



JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF GENETICS
B.Sc. VI SEMESTER GENETICS PAPER VII SYLLABUS (2021 NEP BATCH)

GENES AND DEVELOPMENT

COURSE TITLE	GENES AND DEVELOPMENT
COURSE CODE	21VIGT7 (T)
COURSE CREDITS	04
TOTAL CONTACT HOURS	60
DURATION OF ESE	2 ½ Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	40 Marks
END SEMESTER EXAMINATION (ESE)	60 Marks

COURSE OBJECTIVES:

1. To understand the role of model organisms and study the genes involved in early development.
2. To understand different levels of gene regulation in the development of organisms.
3. To learn the different processes in clinical embryology.
4. To acquire the techniques of assisted reproductive techniques.

COURSE OUTCOMES (COs):

At the end of the course the students

1. Acquire knowledge of the processes involved in the Central Dogma of molecular biology.
2. Recognize the differences in gene regulation processes between prokaryotes and eukaryotes.
3. Compare centrifugation and chromatography techniques based on their functions.
4. Identify and use various types of microscopes.
5. Apprehend the technique followed in molecular biology

CO Mapping with Knowledge Levels

CO No.	Course outcomes statement	Knowledge level
1	Will be able to recognise the role of genes in early development.	K1, K2, K4, K5
2	Will be able to conceptualize the molecular and cellular mechanisms controlling early development of organisms.	K1, K2, K4, K5
3	Will obtain knowledge on the various stages and patterns of embryonic stages and developmental patterns.	K1, K2, K3, K4, K5,
4	Will be able to relate recent advances in clinical embryology.	K1, K2, K4, K5, K6
5	Apprehend the technique followed in the assisted reproductive technology	K1, K2, K3, K4, K5, K6

Knowledge Levels- K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 –Evaluate, K6 – Create

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	CO1	CO2	CO3	CO4	CO5
PO1	✓	✓	✓	✓	✓
PO2	✓	✓	✓	✓	✓
PO3					✓
PO4	✓	✓	✓	✓	✓
PO5					
PO6					
PO7	✓	✓	✓	✓	✓
PO8					
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓

Programme Objectives aligned with Graduate attributes

PO1- Knowledge, PO2- Scientific thinking, PO3- Entrepreneurial skills PO4- Analytical skills , PO5- Communication skills, PO6- Social commitment PO7- Research and Inquiry , PO8- Conservation of Environment\ PO9- Employability, PO10- Academic orientation.

UNIT- 1

15 Hrs.

Basic concepts:

Model organisms for genetic analysis: Insect- *Drosophila*, Nematode- *C. elegans*

Amphibian- *Xenopus laevis*; Fish- *Danio rerio* (Zebra fish), Mammals- *Mus musculus*.

Basic concepts of development: - Potency, commitment, specification, induction, competence, determination, and differentiation; Morphogenetic gradients, pattern formation, cell fate and cell lineage.

Nuclear transplantation experiment: *Xenopus* and *Acetabularia*.

Switching genes on and off during development; Tissue specific methylation, Molecular basis of x chromosome inactivation.

Unit - 2

15 Hrs.

Fertilization and Development:

Types of egg (based on amount and distribution of yolk, Presence and absence of shell and based on the type of development). Planes of cleavage, types of cleavage, factors affecting cleavage.

Fertilization and cleavage in frog, importance of Grey Crescent, Blastulation, presumptive areas and fate map in Frog, Morphogenetic movements Gastrulation in Frog, role of organizers, Organogenesis in Frog-Chondrogenesis, neurogenesis and mesodermal differentiation.

UNIT - 3

15 Hrs.

Genetics of embryonic development in Plants, *Drosophila* and mammals:

Apical-basal axis formation, flowering in *Arabidopsis*; Stages of early embryonic development- 2 cells, octant stage and dermatogens stage. Transition from vegetative to floral development, ABC model and homeotic genes, mad box genes. Genetics of anther development and pollen formation.

Development of *Drosophila* body plan: role of maternal genes, polarization of body axes during oogenesis, role of zygotic genes in establishment of body axis, Homeotic gene expression; Imaginal disc and its development.

Pattern formation and gene expression in mammalian embryos: Axes formation and Hox genes; Genetics of gonadal differentiation in humans.

UNIT – 4

15 Hrs.

Clinical Embryology:

Gametogenesis-Spermatogenesis & Oogenesis (Follicular development & ovulation), fertilization, and implantation. Embryonic stem cells and their applications.

Hormonal control of reproduction, Gonadal malformation, and their genetic basis.

Reproductive failure and causes of infertility; Young syndrome and KALIG gene mutation

Assisted Reproductive Technology (ARTs): Intra-uterine insemination (IUI), Superovulation, Embryo transfer, Intra cytoplasmic sperm injection (ICSI), Gamete intra -fallopian transfer (GIFT), Invitro fertilization (IVF), Zygote intra -fallopian transfer (ZIFT).

GENETICS PRACTICAL PAPER 7

COURSE TITLE	GENES AND DEVELOPMENT
COURSE CODE	21VIGT7 (P)
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/Week
DURATION OF ESE	3 Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	25 Marks
END SEMESTER EXAMINATION (ESE)	25 Marks

Experiments

1. Study of types of eggs (insect, frog, Chick. mammal eggs) and cleavage patterns (early cleavage and late cleavage) 02
2. Study of early development in Blastula and Gastrula of frog. 02
3. Isolation and identification of virgin flies using Virgin band in *Drosophila*
 - a. *Melanogaster* 03
4. Isolation and identification of *Drosophila* egg from Yeast media 03
5. Mounting of imaginal discs in *Drosophila* 04
6. Study of early Development – axis formation in *Drosophila* using chart 03
7. Study of Floral meristem development in *Arabidopsis* (ABC model) using chart 02
8. Observation of the chick embryo development using slides (18, 24,36 and 48 hrs development) 02
9. Study of embryogenesis in *Drosophila melanogaster* 03

References

1. HUMAN GENETICS, Gangane S.D. (2001), 2nd edition, Churchill Livingstone Pvt Ltd., New Delhi.
2. Principles of genetics, D. Peter Snustad, Michael J. Simmons. — 6th ed, John Wiley & Sons (2011)
3. GENETICS ESSENTIALS - Concepts & Connections, 6th edition, Benjamin A Pierce, W.H. Freeman andCompany (2009)
4. Genetics: From Genes to Genomes, by Leland H. Hartwell., et al, McGraw-Hill Education; 5th edition(2014)
5. Gene Regulation: A Eukaryotic Perspective, by Professor David Latchman, Garland Science; 1st edition(2002)
6. DNA Repair and Mutagenesis, Errol C Friedberg et al, ASM Press; 2nd edition (2005)
7. HUMAN CYTOGENETICS, Rooney D.E. (2001), 3rd edition, Oxford University Press, London. GENETICS IN MEDICINE, Thompson M.W. et al 5th edition, W.B. Saunders Company, London.
8. GENETIC BASIS OF COMMON DISEASES, King R.A. et al, Oxford University Press.