ಬೆಂಗಳೂರು
ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
ಅಗು ಧೀ ಅಭಿಕೇಶ
BE BOUNDLESS
BENGALURU
CITY UNIVERSITY

BENGALURU CITY UNIVERSITY

Syllabus for

B.Sc. GENETICS (UG)

CHOICE BASED CREDIT SYSTEM (CBCS)

Framed According to the State Educational Policy (SEP 2024)

I & II SEMESTERS
[To be implemented from the academic year 2024-25]

F O R E W O R D

As per the recommendations made by state education policy led by Prof. Sukhdeo Thorat commission, the Karnataka government has reinforced the three-year degree programme from the academic year 2024-25. The new changes come close on the heels of students and colleges who have expressed concerns over the lack of clarity in pursuing a four year programme as per NEP. As per the recommendations, now colleges can offer degrees with three majors with a general degree in all six semesters; three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory. First a course with practical (skill) orientation which is linked to the theoretical major course and is expected to improve employability. Students have to learn two languages: Kannada/ other Indian languages, and English. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non-discrimination and similar values. Two electives that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline based majors. It is recommended that skill enhancement subjects which will give or involve practical experience may be included. It is also suggested that an elementary level research methodology course with a tutorial based on the survey/laboratory be introduced for single subject specialization and deep specialization in 5th and 6th semesters. The examination pattern will be 80:20- 80 for the semester- end exam, and 20 for internal assessment. Likewise, for practical oriented science subjects, the examination pattern will be 40:10- 40 for the semester- end practical exam, and 10 for internal assessment.

The prominent features of the new scheme framework are:

1. Colleges can offer degrees with three majors -three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory.
2. Students have to learn two languages: Kannada/ other Indian languages, and English.
3. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non-discrimination and similar values.
4. One elective that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline based majors.

I am delighted to present curriculum structure pertaining to B. Sc Degree in subject Genetics. I hope that the curriculum structure and syllabus will pave the way for overall development of the student community. I ensure that, students community will procure the benefits at large in higher education

Dr. P Mahaboob Basha

Chairman
BOS (UG) in Genetics
Bengaluru City University

Proceedings of the meeting of BOS in B. Sc Genetics of Bengaluru City University, Bengaluru.

Reference:

1. Constitution of BOS U.O dated 27.08. 2021
2. G.O. ED: 166/UNE/2023, Bangalore dated 08.05.2024
3. U.O. BCU/SYN/OPS/SEP/61/2024-25 dated 14.06.2024

Adverting to above, the recommendations and drafted circulars made by SEP, Government of Karnataka pertaining to reinforcement of three-year degree courses with three majors was circulated by online mode to all the members of BOS along with proposed curriculum subjects for B. Sc Genetics, for scrutiny.

A workshop followed by Board of Studies meeting was held on **25th June, 2024** from 11.00am-5.00 pm, at central college Bengaluru City University, Bangalore to finalize the drafted syllabus pertaining to B.Sc. Genetics in accordance with SEP-2024.

AGENDA 1: Approval of syllabus for B. Sc in Genetics of 1st & 2nd semesters under SEP-2024.

Resolution: The proposed syllabi for BSc in Genetics, both theory and practical as well as the scheme of the examination for I and II semesters are scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.

The meeting ended with a vote of thanks.
Following BOS members attended the meeting

1. **Dr. P. MAHABOOB BASHA**, Prof. of Zoology, Bangalore University, Bangalore-560056. **Chairman**
2. **Mr. CHANDRAPPA**, Associate Prof. of Zoology, GFGC, Yelahanka, Bangalore. **Member**
3. **Mrs. DHANALAKSHMI. N**, Asst. Prof of Zoology, Vijaya College, RV Road, Bangalore. **Member**
4. **Dr. SHUBHA M,** Asst. Professor in zoology, BMS College for Women, Bengaluru. **Member**
5. **Dr. Ms. PAVANA KAMATH**, Asso. Professor in Genetics, Oxford College, Bengaluru **Member Co-opted**
6. **Dr. SHABANA BEGUM**, Professor of Zoology, MCU, Bangalore **Member Co-opted (E)**
7. **Dr. LATHA V,** Asso. Professor in Zoology, MCU, Bangalore. **Member Co-opted**
8. **Dr. MOHAN KUMAR B.S**, Asso. Professor in Zoology MCU, Bangalore. **Member Co-opted**
9. **Dr. ARUN KUMAR**. Asst. Prof of Genetics, Kristujayanti College, Bangalore. **Member Co-opted**
10. **Ms. SALMA**, Asst. Prof of Genetics Sheshadripuram College, Yelahanaka, B'lore. **Member Co-opted**
11. Dr. C.E. THRIVENI. Asso. professor in Zoology, VVpuram, B'lore Member Co-opted

