Human Physiology Minor

Course code	PSG1MN100				
Course title	Basics in cellular physiology				
Type of course	Minor				
Semester	I				
Academic level	100-199				
Course details	Credit	Lecture per week	Tutorial per week	Practical per week	Total hours
	4	3		2	75
Pre requisites	+2/ VHSC or the following online courses. 1. https://www.coursera.org/learn/physiology 2. https://learn.utoronto.ca/programs-courses/courses/2159-basic-human-physiology 3. https://www.ivyroses.com/Revise/AnatomyPhysiology/index.php 4. https://www.medicalnewstoday.com/articles/organs-in-the-body#organ-systems 5. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture notes/health science students/physiologypti.pdf https://www.classcentral.com/classroom/youtube-anatomy-physiology-45834/60c82bd43739c				
Course objectives	The course aims to students delve into topics such as cell biology, Mendelian inheritance, genetic disorders, and microscopy, gaining both theoretical knowledge and practical skills essential for further studies or careers in biology-related fields.				

Course outcome	**CO statement**	**Cognitive level***	**Knowledge category #**	**Evaluation tools used**
CO1	Explain the structure and functions of a cell, plasma membrane and cell	U	F&C	Short answer , Paragraph type.
CO2	Illustrate the structure of DNA. DNA replication, Mitosis, Meiosis, Chromosomes, Gene and genetic code, types of chromosomes.	U	F&C	
CO3	Predict possible inheritance patterns, in real life or imaginary situations.	AP	C&M	
CO4	Describe the characteristics of various types of chromosomal anomalies.	U	C	

CO5	Acquire skill to handle microscopes and to do biological experiments.	Ap	C&P	
CO6	Compare the characteristics of Mendelian and Non Mendelian inheritance patterns.	U	C	
*- Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge (F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Question paper pattern for external examination:
MODULE 1: Short answer 3 x 3 = 9 marks, Paragraph 2 x 6 = 12 marks, Essay 1 x 10= 10 marks.
MODULE 2: Short answer 3 x 3 = 9 marks, Paragraph 2 x 6 = 12 marks.
MODULE 3: Short answer 2 x 3= 6 marks, Paragraph 2 x 6 = 12 marks, Essay 1 x 10 12 marks.
MODULE 4: Short answer 2 x 3= 6 marks, Paragraph 2 x 6 = 10 marks.

MODULE	Unit	Content	Hours 45 + 30	Marks 70
1	**CYTOLOGY**		15	
	1	Cellular organization	10	
	2	Cell division	5	
2	**GENES AND CHROMOSOMES**		12	
	1	DNA, the genetic material	5	
	2	Concept of a gene	3	
	3	Morphology of chromosomes	4	
3	**ELEMENTS OF HEREDITY AND VARIATION**		12	
	1	Mendelian principles	5	
	2	Non Mendelian inheritance patterns	7	
4	**MUTATIONS AND GENETIC DISORDERS**		6	
	1	Mutations	3	
	2	Chromosomal anomalies	3	
5	**PRACTICALS**		30	

MODULE 1: CYTOLOGY (15 hr)

Unit 1: Cellular organization (10 hr) -Cell theory, cell principle; Cell structure, plasma membrane (fluid mosaic model), Structure and function of cell organelles (Mitochondria, ribosome, ER, Golgi bodies, Lysosomes, cytoskeleton and interphase nucleus); Cell inclusions-brief description of the structure of carbohydrates, lipids and proteins; Unicellularity to multicellularity, differentiation. Brief mention of spatial and temporal control of gene activity: Tissues- brief description of major types.

Unit 2: . Cell division (5 hr)- Cell cycle: G1, S, G2 and M phases, Checkpoints Go Phase; Mitosis; Description of all stages and significance; Meiosis. Description of all stages and significance.

MODULE 2: GENES AND CHROMOSOMES (12 hr)

Unit 1: DNA, the genetic material (5 hr): Structure of DNA, DNA replication- Semiconservative method, Okazaki fragments, leading strand, Lagging strand, the role of enzymes in DNA replication
Unit 2: Concept of a gene (3 hr) - Classical and modern concept, genetic code, introns, exons.

