unit V – Analyzing and Interpreting Results of Quantitative Studies   **9 hrs.**
- Definition of data
- Levels of measurement (nominal, ordinal, scale, ratio)
- Measures of central tendency (mode, median, mean)
- Measures of dispersion (range, standard deviation, variance)
- Descriptive statistics (charts and frequency tables)

- Inferential statistics (exploring differences between groups and exploring relationships between variables)
- Significance level $p \leq 0.05$
- Communicating results by publishing a paper

Textbooks:

Bhattacherjee, A. (2012). *Social science research: Principles, methods, and practices*. Textbooks Collection. Book 3. http://scholarcommons.usf.edu/oa_textbooks/3

Creswell, J. W. (2014). *Research design. Qualitative, quantitative, and mixed methods* (4th edition). Los Angeles, CA: Sage.

Kumar, R. (2011). *Research methodology. A step-by-step guide for beginners* (3rd edition). Los Angeles, CA: Sage. Retrieved from http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf

Reference Books:

Bacon-Shone, J. H. (2013). *Introduction to quantitative research methods*. Hong Kong: Graduate School, The University of Hong Kong. Retrieved from https://hub.hku.hk/bitstream/10722/191018/1/Content.pdf

Bryman, A. (2016): *Social research methods* (5th edition). Oxford, UK: Oxford University Press.

Goode, W. J. & Hatt, P. K. (2017). *Methods in social research*. Hyderabad, India: Asia Law House.

Kothari, C.R. (2004). *Research methodology. Methods and techniques* (2nd revised edition). New Delhi, India: New Age International Publishers. Retrieved from https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf

Krishnaswamy, O. R. & Ranganatham, M. (2013). *Methodology of research in social sciences* (2nd edition). New Delhi, India: Himalaya Publishing House.

Neuman, W. L. (2014). *Social research methods. Qualitative and quantitative approaches* (7th edition). Pearson Education India.

Nick, T. G. (2007). *Descriptive statistics*. In W. T. Ambrosius (Ed.), Topics in biostatistics (p. 33-52) (Series: Methods in Molecular Biology). Totowa, NJ: Humana Press. Retrieved from https://www.researchgate.net/profile/Douglas_Mahoney2/publication/5402488_Linear_Mixed_Effects_Models/links/57e560bf08ae9227da964db4.pdf#page=42

Patel, P. (2009). *Introduction to quantitative methods*. Retrieved from https://www.studocu.com/row/document/takoradi-polytechnic/quantitative-studies/quantitative-methods-practical/2647139?origin=null

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT581   NEUROPHYSIOLOGY AND LEARNING TECHNOLOGIES LABORATORY
<div align="right">0 0 1 1</div>

Summary:
The main objective of this course is to provide basic overview of neurophysiology and learning technology devices such as but not limited learning technology devices, including EEG, VR, AR, eye-tracking and haptics to understand cognition, behaviour in the context of Education This course offers an exploration of the intersection between neurophysiology, and state of the art learning technologies. It aims to equip students with a comprehensive understanding of how devices such as EEG , VR, AR), eye-tracking, and haptics can be utilized to enhance our understanding of cognition and behavior within educational contexts. Through hands-on labs,and project work, students will learn to apply these technologies to solve real-world learning challenges.

Course Outcomes: After completing the course, students will be able to:
CO1: Understand the basic principles of neurophysiology related to learning and cognition. CO2: Gain proficiency in using various learning technologies, including EEG, VR, AR,
eye-tracking, and haptic devices.
CO3: Design and conduct experiments to investigate cognitive processes and learning outcomes.
CO4: Analyze and interpret data from neurophysiological and learning technology devices. CO5: Critically evaluate the application of these technologies in educational settings.

22AVP103   Mastery Over Mind (MAOM)   1-0-2 2

1. Course Overview

Master Over the Mind (MAOM) is an Amrita initiative to implement schemes and organise university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3). This program as part of our efforts for sustainable stress reduction gives an introduction to immediate and long-term benefits and equips every attendee to manage stressful emotions and anxiety facilitating inner peace and harmony.

With a meditation technique offered by Amrita Chancellor and world-renowned humanitarian and spiritual leader, Sri Mata Amritanandamayi Devi (Amma), this course has been planned to be offered to all students of all campuses of AMRITA, starting off with all first years, wherein one hour per week is completely dedicated for guided practical meditation session and one hour on the theory aspects of MAOM. The theory section comprises lecture hours within a structured syllabus and will include invited guest lecture series from eminent personalities from diverse fields of excellence. This course will enhance the understanding of experiential learning based on university's mission: "Education for Life along with Education for Living", and is aimed to allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals.

2. Course Syllabus

Unit 1 (4 hours)

Causes of Stress: The problem of not being relaxed. Need for meditation -basics of stress management at home and workplace. Traditions and Culture. Principles of meditation– promote a sense of control and autonomy in the Universal Human Value System. Different stages of Meditation. Various Meditation Models. Various practices of Meditation techniques in different schools of philosophy and Indian Knowledge System.

Unit 2 (4 hours)

Improving work and study performance. Meditation in daily life. Cultivating compassion and good mental health with an attitude of openness and acceptance. Research and Science of Meditation: Significance of practising meditation and perspectives from diverse fields like science, medicine, technology. philosophy, culture, arts, management, sports, economics, healthcare, environment etc. The role of meditation for stress and anxiety reduction in one's life with insights based on recent cutting-edge technology. The effect of practicing meditation for the wholesome wellbeing of an individual.

Unit 3 (4 hours)

Communications: principles of conscious communication. Relationships and empathy: meditative approach in managing and maintaining better relationships in life during the interactions in the world, role of MAOM in developing compassion, empathy and responsibility, instilling interest, and orientation to humanitarian projects as a key to harness intelligence and compassion in youth. Methodologies to evaluate effective awareness and relaxation gained from meditation. Evaluating the global transformation through meditation by instilling human values which leads to service learning and compassion driven research.

TEXT BOOKS:
1.Mata Amritanandamayi Devi, "Cultivating Strength and vitality," published by Mata Amritanandamayi Math, Dec 2019
2.Swami Amritaswarupananda Puri ,"The Color of Rainbow " published by MAM, Amritapuri.

 REFERENCES:
1.Craig Groeschel, "Winning the War in Your Mind: Change Your Thinking, Change Your Life" Zondervan Publishers, February 2019

2.R Nagarathna et al, "New Perspectives in Stress Management "Swami Vivekananda Yoga Prakashana publications, Jan 1986

3. Swami Amritaswarupananda Puri "Awaken Children Vol 1, 5 and 7 - Dialogues with Amma on Meditation", August 2019

4. Swami Amritaswarupananda Puri "From Amma's Heart - Amma's answer to questions raised during world tours" March 2018

5. Secret of Inner Peace- Swami Ramakrishnananda Puri, Amrita Books, Jan 2018.

6. Mata Amritanandamayi Devi "Compassion :The only way to Peace:Paris Speech", MA Center, April 2016.

7. Mata Amritanandamayi Devi "Understanding and collaboration between Religions", MA Center, April 2016.

8. Mata Amritanandamayi Devi "Awakening of Universal Motherhood: Geneva Speech" M A center, April 2016.

3. **Evaluation and Grading**

Internal			External	Total
Components	*Weightage*		Practical (attendance and class participation) 60%	100%
Quizzes(based on the reading material)	20%	40%		
Assignments (Based on webinars and lecture series)	20%			

4. **Course Outcomes (CO)**

CO1: Relate to the causes of stress in one's life.

CO2: Experiment with a range of relaxation techniques CO3: Model a meditative approach to work, study, and life.
CO4: Develop appropriate practice of MA-OM technique that is effective in one's life CO5: Inculcate a higher level of awareness and focus.
CO6: Evaluate the impact of a meditation technique

*Programme Outcomes(PO)(As given by NBA and ABET)
PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of complex problems
PO5: Modern tools usage
PO6: Engineer and Society
PO7: Environment and Sustainability
PO8: Ethics
PO9: Individual & Team work
PO10: Communication
PO11: Project management & Finance
PO12: Lifelong learning

CO – PO Affinity Map

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2		-	2	3	-	3	-	3	-	-	-
CO2	3	3	3	2	2	_	2	3	3	3	-	3	-	-	-
CO3	3	3	2	2	2	2	2	3	3	3	-	3	-	-	-
CO4	3	3	3	2	-	2	3	3	3	3	-	3	-	-	-
CO5	3	2	2	2	-	2	-	3	2	2	-	2	-	-	-
CO6	3	2	2	2	3	2	_	3	2	2	-	2	-	-	-

24CLT511   **INTERFACES FOR LEARNING**   **3 0 0 3**

Prerequisite: Good reading and writing skills in English

Summary:
This course delves into understanding the users of learning technology, emphasizing the importance of designing technology that caters to the end users' needs for it to be effective. Misunderstandings or ignorance of these needs can lead to poor user interfaces and diminished learning experiences, a concern particularly acute for vulnerable communities dependent on skill training. Through a detailed exploration of learner needs, with a focus on neurodiversity and educational backgrounds, the course uses a case study of low-literacy women in rural India to navigate the full spectrum of user needs analysis and specification.

Course Objectives:
Students will learn to:
1. Identify the different interaction components
2. Identify the design strategies used by the product
3. Place these within the context of contemporary interface design
4. Explore the connection between interface and pedagogy
5. Observe the technology in use in a naturalistic and controlled setting
6. Assess the effectiveness and make recommendations for interface improvement.

Course Outcomes:
CO1: Critical Analysis Skills: Students will develop the ability to critically evaluate technology trends and design decisions for their impact on learning.

CO2: User-Centered Design Proficiency: Gain understanding in designing educational technologies that prioritize user experience and learning outcomes.

CO3: Pedagogical Knowledge: Enhance understanding of various teaching strategies and how technology can support these methods.

CO4: Cognitive Psychology Insight: Acquire insights into how learners process information, aiding in the creation of more effective learning environments.

CO5: Solution Implementation: Apply knowledge to design or improve educational technologies that align with pedagogical goals and cater to learners' cognitive needs.

Skills:
- Interface Analysis: Ability to dissect and understand the mechanics of various user interfaces in educational technologies.
- Critical Evaluation: Skills in critically evaluating the effectiveness of interface designs in facilitating learning.
- Design Thinking: Competence in applying design thinking principles to create or improve user interfaces that align with pedagogical needs.
- Pedagogical Alignment: Understanding of how to match interface designs with specific educational approaches and cognitive processes.
- Observational Research: Proficiency in conducting observational studies to assess technology usage and its impact on learning.
- Recommendation & Implementation: Capability to formulate and articulate actionable recommendations for enhancing user interface designs in educational technologies.

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	X	-	-	-	-	-	-	-	-		
CO2	-	-	X	-	-	-	-	-	-		
CO3	-	X	-	-	-	-	-	X	-		
CO4	-	-	-	-	X	-	-	-	-		
CO5	X	-	-	-	-	-	-	-	X		

Syllabus:

Unit I: Survey of Interfaces for Learning   15 hrs.
- Examination of several distinct Human-Computer Interaction (HCI) styles in learning technologies.
- Identification of design choices and interaction mechanisms.
- Integration of design approaches within the broader HCI domain.

Unit II Major Interface Design   15 hrs.
- Detailed analysis of three major approaches to learning interface designs
- Evaluation of their strengths, weaknesses and affordances
- Mapping interface designs with specific pedagogical approaches

Unit III: Pedagogy, Learning Task and Interface   15 hrs.
- In-depth case study analysis linking a specific pedagogy to a learning technology.
- Exploration of how cognitive tasks align with interface affordances.
- Evaluation of the interface-pedagogy fit and identification of potential improvement.

References:

Ramesh, M. V., Muir, A., Nandanan, K., Bhavani, R. R., & Mohan, R. (2022). HCI curricula for sustainable innovation: the humanitarian focus at Amrita Vishwa Vidyapeetham. Interactions, 29(1), 54-57.

Muir, A. (2021, May). Where HCI Meets the Spiritual Path: The Three Yogas of the Bhagavad Gītā. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-9).

Mallan, V. S., Gopi, S., Muir, A., & Bhavani, R. R. (2017, September). Comparative empirical usability assessment of two HRI input devices for a mobile robot. In 2017 4th International Conference on Signal Processing, Computing and Control (ISPCC) (pp. 331-337). IEEE.

Sachith, K. P., Gopal, A., Muir, A., & Bhavani, R. R. (2017). Contextualizing ICT based vocational education for rural communities: Addressing ethnographic issues and assessing design principles. In Human-Computer Interaction-INTERACT 2017: 16th IFIP TC 13 International Conference, Mumbai, India, September 25-29, 2017, Proceedings, Part II 16 (pp. 3-12). Springer International Publishing.

Unnikrishnan, R., Amrita, N., Muir, A., & Rao, B. (2016, June). Of elephants and nested loops: How to introduce computing to youth in rural India. In Proceedings of the The 15th International Conference on Interaction Design and Children (pp. 137-146).

Norman, D. (2004). Emotional design: Why we love (or hate) everyday things.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT512   COGNITIVE ANTHROPOLOGY CROSS-CULTURAL PERSPECTIVES   3 0 0 3

Prerequisite: Good reading and writing skills in English; Basic understanding of cognitive anthropology and its relevance in society and culture

Course Objectives:
1. To gain a basic understanding of the emergence of cognitive anthropology: Ethnosemantics, Ethnoscience, Ethnolinguistics, and New Ethnography
2. To develop a working knowledge of the relevance of cognitive anthropology in societal development - linguistic relativity
3. To gain an overview of the different principal concepts in cognitive anthropology
4. To understand the various theoretical approaches in cognitive anthropology
5. To understand the application of cognitive anthropology

Course Outcomes:
CO1: Acquire knowledge of the emergence of cognitive anthropology from linguistics and linking between human thought processes and the physical and ideational aspects of culture
CO2: Understand the essential concept of linguistic relativity and influential figures in cognitive anthropology
CO3: Gain insights into various principal concepts like culture model, folk taxonomies, knowledge structures, prototypes, Symbolic Systems
CO4: Gain information on various theories- schema, cultural Consensus Theory, etc
CO5: Understand the use of cognitive anthropology in - education and pedagogy, cross-cultural communication, cognitive ecology

Skills:
- Develop a deeper understanding of the relationship between cognition, thought and culture in society and the emergence of cognitive anthropology.
- Learn about the importance of Sapir–Whorf hypothesis or linguistic relativity hypothesis and other important figures in the field.
- Understand the concepts ingrained in cognitive anthropology.
- Develop an understanding of the various critical theories in cognitive anthropology.
- Grasp how cognitive anthropology is applied in education and pedagogy and cross-cultural communication and Cultural adaptation; cognition in Human-environment interaction from a cognitive perspective.

Course objectives CO-Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1		-	-	-	-	-	-	-	-		
CO2	-	-	X	-	-	-	-	X	-		
CO3	X	-	-	-	-	-	-	-	-		
CO4	-	-	-	-	X	-	-	-	X		
CO5	-	-	-	-	-	-	X	-	-		

Syllabus:

Unit I – Understanding Cognitive Anthropology and its Emergence   9 hrs.

- Introduction: What is Cognitive Anthropology?
- Emergence of Cognitive Anthropology
- Definition, scope, and goals of Cognitive Anthropology
- Historical development of cognitive approaches in anthropology: Ethnosemantics, Ethnoscience, Ethnolinguistics, and New Ethnography

Unit II – Culture and Thought   9 hrs.

- Relationship between culture and cognition
- Language and its role in shaping thought
- Symbolic meaning and communication
- Cognitive aspects of ritual and symbolism
- Linguistic Relativity hypothesis or Sapir - Whorf Hypothesis

Unit III - Principal Concepts   9 hrs.

- Culture Models, Domain, Prototypes, folk models, folk taxonomies, schemata, knowledge structures, Mental models and their cultural variations, Ethnoscience and cognitive mapping,

Unit IV – Theories in Cognitive Anthropology   9 hrs.

- Schema Theory
- Cultural Consensus Theory
- Cultural Consonance Theory

Unit V – Contemporary Applications and Future Directions   9 hrs.

- Use of Cognitive anthropology in various fields - research, ethnography, education, cross-cultural learning and adaptations in human-nature interactions

Textbooks:

D'Andrade, R. G. (1995). *The Development of Cognitive Anthropology.* Cambridge University Press.

Geertz, C. (1973). *The Interpretation of Cultures.* Basic Books.

Lakoff, G., & Johnson, M. (2003). *Metaphors We Live By.* University of Chicago Press.

Bateson, G. (2002). *Mind and Nature: A Necessary Unity.* Hampton Press.

Key Papers:

Tyler, S. A. (1969). Cognitive Anthropology. *Ethnology, 8*(2), 125–152. DOI: 10.2307/3772907

Harris, M. (1968). The Rise of Anthropological Theory: A History of Theories of Culture. *Thomas Y. Crowell Company.*

Gell, A. (1998). Art and Agency: An Anthropological Theory. *Clarendon Press.*

Sperber, D. (1985). Anthropology and Psychology: Towards an Epidemiology of Representations. *Man, 20*(1), 73–89. DOI: 10.2307/2802054

Lakoff, G., & Johnson, M. (1980). The Metaphorical Structure of the Human Conceptual System. *Cognitive Science, 4*(2), 195–208. DOI: 10.1207/s15516709cog0402_4

Nisbett, R. E. (2003). The Geography of Thought: How Asians and Westerners Think Differently... and Why. *Free Press.*

Shweder, R. A., & Bourne, E. J. (1984). Does the Concept of the Person Vary Cross-Culturally? In R. A. Shweder & R. A. LeVine (Eds.), *Culture Theory: Essays on Mind, Self, and Emotion* (pp. 158–199). Cambridge University Press.

Dressler, William W., Mauro C. Balieiro, and José E. dos Santos (2018). "What you know, what you do, and how you feel: Cultural competence, cultural consonance, and psychological distress." Frontiers in psychology 8 : 2355.

Veissière, S. P., Constant, A., Ramstead, M. J., Friston, K. J., & Kirmayer, L. J. (2020). Thinking through other minds: A variational approach to cognition and culture. Behavioral and Brain Sciences, 43.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT513   COGNITIVE PSYCHOLOGY AND NEUROSCIENCE - PART II   3 0 0 3

Prerequisites: Good reading and writing skills in English; Basic understanding of brain anatomy and neural functioning

Summary:
Learners will understand how we use higher-order cognitive skills, such as reasoning and decision-making, but also, how we can make errors in judgement. They will learn what motivates us, where emotions come from, and how cognitive control helps us navigate life. They will also learn how emotions and motivation shape behavioural change. Learners will also grasp the importance of language, how we learn language as infants, and how being able to understand another person's point of view is important for human societies. Finally, learners will appreciate variations in cognitive functioning, such as in neurodivergence.

Course Objectives:
1. To develop a critical understanding of how we use our mind for reasoning and making decisions and how we make errors in judgment.
2. To gain an overview of the neural basis of mental processes, such as reasoning and decision-making, emotion, motivation, and language.
3. To understand how our emotions affect other cognitive processes.
4. To understand the connection between motivation and behavioural change, as well as other theories of behavioural change mechanisms.
5. To gain insight into what language is, why it is important to us as humans, and how infants acquire language.
6. To gain an overview of variations in cognitive functioning (neurodivergence).

Course Outcomes:
CO1: Gain insights into theories from cognitive psychology that explain cognitive processes, such as reasoning and decision-making, emotion, and motivation.
CO2: Gain insights into the neural basis of cognitive processes, such as reasoning and decision-making, emotion, and motivation.
CO3: Understand the connection between motivation and behavioural change, as well as other theories of behavioural change mechanisms.
CO4: Understand the importance and role of language.
CO5: Understand variations in cognitive functioning (neurodivergence).

Skills:
- Understand cognitive psychology theories and the neural basis of cognitive processes, such as reasoning and decision-making, emotion, and motivation.
- Understand the neural basis of cognitive processes, such as reasoning and decision-making, emotion, and motivation.
- Develop a deeper understanding of the relationship between brain function and cognition.
- Grasp how emotion, motivation, and other factors impact behavioural change.
- Gain an overview of variations in cognitive functioning (neurodivergence).