(P. MAHABOOB BASHA)
BOS Chairperson in Zoology &
Genetics(UG)

Dr. P. MAHABOOB BASHA
Professor, Dept. of Zoology
Bangalore University,
Bangalore-560 056, INDIA.

Syllabus for B.Sc. in Genetics

Introduction

The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Genetics and allied courses, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional values which foster rational and critical thinking in the students. This course serves as plethora of opportunities in different fields right from classical to applied Genetics.

PROGRAM OUTCOMES IN B. Sc Genetics (UG)

- **PSO1**-Understand and correlate the concepts of cytology, cytogenetics, Molecular genetics, Human Genetics, Gene Regulation, Developmental Genetics, Plant and Animal cell culture and Applicative Genetics.
- **PSO2**- Understand the basic principles and develop skills for using various Laboratory and analytical instruments and equipment.
- **PSO3**- Perform practical as per laboratory standards in Cytology, cytogenetics, molecular genetics, Human genetics, Developmental genetics, Plant and Animal Cell culture and applicative Genetics.
- **PSO**4- Adapt to Interdisciplinary approach of science.
- **PSO5**- Teamwork and leadership skills including group analysis of data, working together in the research laboratory, joint compositions of written reports, substantive participation in research group meetings, etc.
- **PSO6**- Contributes the knowledge for Nation building.

Program Specific Outcomes:

- **PO1** – Students can gain knowledge on various structure and function of cell organelles.
- **PO2** –Understand and apply the basic principles and applications of cytogenetics.
- **PO3** – Comprehend the structure and function of gene. Understand and analyse the organization of genetic material in prokaryotes and eukaryotes.
- **PO4** – Apply the knowledge and understand the inheritance pattern of genetic diseases, its diagnosis and current trend of treatment and control measures, gain insight to immunology.
- **PO5** – Understand the role of genes in Plant and animal development and correlate the recent advances in clinical embryology.
- **PO6** –Comprehend the genetics basis of evolution.
- **PO7** – Understand and apply various biometrical, computational tools in genetics, Apply the knowledge of genetics in Diagnostics and Genetic Engineering.
- **PO8** – Apply the knowledge of Genetics in Research and development, crop improvement and Animal welfare. Understanding the role of genetic principles in biotechnology, pharmaceuticals and other fields

GRADUATE ATTRIBUTES IN B.Sc. Genetics

Some of the characteristic attributes a graduate in Genetics should possess are:

- Develop fundamental skills required to enter the professional world of Genetics.
- Adapt and appreciate interdisciplinary approach of Research.
- Efficient communication, Critical thinking and problem solving capacity:
- Ethical awareness / reasoning:

BENGALURU CITY UNIVERSITY

DEPARTMENT OF ZOOLOGY/GENETICS

Credit framework for Science Stream (B. Sc) with 3-major subjects (3 + 2 C)

Semester	CORE-1 (T + P)	CORE-2 (T + P)	CORE-3 (T + P)	Elective (E)	Languages (1 & 2)	Compulsory Skill	Total credits
I semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-1 (Constitution Values) = 2	23
II semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-2 (Constitution Values) = 2	23
III semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-1= 2	L-1= 3 L-2= 3		23
IV semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-2= 2	L-1= 3 L-2= 3	Skill-1 = 2 (Pra.knowd.)	25
V semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-2 = 2 (Pra.knowd.)	26
VI semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-3 = 2 (Pra.knowd)	26
Total	36	36	36	4	24	10	146

All numerical may read as credits

Note- **(Two theory): 2** T ^^ with approval from Academic bodies.

Weightage for assessments

Type of Course	**Formative Assessment / IA Marks**	**Summative Assessment Marks**
Theory	**20**	**80**
Practical	**10**	**40**
Projects*		
Experiential Learning (Internships etc.)		

