



BANGALORE UNIVERSITY
Jnanabharathi, Bengaluru-560 056

B.Sc., GENETICS SYLLABUS
(I to II Semesters)

Framed According to the National Educational Policy (NEP 2020)

[To implement from the academic year 2021-22]

Introduction

The curriculum framework for B.Sc. degree in Genetics is structured to offer a broad outline that helps in understanding genetic factors and disorders about promoting health and preventing disease. The course is upgraded keeping in mind the aspirations of students, changing nature of the subject as well as the learning environment. The core concepts within subject have been updated to incorporate the recent advancements, techniques to upgrade the skills of learners. The syllabus under NEP-2020 is expected to enhance the level of understanding among students and maintain the high standards of graduate program offered in the country. Effort has been made to integrate the use of recent technology and MOOCs to assist teaching-learning process among students. The major objective of the graduate program is to elevate the subject knowledge among students, and making them as critical thinkers thereby students can address the issues related to genetics logically and efficiently and helps in securing a career in academia, industry, pharmaceutical research and development in private as well as public sectors. In a nutshell, the course serves as plethora of opportunities in different fields right from classical to clinical genetics.

AIMS AND OBJECTIVES OF UG PROGRAM IN GENETICS

- The Programme offers both classical as well as modern concepts of Genetics in higher education.
- It enables the students to study genetic diversity in both local and global environments.
- To update the concepts concerning genetic diversity among different traits of population, pattern of inheritance.
- To correlate contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tools.
- Bioinformatics and computational tools used in modern sciences will provide ample opportunities to explore different career avenues and provide opportunity to be an entrepreneur.

GRADUATE ATTRIBUTES IN B.Sc. (Hons.) GENETICS

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

- **Disciplinary knowledge and skills**
- **Skilled communication**
- **Critical thinker and problem solving capacity**
- **Logical thinking and reasoning**
- **Team spirit**
- **Leadership quality**
- **Digitally efficacy**
- **Ethical awareness/reasoning**
- **Lifelong learning**

Flexibility

- The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choose a single Major, one Major with a Minor, and one Major with two Minors. Teacher Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.
- One Major subject/discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.
- One Major and one Minor subject/discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities
- Two Major subject/disciplines along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses, including Extracurricular Activities (subject to fulfilling the requirements as stated in 3. i and 3.ii).
- One Major subject/discipline and one Vocational course along with Languages, Generic Electives, Ability Enhancement and Skill Development and courses including Extracurricular Activities.
- One Major Discipline and One Education Discipline along with Languages, Generic Electives, Ability Enhancement and Skill Development Courses including Extracurricular Activities.

• **Weightage for assessments**

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25
Projects*	45	105
Experiential Learning (Internships etc.)		

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

IIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Example: Bachelor of Science (Basic/ Hons.) (with Genetics & Botany as subjects with practicals) with one major and one minor

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective(DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)		Skill Enhancement Courses (SEC)		Total Credits
					Skill based (Credits) (L+T+P)	Value based (Credits) (L+T+P)	
I	Genetics A1(4+2) Botany B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)		SEC-1: Digital Fluency (2) (1+0+2)	Physical Education for Health & Wellness fitness(1)(0+0+2) (1) (0+0+2)	25
II	Genetics A2(4+2) Botany B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)	Environmental Studies (2)		Physical Education - NCC/NSS/R	25
Exit option with Certificate (50 credits)							
III	Genetics A3(4+2) Botany B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs. each)		SEC-2: Artificial Intelligence (2)(1+0+2)	Physical Education- NCC/NSS/R	25
IV	Genetics A4(4+2) Botany B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs. each)	Constitution of India (2)		Physical Education - NCC/NSS/R	25
Exit option with Diploma in Science (100 credits) OR Choose any one of the core subjects as Major and the other as Minor							
V	Genetics A5(3+2) Genetics A6(3+2) Botany B5(3+2)	Vocational-1 (3)			SEC-3: SEC such as Cyber Security (2) (1+0+2)		20
VI	Genetics A7(3+2) Genetics A8(3+2) Botany B6(3+2)	Vocational-2 (3) Internship (2)			SEC-4: Professional Communication (2)		22
Exit option with Bachelor of Science Degree, B. Sc. Degree in Zoology (142 credits) or continue studies with the Major in the third year							
VII	Genetics A9(3+2) Genetics A10(3+2) Genetics A11(3)	Genetics E-1 (3) Genetics E-2 (3) Res. Methodology (3)					22
VIII	Genetics A12(3+2) Genetics A13(3) Genetics A14(3)	Zoology E-3 (3) Research Project (6)*					20
Award of Bachelor of Science Honours Degree, B.Sc.(Hons.) Degree in Genetics (184 credits)							
*In lieu of the research Project, two additional elective papers/ Internship may be offered.							

