CALICUT

UNIVERSITY

SECOND

SEMESTER

FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

SCIENCE OF MENTAL PROCESSES

2024 ADMISSION

PREPARED BY

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DEPARTMENT OF PSYCHOLOGY

CALICUT UNIVERSITY – FOUR-YEAR UNDERGRADUATE PROGRAMME (CU-FYUGP)

BSc PSYCHOLOGY

SEMESTER 2

Programme	B. Sc. Psychology				
Course Title	**Science of Mental Processes**				
Type of Course	**Major With Practical**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Nil				
Course Summary	This course covers fundamental themes in psychology, including cognition, problem-solving and decision-making, and memory and learning. Students explore how people perceive, think, and learn, as well as how they solve problems and make decisions. Understanding these themes provides insights into human behaviour and mental processes, enhancing students' analytical and practical skills.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop the basic understanding of the origin and history of cognitive psychology	U	C	Quiz
CO2	Explain the basic process of problem solving and decision making	U	C	Exam
CO3	Develop fundamental knowledge and practical applications of theories of cognitive domain such as learning and memory	AP	C	Exam/ Seminar

CO4	Apply the principles of learning, memory and forgetting in daily life situation	AP	C	Group discussion/ Practical application
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I	**Cognition**		**10**	**15**
	1	Introduction to cognitive Psychology	2	
	2	History of cognitive Psychology- Early History(empiricism and nativism), focus on introspection, focus on behaviour, and cognitive revolution	4	
	3	Types of reasoning: induction and deduction	2	
	4	Psychological theories of reasoning: Mental logic, Mental models and The probabilistic approach.	2	
II	**Problem solving & decision making**		**10**	**15**
	5	Problem solving cycle Types of problems: Well-structured problems and Ill-structured problems	2	
	6	Obstacles of problem solving(types) Aids to Problem Solving: Trial and error, heuristics, algorithm, forming subgoals, searching for analogy, changing the representation of problem	3	
	7	Introduction Decision Making	1	
	8	Classical Decision Theory- The Model of Economic Man and Woman and Subjective Expected Utility Theory	3	
	9	Heuristics and Biases Fallacies	1	
III	**Memory and forgetting**		**14**	**20**
	10	Key process in memory: encoding, storage and retrieval Measuring memory: recall, recognition, relearning	1	

	11	Sensory memory(iconic- echoic), short term memory(rehearsal, chunking), long term memory(declarative, procedural, episodic, Implicit and explicit memory, flashbulb memory, tip of tongue)	3	
	12	Level of processing theory Working memory model – Alan Baddley	3	
	13	Retrieval cues: encoding specificity principle; context dependent memory and state dependent memory, serial position effect, reconstructive memory; eyewitness testimony, flashbulb memory and meta memory.	2	
	14	Forgetting: Forgetting Curve	1	
	15	Reason for forgetting: decay theory, interference theory, prospective theory, absents of retrieval cues,	2	
	16	Strategies for remembering: rehearsal, elaboration, organization	2	
IV	**Learning**		**11**	**20**
	17	Concept of Learning	1	
	18	Basics of classical conditioning, principles of conditioning: acquisition, extinction, spontaneous recovery, generalization, discrimination and higher order conditioning	2	
	19	Basics of operant conditioning: Law of effect reinforcement, punishment, schedules of reinforcement, shaping and chaining	3	
	20	Cognitive learning: latent learning,	3	
	21	Observational learning	1	
	22	Insight learning	1	
V	**Practical Applications**		**30**	
	1	Carry-out any four experiments of the following: 1. Bilateral transfer 2. Rote/ meaningful learning 3. Massed/ Spaced learning 4. Immediate memory span 5. Working memory scale 6. PGI memory scale	20	
	2	Write applications of classical conditioning and operant conditioning in daily life situation	5	
	3	Assignment: Prepare a life skill training module to improve memory	5	

MODULE 1
COGNITIVE PSYCHOLOGY

- Cognitive psychology is the branch of psychology that focuses on the study of mental processes such as perception, memory, attention, language, problem-solving, and decision-making. It examines how people acquire, process, store, and retrieve information.