*In lieu of the research Project, two additional elective papers/ Internship may be offered

Credit distribution for the course

BENGALURU CITY UNIVERSITY
DEPARTMENT OF ZOOLOGY

PROPOSED CURRICULUM SUBJECTS FOR B. Sc Genetics (UG) 2024-25

Sem	Paper Code	Title of the paper	Total no. of hours	Hours /week	Marks	Internal Assessment*	Total Marks	Credits
I	DSCGT-1	**Cell Biology**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-1	Practical Cell Biology	45	03	40	10	50	2
II	DSCGT-2	**Cytogenetics**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-2	Practical Cytogenetics	45	03	40	10	50	2
III	DSCGT-3	**Molecular Genetics**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-3	Practical Molecular Genetics.	45	03	40	10	50	2
	*Elective-1 DSGE-**1**^*	***Clinical Genetics***	*45*	*03*	*40*	*10*	*50*	*2*
IV	DSCGT-4	**Developmental Genetics**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-4	Practical Developmental Genetics	45	03	40	10	50	2
	*Elective-1 DSGE-**2**^*	***Bioinstrumentation***	*45*	*03*	*40*	*10*	*50*	*2*
	SKILL-1:	COMPULSORY **(Applied Genetics-I)** TITLE to be decided later						*2*
V	DSCGT-5	**Human Genetics**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-5	Practical Human Genetics	45	03	40	10	50	2
	DSCGT-6	**Evolutionary Genetics**	**52**	**04**	**80**	**20**	**100**	**3**
	SKILL-2:	COMPULSORY **(Applied Genetics-II)** TITLE to be decided later						*2*
VI	DSCGT-7	**Genetic Engineering**	**52**	**04**	**80**	**20**	**100**	**3**
	DSCGP-6	Practical	45	03	40	10	50	2
	DSCGT-8	**Applied Genetics**	**52**	**04**	**80**	**20**	**100**	**3**
	SKILL-3 /Internship	COMPULSORY **(Applied Genetics-III)** TITLE to be decided later						*2*

2

OUT line of blue-print of the Question papers to be prepared
(% of share in each category proposed by GOVT.)

THEORY

- **Short answer questions: 20% - 2x 10 =20**
- **Medium size questions: 40%**
  (to test overall understanding of subject): 6x 5 = 30
- **Essay type questions: 40% 30 3 x 10 = 30**

Total Marks: 80

IA marks: 20

Total: 100

PRACTICALS

Total Practical exam Marks: 40

IA marks: 10

Total: 50

I Semester

THEORY: CELL BIOLOGY

Course Description

Program Name	**B.Sc.**	**I Semester**	
Course Title	**CELL BIOLOGY (Theory)**		
Course Code:	**DSCGT1**	No. of Credits	**3**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 hrs.**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

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

Course Out comes(COs)/(POs)	**DSCGT1**	**DSCGT2**
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

Course Pre-requisite(s): outcome.

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

- **CO1.** Understand the basic principles of different types of Microscopes and its application
- **CO2**. Understand the structure and function of all the cell organelles.
- **CO**3. Comprehend the mechanism of cell division, cellular aging and cell death and its regulation.
- **CO4**. Develop comprehensive understanding on the organization of Prokaryotic and eukaryotic chromosome.