2. Course Structure

5.1 Credit distribution for the course

Semester	Course Opted	Course Name	Credits
I	Major Core Course-1 (Theory)	Cell Biology and Genetics	4
	Major Core Course-1 (Practical)	Cell Biology and Genetics	2
	Minor Discipline Course -1 (Theory)	Nutritional Genetics	4
	Minor Discipline Course -1 (practical)	Nutritional Genetics	2
	Open Elective Course -1(Theory)	Principles of Genetics	3
	Skill Enhancement (Vocational) Elective Course -1 (Practical)	Genetic Counselling	2
	II	Major Core Course-2 (Theory)	Bio Instrumentation and Animal Cell Culture
Major Core Course-2 (Practical)		Bio Instrumentation and Animal Cell Culture Cell	2
Minor Discipline Course -2 (Theory)		Medical Genetics	4
Minor Discipline Course -2(Practical)		Medical Genetics	2
Open Elective Course -2(Theory)		Genetic Counselling	3
Exit option with certificate in Genetics (50 credits)*			
III	Major Core Course-3 (Theory)	Biomolecules and Molecular Genetics	4
	Major Core Course-3 (Practical)	Biomolecules and Molecular Genetics	2
	Minor Discipline Course -3 (Theory)	Pharmaco-genetics	4
	Minor Discipline Course -3(Practical)	Pharmaco-genetics	2
	Open Elective Course -3(Theory)	Eugenics, Euthenics and Society	3
	Skill Enhancement (Vocational) Elective Course -3 (Practical)	Genetic diagnostics and Public Health	2
IV	Major Core Course- 4 (Theory)	Human Genetics and Genetic Counselling	4
	Major Core Course-4 (Practical)	Human Genetics and Genetic Counselling	2
	Minor Discipline Course –4(Theory)	Medical and Environmental impact on development	4
	Minor Discipline Course –4(Practical)	Medical and Environmental impact on development	2
	Open Elective Course -4 (Theory)	Human Genetic Disorders	3
Exit option with Diploma in Genetics (100 credits)*			
V	Major Core Course-5 (Theory)	Gene Regulation and DNA Repair	3
	Major Core Course-5 (Practical)	Gene Regulation and DNA Repair	2
	Major Core Course-6 (Theory)	Plant cell and Tissue culture Technology	3
	Major Core Course-6 (Practical)	Plant cell and Tissue culture Technology	2
	Minor Discipline Course -5 Theory)	Radiation Genetics	3
	Minor Discipline Course - 5(Practical)	Radiation Genetics	2
	Discipline Specific Elective Course – 5 (Theory)	Clinical Genetics	3
	Vocational Elective Course -1(Practical)	Geno-toxicology	2

VI	Major Core Course- 7 (Theory)	Genes and Development	3
	Major Core Course - 7 (Practical)	Genes and Development	2
	Major Core Course- 8 (Theory)	Population and Evolutionary Genetics	3
	Major Core Course – 8 (Practical)	Population and Evolutionary Genetics	2
	Minor Discipline Course -6 (Theory)	Scientific Communication	3
	Minor Discipline Course -6 (Practical)	Scientific Communication	2
	Discipline Specific Elective Course – 6 (Theory)	Statistical Genetics	3
	Vocational Elective Course -2 (Practical)	Seed Science and Technology	3
	Internship	Research Centers/Industries/Hospitals	2
Exit option with B.Sc. in Genetics (142credits)*			
VII	Major Core Course- 9 (Theory)	Immunology and Immunogenetics	3
	Major Core Course- 9 (Practical)	Immunology and Immunogenetics	2
	Major Core Course- 10 (Theory)	Cancer and Radiation Genetics	3
	Major Core Course- 10 (Practical)	Cancer and Radiation Genetics	2
	Major Core Course- 11 (Theory)	Microbial Genetics and Technology	3
	Major Core Course- 11 (Practical)	Microbial Genetics and Technology	2
	Discipline Specific Elective Course – 7 (Theory)	Animal Biotechnology	3
	Discipline Specific Elective Course – 7 (Theory)	Forensic Genetics	3
	Open Elective	Research Methodology	3
VIII	Major Core Course- 12 (Theory)	Neurogenetics and Neurological disorders	3
	Major Core Course- 12 (Practical)	Neurogenetics and Neurological	2
	Major Core Course- 13 (Theory)	Behavioural Genetics	3
	Major Core Course- 13 (Practical)	Behavioral Genetics	2
	Major Core Course- 14 (Theory)	Plant Breeding	3
	Major Core Course- 14 (Practical)	Plant Breeding	2
	Discipline Specific Elective Course – 8 (Theory)	Plant Biotechnology	3
	Research Project	Based on student interest and teacher expertise	6
Exit option with B.Sc. (Hons) in Genetics (184 credits)*			
IX	Major Core Course- 15 (Theory)	Genetic Engineering and Stem Cell technology	4
	Major Core Course- 15 (Practical)	Genetic Engineering and Stem Cell technology	2
	Major Core Course- 16 (Theory)	Computational Genetics	4
	Major Core Course- 16 (Practical)	Computational Genetics	2
	Discipline Specific Elective Course – 9 (Theory)	Genomics and Proteomics	3
	Skill Enhancement (Vocational) Elective Course -9	Assisted Reproductive techniques	2
X	Major Core Course- 17 (Theory)	Advanced cellular and Molecular Genetics	4
	Major Core Course- 17 (Practical)	Advanced cellular and Molecular Genetics	2

Major Core Course- 18 (Theory)	Animal/ Experimental Genetic System and Pharmacodynamics	4
Major Core Course- 18 (Practical)	Animal/ Experimental Genetic System and Pharmacodynamics	2
Major Core Course- 19 (Theory)	Environmental Genetics	2
Major Core Course- 19 (Practical)	Environmental Genetics	
Discipline Specific Elective Course – 10 (Theory)	Genetic Engineering	3
Skill Enhancement (Vocational) Elective Course -9	Assisted Reproductive techniques	2
Exit option with M.Sc. in Genetics (268 credits)*		

3. CURRICULUM STRUCTURE

CURRICULUM STRUCTURE FOR UNDER GRADUATE DEGREE PROGRAM IN GENETICS

Name of the Degree: B.Sc. (Hons) Specialization: Genetics (I & II sem) Program Articulation Matrix:

This matrix lists only the core courses. Core courses list the courses that are essential for every student to earn his degree. It includes all types of courses (theory, lab, tutorial, Project, Internships, ... that every student of the course).

