CALICUTUNIVERSITY

THIRD SEMESTER

FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

PHYSIOLOGY OF BEHAVIOUR AND SENSES

FYUGP PSYCHOLOGY-MAJOR

PREPARED BY

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Course code	PSG3MN200				
Course title	Physiology of behaviour and senses				
Type of course	Minor				
Semester	III				
Academic level	200-299				
Course details	Credit	Lecture per week	Tutorial per week	Practical per week	Total hours
	4	3		2	75
Pre requisites	+2/ VHSC or equivalent online courses.				
Course objectives					

MODULE	Unit	Content	Hours 45 + 30	Marks 70
1	**PHYSIOLOGICAL BASIS OF HUNGER AND THIRST**		10	
	1	**Physiology of Hunger**	6	
	2	**Physiological basis of thirst**	4	
2	**PHYSIOLOGICAL BASIS OF EMOTIONS AND SEXUAL BEHAVIOUR**		14	
	1	**Neural basis of emotion and stress physiology**	5	
	2	**Physiology of sexual behaviour**	9	
3	**PHYSIOLOGY OF VISION AND HEARING**		10	
	1	**Vision**	5	
	2	**Auditory System**	5	
4	**GUSTATORY, OLFACTORY AND CUTANEOUS SYSTEM**		11	
	1	**Physiology of taste**	3	
	2	**Physiology of smell**	2	
	3	**Cutaneous senses**	6	
5	**PRACTICALS**		30	

MODULE 1: PHYSIOLOGICAL BASIS OF HUNGER AND THIRST (10 hr)

Unit 1: Physiology of Hunger (6 hr): Neural control of food intake Role of the hypothalamus, Neural centers that influence; Mechanical process of feeding.; Factors that regulate the quantity of food intake, role of hormones (effect of Cholecystokinin, Peptide YY. GLP, and Ghrelin). Short- term regulation of food intake, intermediate and long-term effects of food intake.; (Effect of blood concentrations of glucose, amino acids, lipids on hunger and feeding), temperature regulation ofood intake. Obesity causes and treatment, eating disorders (Bulimia, Anorexia, Inanition, Cachexia, Picca).

Unit 2: Physiological basis of thirst (4 hr): Peripheral factors in water regulation. Central factors in water regulation (cellular dehydration thirst and hypovolemic thirst).; Angiotensin and thirst, Dehydration and water toxicity.

MODULE 2: PHYSIOLOGICAL BASIS OF EMOTIONS AND SEXUAL BEHAVIOUR (14 hr)

Unit 1: Neural basis of emotion and stress physiology (5 hr): Role of frontal lobes. Behavioural functions of the hypothalamus and associated limbic structures, Reward centers, Rage - its association with punishment centers, placidity and tameness. Functions of Amygdala. Stress physiology: Stress and strain-Environmental stressors

Unit 2: Physiology of sexual behaviour (9 hr): Hormones and sexual development - Foetal hormones and the development of reproductive organs, Sex differences in the brain, Perinatal hormones and behavioural development, Puberty: hormones and development of secondary sexual characteristics. Effects of gonadal hormones on adults - Male reproduction-related behaviour and testosterone, Female reproduction-related behaviour and gonadal hormones. Structural differences between the male Neural mechanisms of sexual behaviour hypothalamus and female hypothalamus, the hypothalamus and male sexual behaviour, the hypothalamus and female sexual behaviour,

MODULE 3: PHYSIOLOGY OF VISION AND HEARING (10 hr)

Unit 1: Vision (5 hr): Structure of the human eye, Organization of the retina and visual pathways. Functioning of the eye, visual coding, chemistry of vision, transduction in the retina, theories of colour vision, visual perception. Visual defects (myopia, hypermetropia, presbyopia, astigmatism, cataract, colour blindness, nyctalopia).

Unit 2: Auditory system (5 hr): Characteristics of sound &audible sound frequency: Anatomy of the auditory system. Auditory pathways, auditory perception and hearing abnormalities. statoreceptors.

MODULE 4: GUSTATORY, OLFACTORY AND CUTANEOUS SYSTEM (11 hr)

Unit 1: Physiology of taste (3 hr): Anatomy of taste buds and its function, primary sensations of taste (agents and site of sensation), taste thresholds and intensity discrimination, taste preferences and control of the diet. Taste pathways and transmission of signals into the central nervous system.

Unit 2: Physiology of smell (2 hr): Organization of the olfactory membrane, sense of smell and stimulation of the olfactory cells. Categorizing smell, the transmission of smell signals into the central nervous system.