Contents	60 Hrs.
Unit-I	**15**
• Microscopy: Introduction, history, Principle and Optical Components of microscope: Eye piece, Eye piece tube, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm • Types of microscopes: Light microscopes -Simple, Compound and Stereo, • Phase contrast, Fluorescence, electron microscopy- TEM and SEM, Confocal and Optical pathway in different microscopes. Biological applications of Microscopy: High resolution imaging, immune histochemistry, high-content screening and high throughput imaging. Clinical and Forensic applications	
Unit-II	**15**
Ultrastructure and functions of Cytoplasmic organelles: • **Concept of cell: -** Discovery of cell, cell theory, Cell as a basic unit, Classification of cell types – virus, Prokaryotes, eukaryotes, Comparison between plant and animal cells. • **Plasma membrane:** –Fluid mosaic model, chemical composition, functions of plasma membrane –Osmosis, Diffusion, active and passive transport, bulk transport. • **Nucleus:** Morphology, nuclear envelope, nucleoplasm. Nucleolus- Nucleosome model. • **Mitochondria**: -Kreb's cycle, BIS oxidative phosphorylation. • **Other organelles**: Structure and functions of Endoplasmic reticulum, Golgi bodies, Lysosomes, and peroxisomes.	
Unit-III	**15**
• **Ultra structure of Chromosome:** Organization of prokaryotic chromosome, Macro-molecular organization. Ultrastructure of a Chromosome-Primary and Secondary constriction, Telomeres, SAT-bodies, Heterochromatin and euchromatin. Special chromosomes- structure of Polytene and Lampbrush chromosome. Comparison between prokaryotic and eukaryotic chromosome. • **Cell Cycle Regulation**: G1, S, G2 and M phase, Checkpoints. Mitosis: Stages, Mitotic apparatus, cytokinesis, Mitogens and Inhibitors, Significance. Meiosis: Stages, Synaptonemal complex, crossing over and chiasma formation, Significance. **Cell senescence and Cell death:** Cellular features of Senescence- spontaneous and induced, Mechanism of Programmed cell death and its significance. Fundamental processes of necrosis.	
Unit-IV	**15**
• **Chromosomes** – Definition, description of chromatin structure, Eukaryotic Chromosome: Macro-molecular organization. Primary and Secondary constriction, Sat-bodies, Telomeres, Histones, DNA, Nucleosome, Heterochromatin and Euchromatin and its significance. • **Ultra structure of Chromosome** - Nucleosome model, Karyotype and Ideogram. • **Special types of Chromosomes**: Structure and Significance of Special type of Chromosomes: Polytene, Salivary gland chromosome in Drosophila, Lamp brush chromosome in amphibian Oocyte. Supernumerary B Chromosome.	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-15)

Pedagogy: ……

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Classroom Performance/Participation	05
Total	**20 Marks**

PRACTICAL PAPER: CELL BIOLOGY

Course Title	**CELL BIOLOGY (Practical)**	Practical Credits	**2**
Course Code	**DSCGP1**		**45 hrs.**
Formative Assessment	**10 Marks**	Summative Assessment	**40 Marks**

Course Pre-requisite(s):

Course Outcomes (COs):

Course Out comes(COs)/(POs)	**DSCGP1**	**DSCGP2**
I Core competency	X	
II Critical thinking	X	
III Analytical reasoning	X	
IV Research skills	X	
V Team work	X	

At the end of the course the student should be able to:

1. Understand the working principle and application of different types of microscopes.
2. Develop skills for performing temporary squash techniques to study chromosomes and cell division
3. Develop skill for performing cytological experiments
4. Study the structure of cell organelle using vital staining techniques.

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

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

Experiments	45 hrs.
1. Demonstration of optical components of microscope and calculation of numerical aperture.	3 hrs.
2. Demonstration experiments: Fluorescence, laser scanning, Phase contrast, confocal and scanning electron microscopes.	4 hrs.
3. Measurement of cells using Micrometer (plant / animal cells).	6 hrs.
4. Observation of permanent slides to study various stages of mitosis	2 hrs.
5. Study of different stages of mitosis from Temporary squash preparation of onion root tips.	6 hrs.
6. Observation of permanent slides to study stages of meiosis	2 hrs.
7. Study of different stages of meiosis from temporary squash preparation of Onion flower bud/ Grasshopper Testis.	6 hrs.
8. Temporary squash preparation of salivary gland of Drosophila to study Polytene chromosome.	9 hrs.
9. Vital staining of yeast cells to study mitochondria.	3 hrs.
10. Study of the cells using toluidine/methyl green pyronine blue staining.	4 hrs.

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

Note: submission of practical record is mandatory as a part of practical examination.

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class room Performance/Participation	05
Total	**10 Marks**

References	
1	Karp, G. (2009). *Cell and molecular biology: concepts and experiments*. John Wiley & Sons.
2	Russell, P. J., Hertz, P. E., McMillan, B., & Benington, J. (2020). *Biology: the dynamic science*. Cengage Learning.
3	Roberts, K., Alberts, B., Johnson, A., Walter, P., & Hunt, T. (2002). Molecular biology of the cell. *New York: Garland Science*.
4	Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). *The cell: a molecular approach* (Vol. 4). Washington, DC: ASM press.
5	Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. John Wiley & Sons.
6	Singh, S. P., & Tomar, B. S. (2008). *Cell biology*. Rastogi Publications, Meerut, India.
7	Gupta, P.K. (2010). Cytogenetics. Rastogi Publications, Meerut, India.
8.	Veerakumari. L. (2019). Bioinstrumentation. MJP Publishers, Chennai-600005.