History of Cognitive Psychology

Cognitive psychology has its roots in several intellectual traditions, including philosophy, early psychology, and the development of computer science. Below is a brief historical overview of how cognitive psychology emerged as a distinct discipline:

1. **Philosophical Foundations (Before the 19th Century)**

- Thinkers such as Plato and Aristotle speculated about the nature of human thought, knowledge, and perception.

- René Descartes (17th century) introduced the idea of dualism, which separated the mind from the body and emphasized rational thought.

- John Locke and David Hume (Empiricists) argued that knowledge comes from sensory experience, influencing later theories of learning and cognition.

2. **Early Experimental Psychology (Late 19th – Early 20th Century) Wilhelm Wundt (1879**) established the first psychology laboratory and used introspection to study consciousness. Hermann Ebbinghaus conducted pioneering research on memory and forgetting. William James, an American psychologist, proposed functionalism, which emphasized mental processes in adaptation.

3. The Rise and Dominance of Behaviorism (1910s – 1950s) John Watson and later B.F. Skinner promoted behaviorism, which rejected introspection and focused on observable behavior. Behaviorists

argued that internal mental states were unscientific and should not be studied.

3. **The Cognitive Revolution (1950s – 1970s**): Advances in linguistics, computer science, and neuroscience challenged behaviorism. Noam Chomsky (1959) criticized behaviorist explanations of language, arguing that humans have an innate capacity for language. Herbert Simon and Allen Newell developed computational models of thinking and problem-solving. The introduction of the information-processing model likened the mind to a computer, analyzing how it encodes, processes, stores, and retrieves information.

REASONING: Reasoning is the cognitive process of drawing conclusions based on evidence or premises. It is a fundamental aspect of problem-solving, decision-making, and critical thinking. The main types of reasoning include:

1. Deductive Reasoning

Moves from a general principle to a specific conclusion.

If the premises are true, the conclusion must also be true.

2. Inductive Reasoning

Moves from specific observations to a general conclusion.

PSYCHOLOGICAL THEORIES OF REASONING:

Mental Logic Theory (Natural Deduction Theory): Suggests that people reason using formal rules of logic, similar to a logical proof.

Mental Models Theory (Johnson-Laird, 1983): Proposes that people construct mental simulations of possible situations to reason through problems. Instead of applying strict logical rules, individuals imagine different scenarios and draw conclusions based on them**.**

Probabilistic Reasoning Theory: Argues that human reasoning is based on probabilities rather than strict logical rules.People assess likelihoods instead of making absolute true/false judgments.

MODULE 2

PROBLEM-SOLVING

Problem-solving is the cognitive process of finding solutions to complex or challenging situations. It involves identifying a problem, generating potential solutions, evaluating options, and implementing a solution. It is a fundamental skill in decision-making, critical thinking, and reasoning.

1. Well-Defined Problems

Have a clear goal, initial state, and set of rules for reaching a solution.

Solutions can be reached using algorithms (step-by-step procedures) or logical reasoning.

Ill-Defined Problems: Do not have a clear goal, path, or solution.Often require creativity and insight to solve.

Obstacles to Problem Solving

Problem-solving is often hindered by cognitive, emotional, and situational barriers. These obstacles can prevent individuals from identifying solutions effectively. Below are some common obstacles:

1. **Functional Fixedness:** The tendency to see objects and concepts only in their usual functions rather than in creative ways.
2. **Mental Set:** The tendency to approach problems in a familiar way, even when a new approach is needed.

AIDS OF PROBLEM SOLVING

Trial and error is a fundamental problem-solving strategy that involves testing different solutions until the correct one is found. It is often used when a clear solution is not immediately obvious and requires experimentation.

