

### BASICS IN CELLULAR PHYSIOLOGY

Programme	B.Sc. Zoology				
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 Biology or the following online courses 1. <a href="https://www.coursera.org/learn/physiology">https://www.coursera.org/learn/physiology</a> 2. <a href="https://learn.utoronto.ca/programs-courses/courses/2159-basic-human-physiology">https://learn.utoronto.ca/programs-courses/courses/2159-basic-human-physiology</a> 3. <a href="https://www.ivyrobes.com/Revise/AnatomyPhysiology/index.php">https://www.ivyrobes.com/Revise/AnatomyPhysiology/index.php</a> 4. <a href="https://www.medicalnewstoday.com/articles/organs-in-the-body#organ-systems">https://www.medicalnewstoday.com/articles/organs-in-the-body#organ-systems</a> 5. <a href="https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/physiologypti.pdf">https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/physiologypti.pdf</a> <a href="https://www.classcentral.com/classroom/youtube-anatomy-physiology-45834/60c82bd43739c">https://www.classcentral.com/classroom/youtube-anatomy-physiology-45834/60c82bd43739c</a>				
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 organelles, the structure of carbohydrates, lipids, proteins, control of gene activity and tissues.	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 the 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 = 9marks, paragraph 2 x 6 =12 marks, Essay1 x10 = 10 marks; Module 2 : short answer3 x 3=9 marks, paragraph 2 x 6 = marks; Module 3 : short answer 2 x 3= 6marks, paragraph2 x 6 = 12marks,; Module 4 : short answer 2 x 3= 6 marks, paragraph2 x 6 = 12marks, Essay 1x10 =10 marks*

### **Module 1: CYTOLOGY (15hrs)**

**Unit 1: Cellular organization(10 Hrs)** -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 Hrs)**- 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 hrs)**

**Unit 1: DNA, the genetic material (5hrs)** 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(3hrs)** – Classical and modern concept, genetic code, introns, exons.

**Unit 3: Morphology of chromosomes(4Hrs)** -size, shape, karyotype, ideogram, kinds of chromosomes; Linkage and crossing over, sex-linked chromosomes .

### **Module 3 : Elements of heredity and variation(12hrs)**

**Unit 1: Mendelian principles (5hrs)**- 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 (7hrs)**- Brief description of other patterns of inheritance and genotype expression-incomplete dominance, co-dominance, multiple alleles, epistasis, pleiotropy.

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#### **Module :4 Mutations and Genetic disorders (6hrs)**

**Unit 1: Mutations (3hrs)**- 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 (3hrs)**- 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 Hrs)**

##### **MANDATORY EXPERIMENTS**

1. Operation and maintenance of Microscopes (Simple and Compound)
2. Observation of cell structure using human cheek epithelial cells.
3. Study of Mitosis using onion root tip.
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.
7. Demonstration of Meiosis using grass hopper 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)
11. Study of sex chromosomal anomalies (Klinefelter's & Turner's)
12. Simple Mendelian traits in humans and its inheritance (Pedegree analysis)

##### **References**

1. Vijayakumaran Nair & Jayaprakash, Cell Biology, Genetics, Molecular Biology, Academia, Thiruvananthapuram.
2. Gupta, P.K., Cell and Molecular Biology, Rastogi Publications, Meerat.
3. Dewitt-Saunders, Biology of the cell. B.Sc. Human Physiology syllabus (CCSS) Complementary course 5
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. Freeman publishers.
8. Verma, P. S. and Agarwal, V. K., Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand and Co. New Delhi.

9. De Robertis, E. D. P. and De Robertis, E. M. F., Cell and molecular Biology, 7 thEdn, HolSaunders International Editions

**Online Sources:**

**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	3	-	-	-	-	3					
CO 2	2	3	-	-	-	-	3					
CO 3	-	2	-	-	3	-	2				3	
CO 4	2	4	-	-	-	-	3					
CO 5	-	-	-	3	-	-	3					
CO 6	-	-	3	-	-	-	3					

**Correlation Levels:**

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