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	x	-	-	-	-	-	x	x	-
CO2	x	-	-	-	-	-	x	x	-
CO3	-	-	-	-	-	-	x	x	-
CO4	-	-	-	-	-	-	x	-	-
CO5	-	-	-	-	-	-	x	-	x

Syllabus:

Unit I – Reasoning and Decision-Making   **9 hrs.**
- Types of reasoning: inductive and deductive
- Approaches to reasoning: componential, rules/heuristics and mental models
- Cognitive biases in decision-making (e.g., availability, representativeness, framing effect, and hindsight bias)
- The neural basis of decision-making

Unit II – Neural Basis of Emotion   **9 hrs.**
- Psychological theories of emotion
- The nervous system: Vagus nerve and emotion regulation
- The limbic system as the "emotional brain" and emerging concepts of emotional networks
- The amygdala
- Interactions between emotion and other cognitive processes (LeDoux, Damasio)
- Understanding the minds of others

Unit III - Motivation and Behavioural Change   **9 hrs.**
- Psychological theories of motivation
- Neural basis of motivation
- Behaviour change: habits, nudging, motivation, interest, reinforcement, self-regulation, and self-efficacy, goal setting
- Cognitive control and goal-oriented behaviour
- Behaviour change experiment: Identifying a personal area of behaviour change in collaboration with the Mano Layam Center for Wellbeing and development of a strategic implementation plan

Unit IV - Language   **9 hrs.**
- Definition of language: phonemes, words, and letters; semantics and syntax
- Language acquisition
- Neural models of language comprehension and speech production

Unit V – Neurodivergence   **9hrs.**
- Neurodevelopmental differences: variation of cognitive functioning (neurodivergence) due to autism, ADHD, dyslexia, synesthesia, etc.
- Intense World Theory of autism

Textbooks:

Goldstein, E. B. (2015). *Cognitive psychology: Connecting mind, research, and everyday experience* (4th edition). Cengage Learning.
https://aishwaryajaiswal.com/wp-content/uploads/2022/01/Cognitive-Psychology_-Connecting-Mind-Research-and-Everyday-Experience.pdf

Groome, D. (2014). *An introduction to cognitive psychology. Processes and disorders* (3rd edition). Psychology Press.
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Damasio, A. (1994). *Descartes' error: Emotion, reason and the human brain*. Putnam, 352.

LeDoux, J. (1996). *The emotional brain. The mysterious underpinnings of emotional life*. Simon & Schuster.

Markram, K., & Markram, H. (2010). The intense world theory – A unifying theory of the neurobiology of autism. *Frontiers in Human Neuroscience, 4*, 224. https://doi.org/10.3389/fnhum.2010.00224

Reference Books:

Armstrong, T. (2011). *The power of neurodiversity: Unleashing the advantages of your differently wired brain.* Da Capo Lifelong Books.

Berridge, K. C. (2004). Motivation concepts in behavioral neuroscience. *Physiology & behavior*, *81*(2), 179-209

Berkman, E. T. (2018). The neuroscience of goals and behavior change. *Consulting Psychology Journal: Practice and Research*, *70*(1), 2

Buzsáki, G. (2020). The brain–cognitive behavior problem: a retrospective. *Eneuro*, *7*(4).

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2014). *Cognitive neuroscience. The biology of the mind* (4th edition). Norton.

Hebb, D. O. (1949). *The organization of behavior*. Wiley.

Kandel, E. R., Schwartz, J. H., & Jessell, T. M. (2000). *Principles of neural science* (4th ed). McGraw-Hill.

Kok, A. (2020). *Functions of the brain. A conceptual approach to cognitive neuroscience*. Routledge.

Krebs, C., Weinberg, J., & Akesson, E. (2012). *Lippincott's illustrated reviews of neuroscience*. Wolters Kluwer.

Mesulam, M.-M. (2000). *Behavioral neuroanatomy: Large-scale networks, association cortex, frontal syndromes, the limbic system, and hemispheric specialization*. Association Cortex, Frontal.

Passingham, R. (2016). *Cognitive neuroscience: A very short introduction*. Oxford University Press.

Raichle, M. E. (1998). Behind the scenes of functional brain imaging: A historical and physiological perspective. *Proceedings of the National Academy of Sciences, USA, 95*, 765–772.

Silberman, S. (2017). *Neurotribes: The legacy of autism and how to think smarter about people who think differently*. Atlantic Books.

Streidter, G. (2005). Principles of brain evolution (pp. 217–53). Sunderland, MA: Sinawer.

Ward, J. (2020). The student's guide to cognitive neuroscience (4th edition). Routledge.

Zimmer, C. (2004). *Soul made flesh: The discovery of the brain – and how it changed the world*. New York: Free Press.

ACADEMIC PAPERS

1. Alexander, R., Aragón, O. R., Bookwala, J., Cherbuin, N., Gatt, J. M., Kahrilas, I. J., ... & Styliadis, C. (2021). The neuroscience of positive emotions and affect: Implications for cultivating happiness and wellbeing. *Neuroscience & Biobehavioral Reviews*, *121*, 220-249

2. Barack, D. L., & Krakauer, J. W. (2021). Two views on the cognitive brain. *Nature Reviews Neuroscience*, *22*(6), 359-371

3. Domes, G., Schulze, L., Böttger, M., Grossmann, A., Hauenstein, K., Wirtz, P. H., ... & Herpertz, S. C. (2010). The neural correlates of sex differences in emotional reactivity and emotion regulation. *Human brain mapping*, *31*(5), 758-769

4. Friedman, N. P., & Robbins, T. W. (2022). The role of prefrontal cortex in cognitive control and executive function. *Neuropsychopharmacology*, *47*(1), 72-89

5. Koenig, J., Parzer, P., Haigis, N., Liebemann, J., Jung, T., Resch, F., & Kaess, M. (2021). Effects of acute transcutaneous vagus nerve stimulation on emotion recognition in adolescent depression. *Psychological medicine*, *51*(3), 511-520

6. Mussel, P., & Hewig, J. (2019). A neural perspective on when and why trait greed comes at the expense of others. *Scientific Reports*, *9*(1), 10985

7. Nelson, C. A., Fox, N. A., & Zeanah, C. H. (2023). Romania's abandoned children: The effects of early profound psychosocial deprivation on the course of human development. *Current Directions in Psychological Science*, *32*(6), 515-521

8. Rich, A. N., & Mattingley, J. B. (2002). Anomalous perception in synaesthesia: a cognitive neuroscience perspective. Nature Reviews Neuroscience, 3(1), 43-52.

9. Vuust, P., Heggli, O. A., Friston, K. J., & Kringelbach, M. L. (2022). Music in the brain. *Nature Reviews Neuroscience*, *23*(5), 287-305.

10. Cash, P. J., Hartlev, C. G., & Durazo, C. B. (2017). Behavioral design: A process for integrating behavior change and design. Design Studies, 48, 96-128.

11. Hummel, D., & Maedche, A. (2019). How effective is nudging? A quantitative review on the effect sizes and limits of empirical nudging studies. Journal of Behavioral and Experimental Economics, 80, 47-58.

12. D'Lima, D., Lorencatto, F., & Michie, S. (2020). The behavior change wheel approach. In Handbook on implementation science (pp. 168-214). Edward Elgar Publishing.

13. Whitehead, M., Jones, R., & Pykett, J. (2019). Nudging around the world: a critical geography of the behavior change agenda. Handbook of Behavioural Change and Public Policy, 90-101.

14. Strassheim, H., & Beck, S. (Eds.). (2019). Handbook of behavioral change and public policy. Edward Elgar Publishing.

15. Hallsworth, M. (2023). A manifesto for applying behavioural science. *Nature Human Behaviour, 7*(3), 310-322.

16. Ajzen I, Fishbein M (1972) Attitudes and normative beliefs as factors influencing behavioral intentions. J Pers Soc Psychol 21(1):1–9

17. Baumeister RF, Vohs KD (2007) Encyclopedia of social psychology. Sage, Thousand Oaks

18. Kerlinger FN (1979) Behavioral research: a conceptual approach. Holt, Rinehart and Winston, New York

19. Smelser, N. J., & Baltes, P. B. (2011). International encyclopedia of the social and behavioural sciences. Proceedings of US National Academy of Sciences, 95(3), 922-9.

20. Zettle, R. D., Hayes, S. C., Barnes-Holmes, D., & Biglan, A. (2016). The Wiley Handbook of Contextual Behavioral Science.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT514   RESEARCH METHODOLOGY II: ADVANCED QUANTITATIVE DATA ANALYSIS
3 0 0 3

Prerequisite: Good reading and writing skills in English; basic knowledge of research methodology

Course Objectives:
1. Gain an in-depth understanding of concepts of quantitative data analysis, such as measures of central tendency and dispersion, levels of measurements, normal distribution of the data, and type I and II errors, so that they can be applied in one's research study
2. Gain the ability to distinguish between parametric and non-parametric tests and know when to use which
3. Develop more advanced skills in summarizing and presenting data as graphs and frequencies in descriptive statistics using computer software programs (e.g., SPSS)
4. Know how to measure group differences and test for significance using inferential statistics using computer software programs (e.g., SPSS): Chi-square tests, t-tests, Mann-Whitney U tests, Kruskal-Wallis H tests, as well as ANOVA (Univariate Analysis of Variance) and MANOVA (Multivariate Analysis of Variance)
5. Know how to explore the relationships between variables using cross-tabulations, correlations, and different types of regression analyses
6. Gain the ability to calculate effect sizes and test power, as well as the ability to report results from statistical tests in a scientific research paper
7. Understand the foundations of validating research instruments in order to test for the validity and reliability

Course Outcomes:
CO1: Understand the basic concepts of statistical significance tests, such as levels of measurement, measures of central tendency and dispersion, the normal distribution, significance level Alpha, as well as Type I and Type II Errors
CO2: Knowledge of how to apply statistical tests for hypothesis testing
CO3: Knowledge of how to perform and interpret quantitative statistical analyses with computer software programs (e.g., SPSS)
CO4: Knowledge of how to use computer software programs (e.g., SPSS) to summarize and present data, as well as to do inferential statistical tests for measuring differences between groups and for exploring the relationship between variables
CO5: Understand the concepts of effect size and test power to interpret the results of statistical tests
CO6: Knowledge of how to test the psychometric properties of the research instruments used to validate them for a specific population
CO7: Understand how to report the results of statistical tests in a research paper

Skills:
- Proficiency in computer software programs to perform statistical tests (e.g., SPSS)
- Ability to use statistical tests appropriate for the research question
- Distinguish between parametric and non-parametric tests

- Make graphs with software programs (e.g., SPSS)
- Perform inferential statistics to test hypotheses, such as finding differences between groups and relationships between variables
- Calculate effect size and required sample size
- Test psychometric properties of standardized psychometric scales
- Interpret results of statistical tests
- Report results of statistical tests

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	-	-	-
CO2	X	-	-	-	-	-	-	-	-
CO3	X	-	-	-	-	-	-	-	-
CO4	X	-	-	-	-	-	-	-	-
CO5	X	-	-	-	-	-	-	-	-
CO6	X	-	-	-	-	-	-	-	-
CO7	X	-	-	X	-	-	-	-	-

Syllabus:

Unit I – Basic Concepts of Statistical Tests   **9 hrs.**
Basic concepts of statistical tests:
- Levels of measurement
- Population vs sample
- Normal distribution
- Measures of central tendency and dispersion
- Probability and Bayesian statistics

Unit II – Descriptive Statistics versus Inferential Statistics   **9 hrs.**
Descriptive Statistics:
- Purpose of descriptive statistics: summarizing and presenting data
- Graphs: bar chart, pie chart, histogram
- Frequency tables

Inferential statistics:
- Purpose of inferential statistics
- Null hypothesis (H_0) and alternative hypothesis (H_A)
- Type I and type II errors
- Significance level Alpha (α)
- Critical values (t, Z) and the confidence interval
- One-tailed and two-tailed tests of significance

Unit III – Inferential Statistics Part 1: Measuring Differences Between Groups   **9 hrs.**
- Parametric vs non-parametric tests
- Measuring differences between groups: t-test, univariate analysis of variance (ANOVA), multivariate analysis of variance (MANOVA)
- Non-parametric equivalents: Chi-square test, McNemar's test, Mann-Whitney U test, Wilcoxon signed rank test, Kruskal-Wallis H test

Unit IV – Inferential Statistics Part 2: Exploring Relationships Between Variables   **9 hrs.**
- Cross-tabulation

- Correlation (Spearman's rank correlation and Pearson's product-moment correlation)
- Linear regression
- Multiple regression analysis
- Binary logistic regression analysis

Unit V – Effect Size and Test Power; Validating Psychometric Scales   9 hrs.

Effect size and test power:
- What is the effect size, and why report it?
- Effect sizes of the different statistical tests
- Test power $(1-\beta)$
- Using G*Power to calculate test power and the sample size
- Reporting the effect size and test power in a research paper
- How to report the results of significance tests in APA format
- How to conduct a systematic literature review and meta-analysis

Validating psychometric scales:
- Avoiding errors in measurement
- Testing for validity (e.g., convergent vs discriminant validity)
- Testing for reliability (Cronbach's Alpha)
- Performing factor analysis to confirm subscales

Textbooks:

Bryman, A. & Cramer, D. (2005). *Quantitative data with SPSS 12 and 13. A guide for social scientists.* London, UK: Routledge.

Kothari, C.R. (2004). *Research methodology. Methods and techniques* (2nd revised edition). New Delhi, India: New Age International Publishers. Retrieved from https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf

Urdan, T. C. (2011). *Statistics in plain English* (3rd edition). London, UK and New York, NY: Routledge. Retrieved from https://www.pindex.com/uploads/post_docs/statistics%20in%20plain%20english%20(3rd,%202010)(PINDEX-DOC-6952).pdf

Reference Books:

Bacon-Shone, J. H. (2013). *Introduction to quantitative research methods.* Hong Kong: Graduate School, The University of Hong Kong. Retrieved from https://hub.hku.hk/bitstream/10722/191018/1/Content.pdf

Bhattacherjee, A. (2012). *Social science research: Principles, methods, and practices.* Textbooks Collection. Book 3. http://scholarcommons.usf.edu/oa_textbooks/3

Bryman, A., & Cramer, D. (1999). *Quantitative data analysis with SPSS release 8 for Windows. A guide for social scientists.* London and New York: Taylor & Francis Group. Retrieved from http://hcm2.trali.com.vn/upload/170/20131127/Quantitative%20analysis%20with%20SPSS.pdf

Ellis, S. M., & Steyn, H. S. (2003). Practical significance (effect sizes) versus or in combination with statistical significance (p-values): Research note. Management Dynamics: *Journal of the Southern African Institute for Management Scientists, 12(*4), 51-53. Retrieved from https://www.researchgate.net/profile/Suria_Ellis/publication/293182482_Practical_significance_effect_sizes_versus_or_in_combination_with_statistical_significance_p-values/links/574e76df08aec988526bcb6c/Practical-significance-effect-sizes-versus-or-in-combination-with-statistical-significance-p-values.pdf

Garson, G. D. (2012). *Testing statistical assumptions.* Asheboro, NC: Statistical Associates Publishing.

Gaur, A. S. & Gaur, S. S. (2006). *Statistical methods for practice and research. A guide to data analysis using SPSS.* New Delhi, India: Response Books.

Ghasemi, A. & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology & Metabolism, 10*(2), 486-9. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3693611/pdf/ijem-10-486.pdf

Kumar, R. (2011). *Research methodology. A step-by-step guide for beginners* (3rd edition). Los Angeles,

CA: Sage. Retrieved from
http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf

Nick, T. G. (2007). Descriptive statistics. In W. T. Ambrosius (Ed.), *Topics in biostatistics* (p. 33-52) (Series: Methods in Molecular Biology). Totowa, NJ: Humana Press. Retrieved from
https://www.researchgate.net/profile/Douglas_Mahoney2/publication/5402488_Linear_Mixed_Effects_Models/links/57e560bf08ae9227da964db4.pdf#page=42

Patel, P. (2009). *Introduction to quantitative methods*. Retrieved from
https://hls.harvard.edu/content/uploads/2011/12/quantitative_methods.pdf

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT599   RESEARCH PROJECT I- FROM DESK TO FIELD (WITH FIELD VISIT)   5

This course is part of a series across three semesters with the aim to train and prepare each student to write and conduct research with final submission in the 4th semester: Each student has to choose a research problem and do a field project within a selected area in consultation with the supervisor who will offer continuous guidance to acquire the knowledge and application of research steps. In this class, students get continuous support from the faculty and supervisors to gain the necessary skills to design, conduct and perform research. Research Project I will have the following phases:

- Phase 1 (each 3 credits): Literature Review, Reading, and writing scientific articles,
    - eg submitting a literature list in form of an excel sheet
    - Research ethics
    - Education and AI Policies: Expert talks
- Phase 2 (2 credits): in addition students participate in Field Visit, poster presentation
    - showing observations, population, challenges observed, suggestions for solutions from the lens of CogSci, Edu & Tech
    - Reflections on field experience
- Phase 3: submit a research/dissertation proposal to EC and CSP (2 credits)

Students get the opportunity to publish a Scopus indexed paper at the end of the Research Project Part III course (4th semester). The final evaluation and viva voce will be held at the end of the fourth semester.

Overall Credits: 7

Semester 2

AMRITA VALUE PROGRAMME

VEDANTA IN DAY-TO-DAY LIFE

Introduction: Amrita University's Amrita Values Programme (AVP), is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world. Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Courses offered under the framework of Amrita Values Program:

Art of Living through Amma

Amma's messages can be put into action in our life through pragmatism and attuning our thought process in a positive and creative manner. Every single word Amma speaks, and the guidance received on matters which we consider trivial are rich in content and touch the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us, still keeping the balance of the mind.

Insights from the Ramayana

Historical significance of Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Misinterpretation of Ramayana by Colonial powers and its impact on Indian life - Relevance of Ramayana for modern times.

Insights from the Mahabharata

Historical significance of Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance – Importance of Dharma in society – Message of the Bhagavad Gita - Relevance of Mahabharata for modern times.

Insights from the Upanishads

Introduction: Shruti versus Smrti - Overview of the four Vedas and ten Principal Upanishads - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different modes of consciousness - Sanatana Dharma and its uniqueness - The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

Insights from Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Idea of the Self and Realisation

of the Self – Qualities of a Realised person - Concept of Avatar - Relevance of Mahabharata for modern times.

Swami Vivekananda and his Message

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message to Indians about our duties to the nation.

Great Spiritual Teachers of India
Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramanujacharya, Sri Madhvacharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi
Indian Arts and Literature:

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre, Paintings, Sculpture and architecture – the wonder language, Sanskrit and ancient Indian Literature

Importance of Yoga and Meditation in Life:

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Appreciation of Kerala's Mural Art Forms:

A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. A distinguishing characteristic of mural painting is that the architectural elements of the given space are harmoniously incorporated into the picture. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries CE when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

 Practicing Organic Farming

Life and nature are closely linked through the healthy practices of society for maintaining sustainability. When modern technological knowhow on microorganisms is applied in farming using the traditional practices we can avoid damage to the environment. The course will train the youth on modern practices of organic farming. Amma says "we have to return this land to the coming generations without allowing even the slightest damage to happen to it". Putting this philosophy to practice will bring about an awakening and enthusiasm in all to strive for good health and to restore the harmony in nature"

Ancient Indian Science and Technology

Science and technology in ancient and medieval India covered all the major branches of human knowledge and activities, including mathematics, astronomy, physics, chemistry, medical science and surgery, fine arts, mechanical, civil engineering, architecture, shipbuilding and navigation. Ancient India was a land of sages, saints and seers as well as a land of scholars and scientists. The course gives an awareness on India's contribution to science and technology.

