ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER   **ZOOLOGY** TIME:3HRS/WEEK

Z-Ma2-3501(3) **PRINCIPLES OF GENETICS** MARKS:100

w.e.f 2024-2025 (23AK Batch) **SYLLABUS**

# LEARNING OBJECTIVES

* + To provide the background knowledge on the history of genetics and the importance of Mendelian principles.
  + To provide the required knowledge on the gene interactions
  + To acquaint the students, distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance and extrachromosomal inheritance.
  + To understand the principles of sex determination in animals with a reference to human being, and sex-linked inheritance
  + To understand the human karyotyping and the concept of pedigree analysis basics.

**COURSE OUTCOMES**

By the completion of the course the graduate should be able to –

* CO1- K2- Explain the history of genetics, gain knowledge basic terminology of genetics
* CO2- K2- Describe about interaction of genes, various types of inheritance patterns existing in animals with reference to non-Mendelian inheritance.
* CO3- K2- Discuss knowledge on chromosomal inheritance
* CO4- K5- Summarize various aspects of genetics involved in sex determination,
* CO5- K4- Analyze in-depth knowledge on human karyotyping, pedigree analysis and chromosomal disorders concepts of proteomics and genomics

**UNIT-I:**

* 1. History of Genetics- Concepts of Phenotype, Genotype, Heredity, Variation, Pure lines and Inbreed Lines, Laws of Inheritance
  2. Mendelian Principles on Monohybrid cross, back cross and Test cross
  3. Mendelian Principles on Dihybrid cross

# UNIT-II:

* 1. Linkage - Definition, Types of linkage-complete linkage and incomplete linkage, Significance of linkage.
  2. Crossing over - definition; Mechanism of crossing over: Chiasma Interference and coincidence
  3. Gene Interactions: Incomplete dominance, codominance, Pleiotropy
  4. Gene Interactions**:** Lethal alleles, Epistasis, Non- Epistasis.

# UNIT-III:

* 1. Polygenes (Characteristics & examples)
  2. Multiple Alleles (Characteristics and Blood group inheritance)
  3. Rh inheritance erythroblastosis foetalis
  4. Extra chromosomal inheritance- Kappa particles in Paramecium and Torsion (Shell coiling) in snails.

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# UNIT-IV:

* 1. Sex determination- Chromosomal theory and Genic Balance theory
  2. Sex determination- Hormonal, Environmental and Haplo-diploidy types
  3. Sex linked inheritance: X-linked inheritance
  4. Sex linked inheritance: Y-linked & XY-linked inheritance

# UNIT-V:

* 1. Human karyotyping, Pedigree Analysis(basics)
  2. Autosomal Recessive disorder-Sickle cell anaemia – causes, treatment, inheritance pattern, modes of testing and prevention
  3. Autosomal Dominant disorder- Huntington disease-causes, treatment, inheritance pattern, modes of testing and prevention
  4. Basics on Genomics and Proteomic

# Co-curricular activities (Suggested)

* + Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
  + Observation of blood group inheritance in students, from their parents and grandparents
  + Karyotyping and preparation of pedigree charts for identifying diseases in family history
  + Charts on chromosomal disorders

# REFERENCE BOOKS:

* Harper, P. (2010). Practical genetic counselling. CRC Press.Kessler, S. (Ed.). (2013). Genetic counselling: psychological dimensions. Academic Press. 3. Stevenson, A. C., & Davison, B. C. (2016). Genetic counselling. Elsevier.
* Evans, C. (2006). Genetic counselling: a psychological approach. Cambridge University Press.
* References:
* Atlas of Inherited Metabolic Diseases
* Mendelian Inheritance in Man: A Catalog of Human Genes and Genetic Disorders, Victor A. McKusick, Vol I & II
* Stacy L Blachford (Editor) 2001. The Gale Encyclopedia of Genetic Disorders. Gale Group Publishers, Vol.1 (A-L), Vol.II (M-Z).
* Limoine, W.R. and Cooper, D.NB. 1996: Gene Trophy, Bios Scientific Pub.Oxford.
* REFERENCES:
* Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
* Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
* Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
* Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
* Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
* James D. Watson, Nancy H. Hopkins ‘Molecular Biology of the Gene’
* Gupta P.K., ‘Genetics

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