

Course Name: Biopsychology

Program in which it is offered: B.Sc. (H)Applied Psychology

Course Category: Core
Course Credit Structure: 6
Total Number of Hours: 6
Lecture: 4
Last Revision Year: NA
Course Instructors: Sarin Dominic

Schedule of Offering: Odd
Course Code: XXX
Contact hours per week: 6
Tutorial/Practical: 2
Course co-ordinator : Sarin Dominic

Course Introduction

Biopsychology explores how the brain and nervous system influence human behaviour. Basic understanding of the biological mechanisms underlying psychological processes is a must for anyone in the field of psychology. This knowledge forms the foundation for understanding more complex psychological processes and underlying mechanisms of psychopathology and neurological disorders later on. The present course is designed to serve as a primer to help you learn and understand the known biological underpinnings of human brain functioning, basic cognitive processes, sensation, perception, movement, regulation of biological rhythms, biological drives, learning, memory and emotional behaviours.

Course Objective

- To introduce participants to the field of biopsychology and theoretical sciences which has contributed to the understanding of biological mechanisms of human psychological processes
- To introduce participants to the different research approaches and methods of biopsychology
- To help participants develop basic knowledge of structure and function of human nervous system and its influence on human behaviour
- To help participants develop basic understanding of the sensory and musculoskeletal systems and brain mechanism of sensation, perception and movement
- To help participants develop basic understanding of the neurobiological mechanisms of creation and regulation of internal drives and biological rhythms.
- To help participants understand the physiological mechanisms of learning and memory
- To help participants know the neuroendocrinological mechanisms of creation and regulation of emotional behaviours.

Course Outcome

On successful completion of the course, the participants will be able to

1. Learn about the nature and scope of field of biopsychology
2. Understand and explain the research methods of biopsychology
3. Describe the structure and functions of the nervous system and its divisions
4. Describe the physiological mechanisms of sensation and perception
5. Demonstrate understanding of the brain mechanisms of movement
6. Describe the neuroendocrinological mechanisms of biological rhythms
7. Understanding the physiological mechanisms of learning and memory
8. Describe the neurological mechanisms of creation and regulation of emotions.

Teaching Pedagogy

The coursework will be activity based involving assignments, lectures, visual illustrations, drawing exercises, case studies, class quizzes, lab exercises, presentations, group discussions, debates, webinars with bio psychologists and field visits to human anatomy units and brain labs/museums. Didactic lectures facilitated through informative slide presentations, 3D video illustrations and neuroscience animations will be utilized to help participants understand the basic concepts of neurophysiology. Documentaries, lab visits and expert interactions will be utilized to enhance the learning process. Anatomical drawing exercises and presentations will be helpful in developing visual and spatial brain maps of learned information. Discussions/debates will be organized on core themes to enhance the critical thinking skills.

Module Sessions

Module-I: Introduction to discipline of Biopsychology (8 lecture hours + 4 practical/tutorial hours)

Definition, nature and scope of biopsychology, divisions of biopsychology. Theoretical foundations of biopsychology (Darwin's theory of evolution, Mendelian genetics, epigenetic theory of brain development, neuroanatomy and neurophysiology) methods of research in biopsychology (visualizing and stimulating living human brain, recording human psychophysiological activity, invasive methods, pharmacological methods, behavioural assessments, cognitive neuroscience methods, animal behaviour studies)

Reading:

Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.
Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.
Kalat, J. W. (2019). *Biological psychology*. Boston, MA, USA: Cengage.

Suggested Activities:

- Review of biopsychological researches to learn about the study design and methods employed.
- Group interaction/webinar with a bio psychologist
- Participant presentations and discussions on theoretical foundations of biopsychology
- Discussions on curious case studies in biopsychology
- Debate on ethical aspects of biopsychological research.

Module-II: Neuroanatomy and neurophysiology (16 lecture hours + 8 practical/tutorial hours)

Nervous system and its functions, cells of the nervous system, structure and electrical activity of neurons, communication between neurons. Organization of the nervous system: central and peripheral nervous system and their divisions. Brain anatomy and physiology: major anatomical subdivisions of human brain and their functions, cerebral cortex (hemispheres and lobes), structure and functions of spinal cord, autonomic nervous system and its functions.

Reading:

Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.
Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.
Vaz, M. D., Raj, T. D., & Anura, K. D. (2016). *Guyton & Hall Textbook of Medical Physiology: a South Asian Edition*. Elsevier India.

Suggested Activities:

- In class drawing exercises of brain anatomy
- Class quiz - Labelling the anatomical parts of the nervous system
- Creative hand/computer aided modelling of brain anatomy
- Illustrative presentations by participants on neuroanatomy
- Group interaction with expert in neurophysiology
- Visit to anatomy units/brain museums
- Visit to a neurology unit of a hospital

Module-III: Physiology of sensation and perception (16 lecture hours + 8 practical/tutorial hours)

Senses and types, receptors, sensory systems and neuronal pathways, transduction and stimulus processing in the brain

Vision: Anatomy of the visual system, neural mechanisms of visual perception.

Audition: Anatomy of the auditory system, neural mechanisms of auditory perception.

Gustation: Anatomy of taste buds and gustatory cells, neural mechanisms of perception of gustatory stimulus.

Olfaction: Anatomy of olfactory apparatus, neural mechanisms of perception of olfactory stimulus.

Somatic senses: The body senses (touch, pressure, temperature and pain), perception of body senses

Neural mechanism of perception of kinaesthetic and vestibular sensations

Reading:

Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.

Kalat, J. W. (2019). *Biological psychology*. Boston, MA, USA: Cengage.

Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.