Semester 3

24CLT690   LIVE-IN-LABS   3

Course Objectives

1. Understand the principles of Sustainable Development, Human Centered Design, Participatory Rural Appraisal, Sustainable Change Agents, Ethnographic Action Research and User Need Assessment. 2. Learn the various tools, techniques and templates used in the mentioned concepts to identify the challenges in the villages.
2. Design a sustainable technological intervention for the identified challenge.

Course Outcome

On the successful completion of the Course, the student will be able to –
CO1: Understand the basic concepts and principles of sustainable development
CO2: Learn ethnographic research and utilise the methodologies to enhance participatory engagement
CO3: Prioritize challenges and derive constraints using Participatory Rural Appraisal
CO4: Identify and formulate the research challenges in rural communities
CO5: Design solutions using a human-centred approach

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12
CO1			3								3	3
CO2		3		3		1	1		3	3		3
CO3		3						3	3	3		
CO4		3					1		3	3		3
CO5	3		3				3	3	3	3		3

1 – Substantial; 2 – Moderate; 3 - Strong

Syllabus:

Unit 1 - Sustainable Development
Introduction and History. Basic Concepts, Strategies and Measurement. United Nations Initiatives and Sustainable Development Goals.

Unit 2 - Participatory Rural Appraisal (PRA)
Concept, Principles and Philosophy of PRA. Scope and Dimensions of PRA. Important Tools for PRA. Application of PRA.

Unit 3 - Human-Centered Design (HCD)
Fundamentals of Human-Centered Design. Design Process. User Experience. User Research. Data Analysis. Ideation.

Unit 4 - Sustainable Social Change

Case Study. Introduction. Understanding and identifying the Community Communication Channels

Text Book(s)

There are no required textbooks for this course; all articles, reports and research papers assigned as required reading will be shared with the students by Live-in-Labs® faculties.

Reference(s)

1. *Ramesh, Maneesha Vinodini, Renjith Mohan, and Soumya Menon. "Live-in-Labs: Rapid translational research and implementation-based program for rural development in India." In 2016 IEEE Global Humanitarian Technology Conference (GHTC), pp. 164-171. IEEE, 2016.*

2. *Kadiveti, Hemasagar, Sahithi Eleshwaram, Renjith Mohan, S. Ariprasath, Krishna Nandanan, SG Divya Sharma, and B. Siddharth. "Water Management Through Integrated Technologies, a Sustainable Approach for Village Pandori, India." In 2019 IEEE R10 Humanitarian Technology Conference (R10-HTC)(47129), pp. 180-185. IEEE, 2019.*

3. *Akella, Devi. "Learning together: Kolb's experiential theory and its application." Journal of Management & Organization 16, no. 1 (2010): 100-112.*

4. *Harith, J., Sreeram Kongeseri, Balu M. Menon, J. V. Sivaprasad, P. Aswathi, and Rao R. Bhavani. "Exploring Digital Tool for Participatory Rural Appraisal." International Journal of Pure and Applied Mathematics 119, no. 12 (2018): 2787-2810.*

5. *Vechakul, Jessica, "Human-Centered Design for Social Impact: Case Studies of IDEO.org and the International Development Design Summit." UC Berkeley Electronic Theses and Dissertations 6. Sustainable Development Strategies: A Resource Book. Organization for Economic Co-operation and Development, Paris and United Nations Development Program, New York.*

7. *Field Guide to Human-Centered Design. By IDEO.org. 1st Edition © 2015. ISBN: 978-0-9914063-1-9*

Evaluation Pattern

Assessment	Marks
Workshop (Group Participation)	15
Village Visit Assignments & Reports	15
Problem Identification and Assessment	15
Ideation: Defining the Needs, Proposed Designs & Review	20
Poster Presentation	10
Research Paper Submission	25
Total	**100**
Attendance (To be added separately)	5
Grand Total	**105**

Semester 3

24CLT695   RESEARCH PROJECT II   7

Summary: This course is the first part of a series spanning three semesters, designed to equip students with the knowledge and skills necessary for conducting independent research, culminating in a publication/dissertation submission in the fourth semester. In Research Project II students get further continuous support from the faculty and supervisors to gain the necessary skills to design, conduct and perform research.

Research Project II will especially expose students to perform scientific research skills in the form of

- Scientific thinking and writing (2 credits)
- Data collection (2 credits)
- Output is an internal submission of the first final draft Dissertation/Research Paper to CSP (2 credits)
- Research ethics (1 credit)
- Education and AI Policies: Expert talks and reviewing existing policies across the world (1 credit)

Overall Credits 8

Semester 4

24CLT696   **INTERNSHIP**   **3**

This intensive block field placement occurs after the end-semester examinations in June. It is designed for students to immerse themselves in an organization, acquiring hands-on training and experience that aims at enhancing employability in related fields. Students will collaborate with their placement agencies, contributing to projects and initiatives. The placement offers a deep dive into the operational aspects of organizations at the intersection of cognitive sciences and education, with the potential for employment opportunities upon successful completion of the internship.

(3 credits)

24CLT699   RESEARCH PROJECT III   8

This course is the first part of a series spanning three semesters, designed to equip students with the knowledge and skills necessary for conducting independent research, culminating in a publication/dissertation submission in the fourth semester. Each student has to complete the research project within the selected area with the supervisor, who will offer continuous guidance to acquire the knowledge and application of research steps. The objective of Research Project III is to guide students towards a publication. The final evaluation and presentation at the annual department conference will be held at the end of the fourth semester.

Research Project III includes the following tasks:

- **Revision**, Submission of publication/dissertation draft from Research Project II (1 credits)
- Presentation (annual Conference) (1 credits)
- And **Publication** of Dissertation/Research Paper (3 credits)
- Research ethics (1 credit)
- Education and AI Policies: case examples and white paper (2 credit)

(8 credits)

24CLT 698 ORGANIZING CONFERENCE/WORKSHOP   4

The students are expected to jointly organize a Conference / Workshop as a requirement for the course. Each student will be evaluated for their initiation, organization, coordination, active participation and presentation of their research poster/paper/whitepaper.

(4 credits)

Specializations

I - User Experience (Specialization)

24CLT631   GAME DESIGN   3

Prerequisite: No prerequisites, knowledge of Unity Game Engine knowledge would be a plus (if not, the students can develop prototypes in other media of their choice).

Course Objectives:
1. Gain an understanding of the terminology of game design (mechanics, dynamics, aesthetics, etc.)
2. Gain an understanding of why and how to design games
3. Gain practical knowledge of the game design steps and approaches

Course Outcomes:
By the end of this course, students will:
- Understand what a game is
- Understand what are the main components of the game
- Know what are the main steps of the game design process including:
  - ideating (game narrative, mechanics, characters, rules, goals)
  - pitching
  - prototyping
  - developing functional specifications of the game, etc.

Skills:
By the end of this course, students will be able to:
- Define and properly use the game design terminology "game", "game narrative", "game mechanics", "game narrative", etc.
- Classify the game types and genres
- Choose the appropriate genre, storyline, characters, and game mechanics to create a desired game experience
- Give a pitch on a game idea, and provide and receive critiques
- Create an interactive game prototype and test it with the game's target audience, analyze the user's feedback, and iteratively improve the prototype
- Write a functional specification to prepare the game idea for the development phase

CO-PO Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO9	PSO10
CO1	X	X					X		X	X	
CO2	X	X		X	X		X		X		
CO3			X	X		X			X	X	X

Syllabus:

Unit I – Introduction to Games   **9 hrs.**

- Course overview
- Game history; Variety of games: Serious games. Educational Games, Games as cultural intervention.
- Basic elements of the game

Unit II – Non-Digital Games. Ideating and Pitching   **9 hrs.**

- Game goals and rules.
- Player's experience, concept of chance, game feedback.
- Paper Prototyping.
- Game pitch.

Unit III – Digital Games   **9 hrs.**

- Variety of video games: 2D and 3D, pervasive, VR, AR.
- Game genres.
- MDA framework.
- Game mechanics, dynamics, aesthetics.
- Paper prototyping for an interactive game.
- Optional: digital prototyping.

Unit IV – Developing Further the Game Concept   **9 hrs.**

- Narrative design, storytelling, linear vs non-linear games.
- Research and development process:
    1. Gathering material;
    2. Game concepts;
    3. Character concepts;
    4. Environment concepts.

Unit V – Writing a Functional Specification   **9 hrs.**

- Game documentation:
    1. Pitch document;
    2. Game description: functional specification.

Materials:

Students are required to bring a laptop to class to participate in both the in-class activities and project working sessions. During the class, students might be creating paper prototypes, documents, presentations, pictures, and videos.

Textbooks, Papers, Resources:

1. Rules of Play: Game Design Fundamentals, Katie Salen and Eric Zimmerman
2. The Art of Game Design: A Book of Lenses, Jesse Schell

3. Thompson, Jim, Berbank-Green Barnaby, Cusworth, Nic. Game Design: Principles, Practices, Techniques. John Wiley and Sons, 2007
4. Additional materials – TBD.

Evaluation Pattern:

Assessment	Internal	External
Active Participation	20	
*Continuous Evaluation	30	
Final Project/Content Submitted		50

USER EXPERIENCE (Specialization)

24CLT632 USER NEEDS FOR LEARNING TECHNOLOGY   3

Prerequisite: none
Summary:
This course delves into understanding the users of learning technology, emphasizing the importance of designing technology that caters to the end users' needs for it to be effective. Misunderstandings or ignorance of these needs can lead to poor user interfaces and diminished learning experiences, a concern particularly acute for vulnerable communities dependent on skill training. Through a detailed exploration of learner needs, with a focus on neurodiversity and educational backgrounds, the course uses a case study of low-literacy populations in rural India to navigate the full spectrum of user needs analysis and specification.

Course Objectives:
Students will learn to:
1. To understand the diversity of user needs in learning technology.
2. To emphasize the importance of empathetic, user-centered design in technology development.
3. To equip students with the ability to conduct comprehensive user needs analyses.
4. To provide insights into the design challenges and requirements of vulnerable communities.

Course Outcomes:
CO1: User-Centered Design Proficiency: Gain understanding in designing educational technologies that prioritize user experience and learning outcomes.
CO2: Conduct user needs analysis with proficiency.
CO3: Develop detailed user personas and specify design requirements based on user needs.
CO4: Apply frameworks like Jobs to Be Done effectively in the context of learning technologies.
CO5: Utilize ethical research methods and participatory design to engage users in the design process.

Skills:
• Proficiency in user needs analysis and specification.
• Development of user personas and design requirements.
• Application of design and analysis frameworks to learning technologies.
• Competency in ethical research and participatory design methodologies.

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	X	-	-	-	-	-	-	-	-		
CO2	-	-	X	-	-	-	-	-	-		
CO3	-	X	-	-	-	-	-	X	-		
CO4	-	-	-	-	-	X-	-	-	-		
CO5	X	-	-	-	-	-	-	-	-		

Syllabus:

Unit I: Analysis of Case Study(s) to Identify User Needs for Learning Technology (15 hours)
- For example: Tablet-Based Training for Low-Literacy population in Rural India
- Examination of case study on the Plumbob training (2016/2017).
- Analysis of impact of social and psychological factors on user needs and design
- Discussion on Luria's tea room experiments.
- Comparison of design states before and after intervention.   **15 hrs.**

Unit II Frameworks for Defining User Need   **15 hrs.**
- Development and application of Personas, Goals, and Tasks.
- Exploration of the Jobs-to-Be-Done framework.
- Integration of user requirements within the Software Development Life Cycle.

Unit III: Psychology and Social Factors
- Contrast between oral and textbook learning and teaching methodologies.
- Examination of the role of the implicit teacher-student relationship.
- Study of impact of prior learning experiences, socio-economic backgrounds and other factors such as age on the interaction with learning technologies   **15 hrs.**

Unit IV: Research Methods for Defining User Needs
- Application of participatory design principles and methods including data collection and analysis
- Consideration of ethical implications in design research.
- Execution of a sample research study program.

References:

- Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). About face: The essentials of interaction design (4th ed.). Wiley.
- Cranz, G. (2016). Ethnography for designers. Routledge.
- Krug, S. (2014). Don't make me think, revisited: A common sense approach to web usability. New Riders.
- Mallan, V. S., Gopi, S., Muir, A., & Bhavani, R. R. (2017, September). Comparative empirical usability assessment of two HRI input devices for a mobile robot. In 2017 4th International Conference on Signal Processing, Computing and Control (ISPCC) (pp. 331-337). IEEE.
- Meyer, E., & Wachter-Boettcher, S. (2016). Design for real life. A Book Apart.
- Muir, A. (2021, May). Where HCI meets the spiritual path: The three yogas of the Bhagavad Gītā. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-9).
- Norman, D. A. (2013). The design of everyday things: Revised and expanded edition. Basic Books.
- Norman, D. (2004). Emotional design: Why we love (or hate) everyday things.
- Ramesh, M. V., Muir, A., Nandanan, K., Bhavani, R. R., & Mohan, R. (2022). HCI curricula for sustainable innovation: The humanitarian focus at Amrita Vishwa Vidyapeetham. Interactions, 29(1), 54-57.
- Sachith, K. P., Gopal, A., Muir, A., & Bhavani, R. R. (2017). Contextualizing ICT based vocational education for rural communities: Addressing ethnographic issues and assessing design principles. In Human-Computer Interaction-INTERACT 2017: 16th IFIP TC 13 International Conference, Mumbai, India, September 25-29, 2017, Proceedings, Part II 16 (pp. 3-12). Springer International Publishing.
- Unnikrishnan, R., Amrita, N., Muir, A., & Rao, B. (2016, June). Of elephants and nested loops: How

to introduce computing to youth in rural India. In Proceedings of the The 15th International Conference on Interaction Design and Children (pp. 137-146).

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

USER EXPERIENCE (Specialization)

24CLT633 ASSESSING THE EFFECTIVENESS OF LEARNING TECHNOLOGIES   3

Prerequisite: none
Summary
Building upon foundational knowledge from previous courses, this advanced course dives into three major interaction modalities—audio-visual touchscreen interfaces for phones and tablets, AR/VR and haptic interfaces, and text-based AI interactions. Focused on optimizing these interfaces for various pedagogical approaches, students will critically analyze the opportunities and limitations inherent to each modality, considering the cognitive needs of learners to design effective educational technologies.

Course Objectives:
Students will learn to:
1. To analyze the interaction modalities of audio-visual touchscreens, AR/VR and haptic, and text-based AI.
2. To understand the cognitive needs of learners in relation to different technological interfaces.
3. To apply theoretical knowledge in designing optimized interfaces for specific pedagogical approaches.

Course Outcomes:
CO1:Design and evaluate audio-visual touchscreen interfaces for educational purposes.

CO2: Conceptualize and develop immersive learning experiences using AR/VR and haptic technologies.

CO3: Create effective text-based AI trainers tailored to specific learning outcomes.

Skills:
- Design and development of interactive learning technologies.
- Critical analysis of interface design in the context of learner engagement and pedagogy.
- Practical application of design principles to create customized educational experiences.

-Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	X	-	-	-	-	-	-	-	-		
CO2	-	-	X	-	-	-	-	-	-		
CO3	-	X	-	-	-	-	-	X	-		
CO4	-	-	-	-	-	X-	-	-	-		
CO5	X	-	-	-	-	-	-	-	-		

Syllabus:

Unit I: Audio-Visual Interaction via Smartphone and Tablet   **15 hrs.**

- Case Study: Spoken Language Learning.
- Gamification, bite-size learning strategies.
- Student Project: Design a mini-game for teaching a specific topic, demonstrating the alignment of interaction and pedagogical principles.

Unit II: AR/VR and Haptic Interaction   **15 hrs.**

- Analysis of case studies of Ammachi Labs projects such as motorcycle maintenance, bar bending, construction, etc.
- Structure and design of Immersive environments
- Student Project - students design their own mini-VR interaction to teach a specific topic, with a clear articulation of how the interaction and pedagogy map.

Unit III: Text-Based AI trainer   **15 hrs.**

- Case Study: Using LLMs as a skills trainer.
- Learning theories in the context of dialogs, the role of questioning in learning,
- Strengths and limitations of text-based learning.
- Study Project: Design a text-based AI 'persona' capable of guiding learning through question-answering.

References:

Dirksen, J. (2015). Design for how people learn. New Riders.

Kapp, K. M., & O'Driscoll, T. (2009). Learning in 3D: Adding a new dimension to enterprise learning and collaboration. John Wiley & Sons.

Plass, J. L., Mayer, R. E., & Homer, B. D. (Eds.). (2020). Handbook of game-based learning. Mit Press.

Mayer, R. E. (2005). Cognitive theory of multimedia learning. The Cambridge handbook of multimedia learning, 41, 31-48.

Muir, A. (2021, May). Where HCI meets the spiritual path: The three yogas of the Bhagavad Gītā. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-9).

Norman, D. A. (2013). The design of everyday things: Revised and expanded edition. Basic Books.
Norman, D. (2004). Emotional design: Why we love (or hate) everyday things.

Ramesh, M. V., Muir, A., Nandanan, K., Bhavani, R. R., & Mohan, R. (2022). HCI curricula for sustainable innovation: The humanitarian focus at Amrita Vishwa Vidyapeetham. Interactions, 29(1), 54-57.

Sachith, K. P., Gopal, A., Muir, A., & Bhavani, R. R. (2017). Contextualizing ICT based vocational education for rural communities: Addressing ethnographic issues and assessing design principles. In Human-Computer Interaction-INTERACT 2017: 16th IFIP TC 13 International Conference, Mumbai, India, September 25-29, 2017, Proceedings, Part II 16 (pp. 3-12). Springer International Publishing.

Unnikrishnan, R., Amrita, N., Muir, A., & Rao, B. (2016, June). Of elephants and nested loops: How to introduce computing to youth in rural India. In Proceedings of the The 15th International Conference on Interaction Design and Children (pp. 137-146).

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

I - User Experience (Specialization)

24CLT634   DESIGN BASED RESEARCH   3

Prerequisite: Students should have a foundational understanding of research methodology and preferably familiarity with Educational Technology or Technology Enhanced Learning concepts

Course Objectives:

1. Introduce students to the Design-Based Research (DBR) methodology and its relevance in Educational Technology.
2. Familiarize students with the key features and variants of DBR used in educational research.
3. Guide students through the iterative lifecycles of a research design in DBR, emphasizing practitioner involvement and contextual understanding.
4. Facilitate students applying DBR principles to identify research questions, conduct investigations, prototype interventions, and reflect on outcomes.
5. Engage students in critically analyzing and evaluating existing DBR studies to develop their capacity for creating new knowledge in the Technology-Enhanced Teaching and Learning field.

Course Outcomes:

CO1: Demonstrate a comprehensive understanding of the principles and characteristics of DBR and its applicability in educational research.

CO2: Identify and critique various phases and variants of DBR, showcasing a nuanced understanding of its methodologies.

CO3: Develop practical skills in designing, implementing, and evaluating DBR studies, including data collection, analysis, and interpretation.

CO4: Apply DBR principles to real-world educational contexts, demonstrating the ability to address complex challenges and generate innovative solutions.

CO5: Produce a well-articulated research design proposal applying DBR principles, showcasing their proficiency in conducting rigorous and impactful educational research.