Unit 3: Cutaneous senses (6 hr): Classification - the mechanoreceptive somatic senses (tactile and position), thermo-receptive senses (heat and cold) and pain sense. Detection and transmission of tactile sensations - tactile receptors, detection of vibration, tickling and itch. Sensory pathways for transmitting somatic signals into the central nervous system. Somatosensory cortex, position senses, position sensory receptors. Thermal sensations - thermal receptors, their excitation and transmission of thermal signals. Pain - purpose, types, pain receptors, pain suppressive system, pain sensation.

MODULE 5: PRACTICALS (1 CREDIT, 30 hr)

1. Identification of parts of Eye using charts, models etc.
2. Identification of parts of Ear using charts, models etc.
3. Identification of visual defects myopia, hypermetropia, presbyopia, astigmatism, cataract, nyctalopia.
4. Identification of colour blindness using Ishihara chart.
5. Practice of stress releasing exercises.

Two experiments other than the listed should be designed by the supervising teacher and introduced to the students. Institutional visit to Hospitals or other Medical centers to study the procedures to detect visual or auditory defects in children (not more than one day).

References

1. Text Book of Medical Physiology. Hall and Guyton W.B. Saunders Company, London.
2. Review of Medical Physiology – Ganong. W.F. McGraw Hill INC. New York.
3. Text Book of Anatomy and Physiology – Tortora. Harper Collins College Publications.
4. Text Book of Anatomy & Physiology – Patton & Thibodiau – Mosby.
5. Text book of Medical Physiology – AP Krishna, Scientific publications, New Delhi.
6. Sarada Subrhmanian and K. Madhavan Kutty. A Text Book of Physiology. Onent Longman Publication.
7. Schneider A.M &Tarshis B. An introduction to Physiological Psychology. Random House, New York.
8. Levinthal C.F. Introduction to Physiological Psychology, Prentice Hall. New Delhi.
9. Pinel PJ John, Biopsychology, Pearson.
10. Neil. R.Carlson, Physiology of behavior, Pearson publishers.
11. Carlson, Neil. R., Physiology of Behavior, 8 th edition, Pearson.

MODULE 1: PHYSIOLOGICAL BASIS OF HUNGER AND THIRST

UNIT 1: PHYSIOLOGY OF HUNGER

1. Neural Control of Food Intake

- Hunger is regulated mainly by the **Hypothalamus**.
- Important centers:
  - **Lateral Hypothalamus (LH)** → stimulates hunger ("feeding center")
  - **Ventromedial Hypothalamus (VMH)** → inhibits hunger ("satiety center")
- Damage to LH → loss of appetite
- Damage to VMH → overeating (obesity)

2. Mechanical Process of Feeding

- Includes:
  - Chewing (mastication)
  - Swallowing (deglutition)
  - Digestion
- Stretch receptors in stomach send signals of fullness to brain.

3. Hormonal Regulation of Hunger

- **Ghrelin**
  - Released from stomach
  - Increases appetite
- **Cholecystokinin (CCK)**
  - Released from intestine
  - Decreases food intake
- **Peptide YY**
  - Reduces hunger after meals
- **Glucagon-like peptide-1**
  - Slows digestion and reduces appetite

4. Regulation of Food Intake

- **Short-term regulation**
  - Hunger signals between meals
  - Controlled by hormones and stomach signals
- **Intermediate regulation**
  - Based on digestion and absorption

- **Long-term regulation**
  - Maintains body weight and fat storage

5. Role of Nutrients

- Blood levels influence hunger:
  - Glucose ↓ → hunger increases
  - Amino acids & lipids also affect appetite

6. Temperature Regulation of Food Intake

- Cold environments → increase hunger
- Hot environments → decrease hunger

7. Obesity

- **Definition:** Excess accumulation of body fat
- Causes:
  - Genetic factors
  - Overeating
  - Sedentary lifestyle
- Treatment:
  - Balanced diet
  - Exercise
  - Behaviour therapy
  - Medical intervention (in severe cases)

8. Eating Disorders

- **Anorexia nervosa**
  - Extreme dieting, fear of weight gain
- **Bulimia nervosa**
  - Binge eating + vomiting
- **Pica**
  - Eating non-food items
- **Inanition**
  - Severe malnutrition
- **Cachexia**
  - Seen in chronic illnes

UNIT 2: PHYSIOLOGICAL BASIS OF THIRST

1. Peripheral Factors

- Blood volume and pressure changes
- Kidney regulation of water balance

2. Central Regulation

- Controlled by **Hypothalamus**

Types of thirst:

- **Cellular dehydration thirst**
  - Due to high salt concentration
- **Hypovolemic thirst**
  - Due to loss of blood or fluids