Breaking the Problem into Smaller Parts (Decomposition)

Large or complex problems can be overwhelming, so breaking them into smaller, manageable sub-problems makes them easier to solve.

Using Analogies: Comparing a new problem to a similar, previously solved problem can provide insights

Applying Heuristics (Mental Shortcuts): Heuristics are rules of thumb that simplify problem-solving, though they may not always guarantee a correct answer**.**

Using Algorithms (Step-by-Step Procedures): Algorithms provide a structured, logical way to solve

problems and always lead to a correct solution if followed properly**.**

Decision-making: is the process of selecting the best option from multiple alternatives to achieve a desired goal. It involves evaluating information, analyzing risks, and predicting outcomes before making a final choice.

Classical Decision Theory (CDT)

Classical Decision Theory (CDT) is a rational, mathematical approach to decision-making. It assumes that individuals make decisions by logically evaluating all possible alternatives and selecting the one that maximizes expected benefits.

The Model of Economic Man and Woman: The Economic Man (Homo Economicus) and Economic Woman model describes how individuals make decisions based on rationality, self-interest, and optimization. This model is widely used in economics and decision theory to explain consumer behavior and market interactions.

Subjective Expected Utility (SEU) Theory: is a decision-making model that helps individuals choose between alternatives by considering both personal beliefs (subjective probabilities) and expected utility (perceived benefits) of each option. It extends Classical Decision Theory by incorporating subjective elements like personal preferences and uncertainty**.**

Heuristics (Mental Shortcuts) are quick, rule-of-thumb strategies used to simplify decision-making. They are efficient but can lead to errors or biases.

Cognitive Biases: are systematic errors in thinking that influence our decisions and judgments

Fallacies are errors in logic that weaken arguments and decision-making.

MODULE 3

MEMORY

Key Processes in Memory

Memory is the process by which we encode, store, and retrieve information. It allows us to learn, retain knowledge, and recall past experiences. The three main processes of memory are Encoding, Storage, and Retrieval**.**

Encoding (Input Stage)

Encoding is the process of converting information into a form that can be stored in memory.

Types of Encoding:

- Visual Encoding – Storing information as images (e.g., remembering a face).
- Acoustic Encoding – Storing information based on sound (e.g., remembering a song or rhyme).

Storage (Retention Stage)

Storage is the process of keeping encoded information in memory over time.

Types of Storage:

- Sensory Memory – Holds information for a few seconds (e.g., briefly seeing a flashing light).
- Short-Term Memory (STM) – Holds information for 15–30 seconds (e.g., remembering a phone number before dialing).
- Long-Term Memory (LTM) – Stores information for extended periods (e.g., remembering childhood events).

Retrieval (Recall Stage)

Retrieval is the process of accessing stored information when needed.

Types of Retrieval:

- Recall – Retrieving information without cues (e.g., answering an exam question from memory).
- Recognition – Identifying information when given options (e.g., recognizing a friend in a crowd).
- Relearning – Learning forgotten information again more quickly (e.g., re-studying a language).

Sensory Memory (Immediate, Brief Storage): Sensory memory holds raw sensory information (sights, sounds, smells, etc.) for a very short duration (milliseconds to a few seconds).

Types of Sensory Memory:

- Iconic Memory (Visual) – Stores images for 0.5 seconds (e.g., seeing a flash of light).
- Echoic Memory (Auditory) – Stores sounds for 2–4 seconds (e.g., remembering the last words in a conversation).

Short-Term Memory (STM) (Temporary Working Memory)

Short-term memory stores small amounts of information for 15–30 seconds unless rehearsed. It has a limited capacity (about 7 ± 2 items as per George Miller's theory).

Improving STM:

✓ Chunking – Grouping items into meaningful units (e.g., 1-800-FLOWERS instead of 18003569377).

✓ Rehearsal – Repeating information to extend retention.

Long-Term Memory (LTM) (Permanent Storage)

Long-term memory stores information indefinitely and has an unlimited capacity.