Skills:

- Ability to collaborate effectively with practitioners and stakeholders in educational settings to co-design and implement research interventions.
- Proficiency in utilizing diverse data collection methods and analysis techniques specific to DBR, including qualitative and quantitative approaches.
- Capacity to critically reflect on research processes and outcomes, integrating feedback and adjusting methodologies iteratively.
- Skill in synthesizing and communicating complex research findings to diverse audiences, including educators, policymakers, and researchers.
- Competence in leveraging technological tools and resources to implement and evaluate DBR studies in educational contexts.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	X	X	-
CO2	X	X	-	-	-	X	-	X	-
CO3	X	X	X	-	-	X	-	-	-
CO4	-	X	-	-	-	X	X	X	-
CO5	-	X	-	X	-	X	-	X	-

Syllabus:

Unit I – Introduction to DBR, Nature of a research study with features of DBR   9 hrs.
Design-Based Research as a methodology
Historical roots and different perspectives towards DBR
Involvement of stakeholders in the DBR study's lifecycle

Unit II – DBR phases and variants with respect to research design   9 hrs.
Research Design
DBR Phases
Variants of DBR

Unit III – Four phases of DBR in its most common form   9 hrs.
Identification Phase
Investigation Phase
Prototyping & Assessment Phase
Reflection Phase

Unit IV – DBR and Technology-Enhanced Learning and Teaching   9 hrs.
Technology-Enhanced Learning
Technology-Enhanced Teaching
DBR is one of the prominent methodologies in TEL

Unit V – Reflection and creating a research design following DBR   9 hrs.
Individual and group reflection on the role of DBR in Educational Technology
Preparing a research design by following different variants of DBR

Textbooks and Papers:

1. Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research?. Educational researcher, 41(1), 16-25.
2. Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. The journal of the learning sciences, 13(1), 1-14.
3. Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. Educational technology research and development, 53(4), 5-23.
4. Reimann, P. (2011). Design-based research. In Methodological choice and design (pp. 37-50). Springer, Dordrecht.
5. Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. Educational researcher, 32(1), 5-8.
6. McKenney, S., & Reeves, T. C. (2013). Systematic review of design-based research progress: Is a

little knowledge a dangerous thing?. Educational researcher, 42(2), 97-100.

7. Hoadley, C. M. (2004). Methodological alignment in design-based research. Educational psychologist, 39(4), 203-212.

8. Joseph, D. (2004). The practice of design-based research: Uncovering the interplay between design, research, and the real-world context. Educational psychologist, 39(4), 235-242.

9. Amiel, T., & Reeves, T. C. (2008). Design-based research and educational technology: Rethinking technology and the research agenda. Journal of educational technology & society, 11(4), 29-40.

10. Bell, P. (2004). On the theoretical breadth of design-based research in education. Educational psychologist, 39(4), 243-253.

11. Niglas, K. (2010). The multidimensional model of research methodology: an integrated set of continua. In SAGE Handbook of Mixed Methods in Social & Behavioral Research (2 ed., pp. 215-236). SAGE Publications, Inc., https://doi.org/10.4135/9781506335193

Reference Books:

1. Reinking, D. (2021). Design-based research in education: Theory and applications. Guilford Publications.

2. Tashakkori, A., & Teddlie, C. (2021). Sage handbook of mixed methods in social & behavioral research. SAGE publications.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

II- Optimal Cognitive Functioning & Learning Ecologies (Specialization)

24CLT641 LIFELONG LEARNING & LEARNING ECOLOGIES 3

Prerequisite: Good reading and writing skills in English; Basic knowledge of learning and instruction

Summary:

This course delves into the principles and practices of lifelong learning and the concept of learning ecologies. It is designed for students to understand and foster environments that support continuous learning across various contexts and stages of life. The course will explore the theoretical underpinnings of lifelong learning, the design of learning ecologies that promote adaptability and growth, and the integration of digital tools and social networks to enhance learning experiences.

Course Objectives:

- Understand the fundamental principles of lifelong learning.

- Explore the concept of learning ecologies and their significance in lifelong learning.

- Examine the role of digital technologies and social networks in supporting continuous learning.

- Develop strategies to create and nurture personal and communal learning environments across socio-economic strata

- Analyze case studies of effective lifelong learning practices and learning ecologies.

Course Outcomes and Skills Acquired:

- Comprehensive Understanding of Lifelong Learning: Grasp the core principles, benefits, and challenges of lifelong learning.

- Design and Implementation of Learning Ecologies: Ability to design, implement, and evaluate learning ecologies that support continuous personal and professional development.

- Digital Literacy and Technology Integration: Proficiency in utilizing digital tools and platforms to enhance learning experiences and access knowledge resources.

- Critical Thinking and Adaptability: Enhanced critical thinking skills to navigate and adapt to evolving learning needs and environments.

- Community Building and Collaboration: Skills in fostering collaborative learning communities and networks that encourage shared knowledge and growth.

Course outcomes CO - Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	-	X	-
CO2	-	-	-	X	-	-	-	-	-
CO3	-	X	-	-	-	X	-	-	-
CO4	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	X	-

Syllabus:

Unit 1: Lifelong Learning: Perspectives and Purposes

Topics: This unit explores the concept of 'lifelong learning' and its historical development and application to education and training, considering the difference between the present and the future

- Introduction to Lifelong Learning and Key Considerations
- Theories and Modes of Lifelong Learning
- Emerging Programs and New Approaches
- Sites of Lifelong Learning and Policy Perspectives

Unit 2: Sites of Lifelong Learning and Learning Ecologies

- Defining Learning Ecologies, Learning organizations
- Components and Characteristics of Effective Learning Ecologies

Unit 3: Design of Learning Ecologies for Lifelong Learning

- The design of learning technologies for distance and distributed learning
- contribution of learning ecologies in promoting and sustaining lifelong learning.
- Role of Digital Technologies in Lifelong Learning in open and distance learning
- Development and transformation of Digital Tools and Platforms for e-Learning
- Navigating Digital Information, Literacy, and Lifelong learning

Unit 4: Lifelong Learning: Policy Perspectives and Development

- Strategies for Developing Personal Learning Networks (PLNs)
- Integrating Lifelong Learning Practices into Professional Development
- Evaluating and Adapting Learning Ecologies

Unit 5: Lifelong Learning: Emerging Programs and Future Challenges

- Unpredictability of human future and redefinition of the needs of learning communities (considering research, knowledge, work, digital learning, and literacy)
- Overcoming Barriers to Lifelong Learning
- The Future of Lifelong Learning and Emerging Trends
- Lifelong Learning are considered in relation to various challenges, such as: climate justice, sustainability, precarity, indigeneity, and sexual and gender identity, but also populist politics, migration, and social justice.
- Creating a Culture of Continuous Learning and Adaptablity

Assessment Methods

- Reflection Papers: Analyze personal learning journeys and future lifelong learning goals.

- Project: Design a personal or professional learning ecology incorporating digital tools and a supportive community.

- Case Study Analysis: Evaluate an existing learning ecology and suggest improvements.

- Participation: Active involvement in discussions, peer reviews, and collaborative projects.

Suggested Literature

- Anderson, T. (2003). Towards a theory of online learning. In T. Anderson & F. Elloumi (Eds.), Theory and Practice of Online Learning (pp. 33–60). Athabasca University.
- Aviram, A., & Eshet-Alkalai, Y. (2006). Towards a theory of digital literacy: Three scenarios for the next steps. European Journal of Open, Distance and E-Learning, 1.
- Beeson, I. (2003). Imaginative communities: Turning information technology to expressive use in community groups. In S. Hornby & Z. Clarke (Eds.), Challenge and Change in the Information Society (pp. 104–124). Facet Publishing.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18, 32–42.
- Cope, B., Kalantzis, M., & Searsmith, D. (2021). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. Educational Philosophy and Theory, 53(12), 1229–1245.
- Dede, C., & Richards, J. (Eds.). (2022). The 60-year curriculum: New models for lifelong learning in the digital economy. Routledge.
- Eberle, J., Hod, Y., & Fischer, F. (2019). Future learning spaces for learning communities: Perspectives from the learning sciences. Br. J. Educ. Technol., 50(5), 2071-2074.
- Edwards, R. (2012). Lifelong learning: A posthuman condition? In D. Aspin, J. Chapman, K. Evans, & R. Bagnall (Eds.), Second International Handbook of Lifelong Learning (pp. 151–162). Springer.
- EUCIS-LLP, European Civil Society for Europe – Lifelong Learning Platform. (2015). Manifesto for the future of learning in Europe. Brussels: EUCIS.
- Fauré, E., et al. (1972). Learning to be: The world of education today and tomorrow. Paris: UNESCO.
- Fischer, F., Sommerhoff, D., & Keune, A. (2023). Perspectives on learning from the learning sciences. In International Encyclopedia of Education (Fourth Edition) (pp. 44-56). Elsevier.
- Fischer, F., Hmelo-Silver, C. E., Goldman, S. R., & Reimann, P. (Eds.). (2018). International handbook of the learning sciences. Routledge.
- Freire, P. (2000). Pedagogy of the oppressed (30th Anniversary Edition). New York: Continuum.
- González-Sanmamed, M., Muñoz-Carril, P. C., & Santos-Caamaño, F. J. (2019). Key components of learning ecologies: A Delphi assessment. British Journal of Educational Technology, 50(4), 1639–1655.
- Jackson, N. (2013). The concept of learning ecologies. In Lifewide Learning, Education & Personal Development e-book (Chapter A5). http://www.normanjackson.co.uk/uploads/1/0/8/4/10842717/chapter_a5.pdf
- Kemmis, S., Edwards-Groves, C., Wilkinson, J., & Hardy, I. (2012). Ecologies of practices. In P. Hager, A. Lee, & A. Reich (Eds.), Practice, Learning and Change (Vol. 8, Professional and Practice-based Learning). Springer. https://doi.org/10.1007/978-94-007-4774-6_3
- Raffaghelli, J. E., Romero Carbonell, M., & Romeu, T. (2021). Adopting lifelong learning ecologies to support the development of critical digital literacies.
- Sangrá, A., Raffaghelli, J. E., & Guitert-Catasús, M. (2019). Learning ecologies through a lens: Ontological, methodological and applicative issues. A systematic review of the literature. British Journal of Educational Technology, 50(4), 1619–1638.
- Selwyn, N., Gorard, S., & Furlong, J. (2006). Adult Learning in the Digital Age: Information technology and the learning society. Routledge.
- UNESCO Institute for Lifelong Learning. (2019). Towards CONFINTEA VII: Adult learning and education and the 2030 agenda. Hamburg: UIL.
- Wenger, E. (1998). Communities of Practice. Cambridge University Press.

II- Optimal Cognitive Functioning & Learning Ecologies (Specialization)

24CLT642   OPTIMAL COGNITIVE FUNCTIONING   3

Prerequisite: Good reading and writing skills in English

Summary:
Understand key concepts in cognitive psychology, neuroscience and the mind associated with the perception, pursuit and attainment of your full potential, including the cultural influences on these processes. Gain knowledge and experience of the mind, body, and brain interaction to maximize your potential, resilience, energy, emotional agility and sense of well-being.

Course Objectives:
1. Understand theories of cognitive psychology and neurosciences
2. Relate ancient philosophical concepts to cognition and mind
3. Implement cognitive strategies for enhancing well-being, personal efficacy, and executive functioning
4. Gain insights into the importance of critical thinking skills for problem-solving
5. Gain a deeper understanding of cultural variations in the definition and pursuit of skills and expertise
6. Appreciate the unique strengths of neurodivergent thinking
7. Analyze the role and diversity of cognitive functions in shaping the self

Course Outcomes:

CO1: Acquired knowledge of cognitive processes associated with the perception and pursuit of maximising potential.

CO2: Acquired knowledge and practice of the mind, brain, and body interactions to harness one's potential and overall well-being.

CO3: Developed an understanding of the brain structures and neurophysiology underpinning perception, decision-making and regulation.

CO4: Understood how executive functioning can be optimized to unfold personal potential

CO5: Gained insight into the power of critical thinking

CO6: Understood how to harness the power of cognitive diversity: Cultural diversity in cognitive functioning, as well as the unique potential of neurodivergent thinking

Skills:
- Critical reflection on the mind and cognition
- Appreciation of divergent thinking
- Personal and professional development strategies
- Executive function optimization

- Analytical and critical thinking skills to solve problems and make better decisions
- Cultural sensitivity in relation to cognitive functioning

Course outcomes CO - Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	x	-	-	-	-	x	x	x	x		
CO2	x	-	-	-	-	-	-	x	x		
CO3	x	-	-	-	-	-	x	x	-		
CO4	-	-	-	-	-	x	-	-	x		
CO5	-	x	-	x	-	x	x	x	-		
CO6	x	x	-	-	x	x	x	x	x		

Syllabus:

- **Unit I – Cognitive Psychology, Neuroscience, and the Mind**   **9 hrs.**
  - Theories of cognitive psychology and neurosciences
  - Vedantic philosophy of cognition and mind

- **Unit II – Executive Functioning**   **9 hrs.**
  - Introduction to executive functioning
  - You and your future self: Unfolding personal potential by connecting executive function, mental time-travel and emotional agility

- **Unit III – The Power of Critical Thinking**   **9 hrs.**
  - The importance of higher-order cognitive skills (abstract, analytical, critical thinking skills; metacognition) for problem-solving and decision-making
  - Avoiding cognitive biases (e.g., social priming, stereotypes, attribution biases, confirmation bias)

- **Unit IV –Diversity in Cognition**   **9 hrs.**
  - Theories on how culture shapes our brains
  - Cross-cultural differences in skill acquisition and definition of achievement/success
  - Intense world theory (Markram & Markram, 2010) to explain neurodivergence (ADHD, autism, synesthesia)
  - Unique strengths of neurodivergent thinking

Unit V – Harnessing Your Potential - Tools for Personal Growth and Happiness 9hrs.
  - Introduction to mindfulness techniques to enhance cognitive efficiency
    - Self-reflection/analysis to cultivate awareness of obstacles and, such as focusing on the breath, noticing thoughts without judgment, utilizing body scan to enhance self-regulation, mindful movement
    - Coherence practices focused on heart rate variability
  - Neural Correlates of noble values and principles that cultivate mental health and wellbeing
    - Accessing research-supported regenerative states through higher principles: gratitude, kindness, compassion & self-compassion, loving-kindness practices, and optimism
    - Research-supported methods for emotion regulation
    - Influence of negative cognitions on physical and mental distress and disorders

- Lab exposure: Use of different neurophysiology tools to experience and measure cognitive processes in Lab hours

Textbooks:

McMillan, K. & Weyers, J. (2013). *How to improve your critical thinking & reflective skills*. Harlow, UK: Pearson.

Armstrong, T. (2011). *The power of neurodiversity: Unleashing the advantages of your differently wired brain*. Da Capo Lifelong Books.

Neff, K. (2011). *Self-Compassion: Stop beating yourself up and leave insecurity behind.* HarperCollins Publishers, NY.

Articles and Book Chapters:

Basso J., McHale A., Ende V., Oberlin D., Suzuki W. (2019). Brief, daily meditation enhances attention, memory, mood, and emotional regulation in non-experienced meditators. *Behav Brain Res*. Jan 1;356:208-220. doi: 10.1016/j.bbr.2018.08.023. Epub 2018 Aug 25. PMID: 30153464

Bornemann, B., Herbert, B., Mehling, W., & Singer T. Differential changes in self-reported aspects of interoceptive awareness through 3 months of contemplative training. Front Psychol. 2015 Jan 6;5:1504. doi: 10.3389/fpsyg.2014.01504. PMID: 25610410; PMCID: PMC4284997.

Edwards S., Edwards D., Honeycutt R. (2022). HeartMath as an Integrative, Personal, Social, and Global Healthcare System. *Healthcare (Basel)*, 10(2):376. doi: 10.3390/healthcare10020376. PMID: 35206990; PMCID: PMC8871721.

Elbers, J. & McCraty, R. (2020) HeartMath approach to self-regulation and psychosocial well-being, *Journal of Psychology in Africa*, 30:1, 69-79, DOI: 10.1080/14330237.2020.1712797

Fatmawati, A., Zubaidah, S., Mahanal, S., & Sutopo. (2019). Critical thinking, creative thinking, and learning achievement: How they are related. *Journal of Physics: Conference Series, 1417*, 012070. https://doi.org/10.1088/1742-6596/1417/1/012070

Hölzel, B., et al. (2011). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatric Research: Neuroimaging,* 191(1) 36-43. https://doi.org/10.1016/j.pscychresns.2010.08.006

Jahnke R, Larkey L, Rogers C, Etnier J, Lin F. (2010). A comprehensive review of health benefits of qigong and tai chi. *Am J Health Promot.,* 24(6):e1-e25. doi: 10.4278/ajhp.081013-LIT-248. PMID: 20594090; PMCID: PMC3085832.

Jha, A. P., Stanley, E. A., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion, 10*(1), 54–64. https://doi.org/10.1037/a0018438

Kim H., Cheon E., Bai D., Lee Y., Koo B. (2018) Stress and heart rate variability: A meta-analysis and review of the literature. *Psychiatry Investig*, 15(3),235-245. doi: 10.30773/pi.2017.08.17. Epub 2018 Feb 28. PMID: 29486547; PMCID: PMC5900369.

Luders, E., Toga, A., Lepore, N. & Gaser, C. (2009). The underlying anatomical correlates of long-term meditationL Larger hippocampal and frontal volumes of gray matter. *NeuroImage,* 45(3) 672-678. https://doi.org/10.1016/j.neuroimage.2008.12.061

Lupien, S., McEwen, B., Gunnar, M. *et al.* Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat Rev Neurosci* 10, 434–445 (2009). https://doi.org/10.1038/nrn2639

Markram, K., & Markram, H. (2010). The intense world theory – A unifying theory of the neurobiology of autism. *Frontiers in Human Neuroscience, 4,* 224. https://doi.org/10.3389/fnhum.2010.00224

McCraty, R., Barrios-Choplin, B., Rozman, D., Atkinson, M., Watkins, A. (1998) The impact of a new emotional self-management program on stress, emotions, heart rate variability, DHEA and cortisol. *Integrative Physiological and Behavioral Science*, 33(2), 151- 170.

Mishra, R. C. (2001). Cognition across cultures. In D. Matsumoto (Ed.), *The handbook of culture and psychology* (pp. 119-135). Oxford University Press.

Newberg, A., & Iversen, J. (2003). The neural basis of the complex mental task of meditation: Neurotransmitter and neurochemical considerations. *Medical Hypotheses, 61*(2) 282-291. https://doi.org/10.1016/S0306-9877(03)00175-0

Sood A, Jones DT. On mind wandering, attention, brain networks, and meditation. Explore (NY). 2013 May-Jun;9(3):136-41. doi: 10.1016/j.explore.2013.02.005. PMID: 23643368 Park, D. C., & Huang, C. M. (2010). Culture wires the brain: A cognitive neuroscience perspective. *Perspectives on Psychological Science, 5*(4), 391-400. https://doi.org/10.1177/1745691610374591

Salili, F. (1994). Age, sex, and cultural differences in the meaning and dimensions of achievement. *Personality and Social Psychology Bulletin, 20*(6), 635-648. https://doi.org/10.1177/0146167294206002

Varnum, M. E. W., Grossmann, I., Kitayama, S., & Nisbett, R.E. (2010). The origin of cultural differences in cognition: Evidence for the social orientation hypothesis. *Curr Dir Psychol Sci, 19*(1), 9-13. https://doi.org/10.1177/0963721409359301

Wang Y, Pan B, Yu Z, Song Z. The relationship between preschool teacher trait mindfulness and teacher-child relationship quality: The chain mediating role of emotional intelligence and empathy. Curr Psychol. 2023 Mar 17:1-12. doi: 10.1007/s12144-023-04512-5. Epub ahead of print. PMID: 37359607; PMCID: PMC10021046

Reference Books:

Forman, J. (1990). *Cognitive biases: A fascinating look into human psychology and what you can do to avoid cognitive dissonance, improve your problem-solving skills, and make better decisions.* Primasta.

Mitchell, K. J. (2020). *Innate: How the wiring of our brains shapes who we are.* Princeton University Press.

Silberman, S. (2017). *Neurotribes: The legacy of autism and how to think smarter about people who think differently.* Atlantic Books.

Kok, A. (2020). *Functions of the brain. A conceptual approach to cognitive neuroscience.* Routledge.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

II- Optimal Cognitive Functioning & Learning Ecologies (Specialization)

24CLT643   SOCIAL COGNITION, SOCIAL NEUROSCIENCE, AND TECHNOLOGY   3

Prerequisites: Good reading and writing skills in English; Basic knowledge of cognitive neuroscience

Summary: The course addresses the cognitive and neural bases of social perceptions and interactions, empathy, and compassion, and explores their intersection with artificial intelligence (AI) and educational technologies. It addresses the bidirectional influence of AI that can enhance and augment our understanding of social cognitive processes and behaviour and how insights from social cognition and neuroscience can guide and enhance the development of AI technologies. The course highlights the future implications of AI, including bias detection, for example, in the context of decision-making and cultural stereotypes.

