UG Sem 7

Semester: 7	
Course : Major	
Paper Title: Inheritance Biology and Organogenesis	
Paper code: C4MB230732T/P	**Credits: 6**
Hours/week : 7	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Composite	
No of Modules : No modules	

Course Overview: The course is focussed on the understanding basics of eukaryotic genetics. It statss the introduction to Mendelian genetics and extra chromosomal inheritance along with the understanding and analysis of linkage, recombination and linkage mapping . the course helps to understand human genetics, pedigree analysis and polygenic inheritance patterns . The course also provides the basic introduction to plant and animal developmental biology from embryonic stage till the formation of organs

Course Outcome:

1. Remember: To remember the basics of eukaryotic genetics

2. Understand: To understand the introduction to Mendelian genetics and extra chromosomal inheritance.

3. Apply: To Apply the analysis of linkage, recombination and linkage mapping

4. Analyze: To analyse the human genetics, pedigree analysis and polygenic inheritance patterns

5. Evaluate: To evaluate the basic plant and animal developmental biology from embryonic stage till the formation of organs

6. Create: To apply the role of chromosome number and structure changes in inherited genetic disorders

Prerequisites: ***Basic knowledge about any prior course***

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	Characteristics of Chromosomes: Structural organization of chromosomes, concept of euchromatin, heterochromatin, Karyotypes of human chromosome, chromosome banding..	**12**	**CO1, CO2, CO3, CO4, CO5**	**K1, K2, K3, K4, K5**
II.	Structural variations: Variation in chromosome structure and number and structural abnormality in human; Klinefelter, Turner and Down's syndrome.	**12**	**CO2, CO3, CO4, CO5, CO6**	**K2, K3, K4, K5, K6**
III.	Mendelian and extra chromosomal Inheritance: Mendel's Laws, Chromosomal theory of inheritance,	**12**	**CO1, CO2, CO3,**	**K1, K2, K3, K4, K5**

	Concept of dominance, epistasis, suppressors, penetrance and expressivity. Concept of extra nuclear inheritance with examples		**CO4, CO5**	
IV.	Linkage and recombination: Homologous Recombination-function of RecA, RecBCD, Role of Resolvosome; Site Specific Recombination-functions of Recombinase, Integrase, XerCD system, Immunoglobulin gene rearrangement, gene knock out. Cytological basis and molecular mechanism of crossing over, concept of linkage and mapping of genes.	**12**	**CO2, CO3, CO4, CO5, CO6**	**K2, K3, K4, K5, K6**
V.	Human genetics and polygenic inheritance: Pedigree analysis and basics of polygenic inheritance.	**12**	**CO2, CO3, CO4, CO5, CO6**	**K2, K5, K6**
Vi.	Life cycle of model organisms, Cell division, differentiation, determination, cell fate specification	**12**	**CO3, CO4, CO5, CO6**	**K3, K4, K6**
Vii.	Embryogenesis in plants: Production of gametes, embryo sac development and double fertilization in plants; zygote formation, cleavage, establishment of symmetry in plants; seed formation and germination	**12**	**CO1, CO2, CO3, CO4, CO5**	**K1, K2, K2, K4, K5,K6**
Viii.	Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.	**12**	**CO2, CO3, CO4, CO5, CO6**	**K1, K2, K3, K4, K5**
ix.	Embryogenesis in animals: Fertilization in Sea urchin and mammals-production of gametes, sperm-egg recognition, block to polyspermy, Cleavage, blastulation and formation of germ layers in chick embryo.	**12**	**CO2, CO3, CO4**	**K1, K2, K3, K4, K6**
x.	Morphogenesis and organogenesis in animal: Axis specification and pattern formation in Drosophila, development of tetrapod limb	**12**	**CO3, CO4, CO5, CO6**	**K1, K2, K3**
xi.	cheek cells. Variation of chromosome structure after mutagenesis. Study of polytene	**12**		**K1, K2, K3, K4, K5, K6**

	chromosomes using temporary mounts of salivary glands of Drosophila larvae. Identifying different chromosomes using fly genetics. Identification of different stages of life cycle and organ development in Drosophila. Study of meiotic chromosomes. Study of banding pattern using Giemsa and other dyes. Preparation of artificial seeds using somatic embryogenesi			

Text Books

1. Gardner EJ, Simmons, Snustad- Principles of genetics Wiley-India
2. Weaver, Hedrick Genetics 3 rd Ed MacGraw-Hill Education
3. Griffith, Wessler, Lewontin, Carroll Introduction to Genetic Analysis WH Freeman and Co
4. Klug, Cummins, Spencer, Palladino, Concepts of Genetics
5. Developmental Biology (13th Edition) by Michael J.F. Barresi and Scott F. Gilbert. Oxford University Press
6. Principles of Development (7th Edition) by Lewis Wolpert, Cheryll Tickle, and Alfonso Martinez Arias

Suggested readings

2.

3.

4.

Web Resources

https://3billion.io/blog/what-is-pedigree-analysis-and-why-does-it-matter

https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/chromosome-change

Evaluation Theory Theory 60 (45+15) CIA-10+3+2; Practical 40 CA (38+2)

Paper Structure for Theory Semester Exam Module :

End semester Full Marks: 45

Short questions: 5 (each 1 mark) from 7 (5x1=5)

Long questions: 4 (each 10 marks) from 6 (4x10=40)

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	**Remember**: To remember the role of microbial and plant cell components in relation to their physiological function.	K1
CO2	**Understand:** the stress response in bacteria and plants. and analyze, study the formation of bacterial biofilms and their significance.	K2
CO3	**Apply:** To Apply the concept of microbial and plant physiology in managing stress adaptation of microbes and plants.	K3
CO4	**Analyze:** To analyse the role of signalling systems in bacteria and plants in adaptating to environmental stress responses. To analyse the role of culture medium in propagating plants under tissue culture conditions.	K4
CO5	**Evaluate**: To evaluate the techniques of plant tissue culture techniques and apply them in the field of plant biotechnology. To evaluate the role of signaling system and its effect on the genetic control of microbes and plants.	K5
CO6	**Create:** To apply the role of signalling system in creating novel extremophilic bacterial cells, overcoming plant stress and production of transgenic plants.	K6