Types of Long-Term Memory:

Explicit (Declarative) Memory – Conscious recall of facts and experiences

Episodic Memory – Personal experiences and events.

Example: Remembering your last birthday.

Implicit (Non-Declarative) Memory – Unconscious learning and skills

Procedural Memory – Skills and habits.

Example: Riding a bicycle or typing on a keyboard.

Levels of Processing Theory (Craik & Lockhart, 1972)

The Levels of Processing (LoP) Theory suggests that memory retention depends on how deeply information is processed, rather than the duration of storage. Deeper processing leads to better memory retention.

Working Memory Model – Alan Baddeley & Graham Hitch (1974)

The Working Memory Model (WMM), proposed by Alan Baddeley and Graham Hitch, describes how we temporarily store and manipulate information for cognitive tasks like problem-solving, learning, and reasoning. It replaces the idea of a single short-term memory store and introduces multiple components that work together

Components of the Working Memory Model

- Central Executive – The "control system" that directs attention and manages cognitive tasks.
- Phonological Loop – Handles verbal and auditory information.
- Visuospatial Sketchpad – Processes visual and spatial information.
- Episodic Buffer (Added in 2000) – Integrates information from different sources into a single representation

Retrieval Cues in Memory

Retrieval cues are stimuli that help recall information from memory. They act as mental triggers, making it easier to access stored knowledge. Effective retrieval cues improve memory recall, while weak or missing cues can lead to forgetting.

Types of Retrieval Cues

Context-Dependent Cues: Recall is improved when we are in the same environment where learning occurred.
State-Dependent Cues: Recall is influenced by a person's internal state (e.g., mood, emotions, or intoxication)
Encoding Specificity Principle (Tulving, 1983): Information is best retrieved when the cues at retrieval match the conditions during encoding.
Serial Position Effect (Hermann Ebbinghaus, 1885): The Serial Position Effect refers to the tendency to better recall items from the beginning and end of a list, while struggling to remember those in the middle

- **Reconstructive Memory (Bartlett, 1932)**

Reconstructive memory refers to the idea that memory is not a perfect recording of past events but is actively reconstructed when recalled. Instead of retrieving exact details, we fill in gaps with prior knowledge, expectations, and schemas.

- **Eyewitness Testimony (EWT)**

Eyewitness testimony (EWT) refers to a person's recollection of an event they witnessed, often used in legal settings. While it can be powerful evidence in court, research shows that memory is fallible and can be influenced by various factors.

- **Flashbulb Memory (Brown & Kulik, 1977)**

A highly detailed, vivid, and long-lasting memory of a significant, emotional, or shocking event.

- **Metamemory**

Awareness and understanding of one's own memory abilities and limitations. It involves monitoring and controlling memory processes.

- **Forgetting Curve (Ebbinghaus, 1885)**

The Forgetting Curve, proposed by Hermann Ebbinghaus, describes how memory retention declines over time if no effort is made to retain the information. It shows that forgetting happens rapidly at first and then slows down over time.

Reasons for Forgetting

Forgetting occurs when we fail to retrieve stored information, and psychologists have proposed different theories to explain why this happens. The three major theories include Decay Theory, Interference Theory, and Prospective Memory Failure.

Decay Theory (Ebbinghaus, 1885)

Forgetting occurs over time due to the natural fading of memory traces.

If information is not rehearsed, the neural connections that store it weaken and eventually disappear.

Interference Theory

Forgetting occurs because similar information competes and disrupts recall.

Prospective Memory Failure

Forgetting to perform a future task due to a failure in prospective memory (memory for future intentions).

Absence of Retrieval Cues & Forgetting

Forgetting occurs when retrieval cues (hints or triggers that help recall stored information) are missing or ineffective.

Strategies for Remembering

Enhancing memory requires effective strategies that improve encoding, storage, and retrieval. Here are key methods to boost recall:

Mnemonics (Memory Aids)

✓ Acronyms – Using the first letters of words to form a new, memorable word.

hunking

🔹 Definition: Grouping large sets of information into smaller, meaningful units.

