JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF ZOOLOGY
B.Sc. IV SEMESTER ZOOLOGY PAPER IV SYLLABUS (2024 SEP BATCH)
CELL BIOLOGY, GENETICS AND IMMUNOLOGY

COURSE TITLE	**CELL BIOLOGY, GENETICS AND IMMUNOLOGY**
COURSE CODE	**24IVZL4T**
COURSE CREDITS	**3**
TOTAL CONTACT HOURS	**56 HOURS**
DURATION OF ESA	**3 HOURS**
FORMATIVE ASSESSMENT MARKS	**20 MARKS**
SUMMATIVE ASSESSMENT MARKS	**80 MARKS**

Course Pre-requisite(s): Outcome

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: understanding of cellular architecture and diversity of prokaryotic and eukaryotic cells.

CO2: Acquire a deep insight on the concepts of cell biology and the ultrastructure of cells, structure and function of organelles.

CO3: Illustrate the phases of cell cycle, cell division, reductional division in germ cells.

CO4: To understand the fundamental concepts of immunology including cells and organs of immune system, immune responses, antibody structure, MHC complex and immunization programme.

CO5: Analyze the principles of genetic inheritance and chromosomal variations in organisms and also achieve competence in undergraduate level problem solving skills relevant to the genetics.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	25IVZL4T
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

Content	56 Hrs
Unit - I	**14 hrs**
Cell Biology – 1 • Cell: Discovery of cell, Cell Theory, Ultrastructure of Animal Cell. • Plasma membrane: Structure, Chemical composition and Fluid mosaic model. • Transport across cell membrane: Passive transport (simple and facilitated diffusion; osmosis) and active transport (Na^+- K^+pump), bulk transport. • Components of Cytoplasm, Ultra structure and functions of Mitochondrion, Golgi apparatus, Endoplasmic reticulum, Ribosomes and Lysosomes. • Ultrastructure and functions of Nucleus. • Structural organization of Chromosome. • Chromatin Organization - Nucleosome model.	
Unit – II	**14 hrs**
Cell Biology – 2 • Base composition and structure of DNA and $_t$-RNA. • Types of DNA; RNA – types and functions. • Cell division: Mitosis, significance of mitosis • Cell cycle, its regulation and check points. • Meiosis and its significance, synaptonemal complex, crossing over, chiasma formation. • Apoptosis: Definition, Steps in apoptosis, pathways (intrinsic and extrinsic) and significance. **Genetics – 1** • Genes and Environment: phenocopy, Norm of reactions (Fur colour in Himalayan Rabbit, human twins). • Mendelian Genetics: Terminologies, Mendelian Laws of inheritance - monohybrid and dihybrid, test cross, back cross with minimum 2 problems). • Incomplete Dominance. Gene interaction-Complementary(flower colour in sweet pea) and supplementary gene interactions (coat colour in rat).	
Unit - III	**14 hrs**