SEMESTER-II

THEORY PAPER: Cytogenetics

Program Name	**B.Sc.**	Semester	**II**
Course Title	**CYTOGENETICS**		
Course Code:	**DSCGT2**	No. of Credits	**3**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 hrs.**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Pre-requisite(s):

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

- **CO1:** Understand the Laws of Mendel, gain insight in to various types of gene interaction.
- **CO2:** Gain knowledge on the principles of Linkage and crossing, analyze the construction of genetic map.
- **CO3**: Comprehend the phenomenon of extra nuclear inheritance.
- **CO4:** Gain Knowledge and understand the mechanism of sex linkage and sex determination.
- **CO5:** Understand analyze various structural and numerical chromosomal aberration.

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

Course Out comes(COs)/(POs)	**DSCGT1**	**DSCGT2**
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 intersection cell if a course outcome addresses a particular program outcome.

Contents	**60 Hrs.**
Unit-I	**15 hrs.**
• **History of Genetics:** Concept of allele, gene and genome, Phenotype and Genotype; Heredity, variation, Pure lines and Inbred Lines. Mendelian experiments on pea plants - Law of Segregation; Monohybrid cross, Back cross and Test cross, Law of independent Assortment: Dihybrid cross in pea plant, Back cross and Test cross. • **Multiple Alleles**: Definition, ABO blood groups and Rh factor in Human, Related Genetic Problems. • **Gene Interactions:** Incomplete inheritance and co- dominance, non-epistasis (Comb pattern in fowl). Epistatic interactions-Complementary gene interaction (9:7) (Flower colour in *Lathyrus odoratus*) Supplementary	

gene interaction (9:3:4) (Grain colour in *Zea mays*) Dominant epistasis (Fruit colour in *Cucurbita pepo*) Recessive Epistasis (Coat color in mouse).	
Unit-II	**15 hrs.**
• **Linkage:** Definition of Linkage, Coupling and Repulsion hypothesis, Linkage group- Drosophila, Types of linkage-complete linkage and incomplete linkage, Factors affecting linkage- distance between genes, age, temperature, radiation, sex, chemicals and nutrition. • **Crossing over:** Definition and types of crossing over: Germinal and Somatic crossing over. Stern's experiments in Drosophila, Creighton and Mc Clintock experiment in maize. Molecular mechanism of crossing over - Holiday model. Interference and coincidence, Construction of genetic map (Drosophila). Significance of linkage and crossing over. • **Extra nuclear inheritance:** Characteristic features of Cytoplasmic Inheritance, Mitochondrial DNA, Chloroplast DNA, Sigma factor in Drosophila, Shell coiling in snail. Cytoplasmic Male Sterility (CMS) in maize.	
Unit-III	**15 hrs.**
• **Sex Linkage:** Definition, non – disjunction, Chromosome theory of inheritance. Bridges theory of non-disjunction. Attached X-chromosome. Sex linkage in Drosophila, Poultry. Sex linked inheritance in man (Colour-blindness, Haemophilia). • **Sex Determination** • Chromosome theory of Sex determination: XX-XY, XX-XO, ZZ-ZW, Genic balance theory of Bridges, Intersexes and Super sexes in Drosophila, Y chromosome in sex determination of Melandrium. Environment and sex determination, Hormonal control of Sex determination (Free martins). Gynandromorphs. • Dosage compensation - Lyon's hypothesis, Hyper activation of X in Drosophila and random inactivation in human.	
Unit-IV	**15 hrs.**
Chromosomal aberrations: Numerical: Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy- Autopolyploidy and Allopolyploidy. Aneuploidy- Monosomy, Nullisomy and Trisomy. Structural – Deletions- Notch wing in Drosophila (Terminal, Interstitial), Duplication-Bar eye in Drosophila (Tandem, Reverse tandem and Displaced), Translocation- Rheo discolor (Simple, Isochrome, Reciprocal, Displaced) and Inversions (Pericentric and Paracentric), Inversion heterozygote and polymorphism. Significance of chromosomal aberrations.	