Sem.	Name of the course (with code)	What all program outcomes the course addresses (not exceeding three per course)	Prerequisite courses	Concurrent course (with code)#	Pedagogy##	Assessment \$
I	Cell Biology And Genetics (DSCC5GE NT1)	<ol style="list-style-type: none"> Understand the structure and function of all the cell organelles. Know about the chromatin structure and its location. Understand the Mendel's laws and the its deviations. 	Life science studied as of the options in 12 th standard	Cell Biology and Genetics (DSCC5GE NP1)	House Examination/Test/ Seminars/ Assignment/ Minor project/ Active learning/ Problem based/Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy,
I	Nutritional Genetics (MDC5GE NT1)	<ol style="list-style-type: none"> Understand relationship between food, microbiome, genome and epigenome. Know how a plateful of meal can control metabolism, prevent diseases and improve health. Learn importance of nutrition and effects of adulterants. 	Life science studied as of the options in 12 th standard	Nutritional Genetics (MDC5GENP1)	House Examination/Test/ Seminars/ Assignment/ Minor project/ Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	Formative/summative assessment, Evaluation/ Result analysis/ Application of Heutagogy,

I	Principles of Genetics (OEC5GENT1)	<ol style="list-style-type: none"> 1. Study historical overview and laws Inheritance. 2. Understand Mendel's principles and deviations. 3. Gene interactions and their outcome through gene mapping. 	Life science studied as of the options in 12 th standard		House Examination/Test/ Seminars/ Assignment/ Minor project/ Active learning/ Problem based/ Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy,
I	Genetic Counseling (VEC5GENP1)	<ol style="list-style-type: none"> 1. Learning methods of genetic testing 2. understanding pedigree construction, analysis and risk calculation 3. intensive practical knowledge of Genetic Counseling. 	Life science studied as of the options in 12 th standard		House Examination/Test/ Seminars/Assignment/ Minor project/ Active learning/ Problem based/Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy
II	Bio-instrumentation & Animal cell Culture (DSCC5GENT2)	<ol style="list-style-type: none"> 1. Understand the basic principles of different laboratory equipments. 2. Know the uses of the analytical equipments in various biological applications. <p>Understand the cell lines and culture media and cell culture methods</p>	Life science Studied as of the options in 12 th standard	Bio-instrumentation & Animal Cell Culture (DSCC5GENP2)	House Examination/Test/ Seminars/Assignment/ Minor project/ Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy
II	Medical Genetics (MDC5GEN T2)	<ol style="list-style-type: none"> 1. Understand genetic basis of human diseases and disease gene identification 2. Have insight of techniques used in medical genetics 3. Have thorough knowledge of gene therapy and its strategies 	Life science studied as of the options in 12 th standard	Medical Genetics (MDC5GENP2)	House Examination/Test/ Seminars/Assignment/ Minor project/ Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy
II	Genetic Counselling (OEC5GEN T2)	<ol style="list-style-type: none"> 1. Genetic counselling methods 2. Reproductive risk calculation 3. Ethical and legal issues of genetic counselling 	Life science studied as of the options in 12 th standard		House Examination/Test/ Seminars/Assignment/ Minor project/ Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	Formative /summative assessment, Evaluation/ Result analysis/ Application of Heutagogy

**I SEMESTER B.SC., GENETICS (HONS) THEORY SYLLABUS
DISCIPLINE SPECIFIC CORE COURSE DSCC
THEORY PAPER: DSCC5GENT1: CELL BIOLOGY AND GENETICS**

Course Title: Cell Biology and Genetics Code DSCC5GENT1	Course Credits:04
Total Contact Hours: 56	Duration of DSC: 4Hours
Formative Assessment Marks: 40	Summative Assessment Marks:60

Course Outcomes:

By the end of the course the students will be able to

1. Understand the structure and function of all the cell organelles.
2. Know about the chromatin structure and its location.
3. Understand the Mendel's laws and its deviations.

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

Course Outcomes (COs) / Program Outcomes (POs)		1	2	3	4	5	6	7	8	9	10	11	12
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 outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Course Content

Chapter	Content	Hours
	Unit - 1	14
01	Ultrastructure, chemical composition and functions of Plasma membrane. Ultrastructure and functions of Cytoplasmic organelles: Mitochondria, Krebs' cycle, BIS oxidative phosphorylation, Endoplasmic reticulum, Ribosomes, Lysosomes, Golgi bodies and Cytoskeleton.	
02	Nucleus: Morphology, nuclear envelope, nucleoplasm, nucleolus and chromatin.	

03	Ultra structure of Eukaryotic Chromosome: Macro-molecular organization- Nucleosome model. Primary and Secondary constriction, SAT-bodies, Special chromosomes- structure and function of Polytene and Lampbrush chromosome	
Chapter	Unit – 2	14
04	Molecular Basis Cell Cycle and Cell Division: 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.	
05	Cell senescence and Cell death: cellular features of Senescence- spontaneous and induced, Programmed cell death, Mechanism of cell death and significance.	
06	Cancer Biology: Introduction to cancer, Benign and malignant, Sarcoma, Carcinoma, Lymphoma and leukemia, Properties of malignant cells.	
Chapter	Unit – 3	14
07	Biography of Mendel and his experiments: Law of Segregation: Monohybrid cross, back cross and Test cross, Genetic Problems related. Law of Independent Assortment: Dihybrid cross, Back cross and Test cross, Genetic Problems related.	
8	Multiple Alleles: Definition, ABO blood groups and Rh factor in Human, Genetic Problems related.	
9	Gene Interactions: Deviations from Mendelism: Incomplete inheritance and co-dominance, Complementary gene interaction (9:7), Supplementary gene interaction(9:3:4), Recessive Epistasis, Non-Epistasis (with an example for each trait)	
Chapter	Unit – 4	14
10	Linkage: Linkage definition, cis and trans arrangement of genes, Linkage group in <i>Drosophila</i> and man. Types of linkage – complete and incomplete linkage maps. Linkage map – E.g. <i>Drosophila</i> , construction of linkage maps. Crossing over - Types, mechanism of crossing over, interference and coincidence, Factors affecting linkage and crossing over, significance of linkage and crossing over.	
11	Human Cytogenetics: Normal Human karyotype (Male & Female)	
12	Clinical features and Karyotype of Syndromes: Cri-du-chats, Down's, Edward's, Patau's, Turner's, and Klinefelter's.	