Genetics – 2 • Sex Determination: a. Chromosomal basis of sex determination: XX- XY, XX-XO, ZZ-ZW, ZZ-ZO types with examples b. Environmental sex determination- *Bonellia* and Temperature dependent sex determination in Turtles. c. Hormonal control of sex determination -Free martins • Patterns of inheritance: Autosomal Dominant (Eg. polydactyly), Autosomal recessive (Eg. Albinism), X-linked Dominant (Eg. Hypophosphatemia) and X-linked recessive (Eg. Duchene muscular dystrophy). • X – linked inheritance: Eye colour in Drosophila, Colour blindness and Haemophilia in Man. Y – linked inheritance: Hypertrichosis in man. • Pedigree analysis: Definition, Symbols used in pedigree studies, Pedigree construction and analysis (Problems on polydactyly, albinism, colour blindness and haemophilia in Man). • Human karyotyping- Definition, Patau's classification, Karyotypes of normal male and female, Karyotypes of chromosomal aberrations: Aneuploidy - Autosomal (Down's syndrome and Cri-du-Chat syndrome) and Allosomal (Turner's syndrome and Klinefelter's syndrome). • Eugenics: Definition, positive and negative eugenics. Euthenics and Euphenics.	
Unit - IV	**14 hrs**
Immunology • Definition, types of immunity, Innate and acquired immunity, Humoral immunity and cell mediated immunity, First, Second and third line of defense. • Antigen Processing and Presentation- Properties of antigens and haptens (foreignness, molecular size, heterogeneity), B and T cell epitopes and role of B and T lymphocytes in immune response. • Primary and Secondary Immune response. • Introduction to organs of the Immune system – Primary lymphoid organs-Thymus and Bone marrow, Secondary lymphoid organs-Spleen, Lymph Node, GALT and MALT. • Immunoglobulins: Structure of IgG antibody, Types and functions of immunoglobulins. Antibody-Antigen interaction: affinity, avidity, and specificity. • Major histocompatibility complex - Structure of MHC I & II. MHC and its clinical significance with reference to autoimmunity and immunosuppression. • Vaccines: Types and Uses - Immunization (BCG, OPV, Hepatitis B, Tetanus, DPT). Immunization schedules in infants and their importance in public health.	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

BLUEPRINT FOR QUESTION PAPER
Paper IV

Unit	**Teaching (hrs)**	**Number of Questions**			**Total Marks**
		12 (3 Marks)	08 (5 Marks)	04 (10 Marks)	
Unit 1	14	3	2	1	29
Unit 2	14	3	2	1	29
Unit 3	14	3	2	1	29
Unit 4	14	3	2	1	29
Total	**56 hrs**	**12x3=36**	**8x5=40**	**4x10=40**	**116**

IV SEMESTER ZOOLOGY -PAPER IV
CELL BIOLOGY, GENETICS AND IMMUNOLOGY
PRACTICAL

COURSE TITLE	**CELL BIOLOGY, GENETICS AND IMMUNOLOGY PRACTICAL**
COURSE CODE	**24IVZL4P**
COURSE CREDITS	**2**
TOTAL CONTACT HOURS	**48 HOURS (3 hours per week)**
DURATION OF ESA	**3 HOURS**
FORMATIVE ASSESSMENT MARKS	**10 MARKS**
SUMMATIVE ASSESSMENT MARKS	**40 MARKS**

Course Pre-requisite(s): Outcome

Course Outcomes: After the successful completion of the course, the student will be able to:
CO1: To identify the liver parenchyma cells.
CO2: To prepare stained slides and to observe the different stages of Mitosis and Meiosis.
CO3: To study the chromosomal aberrations and understand the karyotyping analysis
CO4: How chromosomal aberrations are inherited in humans by pedigree analysis in families.
CO5: Solve various genetics problems.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	25IVZL4P
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course out comes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X 'in the inter section cell if a course outcome addresses a particular program outcome.

Sl. No.	Practical Contents	15 Units
1.	Isolation and observation of buccal epithelial cells or Liver Parenchyma cells.	1
2.	Differential centrifugation for separation of cellular components.	1
3.	Mitochondrial staining in Yeast cells using Janus Green stain.	1
4.	Squash preparation to study the different stages of Mitosis in root tip of *Allium cepa.*	2
5.	Squash preparation to study the different stages of Meiosis in grasshopper testis or flower buds of Allium *cepa* (virtual/ slides).	2
6.	To check the selective permeability of RBC's using different concentrations of NaCl solution.	1
7.	Widal test/Dot ELISA/ODD.	1
8.	Study of human Karyotype: Normal and Abnormal – Down's syndrome, Klinefelter's syndrome, Turner's syndrome, cri-du-chat syndrome.	2
9.	Pedigree symbols, pedigree construction and analysis - polydactyly, albinism, colour blindness and haemophilia in Man.	2
10.	Genetic problems: Monohybrid cross, Dihybrid cross, incomplete dominance, gene interaction.	2

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment, Test

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class Room Performance / Attendance	05
Total	**10 marks**

References:

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