🔹 Example: Remembering a phone number as 123-456-7890 instead of 1234567890**.**

Spaced Repetition (Distributed Practice)

Reviewing material at increasing intervals over time.

Active Recall (Self-Testing)

Actively retrieving information instead of passively rereading.

Elaborative Rehearsal

Connecting new information to existing knowledge in meaningful ways.

MODULE 4

LEARNING

Learning is a relatively permanent change in behavior or knowledge due to experience, practice, or study.

Classical Conditioning (Pavlov, 1903)

Classical conditioning is a type of learning through association, where a previously neutral stimulus becomes associated with an automatic response.

Term	Definition	Example (Pavlov's Dog)
Unconditioned Stimulus (UCS)	A natural stimulus that triggers an automatic response.	Food
Unconditioned Response (UCR)	The automatic, natural reaction to UCS.	Salivation
Neutral Stimulus (NS)	A stimulus that initially has no effect.	Bell (before learning)
Conditioned Stimulus (CS)	The previously neutral stimulus that now triggers a response.	Bell (after learning)
Conditioned Response (CR)	The learned response to the conditioned stimulus.	Salivation

Principles of Classical Conditioning

✓ Acquisition – The learning phase where the association between UCS and CS is formed.

✓ Extinction – The conditioned response fades if the CS is repeatedly presented without the UCS.

✓ Spontaneous Recovery – The reappearance of a conditioned response after extinction.

✓ Generalization – Similar stimuli trigger the same response. (Example: A dog salivates to different bell sounds).

✓ Discrimination – Learning to differentiate between similar stimuli. (Example: A dog salivates only to a specific bell tone).

Operant Conditioning (B.F. Skinner, 1938)

Operant conditioning is a learning process where behavior is shaped by consequences (rewards or punishments). Discovered by: B.F. Skinner, based on Thorndike's Law of Effect (behaviors followed by positive outcomes are repeated, while those followed by negative outcomes are avoided).

Type	Definition	Example
Positive Reinforcement	Adding a pleasant stimulus to increase behavior.	Giving a child candy for doing homework.
Negative Reinforcement	Removing an unpleasant stimulus to increase behavior.	Taking painkillers to stop a headache.
Positive Punishment	Adding an unpleasant stimulus to decrease behavior.	Getting a speeding ticket for driving too fast.
Negative Punishment	Removing a pleasant stimulus to decrease behavior.	Losing phone privileges for bad behavior.

Reinforcement Schedules (Ways to Strengthen Behavior)

Type	Description	Example
Continuous Reinforcement	Reward given every time behavior occurs.	Getting a cookie every time you say "please."
Fixed-Ratio Schedule	Reward given after a set number of responses.	Factory workers paid per 10 items produced.
Variable-Ratio Schedule	Reward given after an unpredictable number of responses.	Slot machines in casinos.
Fixed-Interval Schedule	Reward given after a fixed time period.	Getting a paycheck every two weeks.
Variable-Interval Schedule	Reward given at random time intervals.	Surprise quizzes in class.

Cognitive learning is a type of learning that involves actively processing information, understanding concepts, and applying knowledge rather than just reacting to stimuli.

Latent learning is a type of learning that remains hidden until it is needed or there is an incentive to demonstrate it.

Observational Learning (Albert Bandura, 1961)

Observational learning is a type of learning where individuals acquire new behaviors, skills, or attitudes by

watching and imitating others. Discovered by: Albert Bandura, who developed the Social Learning Theory through his famous Bobo Doll Experiment

Insight Learning (Wolfgang Köhler, 1925)

Insight learning is a type of learning that occurs suddenly when an individual realizes a solution to a problem without trial-and-error. Discovered by: Wolfgang Köhler, a Gestalt psychologist, through his experiments with chimpanzees.

🔷 Key Idea: The solution comes as an "Aha!" or "Eureka!" moment, where everything suddenly makes sense.