Text Books:

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. Singh, S. P., & Tomar, B. S. (2008). *Cell biology*. Rastogi Publications, Meerut, India.
4. Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). *The cell: a molecular approach* (Vol. 4). Washington, DC: ASM press.
5. Gupta, P.K. (2010). *Cytogenetics*. Rastogi Publications, Meerut, India.
6. Lewin, B., Krebs, J., Kilpatrick, S. T., & Goldstein, E. S. (2011). *Lewin's genes X*. Jones & Bartlett Learning.

References:

1. Pierce, B. A. (2012). *Genetics: a conceptual approach*. Macmillan publication.
2. Roberts, K., Alberts, B., Johnson, A., Walter, P., & Hunt, T. (2002). *Molecular biology of the cell*. New York: Garland Science.
3. Lodish, Harvey, et al. *Molecular cell biology*. Macmillan, 2008.
4. Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. John Wiley & Sons.

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	20
Seminars/Assignment/ Minor project	15
Participation in class/ Attendance	05
Total	40

**I SEMESTER B.SC., GENETICS (HONS) PRACTICAL SYLLABUS
DISCIPLINE SPECIFIC CORE COURSE– DSCC
PRACTICAL PAPER: CELL BIOLOGY AND GENETICS/DSCC5GENP1**

Course Title/Code: Cell Biology and Genetics / DSCC5GENP1	Course Credits:02
Total Contact Hours: 56	Duration of MD: 4 Hours
Formative Assessment Marks: 25	Summative Assessment Marks:25

By the end of the course the students will be able to

1. Learn techniques in cytogenetics
2. Solve problems on mendelian genetics and its deviation
3. Prepare and analyse the karyotype of normal and syndromic individuals.

Course content

Paper Code	Practical	Credits:2 Hours 56
MDS GENP 1	<ol style="list-style-type: none"> 1. Preparation of pre-treating / fixing agents/ stains for cytological studies. 2. Study of Mitosis using root tips 3. Study of Meiosis using flower buds/ grasshopper testes 4. Preparation of salivary gland chromosomes in <i>Chironomous</i> larvae 5. Preparation of salivary gland chromosomes in <i>Drosophila</i> larvae 6. Blood typing in humans for multiple alleles and Rh factor 7. Histological study of Cancer types using permanent slides 8. Genetic Problems on Monohybrid cross, 9. Genetic Problems on Dihybrid cross 10. Genetic Problems Non-Mendelian Interactions. 11. Problems on Linkage and crossing over. 12. Interference and coincidence. 13. Problems based on construction of genetic map. 	

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	10
Seminars/Assignment/Minor Project	10
Attendance	05
Total	25

**I SEMESTER B. Sc. GENETICS (HONS) THEORY SYLLABUS
OPEN ELECTIVE OEC
THEORY PAPER: OEC5GENT1: PRINCIPLES OF GENETICS**

Course Title: Principles of Genetics Code: OEC5GENT1	Course Credits:03
Total Contact Hours: 42	Duration of OEC: 3 Hours
Formative Assessment Marks: 40	Summative Assessment Marks:60

Course Outcomes (COs):

Upon successful completion, each student will have the basic knowledge:

1. Historical overview and laws Inheritance.
2. Understand Mendel's principles and deviations.
3. Gene interactions and their outcome through gene mapping.

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

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
VI. Core competency	x											
VII. Critical thinking	x											
VIII. Analytical reasoning	x											
IX. Research skills	x											
X. Team work	x											

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.

Course Content

	Content	Hours
Chapter	Unit – 1	42
01	History of Genetics: Pre- Mendelian genetic concepts; Concepts of Phenotype and Genotype; Heredity, variation, Pure lines and Inbred Lines Biography of Mendel; Mendelian experiments on pea plants - Law of Segregation; Monohybrid cross, Back cross and Test cross, genetic problems related. Law of Independent Assortment: Dihybrid cross in pea plant, Back cross and Test cross, genetic problems related.	14

02	Multiple Alleles: Definition, ABO blood groups and Rh factor in Human, Genetic Problems related. Deviations from Mendelism - Incomplete inheritance and Codominance; Inter allelic- Complementary gene interaction (9:7) Ex: <i>Lathyrus odoratus</i> ; Supplementary gene interaction (9:3:4) Ex: Grain color in Maize; Epistasis - Dominant Ex.: Fruit color in <i>Cucurbita pepo</i> , Recessive Inheritance-Ex.: Coat color in Mice. Non- Epistasis - Ex.: Comb pattern in Poultry.	
03	Gene mapping: Linkage - Definition, Linkage group- <i>Drosophila and</i> man; Types of linkage-complete linkage and incomplete linkage, Significance of linkage. Linkage maps: Crossing over - definition; recombination and recombination frequency, Mechanism of crossing over: Chiasma Interference and coincidence; Coupling and Repulsion hypothesis.	
Chapter	Unit – 2	14
04	Sex Determination: Chromosome theory of Sex determination: XX- XY, XX-XO, ZZ-ZW; Intersexes and Super sexes in <i>Drosophila</i> , Y chromosome in sex determination of <i>Melandrium</i> .	
05	Genetic and Hormonal control of Sex determination: Genic balance theory of Bridges, Gynandromorphs, Environment and sex determination.	
06	Sex chromosomes and Dosage compensation:	
Chapter	Unit – 3	14
07	Extra Chromosomal Inheritance: Characteristic features of Cytoplasmic Inheritance; Inheritance of- Mitochondrial DNA, Chloroplast DNA, Kappa particles in <i>Paramecium</i> , Sigma factor in <i>Drosophila</i> , Shell coiling in snail.	
08	Behavioral Genetics: Introduction to Genetics and Behaviour, Mating behavior in <i>Drosophila</i> , Hygienic behavior in Honeybee, Nesting behavior in Ants, Territoriality and conflict behavior in Primates.	
09	Microbial Genetics: Transformation, Conjugation, Lytic cycle, Lysogeny, Transduction, Gene mapping by Conjugation and Transduction.	