Vaz, M. D., Raj, T. D., & Anura, K. D. (2016). *Guyton & Hall Textbook of Medical Physiology: a South Asian Edition*. Elsevier India.

Suggested Activities:

- In class drawing exercises of human sensory systems and receptor pathways
- Class quiz - Labelling the anatomical parts of the sensory systems of human body
- Creative hand/computer aided modelling of sensory systems
- Illustrative presentations by participants explaining sensory systems and neural pathways
- Group interaction with expert in sensory biology
- Visit to anatomy units/brain museums
- Visit to ENT and physiotherapy clinics

Module-IV: Neuronal regulation of sleep and internal environment

(10 lecture hours + 5 practical/tutorial hours)

Sleep and biological rhythms: functions of sleep, physiological mechanisms of sleep and waking, stages of sleep.

Ingestive behaviours: hunger and thirst drives and its functions, neurophysiological mechanisms regulating ingestion, eating patterns and nutrition adherence.

Reproductive behaviour: sexual drive and its functions, neuroendocrinological regulation of sexual and parenting behaviours.

Reading:

Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.

Kalat, J. W. (2019). *Biological psychology*. Boston, MA, USA: Cengage.

Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.

Vaz, M. D., Raj, T. D., & Anura, K. D. (2016). *Guyton & Hall Textbook of Medical Physiology: a South Asian Edition*. Elsevier India.

Suggested Activities:

- In class neural circuit drawing exercises
- Class quiz
- Participant presentations on disorders of sleep and biological rhythms
- Visit to sleep disorder clinic

Module-V: Neurobiology of learning, memory and emotion

(10 lecture hours + 5 practical/tutorial hours)

Learning and memory: Neurobiological mechanism of learning and representation of learned information.

Emotions: brain mechanisms of human emotional experience, neural mechanisms of fear conditioning, neuroendocrinological regulation of stress response.

Reading:

Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.

Toates, F. M. (2011). *Biological psychology*. Harlow: Pearson Education.

Leukel, F. (1978). *Essentials of physiological psychology*. Saint Louis: Mosby.

Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.

Vaz, M. D., Raj, T. D., & Anura, K. D. (2016). *Guyton & Hall Textbook of Medical Physiology: a South Asian Edition*. Elsevier India.

Suggested Activities:

- In class neural circuit drawing exercises
- Class quiz
- Illustrative presentations by participants on brain mechanisms of learning, memory and emotions
- Visit to clinical/rehabilitation facility providing treatment services to individuals with neurological disorders.
- Group interaction with a neuropsychologist

Additional readings (topics for self-study)

- Historical background and development of the discipline of biopsychology
- Brain development and change across lifespan
- Modular organization of brain and localisation of brain functions
- Hemispheric lateralization: Left and right hemispheres and their functional differences, split brain studies
- Neocortical layers and their functions
- Blood supply to CNS
- Protective layers of brain
- Cranial nerves and their respective functions
- Cerebrospinal fluid system (CSF system)
- Structure and functions of peripheral nerves
- Sensory processing disorders
- Sleep disorders
- Neural mechanisms of movement
- Neural mechanisms of forgetting

- Psychoneuroimmunology: Immunity, mood states and disease/well-being
- Psychoneuroendocrinology: HPA axis and regulation of behaviour
- Recent advances in biopsychology

Text Books

- Carlson, N. R. (2008). *Foundations of physiological psychology*. Boston: Pearson/A and B.
- Kalat, J. W. (2019). *Biological psychology*. Boston, MA, USA: Cengage.
- Leukel, F. (1978). *Essentials of physiological psychology*. Saint Louis: Mosby.
- Pinel, J. P. J., & Barnes, S. J. (2018). *Biopsychology*. Harlow: Pearson Education Limited.
- Vaz, M. D., Raj, T. D., & Anura, K. D. (2016). *Guyton & Hall Textbook of Medical Physiology: a South Asian Edition*. Elsevier India.
- Toates, F. M. (2011). *Biological psychology*. Harlow: Pearson Education.

Reference Books

- Kolb, B. & Whishaw, I.Q. (2007). *Fundamentals of human neuropsychology* (6th ed). New York: Worth Publishers.
- Patestas, M., & Gartner, L. P. (2016). *A Textbook of Neuroanatomy, 2nd Edition*. John Wiley & Sons.
- Stahl, S.M. (1998). *Essential psychopharmacology*. London: Cambridge University Press.
- Sadock, B. J., Ruiz, P., & Sadock, V. A. (2015). *Kaplan et Sadocks synopsis of psychiatry: behavioral sciences, clinical psychiatry*. Philadelphia: Wolters Kluwer.
- Hall, S., & Stephens, J. (2019). *Anatomy and physiology*. Amsterdam: Elsevier.
- Berger, W., & Berger, J. (2017). *Neuroanatomy*. Boca Raton: CRC Press, Taylor & Francis Group.
- Brazis, P. W. (2016). *Demyers the neurologic examination: a programmed text, seventh edition*. McGraw-hill Education - Europe.
- Haines, D. E. (2014). *Neuroanatomy: an atlas of structures, sections, and systems*. Philadelphia: Lippincott Williams & Wilkins.
- Kahle, W., & Frotscher, M. (2015). *Color atlas and textbook of human anatomy*. Stuttgart: Thieme.

CIA Components

The coursework of the participant will be evaluated through components of continuous internal assessment (CIA) and exams.

Evaluative components	Percentage
CIA - Internal	
Group learning (Group discussion, Seminars)	30%
Individual learning (Assignments, Mid Semester Exam)	70%
	30% of the total marks
Exam - External	
End semester exam	70% of the total marks
Total	100%