Unit 3: Morphology of chromosomes (4 hr): Size, shape, karyotype, ideogram, kinds of chromosomes; Linkage and crossing over, sex-linked chromosomes

MODULE 3: ELEMENTS OF HEREDITY AND VARIATION (12 hr)

Unit 1: Mendelian principles (5 hr): Mendel's work and laws of inheritance (monohybrid cross, dihybrid cross, test cross). Brief explanation of terms-alleles, homozygosity, heterozygosity, genotype, phenotype.
Unit 2: Non Mendelian inheritance patterns (7 hr): Brief description of other patterns of inheritance and genotype expression-incomplete dominance, co-dominance, multiple alleles, epistasis, pleiotropy.

MODULE: 4 MUTATIONS AND GENETIC DISORDERS (6 hr)

Unit 1: Mutations (3 hr): Gene Mutation-Kinds of mutation, classification (Somatic, gametic, point, spontaneous, induced, dominant, recessive and silent mutations). Gene mutation disorders - albinism, phenylketonuria, alkaptonuria, galactosemia, brachydactyly.
Unit 2: Chromosomal anomalies (3 hr): Autosomal anomalies - Down's syndrome, Edward's syndrome, Cri du chat syndrome. Sex chromosomal anomalies - Klinefelter's syndrome and Turner's syndrome.

MODULE 5: PRACTICALS (1 CREDIT, 30 hr) MANDATORY EXPERIMENTS

1. 1 Operation and maintenance of Microscopes (Simple and Compound)
2. Demonstration and identification of different tissues using charts.
3. Study of Mitosis and Meosis using suitable charts.
4. Experiments on monohybrid and dihybrid cross (Mendelian inheritance).

Of the remaining experiments any 4 can be selected by the Institution from the following list. Two experiments other than the listed should be selected by the Supervising teacher and introduced to the students.

Virtual Labs (Suggestive sites)

5. Study of different types of tissues using permanent slides.
6. Determination of human blood group using ABD antisera.
1. Demonstration of Meiosis using grasshopper testes.
8. Study on models of DNA and RNA structure.
9. Study of normal human karyotype (Male & Female).
10. Study of autosomal anomalies (Down's, Edward's and Cri du-chat syndrome).
11. Study of sex chromosomal anomalies (Klinefelter's & Turner's syndrome).
12. Simple Mendelian traits in humans and its inheritance (Pedigree analysis).

References

1. Vijayakumaran Nair & Jayaprakash, Cell Biology, Genetics, Molecular Biology, Academia, Thiruvananthapuram.
2. Guptha, P.K., Cell and Molecular Biology, Rastogi Publications, Meerat.
3. Dewitt-Saunders, Biology of the cell.
4. Strickberger W.M-Mac Millon, Genetics.
5. Gerald Karp, Cell and Molecular Biology: Concept and Experiments.
6. Roothwell, Human Genetics, Prentice Hall.
7. Lodish; Verk; et.al; Molecular Cell Biology, W.H. Freemann publishers.
8. Verma, P. S. and Agarwal, V. K., Cell Biology, Genetics, Molecular Biology, and Ecology, S. Chand and Co. New Delhi.
9. De Robertis EDP and De Robertis EMF., Cell and molecular biology. 7th Edition Saunders International Edition.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	--	--	--	--	3	--	--	--	--	--
CO2	2	3	--	--	--	--	3	--	--	--	--	--
CO3	--	2	--	--	3	--	2	--	--	--	3	--
CO4	2	4	---	--	--	--	3	--	--	--	--	--
CO5	--	--	--	3	--	--	3	--	--	--	--	--
CO6	--	--	3	--	--	--	3	--	--	--	--	--

Level	Correlation
--	Nil
1	Slightly/ Low
2	Moderate/ Medium
3	Substantial/ High

Course code	PSG1MN101				
Course title	Neurophysiology				
Type of course	Minor				
Semester	II				
Academic level	100-199				
Course details	Credit	Lecture per week	Tutorial per week	Practical per week	Total hours
	4	3		2	5
Pre requisites	+2/ VHSC or equivalent online courses.				
Course objectives					