Text Books:

1. Concepts of Genetics. Klug, WS., Cummins, MR., Spencer, C., Palladino, MA. 2020. 10th Edition. Pearsons Publication.
2. Genetics: A Conceptual approach. Benjamin A. Pierce. 2000. 7th edition. McMillan Publication.
3. Genetics From Genes to Genomes. Hartwell. L., Michael. L Gold berg., Anne E. Reynolds and Lee. M. Silver. 2009. 4th Edition. Mc Graw Hill Publication.
4. Genetics: Analysis & Principles. Robert J. Brooker 7th Edition. Mc Graw Hill Publication.
5. Genetics: Analysis of Genes and Genomes. Daniel L. Hartl 2014. 5th Edition Jones and Bartlett Publishers. Inc.
6. Principles of Genetics. Snustad Simmons. 2008. 6th Edition. John Wiley Publication.
7. Trun, N., & Trempy, J. (2009). Fundamental bacterial genetics. John Wiley & Sons.
8. Streips, U. N., & Yasbin, R. E. (Eds.). (2004). Modern microbial genetics. John Wiley & Sons.

References:

1. Advanced Genetics. G. S. Miglani. Alpha Science International, Ltd. 2012.
2. Fundamentals of Biostatistics. 2nd Edition. Khan & Khanum. 2004. Ukaaz publications.
3. Principles of Genetics, 7th Edition, Robert H. Tamarin. 2002. Tata- Mc Graw Hill Publications.
4. Theory and Problems of Genetics. W. D. Stansfield. 2002. Mc Graw Hill Publications.
5. Chromosomal Aberrations: Basic and Applied aspects by Obe.G. and A.T. Natarajan (1990) Springer Verlag, Berlin.
6. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha , Vikas Publishing House Private, Limited, 1998.
7. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.
8. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.
9. Genetic Maps, 6th edition by O'Brien, S (1993)
10. Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.
11. Principles of Genetics by E.J.Gardener, M.J.Simmons and D.P.Snustad.J.Wiley and Sons pubs (1998).

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	20
Seminars/Assignment/ Minor project	15
Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	05
Total	40

**I SEMESTER B.SC., GENETICS (HONS) PRACTICAL SYLLABUS
SKILL ENHANCEMENT (VOCATIONAL) ELECTIVE COURSES-SEEC
PRACTICAL PAPER: VEC5GENP1: GENETIC COUNSELING**

Course Title: Genetic Counseling Code: VEC5GENP1	Course Credits: 02
Total Contact Hours: 56	Duration of ESA: 04
Formative Assessment Marks: 25	Summative Assessment Marks: 25

Course Outcomes (COs):

At the successful completion of the course students will have

1. Learned methods of genetic testing
2. Mastered pedigree construction, analysis and risk calculation
3. Intensive practical knowledge of Genetic Counseling.

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

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
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 outcomes whose attainment is attempted in this course. Mark „X” in the intersection cell if a course outcome addresses a particular program outcome.

Paper Code:	Content	Credit-02 Hours - 56
VEC5GENP1	<ol style="list-style-type: none"> 1. Blood grouping and Rh in humans 2. Hemoglobin electrophoresis (paper electrophoresis) 3. Detection of inborn errors of metabolism– mucopolysaccharidosis, Galactosemia, PKU. 4. Human karyotyping 5. Demonstration of prenatal diagnosis 6. Chorionic villi sampling demo or virtual lab 7. Amniocentesis demo or virtual lab 8. Demonstration of Ultrasonography 9. Scoring dysmorphic features in syndromic patients 10. Genetic Counseling methods based on case history 11. Construction and analysis of Pedigree 12. Risk calculation 13. Assessment of inheritance of quantitative characters 14. To study the communication process of Genetic counseling for genetic testing. 	

Textbooks:

1. Harper, P. (2010). Practical genetic counselling. CRC Press.
2. Kessler, S. (Ed.). (2013). Genetic counselling: psychological dimensions. Academic Press.
3. Stevenson, A. C., & Davison, B. C. (2016). Genetic counselling. Elsevier.
4. Evans, C. (2006). Genetic counselling: a psychological approach. Cambridge University Press.

References:

1. Atlas of Inherited Metabolic Diseases.
2. Mendelian Inheritance in Man: A Catalog of Human Genes and Genetic Disorders, Victor A. McKusick,.2 Vol I & II
3. Stacy L Blachford (Editor) 2001. The Gale Encyclopedia of Genetic Disorders. Gale Group Publishers, Vol.1 (A-L), Vol.II(M-Z).
4. Limoine, W.R. and Cooper, D.NB. 1996: Gene Trophy, Bios Scientific Pub.Oxford.