Course Objectives:

- Investigate cognitive mechanisms driving social interactions.
- Delve into the evolution, methodologies, and pivotal theories of social cognition.
- Comprehend empathy and compassion through a social neuroscience lens.
- Assess the impact of social cognition and neuroscience findings on AI technologies and their implementation in educational contexts.

Course Outcomes:

Upon completing this course, students will be able to:

- CO1: Grasp foundational concepts in social cognition.
- CO2: Analyze and implement social cognition research methodologies.
- CO3: Identify neural correlates of empathy and compassion.
- CO4: Assess the impact of social cognition and neuroscience on education and AI applications.
- CO5: Design and critically evaluate research studies within the social cognition domain.

Skills Acquired:

- Critical analysis of social cognitive research.
- Insight into neural mechanisms behind empathy and compassion.
- Ability to evaluate the significance of social cognition and neuroscience in education and AI.
- Application of social cognition theories to practical scenarios.

Course outcomes CO - Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	x	-	-	-	-	x	x	x	x
CO2	x	-	-	-	-	-	-	x	x
CO3	x	-	-	-	-	-	x	x	-
CO4	-	-	-	-	-	x	-	-	x
CO5	-	x	-	x	-	x	x	x	-
CO6	x	x	-	-	x	x	x	x	x

Unit 1: History and Foundations of Social Cognition

- Introduction and historical overview of social cognition.
- Basic processes in social cognition and foundations of social neuroscience

Unit 2: Social Perception and Schemas

- The development of stereotypes and their impact on social cognition
- Implicit social cognition, prejudice and discrimination
- Attribution theory and attribution errors
- Representation in social cognition: Person and event representation, self-concept and self-knowledge
- Impression formation, social schemas, and biases.

Unit 3: Empathy and Compassion from a Social Neuroscience Perspective

- Social neuroscience perspectives on empathy and compassion.
- Mirror neurons, emotional contagion, prosocial behavior
- Social psychological phenomena in the context of compassion and empathy (in-group, out-group, bystander effect, etc.)
- Integration of Vedic perspectives on empathy and compassion.

Unit 4: Social Cognition and Social Neuroscience for Educational Technology and AI in Education

- Social aspects of cognition and computing: Social computing in relation to cognitive computing and affective computing, Social Internet of Things (SIoT)
- The rise of social computing and ethical issues
- Teaching and Instruction: Components of human teaching vs. learning in the digital world
- Bridging social neuroscience with education

Unit 5: Influence of History and Global Policy on Education

- The social cognition of political attitudes
- The impact of social cognition on the development of global politics, education, and technology
- Politics, gender, and education
- Influence of politics on educational policies in India
- Perspectives on sociocultural aspects in the context of education and learning

Textbooks suggestions:

Unit1:
- Carlston, D. E. (Ed.) (2013). The Oxford handbook of social cognition. Oxford University Press.
- Wyer Jr, R. S., & Srull, T. K. (Eds.). (2014). Handbook of social cognition. Volume 2: Applications. Psychology Press.
- Augoustinos, M., Walker, I., & Donaghue, N. (2014). Social cognition: An integrated introduction (3rd Edition). Sage.
- Decety, J., & Cacioppo, J. T. (Eds.). (2011). The Oxford handbook of social neuroscience. Oxford Library of Psychology.

Unit 2:

- Dovidio, J. F., Hewstone, M., Glick, P., & Esses, V. M. (Eds.). (2010). *The SAGE handbook of prejudice, stereotyping, and discrimination*. Sage.
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III - Neurophysiology Tools and Learning Technologies (Specialization)

24CLT652   NEUROPHYSIOLOGY LABORATORY   3

https://www.amrita.edu/program/mscyoga-and-cognitive-science/

24CLT653   COMPUTATIONAL NEUROSCIENCE   3

https://www.amrita.edu/program/mscyoga-and-cognitive-science/

24CLT654 NEUROIMAGING TECHNIQUES ND COGNITIVE ELECTROPHYSIOLOGY

in progress - Axxonet

24CLT651 VIRTUAL REALITY, AUGMENTED REALITY, and HAPTICS FOR LEARNING   3

Prerequisite: NA

Summary: This course focuses on the basics of haptics technologies, VR/AR. In this technology there are different components(technology) involved like, electronic sensors and actuators, rendering and virtual
reality. These above mentioned topics discussed about the fundamental concepts of how to design, develop and test a basic haptic simulator tied with VR/AR which will help to improve the skills in different areas. Nowadays haptics simulators are very much used in teaching the skills in different areas like medical areas, vocational aspects. Gaming and entertainment is another area which is growing very fast. So this course will help the students to get an understanding about the haptics devices and VR/AR applications.

Course Objectives:
1. Understand haptics, which is the study of touch: involves human interaction with real, remote, and virtual objects through the sense of touch.
2. Identify the primary mechanisms of human haptic sensing
3. Understand virtual reality and teleoperation systems
4. Develop skills at designing haptic based VR/AR systems in the context of learning and teaching
5. Applying the concepts of Haptics/VR/AR to design, develop and implement an application

Course Outcomes:
CO1: : Understand haptics, which is the study of touch: involves human interaction with real, remote, and virtual objects through the sense of touch.

CO2: Identify the primary mechanisms of human haptic sensing

CO3: Understand virtual reality and teleoperation systems

CO4: Develop skills at designing haptic based VR/AR systems in the context of learning and teaching

CO5: Applying the concepts of Haptics/VR/AR to design, develop and implement an application

Skills:
- Problem-solving using analogical reasoning.
- Analytical skills in interpreting mental imagery and representations.
- Understanding of the interplay between language, thought, and sensory processing.

Program outcome PO - Course Outcomes CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	X	-	-	-	-	-	-	-	-		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO2	-	-	X	-	-	-	-	-	-		
CO3	-	X	-	-	-	-	-	-	-		
CO4	-	-	-	-	-	-	-	-	-		
CO5	X	-	-	-	-	-	-	-	-		

Unit I: Overview of Virtual Reality, Augmented Reality and Teleoperation Systems   9 hrs.

- Introduction to the history and evolution of Virtual Reality (VR), Augmented Reality (AR), and teleoperation systems. Overview of haptic technology, Overview of different VR and AR headsets, haptic devices, and simulators, Application of VR and AR in learning and teaching environments.

- Practical Component: Begin a course-long project to design a VR/AR application focused on enhancing learning and teaching. This project will serve as a practical thread that ties all units together.History of VR, AR, teleoperation, Haptics

- Different headsets, haptics devices, simulators and its applications for Learning and teaching

- start to design of an application for learning and teaching throughout the course

Unit II: Introduction of VR/AR Applications   9 hrs.
- **Introduction to users interfaces such as Unity 3D**
- Introductions to SDKs
- Integrating hardware to software: connecting the VR/AR headsets to eg Unity 3D

Unit III: Applications of Haptics VR/AR   9 hrs.
- Introduction to existing haptics/vr applications
- Understanding the architecture of Haptics,/VR/AR application, electronic sensors and actuators, rendering

Unit IV – Project Work   9 hrs.
- design, development and implementation of application in the context of Learning and teaching

Suggested Readings:
1. Kern, Thorsten A. Engineering haptic devices: a beginner's guide for engineers. Springer Science & Business Media, 2009.

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT661 THE DNA OF TEACHING 3

Summary:

Teaching may be one of nature's most remarkable inventions. In this course, we will explore potential answers to the questions: why do we teach in the first place? And what has to be in place intellectually, interpersonally, emotionally, ethically and more for teaching to occur?

Course Objectives:

The main aims and objectives of the course are to investigate the underpinnings of teaching and enable students to gain an understanding of how various disciplines can help us better achieve this understanding.

1. Identify main questions asked about teaching
2. Identify issues in the various sciences that inform us about the ontology of teaching
3. Be cognizant of answers to the questions provided by various sciences
4. Recognize open questions and potential avenues of exploration to provide answers

Course Outcomes:

By the end of this course, students should be able to:

CO1: Understand why theories and research in the cognitive sciences are not independent of philosophical issues.

CO2: Recognize questions in the cognitive sciences and their philosophical underpinnings.

CO3: Have a working acquaintance with various solutions in philosophy that have been offered for issues in the cognitive sciences.

Course Outline

I. **What is Teaching?**

   ○ How do we define teaching?
   ○ What separates teaching from other forms of communication?

II. **A Map of Philosophy's Domains**

   • What is the ontology of teaching?

III. **What fields can help us understand teaching?**

   • What does each field contribute to our understanding of teaching?

Course tools to deepen understanding and knowledge acquisition

- Reading professional literature
- Classroom discussions of readings
- Students will present an issue in teaching in class and lead a discussion about it.
- Students will write an essay on an issue about teaching.

Methods of Assessment

- Class participation
- Each student will give an oral presentation of an issue in teaching. The presentation will be based on professional literature in addition to the course's compulsory readings.
- Each student will write a paper on an issue in teaching

Assessment Weightings

Components	
Class participation	10%
Class oral presentation	40%
A paper about philosophical assumptions regarding research studies in a particular area.	50%
	100%

Compulsory Reading Material

FIRST READING

SECOND READING (Between our second and third meetings)

THIRD READING (Between our third and fourth meetings

Class Meetings (10 meetings, each for 1.5 hours for a total of 15 hours)

Meeting 1

1. Course presentation. Discussions of some issues that will appear in the course.
2. ASSIGNMENT: Read the article.

Meeting 2

- Discussion of the article.
- ASSIGNMENT: Read the article.

Meeting 3

- Discussion of the article.
- Student discussions and decisions about what each tentatively wants to present in a future meeting.
- ASSIGNMENT: Read the articles

Meeting 4

- Discussion of the article.
- Student discussions and decisions about what each will be presenting in a future meeting.

- ASSIGNMENT: Student begin preparing the topic they chose to present

Meeting 5

- Student discussions and decisions about what each will be presenting in a future meeting.
- ASSIGNMENT: Students create an outline of the topic they chose to present

Meeting 6

Students present their outline of the topic they chose to present.

Meeting 7

Two students present their topic with a 15-minute presentation, allowing for 25 minutes of discussion, questions and answers.

Meeting 8

Two students present their topic with a 15-minute presentation, allowing for 25 minutes of discussion, questions and answers.

Meeting 9

Two students present their topic with a 15-minute presentation, allowing for 25 minutes of discussion, questions and answers.

Meeting 10

Group discussion summarizing the course.

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Pasquinelli, E., & Strauss, S. (2018). Introduction: Teaching and its building blocks. *Review of Philosophy and Psychology, 9*, 719-749. https://doi.org/10.1007/s13164-018-0422-3

Biological evolution and teaching

Thornton, A., & Raihani, N. J. (2008) The evolution of teaching. *Animal Behaviour, 75(6)*, 1823–36.

Nonhuman teaching

Caro, T. M., & Hauser, M. D. (1992) Is there teaching in nonhuman animals? *Quarterly Review of Biology 67*, 151–74.

Thornton, A., & McAuliffe, K. (2006) Teaching in wild meerkats. *Science 313(5784),* 227–29.

Teaching in prehistory as evidenced by cognitive archeology

Assaf, E., Nunziante-Cesaro, S., Gopher, A. & Venditti, F. (2023). Learning by doing: Investigating

skill through techno-functional study of recycled lithic items from Qesem Cave (Israel). *Journal*

of Archaeological Method and Theory 30, 64–102. https://doi.org/10.1007/s10816-022-09590-6

Teaching in developing children

Strauss, S., & Ziv, M. (2012). Teaching is a natural cognitive ability among humans. *Mind, Brain and Education, 6(4)*, 186-196. doi: 10.1111/j1751-228X.2012.01156.x

Bonawitz, E., Shafto P., Gweon, H., Goodman, N. D., Spelke, E. & Schultz, L. (2011) The double-edged sword of pedagogy: instruction limits spontaneous exploration and discovery. Co*gnition, 120*, 322–330. doi:10.1016/j.cognition.2010. 10.001

Cultural variations of teaching: Hunter and gatherers

Hewlett B. S. & Roulette C. J. (2016). Teaching in hunter– gatherer infancy. *Royal Society of Open Science, 3*, 150403. http://dx.doi.org/10.1098/rsos.150403

Emotional and motivational underpinnings of teaching

Teaching and cultural transmission

Laland, K. N., & Hoppitt, W. (2003). Do animals have culture? *Evolutionary Anthropology, 12*, 150–159. doi:10.1002/evan.10111

Caldwell C. A., Cornish, H. & Kandler, A. (2016). Identifying innovation in laboratory studies of cultural evolution: Rates of retention and measures of adaptation. *Philosophical Transactions of the Royal Society, B 371: 20150193*. http://dx.doi.org/10.1098/rstb.2015.0193

Scalise Sugiyama, M. (2017) Oral storytelling as evidence of pedagogy in forager societies. *Frontiers of Psychology, 8* (471). doi: 10.3389/fpsyg.2017.00471

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT662 PSYCHOMOTOR SKILL TRAINING TO ENHANCE LEARNER PERFORMANCE   3

Summary:

This course aims to equip students with a comprehensive understanding of the essential mechanisms underlying the acquisition of motor skills. It will cover a wide range of principles, facts, and theories related to physical, cognitive, behavioral, and social aspects of motor learning and performance. Participants will engage in critical thinking through an array of laboratory exercises and project work. The curriculum is designed to foster a deep analytical understanding of motor skill learning and its application in a variety of contexts.

Course Objectives:

1. To gain a basic understanding of the term "skill" and classify various types of skills within the context of motor learning.
2. To describe Information Processing in Motor Learning by utilizing the "Stages of processing" concept to explain how information is processed during motor learning and performance.
3. To illustrate the purpose and attributes of motor programs in motor skill acquisition.
4. To examine how individual variances contribute to the nature of motor abilities.
5. To apply principles of motor learning, along with behavioral and social theories, in teaching and learning novel motor skills.
6. To elucidate the relationship between structured learning experiences and the enhancement of skilful movement for all learners.
7. To utilize a range of feedback methods to indicate progress in the development of skilful movement.
8. To apply different methods to augment self-motivation and the motivation of learners in acquiring new motor skills.
9. To administer time, space, and equipment efficiently to facilitate the instruction of a new skill to novice learners.

Course Outcomes:

CO1: Understand and classify motor skills for effective learning.
CO2: Explain information processing in motor learning.
CO3: Illustrate the role of motor programs in skill acquisition.
CO4: Analyze individual differences in motor abilities.
CO5: Apply motor learning principles to teach and learn new skills efficiently.

Skills:

- Ability to classify various types of motor skills within the context of motor learning.
- Understanding of how information is processed during motor learning and performance using the stages of processing concept.
- Ability to describe the purpose and attributes of motor programs in motor skill acquisition.
- Capability to examine how individual differences contribute to motor abilities.
- Proficiency in applying motor learning principles, along with behavioral and social theories, in teaching and learning novel motor skills.
- Understanding of how structured learning experiences enhance skillful movement for all learners.
- Competence in utilizing a range of feedback methods to indicate progress in skillful movement development.
- Skill in applying different methods to augment self-motivation and motivation of learners in acquiring new motor skills.
- Ability to administer time, space, and equipment efficiently to facilitate the instruction of new skills to novice learners.

Course outcomes CO - Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
CO1	x	-	-	-	-	x	x	x	x		
CO2	x	-	-	-	-	-	-	x	x		
CO3	x	-	-	-	-	-	x	x	-		
CO4	-	-	-	-	-	x	-	-	x		
CO5	-	x	-	x	-	x	x	x	-		
CO6	x	x	-	-	x	x	x	x	x		

Syllabus:

Unit I: Introduction to Motor Learning and Movement Preparation   9 hours

Skill taxonomy - what is a skill?, Fine versus gross motor skills, discrete, serial, or continuous skills, closed-open skills, Gentile's taxonomy, Fleishman's taxonomy, approaches to perception - information processing model and ecological approach, reaction time, Hick's law, attentional capacity, arousal, selective attention, attentional focus, visual search

Unit II: Theories of Motor Control   9 hours

Degrees of freedom, motor program theory, dynamic systems theory, generalized motor program, parameters, constraints-led approach

Unit III: Stages of Learning, Preparation for Learning and Skill Presentation   9 hours

Fitts and Posner's three-stage model, Gentile's two-stage model, performance Improvements, learning styles, positive transfer, negative transfer, motivation for learning, hands-on instruction, hands-off instruction

Unit 4: Motor Skill Practice Design   9 hours

Whole versus part practice, part practice methods – segmentation, fractionization, simplification, attention cueing, goal setting, cognitive rehearsal of a movement, constant practice versus variable practice, contextual interference, blocked and random practice, massed and distributed practice, rest intervals

Unit 5: Errors and Feedback   9 hours

Conducting an observation of learner's performance, diagnosing errors, comprehension errors, errors in selection, execution errors, errors in decision making. Feedback - intrinsic feedback, augmented feedback, knowledge of results, knowledge of performance, sandwich approach to providing feedback, feedback frequency.

Textbooks and Papers:

- Coker, C. (2017). *Motor learning and control for practitioners*. Routledge.
- Schmidt, R. A., Lee, T. D., Winstein, C., Wulf, G., & Zelaznik, H. N. (2018). Motor control and learning: A behavioral emphasis. Human Kinetics.

Reference Books:

- Magill, R., & Anderson, D. I. (2010). *Motor learning and control*. New York: McGraw-Hill Publishing.
- Adams, J. A. (1987). Historical review and appraisal of research on the learning, retention, and transfer of human motor skills. *Psychological Bulletin, 101*(1), 41–74. https://doi.org/10.1037/0033-2909.101.1.41
- Madhavan, S., & Shah, B. (2017). Enhancing motor skill learning with transcranial direct current stimulation—A concise review with applications to stroke. *Frontiers in Psychiatry, 8*, 1–12. https://doi.org/10.3389/fpsyt.2012.00066

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT663   **LEARNING ENGINEERING**   **3**

Prerequisite: A foundational understanding of educational psychology, computer science principles, and basic research methodologies.

Course Objectives:
1. Investigate current directions in Learning Engineering, including its history, interdisciplinarity, research projects, milestones, approaches, tools, research designs, career opportunities, and philosophical stances.
2. Identify trends in Learning Engineering to understand its evolving nature and potential future developments.
3. Explore core and applied sciences at different levels of Learning Engineering to grasp the underlying principles and methodologies.
4. Cluster existing Learning Engineering tools based on parameters such as technological choice, pedagogical underpinning, and educational impact to understand their diverse applications and implications.
5. Plan an individual Learning Engineering tool proposal addressing a specific educational problem, fostering innovation, critical thinking, and problem-solving skills.

Course Outcomes:
CO1: Gain a comprehensive understanding of Learning Engineering, its historical evolution, interdisciplinary nature, and diverse educational applications.

CO2: Analyze and evaluate current trends and advancements in Learning Engineering, enabling informed decision-making and adaptation to emerging technologies and methodologies.

CO3: Demonstrate proficiency in identifying and applying core scientific principles and methodologies relevant to Learning Engineering, facilitating the development of research and analytical skills.

CO4: Evaluate and categorize existing Learning Engineering tools based on various criteria, fostering the ability to assess technological solutions and their potential impact on educational practices.

CO5: Develop and present a viable Learning Engineering tool proposal addressing a real-world educational challenge, showcasing the ability to conceptualize, plan, and communicate innovative solutions in the field.