Course outcome	**CO statement**	**Cognitive level***	**Knowledge category #**	**Evaluation tools used**
CO1	Identify the different types of nerve cells, glial cells and nerve fibres.	R	F	
CO2	Describe the structure and functions of CNS and reflex actions, types of reflex actions.	U	F & C	
CO3	Describe the structure and functions of the Cerebellum and Basal Ganglia	U	F & C	
CO4	Describe the structure and functions of the U F&C Cerebral Cortex, the functions of Brain in communication, and various theories of sleep and imaging techniques.	U	F & C	
CO5	Attain skill in doing experiments related to neurophysiology.	Ap	P	
CO6	Identify various functional deformities of brain from the symptoms shown by individuals in real life or imaginary situations.	Ap	M	

*- Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Question paper pattern for external examination:
MODULE 1: Short answer 3 x 3= 9 marks, Paragraph 1 x 6 = 6 marks.
MODULE 2: Short answer 3 x 3= 9 marks, Paragraph 2 x 6 = 12 marks, Essay 1 x 10 =10 marks.
MODULE 3: Short answer 2 x 3= 6 marks, Paragraph 1 x 6 = 6 marks, Essay 1 x 10 = 10 marks.
MODULE 4: Short answer 2 x 3= 3 marks, Paragraph 4 x 6 = 24 marks.

MODULE	Unit	Content	Hours 45 + 30	Marks 70
1	**THE NERVOUS SYSTEM**		11	
	1	Divisions of Nervous system and tissue	6	
	2	Nerve impulse	5	
2	**THE CENTRAL NERVOUS SYSTEM**		11	
	1	Brain	3	
	2	Spinal cord	2	
	3	Reflex Action	4	
	4	Neural control of muscle tone and posture	2	
3	**THE CEREBELLUM AND THE BASAL GANGLIA**		11	
	1	The Cerebellum and its motor functions	2	
	2	Anatomical functions, areas of the cerebellum	3	
	3	Function of the cerebellum in overall motor control	2	
	4	The basal ganglia-their motor functions	4	
4	**THE CEREBRAL CORTEX, SLEEP AND TECHNIQUES IN NEUROPHYSIOLOGY**		12	
	1	Functions of the specific cortical areas	4	
	2	Function of the brain in communication	2	
	3	Sleep	2	
	4	Techniques in neurophysiology	4	
5	**PRACTICALS**		30	

MODULE 1: THE NERVOUS SYSTEM (11 hr)

Unit 1 Divisions of Nervous system and tissue (6 hr): (CNS, PNS - somatic and autonomic); Nervous tissue (neurons, nerve fibres, nerves, synapse); Non nervous tissue and other materials (neuroglia, meninges, Cerebro-spinal fluid, Blood- CSF and blood-brain barriers).
Unit 2: Nerve impulse (5 hr): Ceneration, conduction, synaptic transmission, the role of calcium ions,action of transmitter substances on the postsynaptic neuron, types of transmitter substances.

MODULE 2: THE CENTRAL NERVOUS SYSTEM (11 hr)
Unit 1: Brain (3 hr): An overview (Forebrain, midbrain, hindbrain).
Unit 2: Spinal cord (2 hr): An overview of its structure and organization.
Unit 3: Reflex action (4 hr): Reflex arc, muscle spindle, Golgi tendon organ, Types of reflexes-monosynaptic reflex, multi-synaptic reflex, crossed extension reflex, mass reflex.
Unit 4: Neural control of muscle tone and posture (2 hr):

MODULE 3: THE CEREBELLUM AND THE BASAL GANGLIA (11 hr)

Unit 1: The Cerebellum and its motor functions (2 hr):
Unit 2: Anatomical functions, areas of the cerebellum (3 hr):
Unit 3: Function of the cerebellum in overall motor control (2 hr):
Unit 4: The basal ganglia-their motor functions (4 hr): Role of the basal ganglia for cognitive control,functions of neurotransmitters with basal ganglia.

MODULE 4: THE CEREBRAL CORTEX, SLEEP AND TECHNIQUES IN NEUROPHYSIOLOGY (12 hr)

Unit 1: Functions of the specific cortical areas (4 hr): Association areas (parietooccipito temporal, prefrontal and limbic association areas with special emphasis on Wernicke's area and Broca's area), area for recognition of faces, the concept of the dominant hemisphere.
Unit 2: Function of the brain in communication (2 hr): Sensory and Motor aspects of communication
Unit 3: - Sleep (2 hr): Basic theories of sleep, Brain waves, Slow-wave sleep and REM sleep.
Unit 4: Techniques in neurophysiology (4 hr): Brain imaging - CT, MRI, PET, CBF, EEG, Lesioning, and Electrical Stimulation of Brain (ESB).