PRACTICAL PAPER: Cytogenetics

Course Title	**CYTOGENETICS (Practical)**	Practical Credits	**2**
Course Code	**DSCGP-2**	Contact Hours	**45 hrs.**
Formative Assessment	**10 Marks**	Summative Assessment	**40 Marks**

Course Pre-requisite(s):

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

Course Out comes(COs)/(POs)	**DSCGP1**	**DSCGP2**
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.

Experiments	**45 hrs.**
1. Culturing and maintenance of *Drosophila.*	**3hrs**
2. Observation of Sexual dimorphism in Drosophila.	**3hrs**
3. Mounting of sex comb in *Drosophila.*	**3hrs**
4. Study of drosophila mutants- body colour mutant, wing mutant and eye mutants.	**3hrs**
5. Study of ABO blood group system in Human.	**3hrs**
6. Genetic problems on Monohybrid, Dihybrid cross, epistasis and No mendelian Inheritance	**6hrs**
7. Genetic problems on Multiple alleleism and sex linkage	**6hrs**
8. Induction of polyploidy in *Allium sepa.*	**6hrs**
9. Study of translocation in *Rheo.*	**6hrs**
10. Preparation of buccal epithelial smear and observation of Barr body.	

References

1	Snustad and Simmons, Principles of Genetics, 6th Edition, 2015 John Wiley Publications
2	William S. Klug (Author), Michael R. Cummings (Author), Charlotte A. Spencer, Concepts of Genetics, 11th Edition ,2019 Pearson Publcation
3	Genetics: A Molecular Approach, 3rd Edition by Peter j Russell, Pearson India, 2016.
4	Brown T A, Genetics: A Molecular Approach, 3rd Edition, Garland Science Publication
5	Gupta P K, Genetics, 5th Edition, Rastogi Publications. 2022.
6	Veer Bala Rastogi, Genetics 4th Edition 2019.
7	Verma P.S. and Agarwal V.K,Genetics, 9th Edition, S.Chand and co.

Formative Assessment for Practical

Assessment Occasion/type	**Marks**
House Examination/Test	05
Classroom Performance/Participation	5
Total	**10 Marks**

Formative Assessment as per NEP guidelines are compulsory

Scheme of Practical Examination

I- Semester

PAPER I: CELL BIOLOGY **[Code: DSCG –P1]**

(Practical based on DSCG-T1)

Duration: 03 hrs. **Max Marks: 40**

Scheme of Valuation

1. Preparation of temporary squash to study Mitosis/ meiosis /Polytene chromosome
   (Preparation -6 marks, Identification-2marks, comment – 4 marks) **(10 marks)**
2. Measure the area of the given cell using micrometry. **(8marks)**
   (calibration and performance:4 marks; calculation & comment-4 marks)
3. Perform vital staining/Toluidine blue/ Methyl green pyronine staining of the given sample.
   (Preparation -3marks, comments – 2 marks) **(5 marks)**
4. Identify and comment on A, B, C and D
   (A&B-Microscopes C&D stages of mitosis/meiosis (**12 marks)**
   (Identification-1 mark; comments-2 marks)
5. Record- (**5 marks)**

II Semester

PAPER II: CYTOGENETICS [Code: DSCG -P2]

(Practical Based on Theory Paper: DSCG-T2)

Duration: 3 hrs. **Max Marks: 40**

Scheme of Valuation

1. Prepare a smear of buccal epithelium to identify Barr body**.** **(12 marks)**
   (Preparation -6 marks, Identification-2marks, comment- 4marks)
2. Prepare a temporary squash of *Allium cepa*/ *Rheo discolor*. (**8 marks)**
   (Preparation -5 marks, Identify & comment- 3marks
3. Mount the sex comb of *Drosophila* / Blood typing - **(7marks)**
   (Preparation -4 marks, comments- 3marks)
4. Genetic problems (Any two- multiple allele/sex linkage, Gene interactions)
   (4x2=8 marks)
5. Record- (**5 marks)**

Scheme of Internal Assessment Marks:

Theory:

Sl. No.	Particulars	IA Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	10
3	Assignments /Seminar / Case Study / Project work / Reports on - Field visits made for observation and collection of data etc.,	05
	TOTAL Theory IA Marks	**20**

Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	05
2	Active participation in practical classes (Attendance)	05
	TOTAL Theory IA Marks	**10**