Skills:
- Ability to critically analyze and evaluate educational technology tools and methodologies within Learning Engineering.
- Proficiency in designing and conducting research projects in Learning Engineering, including data collection, analysis, and interpretation.
- Competence in applying evidence-based decision-making strategies to address complex educational challenges using Learning Engineering principles and tools.
- Skill in synthesizing interdisciplinary knowledge from educational science, psychology, and

computer science to inform Learning Engineering practices.
- Capability to conceptualize, develop, and propose innovative Learning Engineering solutions tailored to specific educational contexts and needs.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	X	X	-
CO2	X	X	-	-	-	-	-	X	-
CO3	X	X	X	-	-	X	-	-	-
CO4	X	X	X	-	-	-	X	-	-
CO5	-	X	-	X	-	X	-	X	-

Syllabus:

Unit I – Introduction to Learning Engineering and its Impact on Lifelong Learning   6 Hrs.
Introduction and history of LE
Interdisciplinarity in LE and a model of self-initiated education
Scenario of developed countries and the Indian context under NEP2020

Unit II – Evidence-based Decision-making within Educational Technology   6 Hrs.
Evidence ecosystem and evidence-based thinking under the lens of Scientific thinking
History: A marriage among educational science, psychology, and computer science
EdTech industry and tools

Unit III – (Multimodal) Learning Analytics and Technology-Enhanced Learning   6 Hrs.
Technology-Enhanced Learning under Educational Technology and European Approach
Major milestone research projects, Learning performance and context, Tools, and Challenges and future lines
Soft and hard MMLA, Modalities and tools, and Learning constructs, and data processing pipeline

Unit IV – Common Research Methodologies   6 Hrs.
Practitioner involvement and the context of practice
Iterative nature
Design-Based Research, Participatory Approach, and Engineering Method

Unit V – Adoption and Milestones of LE   6 Hrs.
Adaptability, Scalability while meeting reusability and Challenges
Assessment tools and Dashboards
LE tools competition

Textbooks and Papers:
1. Dym, C. L. (1999). Learning engineering: Design, languages, and experiences. Journal of Engineering Education, 88(2), 145-148.
2. Johri, A., & Olds, B. M. (2011). Situated engineering learning: Bridging engineering education research and the learning sciences. Journal of Engineering Education, 100(1), 151-185.
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Toward a policy and research agenda. Educational policy, 22(4), 578-608.

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28. https://www.the-learning-agency-lab.com/learning-strategies/elaboration/
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Reference Books:

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6. Mor, Y., & Winters, N. (2007). Design approaches in technology-enhanced learning. Interactive Learning Environments, 15(1), 61-75.
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IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT665 SOCIO-COGNITION AND COLLABORATIVE LEARNING
3

Summary: This course explores the interplay between social cognitive and sociocultural processes in learning environments, with a focus on collaborative learning enhanced by emerging educational technologies. It aims to equip students with a deep understanding of how social interactions and technology influence learning and teaching processes.

Course Objectives:

- Understand the foundational theories of socio-cognitive and sociocultural processes in learning.
- Understand the foundational concepts of collaborative learning
- Get an overview on effective collaborative learning environments incorporating current educational technologies.
- Explore the potential of human-AI collaboration in learning and teaching contexts.
- Evaluate the implications of socio-cognitive strategies for practice, policy, and future educational applications.

Course Outcomes:

CO1: Demonstrate a comprehensive understanding of socio-cognitive and sociocultural aspects in learning.

CO2: Critically assess collaborative learning models and their effectiveness in enhancing learning outcomes.

CO3: Develop strategies for creating inclusive learning environments and apply socio-cognitive strategies in practical educational scenarios.

Skills:

- Applying socio-cognitive and sociocultural theories to learning environments.
- Ability to design and evaluate collaborative learning frameworks.
- Integrating human-AI collaboration into educational practices.
- Expertise in developing inclusive and adaptive learning strategies tailored to diverse learner needs.

Unit 1: Socio-Cognitive and Sociocultural Processes of Learning

- Foundations of Social-Cognition and Sociocultural Perspectives
- Role of Socio-Cognitive Processes: Modeling, Self-Efficacy, and Self-Regulation
- Sociocultural Theories in Learning and Education

- Indigenous processes of learning

Unit 2: Foundations of Collaborative Learning

- Research on Collaborative Learning
- ICAP Model
- Cognitive and Socio-Emotional Aspects of collaborative learning

Unit 3: Designing Collaborative Learning Environments with Emerging Educational Technologies

- Technology-Enhanced Learning: Socio-Cognitive and Sociocultural Approaches
- Social Internet of Things
- Practical Applications of Theories in Diverse Settings

Unit 4: Shared Cognition and Hybrid Intelligence

- Principles for Embodied Design
- Human-AI Collaboration in Learning and Teaching
- Hybrid Decision Making, Delegation to AI

Unit 5: Implications for Practice, Policy, and Future Applications

- Case Studies on Socio-Cognitive Strategies
- Designing Inclusive Learning Environments
- Supporting Learners with Diverse Needs

Chang, A., Wiewiora, A., & Liu, Y. (2021). A socio-cognitive approach to leading a learning project team: A proposed model and scale development. International Journal of Project Management, 39(6), 646-657.

Eberle, J., Hod, Y., & Fischer, F. (2019). Future learning spaces for learning communities: Perspectives from the learning sciences. Br. J. Educ. Technol., 50(5), 2071-2074.

Fischer, F., & Opitz, A. (2022). Learning to diagnose with simulations: Examples from teacher education and medical education. Cham: Springer International Publishing.

Fischer, F., Sommerhoff, D., & Keune, A. (2023). Perspectives on learning from the learning sciences. In International Encyclopedia of Education (Fourth Edition) (pp. 44-56). Elsevier.

Fischer, F., Hmelo-Silver, C. E., Goldman, S. R., & Reimann, P. (Eds.). (2018). International handbook of the learning sciences. Routledge.

Fischer, F., & Opitz, A. (2022). Learning to diagnose with simulations: Examples from teacher education and medical education. Cham: Springer International Publishing.

Isohätälä, J. (2020). The interplay of cognitive and socio-emotional processes in social interaction: Process-oriented analyses of collaborative learning.

Järvelä, S., Nguyen, A., & Hadwin, A. (2023). Human and artificial intelligence collaboration for socially shared regulation in learning. British Journal of Educational Technology.

Molenaar, I., de Mooij, S., Azevedo, R., Bannert, M., Järvelä, S., & Gašević, D. (2023). Measuring self-regulated learning and the role of AI: Five years of research using multimodal multichannel data. Computers in Human Behavior, 139, 107540.

Radkowitsch, A., Vogel, F., & Fischer, F. (2020). Good for learning, bad for motivation? A meta-analysis on the effects of computer-supported collaboration scripts. International Journal of Computer-Supported Collaborative Learning, 15, 5-47.

Sacco, K., & Bucciarelli, M. (2008). The role of cognitive and socio-cognitive conflict in learning to reason. Mind & Society, 7, 1-19.

Weinberger, A., Fischer, F., & Mandl, H. (2023, January). Fostering computer supported collaborative learning with cooperation scripts and scaffolds. In Computer Support for Collaborative Learning (pp. 573-574). Routledge.

Varela, F. J., Thompson, E., & Rosch, E. (1991). The embodied mind: Cognitive science and human experience. Cambridge, MA: MIT Press

Vogel, F., Wecker, C., Kollar, I., & Fischer, F. (2017). Socio-cognitive scaffolding with computer-supported collaboration scripts: A meta-analysis. Educational Psychology Review, 29, 477-511.

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT666 LEARNING ANALYTICS AND EDUCATIONAL DATA MINING   3

Prerequisites: A foundational understanding of statistics, proficiency in programming languages such as Python or R, and a basic knowledge of educational theory and practices.

Summary:

This course delves into the interdisciplinary domains of data mining, machine learning, and educational theory to analyze and interpret educational data effectively. Spanning five units, the course begins with exploring Educational Data Mining (EDM), tracing its historical development, technical foundations, and key challenges. Subsequently, it transitions to Learning Analytics (LA), examining its evolution, tools, and integration challenges within formal education systems. The course then explores the intersection of EDM and LA, elucidating their philosophical, social, and computational disparities while highlighting their shared analysis techniques and data processing pipelines. Furthermore, students will gain insights into modelling and interpreting educational data, emphasizing the fusion of technical advancements with educational theories. Finally, the course culminates in Multimodal Learning Analytics (MMLA), addressing the complexities of analyzing multiple modalities in learning environments and the challenges associated with stakeholder involvement, data processing, and integration. Throughout the course, students will use diverse machine learning algorithms, data visualization techniques, and real-world case studies to develop a nuanced understanding of leveraging data for educational insights and decision-making.\

Course Objectives:

1. Understand the fundamental principles and historical development of Educational Data Mining (EDM) and Learning Analytics (LA).
2. Explore diverse machine learning algorithms and data processing pipelines utilized in EDM and LA for analyzing educational data.
3. Investigate the interdisciplinary nature of EDM and LA, examining philosophical, social, and computational perspectives.
4. Develop modeling, interpreting, and visualizing educational data skills to derive actionable insights for educational stakeholders.
5. Analyze the challenges and opportunities in implementing Multimodal Learning Analytics (MMLA) solutions in educational settings.

Course Outcomes:

CO1: Demonstrate proficiency in utilizing machine learning algorithms and data processing techniques for educational data analysis.

CO2: Critically evaluate EDM and LA solutions' strengths, limitations, and ethical implications in educational contexts.

CO3: Apply theoretical frameworks and analytical methods to model and interpret educational data effectively.

CO4: Communicate insights from educational data analysis to diverse stakeholders through clear and concise visualizations and reports.

CO5: Develop strategies to address integration and adoption challenges in implementing MMLA solutions, fostering data literacy among educational stakeholders.

Skills:

1. Develop proficiency in statistical analysis, data visualization, and programming, essential for interpreting and communicating insights from educational data.
2. Acquire specialized knowledge in educational theory and practices, enabling the integration of data-driven insights into instructional design and pedagogical decision-making.
3. Cultivate critical thinking and problem-solving skills to address complex challenges in educational data mining, learning analytics, and multimodal learning analytics.
4. Enhance interdisciplinary collaboration and communication skills to effectively engage with diverse stakeholders in implementing data-driven educational interventions, including educators, researchers, and policymakers.
5. Foster a commitment to ethical data practices and a deep understanding of privacy and security considerations when handling sensitive educational data, ensuring responsible use and dissemination of insights derived from data analysis.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	X	-	-	-	-	X	-
CO2	X	X	-	-	X	-	-	-	-
CO3	X	X	-	-	-	X	-	-	-
CO4	-	-	-	X	-	X	-	-	-
CO5	-	X	-	X	-	X	X	-	-

Syllabus:

Unit 1: Educational Data Mining (EDM)

Overview: Introduction to EDM; Fundamentals of EDM; Development of this field over time; Historical and recent technical perspectives in EDM; Technical and data infrastructures in EDM; Diverse set of ML algorithms for mining used in EDM; Some evidence-based key solutions; Major failures that the EDM filed has faced; Open challenges.

Unit 2: Learning Analytics (LA)

Overview: Introduction to LA; Fundamentals of LA; Development of this field over time; Historical and interdisciplinary perspectives in LA; LA solutions, tools, infrastructures, and architectures; Monomodality in LA for more than a decade; Diverse set of ML algorithms for predicting performance across different educational constructs; Integration and adoption challenges of LA in formal education; Open research challenges; Low-cost LA and Global South.

Unit 3: EDM and LA

Overview: Differences in philosophical, social, educational, computational, and psychological stances in EDM and LA; Data processing pipelines; What theories help to build the pipelines in

these two fields; ML and AI lenses in the fields; Analysis techniques used in LA and EDM; Limitations and opportunities centered to the required data in these two fields.

Unit 4: Modeling and Interpretation of Educational Data across these two fields

Overview: Latent constructs in measuring educational constructs, especially related to learning and teaching; Identification of constructs and modalities with technical advancements while keeping educational theories and pedagogies in the center; Data preparation, organization, fusion, analysis, and visualization; Sense-making of visualized data with educational stakeholders.

Unit 5: Multimodal Learning Analytics (MMLA)

Overview: Mono-modality versus multimodality in learning; Need of MMLA over LA; Technical advancements that enable the tapping of multiple modalities from a learning situation; Complexities in designing an MMLA situation by involving cross-disciplinary stakeholders like teachers, students, researchers, and syllabus designers; Complexities in designing and following any standard multimodal data processing pipeline; Challenges in the development of MMLA solutions; Integration and adoption issues; Data literacy of educational stakeholders and MMLA.

Textbooks and Papers:

1. Peña-Ayala, A. (2014). Educational data mining. Studies in Computational Intelligence, 524.

2. Larusson, J. A., & White, B. (Eds.). (2014). Learning analytics: From research to practice (Vol. 13). Springer.

3. Romero, C., Ventura, S., Pechenizkiy, M., & Baker, R. S. (Eds.). (2010). Handbook of educational data mining. CRC press.

4. Rodriguez, C. O. (2013). Two distinct course formats in the delivery of connectivist MOOCs. Turkish Online Journal of Distance Education, 14(2), 66-80.

5. ElAtia, S., Ipperciel, D., & Zaïane, O. R. (Eds.). (2016). Data mining and learning analytics: Applications in educational research. John Wiley & Sons.

6. Lester, J., Klein, C., Johri, A., & Rangwala, H. (Eds.). (2018). Learning analytics in higher education: Current innovations, future potential, and practical applications. Routledge.

7. Romero, C., & Ventura, S. (2010). Educational data mining: a review of the state of the art. IEEE Transactions on Systems, Man, and Cybernetics, Part C (applications and reviews), 40(6), 601-618.

8. Krumm, A., Means, B., & Bienkowski, M. (2018). Learning analytics goes to school: A collaborative approach to improving education. Routledge.

9. Siemens, G., & Baker, R. S. D. (2012, April). Learning analytics and educational data mining: towards communication and collaboration. In Proceedings of the 2nd international conference on learning analytics and knowledge (pp. 252-254).

10. Daniel, B. K. (Ed.). (2016). Big data and learning analytics in higher education: current theory and practice. Springer.

11. Oviatt, S., Schuller, B., Cohen, P., Sonntag, D., & Potamianos, G. (2017). The handbook of multimodal-multisensor interfaces, volume 1: Foundations, user modeling, and common modality combinations. Morgan & Claypool.

12. Shankar, S.K., Ruiz-Calleja, A., Prieto, L.P., Rodríguez-Triana, M.J., Chejara, P., & Tripathi, S. (2023), CIMLA: A Modular and Modifiable Data Preparation, Organization, and Fusion Infrastructure to Partially Support the Development of Context-aware MMLA Solutions. JUCS - Journal of Universal Computer Science 29(3): 265-297. https://doi.org/10.3897/jucs.84558

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Reference Books:

1. de Baker, R. S. J., & Inventado, P. S. (2014). Chapter X: Educational Data Mining and Learning Analytics. Comput. Sci, 7, 1-16.

2. Ferguson, R. (2012). Learning analytics: drivers, developments and challenges. International Journal of Technology Enhanced Learning, 4(5-6), 304-317.

3. Siemens, G., & Gasevic, D. (2012). Guest editorial-learning and knowledge analytics. Journal of Educational Technology & Society, 15(3), 1-2.

4. Romero, C., & Ventura, S. (2010). Educational data mining: a review of the state of the art. IEEE Transactions on Systems, Man, and Cybernetics, Part C (applications and reviews), 40(6), 601-618.

5. Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an "early warning system" for educators: A proof of concept. Computers & education, 54(2), 588-599.

6. Ellis, R. A., Han, F., & Pardo, A. (2017). Improving learning analytics–Combining observational and self-report data on student learning. Journal of Educational Technology & Society, 20(3), 158-169.

7. Elmoazen, R., Saqr, M., Tedre, M., & Hirsto, L. (2022). A systematic literature review of empirical research on epistemic network analysis in education. IEEE Access, 10, 17330-17348.

8. Lynch, R., & Dembo, M. (2004). The relationship between self-regulation and online learning in a blended learning context. International Review of Research in Open and Distributed Learning, 5(2), 1-16.

9. Slade, S., & Prinsloo, P. (2013). Learning analytics: Ethical issues and dilemmas. American Behavioral Scientist, 57(10), 1510-1529.

10.   Chejara, P., Prieto, L. P., Rodríguez-Triana, M. J., Ruiz-Calleja, A., Kasepalu, R., & Shankar, S.K. (2023, March). How to Build More Generalizable Models for Collaboration Quality? Lessons Learned from Exploring Multi-Context Audio-Log Datasets using Multimodal Learning Analytics. In LAK23: 13th International Learning Analytics and Knowledge Conference (LAK2023). ACM, USA, 111–121. https://doi.org/10.1145/3576050.3576144

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT667   **INSTRUCTIONAL DESIGN**   **3**

Prerequisite: A foundational understanding of Instructional Design based on Principles of the Learning Sciences

Course Objectives:
- Understand the Evolution and Applications of Programming Languages: To familiarize students with the historical development of programming languages, their comparative strengths, and applications.
- Master Basic Programming Constructs: To ensure students can effectively use variables, data types, and operators to construct programs.
- Develop Problem-Solving Skills: To enable students to apply programming concepts and logical thinking to solve problems.
- Grasp Functions and User Interaction: To teach students how to modularize code using functions and interact with users through input and output operations.
- Introduce Object-Oriented Programming (OOP) Concepts: To provide students with a foundational understanding of OOP principles and their application in software development.

Course Outcomes:
CO1: Demonstrate an understanding of the historical development and applications of various programming languages.

CO2: Effectively utilize variables, data types, and operators in programming.

CO3: Apply programming constructs and logic to solve computational problems.

CO4: Design and implement functions for modular code development and manage user inputs and outputs effectively.

CO5: Understand and apply basic object-oriented programming concepts in software development.

Skills:
- Problem-solving and logical thinking: Applying programming constructs to solve real-world problems.
- Programming proficiency: Writing efficient, readable, and maintainable code in one or more programming languages.
- Understanding of OOP: Grasping the fundamentals of object-oriented design and its implementation.
- Code modularization: Using functions to organize and modularize code for better readability and maintenance.
- User interaction management: Designing user interfaces and handling user inputs and outputs.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1									
CO2	X		X						
CO3									
CO4				X					

CO5								
CO9	x						x	

Syllabus:

Unit I – History and Theoretical Overview of Instructional Design   9 hrs.

● Introduction to Learning Theories: Behaviorism, Cognitivism and Knowledge Processing, Constructivism and Social Constructivism and Active Learning

Unit II – Identifying a Need for Instruction - Overview of Learning theories   9 hrs.
● Introduction to Learning Theories: Behaviorism, Cognitive Learning theories and Knowledge Processing, Constructivism and Social Constructivism, Applying Learning Theories in Design
● Conduct needs analysis to identify gaps in knowledge and skills

Unit III – Developing Instructional Material Based on Insights from Learning Sciences
9 hrs.
● Different types of instructional materials, such as text, images, audio, and video, non-digital materials,
● Developing effective instructional materials, designing personalized and adaptive design ID
● Evaluation and Iteration: Methods for evaluating instructional design implementations, Case Studies: Analysis of real-world instructional design projects to understand application and problem-solving in practice.

Unit IV – Evaluation: Developing Evaluation Instruments   9 hrs.
● Introduction to Educational Evaluation, Designing valid Evaluation Instruments, Analyzing and Interpreting Evaluation Data,
● Principles of personalized and adaptive instructional design to meet individual learner needs
● Ethical Considerations in Educational Evaluation

Unit V – Instructional Design implementation, Project Management, and Instructional Challenges   9 hrs.
● Overview of Instructional Design Implementation Steps, Project Management in Instructional Design: Key principles, tools, and strategies, Addressing Instructional Challenges: Strategies for overcoming common hurdles
● Future Trends in Instructional Design: Exploring emerging trends and how they impact the design and implementation process.

Textbooks and Papers:

● Branch, R. M. (2009). Instructional design: The ADDIE approach. Springer.
● Clark, R. C., & Mayer, R. E. (2016). E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning (4th ed.). Wiley.
● Dick, W., Carey, L., & Carey, J. O. (2015). The systematic design of instruction (8th ed.). Pearson.
● Morrison, G. R., Ross, S. M., Morrison, J. R., & Kalman, H. K. (2019). Designing effective instruction

(8th ed.). Wiley.