3. Hormonal Regulation

- **Angiotensin II**
  - Stimulates drinking behavior

4. Disorders

- **Dehydration** → lack of water
- **Water toxicity** → excess water causing electrolyte imbalance

MODULE 2: PHYSIOLOGICAL BASIS OF EMOTION AND SEXUAL BEHAVIOUR

UNIT 1: NEURAL BASIS OF EMOTION & STRESS

1. Brain Structures

- **Frontal lobe**
  - Controls emotional expression and decision-making
- **Amygdala**
  - Fear, anger, aggression
- **Hypothalamus**

- Regulates emotional responses

2. Limbic System

- Includes:
  - Amygdala
  - Hippocampus
  - Hypothalamus
- Functions:
  - Emotion
  - Motivation
  - Memory

3. Reward & Punishment Centers

- Reward → pleasure, reinforcement
- Punishment → fear, avoidance

4. Rage, Placidity & Tameness

- Rage → hypothalamic stimulation
- Placidity → reduced aggression
- Tameness → behavioral control

5. Stress Physiology

- **Stress:** Body's response to demand
- Types:
  - Acute stress
  - Chronic stress
- Stressors:
  - Environmental (heat, noise)
  - Psychological (fear, anxiety)

UNIT 2: PHYSIOLOGY OF SEXUAL BEHAVIOUR

1. Hormones & Development

- Foetal hormones:
  - Develop reproductive organs
- Perinatal hormones:
  - Influence brain and behaviour

2. Puberty

- Hormonal changes lead to:
  - Secondary sexual characteristics
  - Reproductive maturity

3. Sex Differences in Brain

- Structural differences in hypothalamus
- Influence behaviour patterns

4. Adult Hormonal Effects

- Testosterone → male sexual behaviour
- Female hormones → regulate reproductive cycle and behaviour

5. Neural Mechanisms

- Hypothalamus plays key role in:
  - Male sexual behaviour
  - Female sexual behaviour

MODULE 3: PHYSIOLOGY OF VISION AND HEARING

UNIT 1: VISION

1. Structure of Eye

- Cornea, lens, retina, iris, pupil

2. Retina Organization

- Photoreceptors:
  - Rods → night vision
  - Cones → colour vision

3. Visual Pathways

- Retina → optic nerve → brain (visual cortex)

4. Visual Transduction

- Light → electrical signals in retina

5. Theories of Colour Vision

- Trichromatic theory
- Opponent-process theory

6. Visual Defects

- Myopia → near-sightedness
- Hypermetropia → far-sightedness
- Presbyopia → age-related
- Astigmatism → irregular curvature
- Cataract → cloudy lens
- Colour blindness → inability to distinguish colours
- Nyctalopia → night blindness

UNIT 2: AUDITORY SYSTEM

1. Characteristics of Sound

- Frequency (pitch)
- Amplitude (loudness)

2. Anatomy of Ear

- Outer ear
- Middle ear
- Inner ear (cochlea)

3. Auditory Pathway

- Ear → auditory nerve → brain

4. Hearing Abnormalities

- Deafness
- Hearing loss

5. Statoreceptors

- Help maintain balance (vestibular system)

MODULE 4: GUSTATORY, OLFACTORY AND CUTANEOUS SYSTEM

UNIT 1: PHYSIOLOGY OF TASTE

1. Taste Buds

- Located on tongue
- Contain taste receptors

2. Primary Taste Sensations

- Sweet
- Sour
- Salty
- Bitter

- Umami

3. Taste Threshold & Intensity

- Minimum concentration needed to detect taste
- Intensity increases with concentration

4. Taste Pathway

- Taste receptors → brain (gustatory cortex)

UNIT 2: PHYSIOLOGY OF SMELL

1. Olfactory Membrane

- Contains receptors for smell

2. Smell Perception

- Chemicals stimulate olfactory cells

3. Pathway

- Olfactory receptors → brain

UNIT 3: CUTANEOUS SENSES

1. Types of Sensations

- **Mechanoreception** → touch, pressure
- **Thermoreception** → heat, cold
- **Pain (nociception)**

2. Tactile Sensations

- Receptors detect:
  - Touch
  - Vibration
  - Tickling
  - Itch

3. Sensory Pathways

- Skin → spinal cord → brain

4. Somatosensory Cortex

- Processes body sensations

5. Thermal Sensations

- Heat and cold receptors

6. Pain

- **Purpose:** Protection
- Types:
  - Fast pain
  - Slow pain
- Pain receptors → detect damage

7. Pain Control

- Brain has pain-suppressing system