Databases:

1. Online Mendelian Inheritance in Man (OMIM)
2. Pictures of Standard Syndromes and Undiagnosed Malformations (POSSUM)
3. London Dysmorphology Database (LDDDB)

Course Books published in English and Kannada may be prescribed by the Universities and College

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	10
Seminars/Assignment/Minor Project	10
Attendance	05
Total	25

**II SEMESTER B.SC., GENETICS (HONS) THEORY SYLLABUS
DISCIPLINE SPECIFIC -DSC
THEORY PAPER: DSCC5GENT2- BIOINSTRUMENTATION AND ANIMAL CELL
CULTURE**

Course Title: Bioinstrumentation and Animal Cell Culture Code: DSCC5GENT2	Course Credits: 04
Total Contact Hours: 56	Duration of ESA: 3 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, the students will be able to:

4. Understand the basic principles of different laboratory equipments.
5. Know the uses of the analytical equipments in various biological applications.
6. Understand the cell lines and culture media and cell culture methods

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

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
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 outcomes whose attainment is attempted in this course. Mark „X” in the intersection cell if a course outcome addresses a particular program outcome.

Course Content

	Content	Hours
Chapter	Unit – 1	56
		14
1.	Microscopy: Introduction, and history of Microscopy 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.	
2.	Types of microscopes: Simple and Compound microscopes, Light microscopes, Fluorescence, electron microscopy (transmission and scanning), Phase contrast, Confocal, Stereo microscopy, Optical pathway in different microscopes.	
3.	Uses of microscopy and biological applications: High resolution imaging, immune histochemistry, high-content screening and high-throughput imaging, Medical science, Forensic laboratories.	
Chapter	Unit – 2	14
04	Analytical Instruments: pH meter- principle and components of pH meter. Thermometer: principle, types of thermometers-digital, mercury, strip-type, Infrared, Axillary.	
05	Colorimeter: principles of measurement and applications. Spectrophotometer: Beer-Lambert's Law in spectrometry, UV spectrophotometers, Atomic absorption spectroscopy (AAS), Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) Spectrophotometers, Flame photometer.	
06	Different types of sterilization methods: Autoclave, steam sterilizers, dry heat sterilizers and ovens and UV chambers.	
Chapters	Unit – 3	14
07	Instruments used in separation techniques: Centrifugation: Principle and applications of centrifuge, types of centrifuge-high speed centrifuge, ultra-centrifuge, Refrigerated centrifuge. Rotors: Types of rotors- vertical, Swing-out, Fixed angle.	
08	Chromatography: Principle, types and application of Chromatography-paper chromatography, ion exchange, gel filtration, HPLC, affinity chromatography.	
09	Electrophoresis: Principle and applications of electrophoresis. Types of electrophoresis: vertical and horizontal. Components: Electrodes, Power supply, electrophoresis chamber	

Chapter	Unit – 4	14
10	Animal cell culture: Principles of cell culture, cell types, cell lines, Primary culture, secondary culture, cryopreservation, contaminations, organotypic culture	
11	Requirements in Animal Cell Culture: Equipments used in Cell culture, Culture vessels, Aseptic techniques. Cell culture media: Natural and defined, role and components of serum in culture. <i>In vitro</i> transformation of animal cells, Types of cell culture.	
12	Applications of cell culture: Cell culture in biomedical research, karyological studies, amniocentesis, mutagenesis, Cytotoxicity assays.	

Text Books:

1. Alberts B, Johnson A, Lewis J, et al. "Molecular Biology of the Cell", 2002, 4th edition, New York: Garland Science.
2. Lodish H, Berk A, Zipursky SL, et al. "Molecular Cell Biology". 2000, 4th edition. New York: W. H. Freeman.
3. R. Freshney, "Culture of Animal Cells-A Manual of Basic Technique and Specialized Applications", 2015, Seventh edition, Wiley Blackwell.
4. John M. Davis, "Animal Cell Culture: Essential Methods" 2011, John Wiley & Sons Ltd.
5. A. J. Ninfa and D. P. Ballou, *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*, 1998 2nd Edition Wiley.
6. J. Sambrook and D. W. Russell, *Molecular Cloning: A Laboratory Manual*, 2001, 3rd Edition Cold Spring Harbor Laboratory Press.

References:

1. Bronzino, J. D. (1986). Biomedical engineering and instrumentation. PWS Publishing Co...
2. Willard Van Nostrand, "Instrumental Methods of Analysis"-
3. Sharms, "Instrumental Methods", S Chand & Co.
4. Harry Bronzino E, "Handbook of Biomedical Engineering and Measurements", Reston, Virginia.
5. Jacobson & Websler, "Medicine & Clinical Engg"
6. Leslie Cromwell, "Biomedical Instrumentation and Measurements"
7. Geddes & Baker, "Principles of Applied Biomedical Instrumentation" Wiley.

Course Books published by College teachers may be used

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	20
Seminars/Assignment/ Minor project	15
Attendance	05
Total	40

**II SEMESTER B.SC., GENETICS (HONS) PRACTICAL SYLLABUS
DISCIPLINE SPECIFIC CORE COURSE - DSCC
PRACTICAL PAPER: DSCC5GENP2: BIOINSTRUMENTATION AND ANIMAL
CELL CULTURE**

Course Title: Bioinstrumentation and Animal Cell Culture Code: DSCC5GENP2	Course Credits: 02
Total Contact Hours: 56	Duration of ESA: 4 Hours
Formative Assessment Marks: 25	Summative Assessment Marks: 25

Course Outcomes (COs):

At the end of the course, the students will be able to:

1. Understand the lab safety and maintenance of different laboratory equipments.
2. Operate different laboratory equipments.
3. Handle and culture different cell lines.