- Piskurich, G. M. (2015). Rapid instructional design: Learning ID fast and right (3rd ed.). Wiley.
- Fischer, F., Hmelo-Silver, C. E., Goldman, S. R., & Reimann, P. (Eds.). (2018). International handbook of the learning sciences. Routledge.
- Fischer, F., & Opitz, A. (2022). Learning to diagnose with simulations: Examples from teacher education and medical education. Cham: Springer International Publishing.
- Sawyer, R. K. (2022). An introduction to the learning sciences. The Cambridge handbook of the learning sciences, 1-24.
- Slavin, R. E. (2018). Educational psychology: Theory and practice. Pearson.
- Teasley, S. D. (2019). Learning analytics: Where information science and the learning sciences meet. Information and Learning Sciences, 120(1/2), 59-73.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

IV Adaptive and Personalized Learning, Teaching and Technology (Specialization)

24CLT668   EDUCATIONAL TECHNOLOGY   3

Prerequisite: Successful completion of an introductory course in Education or equivalent foundational knowledge in educational theories and practices.

Course Objectives:
1. Articulate Key Concepts with Practical Significance: Students will articulate key concepts in Educational Technology with practical significance, showcasing an understanding beyond theoretical knowledge.
2. Apply Historical Insights in Decision-Making: Graduates will apply insights from the historical evolution of Educational Technology to make informed decisions, demonstrating a critical understanding of how past practices influence contemporary education.
3. Proficiently Apply TPACK Framework: Students will apply the TPACK framework to integrate content, pedagogy, technology, and context, enhancing their ability to design and deliver effective learning experiences.
4. Analyze and Contribute to Policy Implementation: Graduates will analyze existing educational policies, propose practical solutions for implementation at different levels, and actively contribute to improving educational systems.
5. Demonstrate Innovative Pedagogical Expertise: Students will demonstrate expertise in implementing innovative pedagogies, showcasing adaptability in diverse educational contexts, and addressing challenges with creative and effective solutions.

Course Outcomes:
CO1: Application of Foundational Concepts in Practice: Graduates will be equipped to apply the foundational concepts of Educational Technology in real-world educational settings, fostering effective learning environments.
CO2: Informed Decision-Making through Historical Perspectives: Students will develop the ability to make informed decisions by drawing insights from the historical evolution of Educational Technology and applying lessons from the past to current and future educational challenges.
CO3: Strategic Integration of Frameworks for Enhanced Teaching: Graduates will strategically integrate contemporary frameworks like TPACK into their teaching practices, optimizing content, pedagogy, technology, and context to enhance student learning.
CO4: Policy Advocacy and Implementation Skills: Students will learn to advocate for and implement educational policies at various levels, including designing syllabi and curricula and contributing to improving educational systems.
CO5: Innovative Pedagogical Adaptability: Graduates will demonstrate adaptability by implementing innovative pedagogies, fostering active, collaborative, and project-based learning, and successfully navigating challenges presented by evolving

educational landscapes.

Skills:
- Technological Integration Skills: Students will develop the ability to integrate educational technologies into instructional strategies, enhancing the overall learning experience.
- Policy Analysis and Design Competence: Graduates will acquire skills to analyze and contribute to educational policies critically, enabling them to design and implement effective educational frameworks actively.
- Innovative Pedagogical Expertise: Students will cultivate expertise in employing innovative pedagogical approaches, including active learning, collaboration, and project-based methodologies, fostering engaging and dynamic learning environments.
- Strategic Decision-Making in Education: Graduates will hone their decision-making skills by drawing from historical perspectives and applying contemporary frameworks, ensuring strategic and informed choices in educational practices.
- Adaptability to Evolving Educational Landscapes: Students will develop adaptability to navigate challenges in the ever-evolving educational landscape, demonstrating the flexibility to incorporate emerging technologies and pedagogical approaches into their teaching methodologies.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	X	-	-
CO3	-	X	-	-	-	X	-	X	-
CO4	-	-	-	-	X	-	X	-	-
CO5	-	X	-	X	-	X	X	X	-

Syllabus:

Unit I – Foundations of Educational Technology　　　　　　　　　　**10 Hrs.**
Defining 'Education' and its Fundamentals
Understanding the Essence of 'Technology'
Necessity and Scope of Educational Technology

Unit II – Historical Perspectives　　　　　　　　　　**5 Hrs.**
Ancient and Medieval Educational Technologies

Unit III – Frameworks for 21st Century Learning　　　　　　　　　　**10 Hrs.**
TPACK Framework - Integrating Content, Pedagogy, Technology, and Context
Developing Expertise - TPK, PCK, TCK, and PACK
Contextual Factors in TPACK Knowledge

Unit IV – Policy and Implementation　　　　　　　　　　**10 Hrs.**
Syllabus and Curriculum Design
Implementing Educational Policies at Different Levels
National-Level Educational Policies

Unit V – Innovative Pedagogies and Challenges　　　　　　　　　　**10 Hrs.**

Active, Collaborative, and Project-Based Learning
Exploring Outdoor and Mobile Learning
Adapting Educational Technologies during Crisis (e.g., COVID-19)

Textbooks and Papers:

1. Dewey, J. (1986, September). Experience and education. In The educational forum (Vol. 50, No. 3, pp. 241-252). Taylor & Francis Group.
2. McCarthy, J., & Wright, P. (2004). Technology as experience. interactions, 11(5), 42-43.
3. Ramteke, R. D., Tawalare, K. A., & Tawalare, K. K. (2015). Ancient teaching learning method-guru shishya parampara. Journal of Education Technology in Health Sciences, 2(1), 22-24.
4. Davies, P. (1999). What is evidence-based education?. British journal of educational studies, 47(2), 108-121.
5. Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. Contemporary issues in technology and teacher education, 9(1), 60-70.
6. Heitink, M., Voogt, J., Fisser, P., Verplanken, L., & van Braak, J. (2017). Eliciting teachers' technological pedagogical knowledge. Australasian Journal of Educational Technology, 33(3).
7. Lachner, A., Backfisch, I., & Stürmer, K. (2019). A test-based approach of modeling and measuring technological pedagogical knowledge. Computers & Education, 142, 103645.
8. Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. Journal of educational computing research, 32(2), 131-152.
9. Mishra, P., & Koehler, M. (2005). Educational technology by design: Results from a survey assessing its effectiveness. In Society for Information Technology & Teacher Education International Conference (pp. 1511-1517). Association for the Advancement of Computing in Education (AACE).
10. Aithal, P. S., & Aithal, S. (2020). Analysis of the Indian National Education Policy 2020 towards achieving its objectives. International Journal of Management, Technology, and Social Sciences (IJMTS), 5(2), 19-41.
11. Ferdig, R. E. (2006). Assessing technologies for teaching and learning: understanding the importance of technological pedagogical content knowledge. British journal of educational technology, 37(5), 749-760.
12. Heift, T., Mackey, A., & Smith, B. (2019). History, pedagogy, data and new directions: An introduction to the educational technology issue. Annual Review of Applied Linguistics, 39, 1-7.
13. Mishra, P., Koehler, M. J., & Kereluik, K. (2009). Looking back to the future of educational technology. TechTrends, 53(5), 49.

Reference Books:

1. Saettler, P. (2004). The evolution of American educational technology. IAP.
2. Gess-Newsome, J. (1999). Pedagogical content knowledge: An introduction and orientation. In Examining pedagogical content knowledge (pp. 3-17). Springer, Dordrecht.
3. Van Driel, J. H., & Berry, A. (2010). Pedagogical content knowledge. In International encyclopedia of education (pp. 656-661). Academic Press.
4. Huddart, D., Hirniak, J., Sethi, R., Hayer, G., Dibblin, C., Rao, B. M., ... & Sethi, S. (2020). # MedStudentCovid: How social media is supporting students during COVID-19. Medical Education, 54(10), 951.
5. Wong, A., Ho, S., Olusanya, O., Antonini, M. V., & Lyness, D. (2021). The use of social media and online communications in times of pandemic COVID-19. Journal of the Intensive Care Society, 22(3), 255-260.
6. Tabira, Y., & Otieno, F. X. (2017). Integration and implementation of sustainable ICT-based education in developing countries: low-cost, en masse methodology in Kenya. Sustainability Science, 12(2), 221-234.
7. James, J. (2011). Low-cost computers for education in developing countries. Social indicators research, 103(3), 399-408.
8. Issroff, K., & Scanlon, E. (2002). Educational technology: The influence of theory. Journal of Interactive Media in education, 6.
9. Johan, R., & Harlan, J. (2014). Education nowadays. International Jounal of Educational Science

and Research (IJESR), 4(5), 51-56.

10.   Emad, G., & Roth, W. M. (2009). Policy as boundary object: A new way to look at educational policy design and implementation. Vocations and Learning, 2(1), 19-35.

11.   Dyer, C. (1999). Researching the implementation of educational policy: A backward mapping approach. Comparative education, 35(1), 45-61.

12.   Bijker, W. E. (2010). How is technology made?—That is the question!. Cambridge journal of economics, 34(1), 63-76.

13.   Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). Journal of Educational Technology & Society, 13(4), 63-73.

Soft Core

Students can opt for any of the Soft Core technology courses from the list based on their Bachelor's Qualification.

24CLT671 NATURAL LANGUAGE PROCESSING   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24CLT672   DEEP LEARNING   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24CLT673 FOUNDATION OF DATA SCIENCE   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24CLT674   ARTIFICIAL INTELLIGENCE   3-0-0-3

Prerequisites
- Machine Learning
- Programming languages
- Probability

Summary:

Gain a historical perspective of AI and its foundations. Become familiar with basic principles of AI toward problem solving and intuitive understanding of approaches of inference, perception, knowledge representation, and learning.

Course Objectives
- Illustrate the reasoning on Uncertain Knowledge
- Explore the explanation-based learning in solving AI problems
- To explore advanced career opportunities.
- Demonstrate the applications of soft computing and Evolutionary Computing algorithms

Course Outcomes

Cos	Description
CO1	To be aware of the basics of AI and its need along with the issues in designing search problems.
CO2	Understand and apply various search algorithms in real world problems.
CO3	To get a thorough idea about the fundamentals of knowledge representation, inference and theorem proving.
CO4	Express and comprehend the working knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO5	To gain the aptitude to apply knowledge representation and reasoning to real-world problems.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	-	-	-	-	2	1	1	2
CO2	2	1	1	-	-	1	-	2	2	1	1	2
CO3	3	2	1	1	-	-	-	-	2	1	-	2
CO4	1	2	1	1	-	1	1	2	1	1	1	2
CO5	2	1	1	1	-	-	1	2	1	1	1	2

Syllabus

Unit I

Artificial Intelligence – Basics, The AI Problems – The Underlying Assumption – What is an AI technique – Criteria for Success. Problems, Problem Spaces and Search – Defining Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the design of Search Programs.

Unit II

Heuristic Search Techniques - Generate – and – Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction - Means - Ends Analysis. Knowledge Representation issues – Representations and Mapping - Approaches to knowledge Representation – Issues in knowledge Representation – The Frame Problem. Case study based on search algorithms (to be considered as part of continuous assessment).

Unit III

Using Predicate Logic – Representing simple facts in Logic – Representing Instance and Isa Relationship –
Computable Functions and Predicates – Resolution – Natural Deduction. Representing Knowledge Using Rules
– Procedural versus Declarative knowledge – Logic Programming – Forward versus Backward Reasoning –
Matching – Control Knowledge.
Case study based on reasoning (to be considered as part of continuous assessment).

Unit IV

Reasoning under Uncertainty – Introduction to Non-monotonic Reasoning – Augmenting a Problem Solver –
Implementation: Depth - First Search, Fuzzy Logic.
Game Playing - The Minimax Search Procedure – Adding Alpha-Beta Cut-offs.
Applications of artificial intelligence- Case study on social networks using neural networks, DNA sequencing using AI techniques.

Textbooks / References:

1. Artificial Intelligence (Second Edition) – Elaine Rich, Kevin knight (Tata McGraw-Hill)
2. A Guide to Expert Systems – Donald A. Waterman (Addison-Wesley)
3. Principles of Artificial Intelligence – Nils J. Nilsson (Narosa Publishing House)
4. Introduction to Artificial Intelligence – Eugene Charnaik, Drew McDermott (Pearson Education Asia).

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT675   BASICS OF COMPUTER PROGRAMMING   3

Prerequisite: Good reading and writing skills in English

Course Objectives:
- Understand the Evolution and Applications of Programming Languages: To familiarize students with the historical development of programming languages, their comparative strengths, and applications.
- Master Basic Programming Constructs: To ensure students can effectively use variables, data types, and operators to construct programs.
- Develop Problem-Solving Skills: To enable students to apply programming concepts and logical thinking to solve problems.
- Grasp Functions and User Interaction: To teach students how to modularize code using functions and interact with users through input and output operations.
- Introduce Object-Oriented Programming (OOP) Concepts: To provide students with a foundational understanding of OOP principles and their application in software development.

Course Outcomes:
CO1:Demonstrate an understanding of the historical development and applications of various programming languages.

CO2: Effectively utilize variables, data types, and operators in programming.

CO3: Apply programming constructs and logic to solve computational problems.

CO4:Design and implement functions for modular code development and manage user inputs and outputs effectively.

CO5: Understand and apply basic object-oriented programming concepts in software development.

Skills:
- Problem-solving and logical thinking: Applying programming constructs to solve real-world problems.
- Programming proficiency: Writing efficient, readable, and maintainable code in one or more programming languages.
- Understanding of OOP: Grasping the fundamentals of object-oriented design and its implementation.
- Code modularization: Using functions to organize and modularize code for better readability and maintenance.
- User interaction management: Designing user interfaces and handling user inputs and outputs.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X								
CO2			X		X		X		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO3									
CO4					X				
CO5		X							

Syllabus:

Unit I – Introduction to Programming   9 hrs.

- History and evolution of programming: Tracing the journey of programming from its inception to the present, highlighting the development and evolution of various programming languages.
- Programming language comparison: Examining the progression of different programming languages over time and comparing their features, strengths, and applications.
- Diverse applications of programming languages: Exploring the various uses and applications of different programming languages in technology and development.

Unit II – Variables and Datatypes   9 hrs.

- Basics of data types: An introduction to primary data types such as Float/Double, Integer, String, and Character.
- Comprehending variables: Gaining an understanding of how variables work and their role in programming.

Unit III – Knowing the Operators   9 hrs.

- Arithmetic operations with numbers: Exploring the fundamentals of addition, multiplication, subtraction, and division on numerical data.
- Manipulating strings: Understanding how to concatenate strings, along with the implications of multiplication, subtraction, and division operations on string data.

Unit IV – Functions and Input from the User   9 hrs.

- Fundamentals of functions: A primer on the concept and importance of functions in programming.
- Varieties of functions: Exploring both parameterized and non-parameterized functions, highlighting their differences and uses.
- Handling user data: Understanding how to manage user inputs and outputs through functions.

Unit V – OOPS concepts   9 hrs.

- Learning and using basic oops concepts

Textbooks and Papers:

- Freeman, E., Robson, E., Bates, B., & Sierra, K. (2004). Head First Design Patterns: A Brain-Friendly Guide. O'Reilly Media. This guide introduces design patterns in an accessible manner, crucial for effective object-oriented design and programming.

- Gaddis, T. (2018). Starting Out with C++ from Control Structures to Objects (9th ed.). Pearson. Offers a solid foundation in C++ programming, covering basic to intermediate concepts, and introduces object-oriented programming.

- Schildt, H. (2019). Java: A Beginner's Guide (8th ed.). McGraw-Hill Education. Provides a comprehensive introduction to Java programming, focusing on fundamental programming concepts and the application of OOP principles.

- Zelle, J. (2010). Python Programming: An Introduction to Computer Science (2nd ed.). Franklin,

Beedle & Associates Inc. This book is a great introduction to programming concepts and problem-solving techniques using Python, known for its readability and broad applicability in modern software development.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT676 INTRODUCTION TO MACHINE LEARNING USING PROGRAMMING LANGUAGES 3

Prerequisite: A foundational understanding of educational psychology, computer science principles, and basic research methodologies.

Course Objectives:

- Master Data Preprocessing Techniques: Equip students with the skills to clean, manipulate, and prepare for using real-world data for analysis, particularly emphasizing educational datasets
- Explore Machine Learning Techniques: Introduce supervised, unsupervised, and reinforcement learning, and discuss their applicability and implementation in Python for educational data analysis.
- Implement Machine Learning Algorithms: Develop hands-on proficiency in applying machine learning algorithms to datasets, emphasizing the process from data preprocessing to algorithm selection and implementation.
- Evaluate Model Performance: Teach students to assess the performance of machine learning models using various metrics, enabling them to understand model effectiveness and areas for improvement in the context of educational challenges.

Course Outcomes:

CO1: Students will be able to preprocess data, handling issues like missing values, noise, and sampling biases, to make it suitable for machine learning analysis.

CO2: Students will learn to select and apply appropriate machine learning algorithms for various educational problems, using Python as the primary tool.

CO3: Students will be able to critically analyze the outputs of machine learning models and use this analysis to propose improvements or interventions in educational settings.

Skills:

- Critical Analysis: Skill in analyzing and evaluating ed-tech tools and methodologies, including machine learning model outcomes.
- Research and Design: Proficiency in executing Learning Engineering research, covering machine learning application, data handling, and analysis.
- Evidence-Based Decision Making: Ability to use evidence-based strategies for tackling educational challenges with machine learning tools.
- Interdisciplinary Synthesis: Competence in merging knowledge from educational science, psychology, computer science, and machine learning for Learning Engineering.
- Innovative Solutions Development: Skill in creating and proposing unique Learning Engineering solutions, utilizing machine learning for specific educational needs.

Course Outcomes (CO) - Program Outcomes (PO) Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	X	-	-	-	-	-	X	X	-
CO2	X	X	-	-	-	-	-	X	-
CO3	X	X	X	-	-	X	-	-	-
CO4	X	X	X	-	-	-	X	-	-
CO5	-	X	-	X	-	X	-	X	-

Syllabus:

Unit I – Basics of Data Analytics through through Programming Languages   9 hrs.
- Introduction to programming languages: Covering the core concepts and syntax of a programming language (e.g., Python) for beginners.
- Data Handling with a programming language (e.g., Python): Utilizing the programming language's (e.g., Python's) essential tools and techniques, including the Pandas and Matplotlib libraries, for data discovery, visualization, manipulation, and cleaning.
- Machine Learning Landscape: A comprehensive overview of the field of machine learning, outlining key concepts, techniques, and applications.
- Data Challenges in ML: Addressing common issues encountered in machine learning datasets, such as missing values, noise, and imbalanced data.

Unit II – Introduction to ML through Programming Languages   9 hrs.
- Overview of Learning Paradigms: Exploring the distinctions between supervised, unsupervised, and reinforcement learning methodologies.
- Understanding the Bias-Variance Tradeoff: An introductory guide to balancing bias and variance to prevent overfitting and underfitting in machine learning models.
- Exploring Key Machine Learning Algorithms: A primer on various machine learning algorithms including linear regression, decision trees, random forests, and ensemble learning approaches.
- Examples of Classification and Regression: Demonstrating practical applications of machine learning through classification and regression scenarios.

Unit III – Training and Testing of Data Using ML Algorithms   9 hrs.
- Building Fundamental ML models with a programming language (e.g., Python): Covers the creation of simple machine learning models, including the application of feature scaling and the development of training and testing data splits.

Unit IV – Evaluating the Performance of the Algorithm   9 hrs.
- Assessment of ML Model Effectiveness: Utilizing various performance indicators to measure the success of machine learning models.
- Practical Application of Learned Concepts: Engaging in hands-on exercises to apply and reinforce the knowledge gained.

Reference Books:

[1] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build   Intelligent Systems, 2nd Edition Aurelien Geron O'Reilly

[2] Russell and Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall.