MODULE 5: PRACTICALS (1 CREDIT, 30 hr) MANDATORY EXPERIMENTS

1. Identification of parts of Brain using charts, models etc.
2. Identification of Brain waves - Slow wave sleep, REM sleep etc.
3. Demonstration of reflexes- Superficial reflexes, Deep tendon reflexes, Primitive or spinal reflexes. Tonic or brainstem reflexes.
4. Demonstration of cranial nerve integrity.
5. Demonstration of motor function.
6. Demonstration of assessment of cognitive function – Memory.
7. Demonstration of assessment of speech and communication.

For conducting the experiments from No. 3 to 7, the students can visit any Physiotherapy clinic or institute, or the teacher can find the help of any professionals from Medical field. The total duration of the institutional visit or the consultation with the professional must not exceed 10 hr. Two experiments other than the listed should be selected by the supervising teacher and introduced to the students.

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.
9. Schneider A.M &Tarshis B. An introduction to Physiological Psychology. Random House, New York.
10. Levinthal C.F. Introduction to Physiological Psychology, Prentice Hall. New Delhi.
11. Pinel PJ John, Biopsychology, Pearson.
12. Neil. R.Carlson, Physiology of behavior, Pearson publishers.
13. Carlson, Neil. R., Physiology of Behavior, 8 th edition, Pearson.

14. Chatterjee, C.C, Human Physiology, Medical Allied Agency.
15. Text book of Medical Physiology – AP Krishna, Scientific publications, New Delhi.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	--	--	--	--	--	3	--	--	--	--	--	--
CO2	--	3	--	--	--	--	3	--	--	--	--	--	--
CO3	--	3	--	--	--	--	3	--	--	--	--	--	--
CO4	--	3	---	--	--	--	3	--	--	--	--	--	--
CO5	--	--	--	3	--	--	--	--	3	--	--	--	--
CO6	--	--	--	--	3	--	--	--	--	--	3	--	--

Level	Correlation
--	Nil
1	Slightly/ Low
2	Moderate/ Medium
3	Substantial/ High

Course code	PSG2MN200				
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					

Course outcome	CO statement	Cognitive level*	Knowledge category #	Evaluation tools used
CO1	Describe the physiological control of thirst and hunger, factors affecting hunger and thirst.	U	F & C	
CO2	Explain importance of sex hormones, causes of stress, and the list of hormones influencing sexual behaviour.	U	F & C	
CO3	Predict the nature of defects caused by the damage or deformity of different parts of eye and ear.	Ap	F & C	
CO4	Describe the sensory pathways for the gustatory, olfactory, thermosensory, pain sensations.	U	F & C	

CO5	Attain skill in doing experiments related to sensory functioning.	Ap	P	
CO6	Prepare report on visiting institutions like, hospitals to study the sensory perception Ap P analysis procedures.	Ap	P	
*- Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Question paper pattern for external examination:
MODULE 1: Short answer 2 x 3= 6 marks, Paragraph 1 x 6 = 6 marks;
MODULE 2: Short answer 3 x 3= 9 marks, Paragraph 2 x 6 = 12 marks, Essay 1 x 10 = 10 marks.
MODULE 3: Short answer 2 x 3= 6 marks, Paragraph 2 x 6 =12 marks, Essay 1 x 10 = 10 marks.
MODULE 4: Short answer 2 x 3= 6 marks, Paragraph 3 x 6 = 18 marks.

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 of

food 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.
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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.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	3	--	--	--	--	3	--	--	--	--	--	--
CO2	--	3	--	--	--	--	3	--	--	--	--	--	--
CO3	--	--	--	--	3	--	3	--	--	--	--	--	--
CO4	--	3	--	--	--	--	3	--	--	--	--	--	--
CO5	--	--	--	3	--	--	--	--	3	--	--	--	--
CO6	--	--	--	3	--	--	--	3	--	--	--	--	--

Level	Correlation
--	Nil
1	Slightly/ Low
2	Moderate/ Medium
3	Substantial/ High