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

Course Outcomes (COs) / Program Outcomes (POs)		1	2	3	4	5	6	7	8	9	10	11	12
I.	Core competency	x											
II.	Critical thinking	x											
III.	Analytical reasoning	x											
IV.	Research skills	x											
V.	Team work	x											

Course Content

Chapter	Content	Hrs
	<u>Unit - 1</u>	56
	<ol style="list-style-type: none"> 1. Demonstration of optical Components of microscope: Eye piece, Eye piece tube, Nose piece, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm. 2. Fluorescence Microscopy: viewing cells stained with fluorescent dyes. 3. Demonstration experiments on, laser scanning, Phase contrast, confocal and scanning electron microscopy. 4. Preparation of buffers using pH meter. 5. Temperature recording using Thermometer 6. Colorimetric estimation of proteins 7. Protein estimation by Bradford reagent method. 8. Demonstration of Beer-Lambert's Law in spectrometry 9. Recording ultraviolet absorption spectra for DNA 10. Demonstration of UV spectrophotometers, Atomic absorption spectroscopy, Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) Spectrophotometers, Flame photometer. 11. Chromatography: size exclusion chromatography of a crude mixture of proteins using standard matrix and dyes 12. Demonstration of components of different centrifuges. Rotors: Types of rotors- vertical, Swing-out, Fixed angle. 13. Agarose electrophoresis of DNA 14. SDS-PAGE electrophoresis of proteins 15. Demonstration of cell culture and cell lines. 16. Demonstration of sterilization methods: Autoclave, steam sterilizers, dry heat sterilizers and ovens and UV chambers. 	

Text Books:

1. Alberts B, Johnson A, Lewis J, et al. "Molecular Biology of the Cell", 2002, 4th edition, New York: Garland Science.
2. Lodish H, Berk A, Zipursky SL, et al. "Molecular Cell Biology". 4th edition. New York: W. H. Freeman; 2000.
3. R. Freshney, "Culture of Animal Cells-A Manual of Basic Technique and Specialized Applications", 2015, Seventh edition, Wiley Blackwell.
4. John M. Davis, "Animal Cell Culture: Essential Methods" 2011, John Wiley & Sons Ltd.
5. A. J. Ninfa and D. P. Ballou, *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*, 1998 2nd Edition Wiley.
6. J. Sambrook and D. W. Russell, *Molecular Cloning: A Laboratory Manual*, 2001, 3rd Edition Cold Spring Harbor Laboratory Press.

References:

1. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engg . , Boston.
2. Willard Van Nostrand, "Instrumental Methods of Analysis"-
3. Sharms, "Instrumental Methods", S Chand & Co.
4. Harry Bronzino E, "Handbook of Biomedical Engineering and measurements", Reston, Virginia.

Course Books published by College teachers may be used

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	10
Seminars/Assignment/Minor Project	10
Active learning/Problem based/Review Writing/ Paper presentation	05
Total	25

**II SEMESTER B.SC., GENETICS (HONS) THEORY SYLLABUS
OPEN ELECTIVE COURSE-OEC
THEORY PAPER: OEC5GENT2: GENETIC COUNSELLING**

Course Title/Code: Genetic Counselling / OEC5GENT2	Course Credits:03
Total Contact Hours: 42	Duration of OEC: 3 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

Upon successful completion, each student will have the basic knowledge of

1. Genetic counselling methods
2. Reproductive risk calculation
3. Ethical and legal issues of genetic counselling

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

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
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 outcomes whose attainment is attempted in this course. Mark „X’ in the intersection cell if a course outcome addresses a particular program outcome.

Course Content:

Chapter	Content	Hours
		42
	Unit – 1	14
01	Genetic Counselling: Introduction; Historical over view, types and scope. Counsellor: Definition, Role, Qualities and responsibilities; Consultant- Definition, needs, Rights.	
02	Individual counselling: Definition, objectives, important issues in genetic counselling, Counselor’s background, cultural knowledge, health benefits, family issues, building rapport, empathy in family.	

03	Group counselling: Definition, objectives, types of groups, theoretically oriented group counselling; Behavioral counselling; Transactional counselling; Group crisis intervention. Family counselling – Definition, objectives, selecting family therapy as the method of choice, family counselling theories and psychoanalytical therapies.	
Chapter	Unit – 2	14
04	Process of Genetic Counselling: Information gathering, medical evaluation, Physical examination and investigations. Medico legal case - Diagnosis based on medical history (Past medical, social and family history); Risk Psychological aspects of counselling: assessments – Communication, discussion of options.	
05	Psychological aspects of counselling: Role of social workers; Nutritional; occupational; Physical; Speech therapist; Psychologists and school professional in genetic counselling. Educating the consultant; Presenting the Risks, Options and Guiding; Diagnostics problems in Genetic counselling; Indications for genetic counselling and genetic counselling case management	
06	Reproductive risk assessments: Reproductive failures; consanguinity; endogamous marriages and its impact on genetic disorders.	
Chapter	Unit – 3	14
07	Registries for Genetic Counselling: Registries and support groups for rare medical disorders; Principles of predictive counselling and testing in late onset disorders imparting results of predictive testing; Counselling and management in follow up sessions.	
08	Ethical concerns in genetic counselling: Ethical issues in testing of minors; Prenatal diagnosis in late onset disorders; Ethical, legal and social issues (ELSI).	
09	Acts and amendments: The medical termination of pregnancy act 1971; The Pre- natal diagnostic techniques act 1994; Regulatory bodies of Genetic counselling – BGCI (India); ABGC (USA); CAGC (Canada).	

Text books:

1. Doing a literature review in health and social care: a practical guide, Helen Aveyard (2014).
2. Doing your research project: a guide for first-time researcher, Judith Bell with Stephen Waters (2014).
3. Facilitating the genetic counseling process: practice-based skills. Patricia McCarthy Veach, Bonnie S. LeRoy and Nancy P. Callanan (2018).