[3.] http://www.stanford.edu/class/cs229/materials.html

[4.] http://www.stanford.edu/class/cs221/handouts.html

[5.] Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

[6.] Richard Sutton and Andrew Barto, "Reinforcement Learning: An Introduction", MIT Press, 1998.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24CLT677 COMPUTATIONAL INTELLIGENCE 3-0-0-3

Semester III or IV	Hours of Instruction/week – 3
Course Code:	No. of Credits – 3
L-T-P–C 3-0-0-3	Total - 45 hrs

Prerequisites:

- Machine Learning
- Programming languages
- Probability

Course Objectives:

The Objective of the course is to make students familiar with basic principles of various computational methods of data processing that can commonly be called computational intelligence. This course introduces the fundamentals of key intelligent systems technologies including knowledge-based systems, neural networks, fuzzy systems, and evolutionary computation.

Course Outcomes:

COs	Description
CO1	Understand the need for and importance of Computational intelligence.
CO2	Understand the concepts of neural networks and backpropagation learning.
CO3	Implement associative memory using neural networks.
CO4	Understand the idea of fuzzy logic in real-world problems.
CO5	Understand hybrid approaches to solve real-world problems.

CO-PO Mapping:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-
CO4	2	3	3	-	-	-	-		
CO5	2	3	3	-	-	-	-	-	-

Syllabus:

Unit I

Artificial Intelligence – a Brief Review – Pitfalls of Traditional AI – Need for Computational Intelligence Importance of Tolerance of Imprecision and Uncertainty – Overview of Artificial Neural Networks - Fuzzy Logic-Evolutionary Computation.

Unit II

Neural Networks: Biological and Artificial Neuron, Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron - Multilayer Perceptron – Backpropagation Learning.

Unit III

Neural Networks as Associative Memories - Hopfield Networks, Bidirectional Associative Memory. Topologically Organized Neural Networks – Competitive Learning, Kohonen Maps.

Unit IV

Fuzzy Logic: Fuzzy Sets – Properties – Membership Functions - Fuzzy Operations. Fuzzy Logic and Fuzzy Inference - Applications. Evolutionary Computation – Constituent Algorithms.

Unit V

Swarm Intelligence Algorithms - Overview of other Bio-inspired Algorithms - Hybrid Approaches (Neural Networks, Fuzzy Logic, Genetic Algorithms etc.). Case Studies: Prediction Models, Optimization Models.

Textbooks / References:

1. Laurene Fausett, Fundamentals of Neural Networks, 2nd edition, Pearson, 1993

2. Ross T J, ―Fuzzy Logic with Engineering Applications‖, McGraw Hill, 1997.

3. Eiben A E and Smith J E, ―Introduction to Evolutionary Computing‖, Second Edition, Springer,

   Natural Computing Series, 2007.

4. Kumar S, ―Neural Networks - A Classroom Approach‖, Tata McGraw Hill, 2004.

5. Engelbrecht, A.P, ―Fundamentals of Computational Swarm Intelligence‖, John Wiley & Sons,

   2006.

6. Konar. A, ―Computational Intelligence: Principles, Techniques and Applications‖, Springer

   Verlag, 2005.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

Open Electives

(in Collaboration with other Departments and Industry Partners)

24OEL531 FOUNDATIONS OF ARTIFICIAL INTELLIGENCE 3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24OEL532   MACHINE LEARNING   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24OEL533 ARTIFICIAL INTELLIGENCE FOR ROBOTICS   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

24OEL534   AUTOMATION AND ROBOTICS   3

Summary:

This course provides the detailed idea about the fields of robotics and its control mechanisms.

Course Objectives:

1. The main objective is to provide information on various parts of robots and ideas on the fields of robotics.
2. It also focuses on various kinematics and inverse kinematics of robots, trajectory planning of robots and to study the control of robots for some specific applications.

Course Outcomes:

COs	Description
CO1	Describe the fields of robotics and explain the major components
CO2	Explain about various robot processes and functions
CO3	Discuss the various Programmable Logic Control and Experiment with various control mechanisms of robotics.
CO4	Explain the kinematics of robots and trajectory,
CO5	Implement different applications of robotics

CO-PO Mapping

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9
CO1	3	-	-	-	-	-	3		
CO2	2	1	-	-			1		
CO3	3		2			3			
CO4		1				2	1		2
CO5	2							1	

Syllabus:

Unit I

Introduction - Definition and Origin of Robotics, Types of Robotics, Major Components, Historical development of Robot, Robotic System and Robot anatomy, Degrees of freedom, Coordinate System and its type Asimov's laws of robotics, Dynamic stabilization of robots.

Unit II

Power Sources and Sensors - Hydraulic, pneumatic and electric drives, determination of HP of motor and gearing ratio, variable speed arrangements, path determination, micro machines in robotics, machine vision, ranging, laser, acoustic, magnetic, fibre optic and tactile sensors.

Unit III

Manipulators, Actuators, and Grippers - Manipulators, Classification, Construction of manipulators, manipulator dynamics and force control, electronic and pneumatic manipulator control, End effectors, Loads and Forces, Grippers, design considerations, Robot motion Control, Position Sensing.

Unit IV

Kinematics and Path Planning - Solution of Inverse Kinematics Problem, Multiple Solution Jacobian Work Envelop, Hill Climbing Techniques, Robot Programming Languages. Process Control and Types, On-Off Control Systems, Proportional Control Systems, Proportional Plus Integral (PI) Control Systems, Three Mode Control (PID) Control Systems, Process Control Tuning.

Case Studies:

Multiple robots, Machine Interface, Robots in Manufacturing and not-Manufacturing Application, Robot Cell Design, Selection of a Robot.

Laboratory Works:

The laboratory work should be focused on the implementation of sensors, design of control systems. It should also deal with developing programs related to robot design and control using python.

Textbooks:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw Hill.

2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers.

References:

1. Jain K.C. and Aggarwal B.E., Robotics – Principles and Practice, Khanna Publishers

2. Schuler, C.A. and McNamee, W.L. Modern Industrial Electronics, Macmillan/McGraw-Hill

3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An Integrated Approach, Prentice Hall of India.

4. Deb.S.R., Robotics Technology and Flexible Automation, John Wiley, USA 1992.

5. Asfahl C.R., Robots and Manufacturing Automation, John Wiley, USA 1992

6. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.

7. Issac Asimov I. Robot, Ballantine Books, New York, 1986.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24OEL535   NATURAL LANGUAGE PROCESSING   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

OR

24OEL535   NATURAL LANGUAGE PROCESSING   3

Course Description

This course is intended as a theoretical and methodological introduction to the most widely used and effective current techniques, strategies and toolkits for natural language processing. The ability to harness, employ and analyze linguistic and textual data effectively is a highly desirable skill for academic work, in government, and throughout the private sectors.

Course Objectives

- Students will be able to comprehend the importance of using natural language processing when resolving issues in the real world.
- Enables students to apply and match the proper processing technique to a given situation. · Students will be in a position to exhibit the necessary design abilities for large collection sets. Additionally, capable of understanding and presenting cutting-edge, sophisticated NLP research materials to an audience.

Course Outcomes

COs	Description
CO1	Discern the concept of POS tagging and CFG for the English language.
CO2	Cognize the Vector Representation of words and skip-gram models
CO3	Explore semantic analysis algorithms and deep learning techniques, to apply them in various NLP applications.
CO4	Acquainted with Mathematical and programming tools for implementing NLP applications.

CO-PO Mapping

PO/ PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	3	2	2	-	3	-	1	2	1
CO2	2	3	3	-	-	3	2	1	1
CO3	1	3	3	1	3	2	1	2	-
CO4	2	3	3	3	3	3	1	1	2

Syllabus

Unit I
Basics of Machine Learning, Python Programming language, Basics of Probability, Introduction - terminologies - empirical rules – Statistical Properties of words – Probability and NLP – Vector Space Models - Pre-processing Tokenization, Parts-Of-Speech (POS) tagging, chunking, syntax parsing, Dependency parsing.

Unit II
Vector Representation of words – Contextual Understanding of text – Cooccurrence of matrix – N-grams – Dense Word Vector. Word2Vec – CBOW and Skip-gram Models – One-word learning architecture- Forward pass for Word2Vec – Reduction of complexity – subsampling and negative sampling. Continuous Skip-Gram Model, GloVe, BERT, XLNet.

Unit III
NLP Applications: Named Entity Recognition, Sentiment analysis, Text categorization using Machine learning algorithms, SVD and Latent semantic Indexing, Probabilistic Latent Semantic Indexing (pLSI) and Latent Dirichlet Allocation (LDA).
Deep Learning for NLP: Neural Networks Basics, Feedforward Neural Network, Recurrent Neural Networks, LSTM, An Introduction to Transformers and Sequence-to-Sequence Learning.

Unit IV
Historical Approaches to Machine Translation – Statistical Machine Translation – Translation Models – Healthcare Data analysis and Text visualization: Summarizing lengthy blocks of narrative text, such as a clinical note or academic journal article. Answering unique free-text queries that require the synthesis of multiple data sources. Introduce Mathematical and programming tools to visualize a large collection of text documents.

Textbooks / References:

1. C.D. Manning et al, "Foundations of Statistical Natural Language Processing," MIT Press. MIT Press, 1999. isbn: 9780262133609.
2. James Allen, "Natural Language Processing with Python", O'Reilly Media, July 2009. 3. NiladriSekhar Dash and S. Arulmozi, Features of a Corpus. Singapore: Springer Singapore,2018, pp. 17– 34. ISBN: 978-981-10-7458-5.
4. Ian Goodfellow, YoshuaBengio, and Aaron Courville, Deep Learning, http://www.deeplearningbook.org. MIT Press, 2016.
5. NitinIndurkhya and Fred J Damerau, "Handbook of natural language processing," Chapman and Hall/CRC, 2010.
6. Daniel Jurafsky and James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition," 1st. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2000. isbn: 0130950696.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24OEL536   DEEP LEARNING   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

OR

24OEL536   DEEP LEARNING   3

Semester III or IV	Hours of Instruction/week – 3
Course Code:	No. of Credits – 3
L-T-P–C 3-0-0-3	Total - 45 hrs

Summary:

This course builds from a one node neural network to a multiple feature, multiple output neural networks. After an understanding of how neural networks work and the parameters that control deep learning systems, building of deep learning neural networks and various applications.

Course Objectives
- Understand the context of neural networks and deep learning
- Know how to use a neural network
- Understand the data needs of deep learning
- Have a working knowledge of neural networks and deep learning.
- Explore the parameters for neural networks

Course Outcomes

Cos	Description
CO1	Identify the roles of neural networks in deep learning
CO2	Design of different Convolutional Neural Networks for problem solving
CO3	Implement various unsupervised deep learning techniques
CO4	Design convolution networks for various Computer Vision problems

CO-PO Mapping

PO/ PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	3	2	3	-	-	-	-	-	-
CO2	3	3	1	3	-	-	-	-	1
CO3	2	3	2	-	-	-	-	-	1
CO4	3	1	3	1	1	-	-	-	1

Syllabus:

Unit I
Introduction to Deep Neural Networks: Feed forward Neural networks. Gradient descent and the back propagation algorithm, Intuition of Neural Networks Loss functions, Optimization, Unit saturation, aka the vanishing gradient problem, and ways to mitigate it.

Unit II
Convolutional Neural Networks, Training Neural Networks, Understanding Neural Networks Through Deep Visualization and Recurrent Neural Networks: Architectures, convolution / pooling layers, LSTM, Encoder Decoder architectures.

Unit III
Deep Unsupervised Learning: Auto encoders (standard, sparse, denoising, contractive, etc), variational auto encoders, denoising encoders, Adversarial Generative Networks.

Unit IV
Deep Belief Networks: Energy Based Models, Restricted Boltzmann Machines, Sampling in an RBM. Applications of deep neural networks in handwritten character recognition, face recognition, semantic web, social networks.

Textbooks / References:

1. Domingos, Pedro. "A few useful things to know about machine learning." Communications of the ACM 55.10 (2012): 78-87.
2. Li Fei-Fei (Stanford), Rob Fergus (NYU), Antonio Torralba (MIT), "Recognizing and Learning Object Categories" (Awarded the Best Short Course Prize at ICCV 2005).
3. Baydin, AtilimGunes, Barak A. Pearlmutter, and Alexey AndreyevichRadul. "Automatic differentiation in machine learning: a survey." arXiv preprint arXiv:1502.05767 (2015). 4. Bengio, Yoshua. "Practical recommendations for gradient-based training of deep architectures." Neural Networks: Tricks of the Trade. Springer Berlin Heidelberg, 2012. 437-478.
5. LeCun, Yann A., et al. "Efficient backprop." Neural networks: Tricks of the trade. Springer Berlin Heidelberg, 2012. 9-48.
6. Simonyan, Karen, Andrea Vedaldi, and Andrew Zisserman. "Deep inside convolutional networks: Visualising image classification models and saliency maps." arXiv preprint arXiv:1312.6034 (2013). 7. Zeiler, Matthew D., and Rob Fergus. "Visualizing and understanding convolutional networks." Computer vision–ECCV 2014. Springer International Publishing, 2014. 818- 833.
8. Springenberg, Jost Tobias, et al. "Striving for simplicity: The all convolutional net." arXiv preprint arXiv:1412.6806 (2014).
9. Russakovsky, Olga, et al. "Imagenet large scale visual recognition challenge." International Journal of Computer Vision 115.3 (2015): 211-252.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24OEL537 MACHINE LEARNING FOR BIG DATA   3

https://www.amrita.edu/program/m-tech-artificial-intelligence/

OR

24OEL537   MACHINE LEARNING FOR BIG DATA   3

Summary:

This course will enable students to understand the basic concepts of machine learning. It will help students to apply different machine learning models to real-world problems.

Course Objectives:

· To understand basic concepts of machine learning
· To familiarize the machine learning models like linear and logistic regression
· To understand different classifiers
· To understand different clustering algorithms

Course Outcomes

Cos	Description
CO1	Able to understand the definition, tools and applications of machine learning
CO2	To implement prediction models using linear regression.
CO3	To understand different classifiers and their implementation.
CO4	To understand the concepts of neural networks.
CO5	To understand different clustering algorithms.

Syllabus:

Unit I

Introduction to ML; Problems, data and tools. Learning systems, goals, challenges and applications of the machine learning systems. Aspects of developing system, training data, testing data, concept representation, classification errors, validation. Dimensionality Reduction, Data compression, PCA.

Unit II

Linear regression, SSE, gradient descent, bias and variance estimation, overfitting and underfitting, regularization, ridge and lasso regression.

Unit III

Logistic regression, hypothesis representation, decision boundary, cost function, multi-class classification. Nearest neighbour methods. Decision Tree learning, representing concepts as decision trees, picking the best splitting attribute: entropy and information gain. Probability and classification, Naïve Bayes classification, EM algorithm, kernels, Kernel regression, kernels, Support vector machine (SVM) and kernels, kernel optimization. Linear Discriminant Analysis algorithm.

Unit IV

Neural networks learning, non-linear hypothesis, model representation, perceptron, cost function, back propagation algorithm.

Unit V

Unsupervised learning, clustering, different clustering methodologies. Current problems on Machine Learning.

Textbooks / References:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997.
2. Duda, Richard, Peter Hart, and David Stork, "Pattern Classification" Second Edition, New York, NY: Wiley-Interscience, 2000.
3. Hastie, T., R. Tibshirani, and J. H. Friedman, "The Elements of Statistical Learning: DataMining, Inference and Prediction", New York, Springer, 2001
4. Christopher, M. Bishop. Pattern Recognition and Machine Learning, Springer-Verlag New York, 2016.

Evaluation Pattern:

Assessment	Internal	External
Active Participation in Class	10	
*Continuous Assessment (CA)	40	
Content produced over the course and submitted at the last		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24OEL538   FOUNDATIONS CORPORATE SOCIAL RESPONSIBILITY (CSR)   3

Prerequisite: Elective

Summary:
Corporate Social Responsibility (CSR) is an emerging area of Social Work in India. This course will familiarize the students with the concept of CSR. For an individual, as for an organization, CSR gives an opportunity to participate as a responsible enlightened citizen and organization. The evolution of CSR has had a far-reaching impact on development in India.

Course Objectives:
1. Understand the environmental, social, and economic drivers and risks impacting companies – along with the major business opportunities for integrating sustainability factors within the core business strategy.
2. Understand the global perspectives of CSR and particular CSR practices in India.
3. Gain knowledge on the impact of CSR on corporate culture, particularly as it relates to social issues.
4. Provide students with conceptual clarity on the need, purpose, and relevance of research applicability in CSR practice.
5. Acquire skills to frame CSR policies and practices appropriate to the Indian workplace.

Course Outcomes:

CO1: Acquired knowledge in the global perspectives of CSR and particular CSR practices in India

CO2: Understood the impact of CSR implementation on corporate culture, particularly as it relates to social issues

CO3: Understood the need, purpose, and relevance of research applicability in CSR practice and frame CSR policies and practices appropriate to the Indian workplace

Skills:
- Gain an overview of key philosophical perspectives and concepts in cognitive science.
- Develop a deeper understanding of how philosophical and conceptual analysis has influenced concepts and theories in cognitive sciences.
- Grasp how foundational assumptions have shaped cognitive science and how they can be challenged.
- Differentiate between philosophical concepts and their application within empirical research in cognitive sciences.
- Understand how the conceptualisation of mind, language, and cognition has influenced empirical research in the cognitive sciences.
- Develop a basic understanding of the traditional philosophical issues continue to challenge contemporary cognitive scientists and how empirical research has influenced philosophy.
- Demonstrate an enhanced ability to engage in critical analysis and argument through reading and group discussions.
- Demonstrate an ability to articulate their views in a systematic manner through their philosophical writing and dialogue, with a focus on clarity of idea and coherent justification.
- Demonstrate confidence in undertaking work through independent learning and taking responsibility for their learning.

Course objectives CO-Program outcome PO - Mappings

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		

CO1		-	-	-	-	-	-	-	-	
CO2	-	-	-	-	-	-	-	-	-	
CO3	-	-	-	-	X	X	X	-	X	

Syllabus:

Unit I – Understanding CSR   9 hrs.

Understanding CSR- Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy.CSR and Indian corporate.

Unit II – Structure of CSR   9 hrs.

In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting; Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities.

Unit III – CSR and Social Work   9 hrs.

CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Role of implementation agency in Section 135 of the Companies Act, 2013.Effective CSR implementation. Role and expectations of social worker in CSR programmes.

Unit IV – Project Management in CSR initiatives   9 hrs.

Project and programme; Monitoring and evaluation of CSR Interventions. CSR Documentation and report writing. Reporting framework, format and procedure. Social Enterprise and Government Initiatives.

Unit V – Models of CSR   9 hrs.

Business Model, Social Marketing, Crowdfunding, Social Entrepreneurship – Case studies.

Textbooks and Papers:

Corporate Governance, Ethics and Social Responsibility, V Bala Chandran and V Chandrasekaran, PHI learning Private Limited, New Delhi 2011.

UNDP (nd) Governance indicators: A users guide . Oslo: UNDP

Rao, V.S.L. (2009) Human Resource Management, New Delhi, Excel Books,

Reference Books:

White H. (2005) Challenges in evaluating development effectiveness: Working paper 242, Institute of Development Studies, Brighton.

Rao, Subbha (1996) Essentials of Human Resource Management and Industrial Relations, Mumbai, Himalaya

Evaluation Pattern:

Assessment	Internal	External
Midterm Exam	30	
*Continuous Assessment (CA)	20	
End Semester		50

*CA - Can be Quizzes, Assignment, Projects, and Reports, and Seminar

24OEL539 DECISION MODELS IN MANAGEMENT (DMM)   3

https://www.amrita.edu/course/decision-models-in-management-dmm/

24OEL540 INDIVIDUAL AND GROUP BEHAVIOUR DYNAMICS IN ORGANIZATIONS (I & GBDO)   3

https://www.amrita.edu/course/individual-and-group-behaviour-dynamics-in-organizations-i-gbdo/

24OEL541   HUMAN RESOURCE MANAGEMENT (HRM)   3

 (has training and development in it)

https://www.amrita.edu/course/human-resource-management-hrm/

24OEL542   TALENT ACQUISITION & LEARNING AND DEVELOPMENT (TA & LD)   3

https://www.amrita.edu/course/talent-acquisition-learning-and-developmentta-ld/