4. Family communication about genetics: theory and practice, Clara L. Gaff and Carma L. Bylund (2010).
5. Foundations of perinatal genetic counseling: a guide for counselors, Amber Mathiesen and Kali Roy (2018).
6. Gardner and Sutherland's chromosome abnormalities and genetic counselling, R.J. McKinlay Gardner and David J. Amor (2018).
7. Genetic counseling: ethical challenges and consequences, Dianne M. Bartels, Bonnie S. LeRoy, and Arthur L. Caplan (2011).
8. Genetic counseling for adult neurogenetic disease: a casebook for clinicians, Jill S. Goldman (2015).
9. Genetic counseling research: a practical guide, Ian M. MacFarlane, Patricia McCarthy Veach, Bonnie S. LeRoy (2014).
10. A guide to genetic counselling, edited by Wendy R. Uhlmann, Jane L. Schuette, Beverly M. Yashar (2009).

References:

1. Helping the client: a creative practical guide, John Heron (2001).
2. How to read a paper: the basics of evidence-based medicine, Trisha Greenhalgh (2014).
3. Make it stick: the science of successful learning, Peter C. Brown, Henry L. Roediger and Mark A. McDaniel (2014).
4. Normative and pragmatic dimensions of genetic counseling: negotiating genetics and ethics, Joseph B. Fanning (2016).
5. Practical genetic counselling, Peter S. Harper (2010).
6. Thompson & Thompson genetics in medicine, Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard, Ada Hamosh (2016).

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	20
Seminars/Assignment/ Minor project	15
Active learning/Problem based/Review Writing/ Paper presentation/ Case studies	05
Total	40

**Course pattern and scheme of examination for B.Sc./ B.Sc. (Hons.)
as per NEP (2021-22 onwards)
Subject: GENETICS**

SL No.	Semester	Title of the paper	Teaching hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (hours)		Total Marks / paper	Credits	
				Theory	Practical	Theory			Practical			Theory	Practical		Theory	Practical
						Max.	MIN.	IA	Max.	MIN.	IA					
1	I	CORE subject	56	4	4	60	22	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	-	3	50	-	2
2	II	CORE subject	56	4	4	60	22	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	-	3	50	-	2

Scheme of Internal Assessment Marks: Theory

Sl. No.	Particulars	IA Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	20
3	Assignments /Seminar / Case Study / Project work / Reports on - Field visits made for observation and collection of data etc.,	15
	TOTAL Theory IA Marks	40

Scheme of Internal Assessment: Marks Practicals

Sl. No.	Particulars	IA Marks
1	Practical Test	05
2	Submission of Project Report	05
3	Viva-voce on project report	05
4	Active participation in practical classes (Attendance)	05
5	Practical Record(s)	05
	TOTAL Theory IA Marks	25

I semester B.Sc. Genetics (HONS) Major core course-1
SCHEME OF PRACTICAL EXAMINATION
Practical Paper: Cell Biology and Genetics (DSCC5GENP1)

Duration: 3Hrs Max. Marks: 25

1. Prepare a temporary squash of the onion root tip. Identify and comment on the stages with neat labeled diagram. (Mitosis). **(6 Marks)**

OR

- Prepare a temporary squash of the Onion flower bud/ Grasshopper Testis. Identify and comment on the stages observed.
2. Prepare the Polytene chromosome from the given material (Drosophila Larvae/ Chironomous Larvae) and comment with a neat labelled diagram **(6 Marks)**
3. Perform the blood typing and interpret the result. **(6 Marks)**
4. Solve the Genetic Problems **(3.5 X 2=7 marks)**
 - a. problem on Linkage
 - b. problems on calculation of interference and construction of Genetic map

I semester B.Sc. Genetics (HONS) Minor discipline course-1
SKILL ENHANCEMENT (VOCATIONAL) ELECTIVE COURSES-SEEC
PRACTICAL PAPER: VEC5GENP1: GENETIC COUNSELING
PRACTICAL EXAMINATION

Duration: 3Hrs Max. Marks: 25

1. Separate hemoglobin by Paper electrophoresis **(6 marks)**
 2. Construct the pedigree for the given data /analyse the given pedigree **(6 marks)**
 3. Detect the blood group of the given sample and comment on the result **(4 marks)**
 4. Analyse the given case history and assess the risk of occurrence. **(4 marks)**
 5. Identify and comment on the given spotters (a &b). **(2.5 X 2) (5 marks)**
-
-

II semester B.Sc. Genetics (HONS) Minor discipline course-1
SCHEME OF PRACTICAL EXAMINATION
Practical Paper: Medical Genetics (MDC5GENP2)

Duration: 3Hrs Max. Marks: 25

1. Isolate DNA/RNA from Human blood. **(8 Marks)**

OR

- Separation of DNA/RNA by electrophoresis.
2. Separate Hemoglobin by paper electrophoresis. **(8 Marks)**
3. Estimate the amount of DNA/RNA by spectrophotometric method. **(6 Marks)**
4. Analyze/ construct Pedigree or Blood group assessment/ Spotters (Karyotype) **(3 Marks)**

II semester B.Sc. Genetics (HONS) Minor discipline course-1
SCHEME OF PRACTICAL EXAMINATION
Practical Paper: Bioinstrumentation and animal cell culture (DSCC5GNP2)

Duration: 3Hrs Max. Marks: 25

1. Separate DNA by Agarose Gel electrophoresis. **(8 Marks)**

OR

 - Separate Protein by SDS Page
 2. Estimate the amount of Protein present in the given sample by Bradford's method **(8 Marks)**
 3. Write the working principle and application of (Microscopy / Spectrophotometer / Centrifuge) **(3X2 =6 Marks)**
 4. Prepare a buffer for the given pH. **(3 Marks)**
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