



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಲ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-14/AD-HOC /Appl.Genetics (UG) /20-21/ ೨೪೪

Date:
16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Applied Genetics UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

- Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special Ad-hoc Res. No. 01, dt. 27.07.2020
3. Special Faculty Res. No. 16, dt. 11.08.2020.
3. Special Academic Council Res. No. 48, dt. 21.08.2020.
4. Vice-Chancellor's order dated - 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Applied Genetics UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

Handwritten: 15/10/2020
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Applied Genetics (UG), Dept. of Applied Genetics, K.U.Dharwad.
2. The Chairman, Dept. of Applied Genetics, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwc to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analyst, Computer Unit Exam Section, K.U.Dharwad.



KARNATAK UNIVERSITY, DHARWAD

B.Sc. Programme

**DRAFT SYLLABUS FOR
GENETICS (OPT.)**

**AS DISCIPLINE SPECIFIC COURSE (DSC) and
SKILL ENHANCEMENT COURSE (SEC)**

**UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)**

Effective from 2020-21

B.Sc. (General) Programme structure under CBCS

Semester	*Core			Elective			Ability Enhancement Course						Total Credits
	DSC			**DSE			***SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	4+0+4	4+2=6							English-1	2+1+0	2+1=3	26
	DSC-2A	4+0+4	4+2=6							MIL-1	2+1+0	2+1=3	
	DSC-3A	4+0+4	4+2=6							ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	4+0+4	4+2=6							English-2	2+1+0	2+1=3	26
	DSC-2B	4+0+4	4+2=6							MIL-2	2+1+0	2+1=3	
	DSC-3B	4+0+4	4+2=6							CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	4+0+4	4+2=6							English-3	2+1+0	2+1=3	24
	DSC-2C	4+0+4	4+2=6							MIL-3	2+1+0	2+1=3	
	DSC-3C	4+0+4	4+2=6										
IV	DSC-1D	4+0+4	4+2=6							English-4	2+1=0	2+1=3	24
	DSC-2D	4+0+4	4+2=6							MIL-4	2+1=0	2+1=3	
	DSC-3D	4+0+4	4+2=6										
V				DSE-1E	4+0+4	4+2=6	SEC-1E	2+0+0	2				22
				DSE-2E	4+0+4	4+2=6	SEC-2E	2+0+0	2				
				DSE-3E	4+0+4	4+2=6							
VI				DSE-1F	4+0+4	4+2=6	SEC-1F	2+0+0	2				22
				DSE-2F	4+0+4	4+2=6	SEC-2F	2+0+0	2				
				DSE-3F	4+0+4	4+2=6							
TOTAL			72			36			08			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week (no tutorial for practical subject).

* If the Discipline Specific Course (DSC) under CBCS is Mathematics, there shall be two papers of 75 marks each. Then L+T+P = (2x3)+(2x1)+0, but credit shall be 6 only.

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

*** SEC 1 & 2 shall be from all three DSC but student shall choose any two in each semester (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks(40 Sem. End exam +10 IA Exam).

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/ Constitution of India / SEC shall have 30 hrs syllabus / semester for 50 marks in theory/ Practical (40 Sem. End exams +10 IA Exam).

Karnatak University, Dharwad
CBCS syllabus for Under Graduate Programme in GENETICS (optional)

Effective from 2020-21

OUTLINE OF THE COURSE

Semester	Theory/ Practical	PAPER Code	Total Teaching Hours/week	Total Teaching hours/sem	Duration of Exams.	Internal Assessment Marks	Sem end Exam Marks	Total Marks	Credits
I	Theory	DSC GENT:101	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC GENP:102	04 hrs	60	03 hrs	10	40	50	02
II	Theory	DSC GENT:201	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC GENP:202	04 hrs	60	03 hrs	10	40	50	02
III	Theory	DSC GENT:301	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC GENP:302	04 hrs	60	03 hrs	10	40	50	02
IV	Theory	DSC GENT:401	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC GENP:402	04 hrs	60	03 hrs	10	40	50	02
V	Theory	DSE GENT:501A OR GENT:501B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE GENP:502A OR DSE GENP:502B	04 hrs	60	03 hrs	10	40	50	02
	Practical	SEC-GENP:503	04 hrs	60	3 hrs	10	40	50	02
VI	Theory	DSE GENT:601A OR GENT:601B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE GENP:602A OR DSE GENP:602B	04 hrs	60	03 hrs	10	40	50	02
	Practical	SEC-GENP:603	04 hrs	60	3 hrs	10	40	50	02
Total						200	800	1000	40

***Credit means the unit by which the course work is measured. One hour session of Lecture per week for 16 weeks amounts to 1 credit.**

Four hours session of Practicals per week for 16 weeks amounts to 2 credits per semester.

** Student has to choose only one elective (DSE) during his/her fifth and sixth semester.

Discipline Specific Course (DSC)
Discipline Specific Elective (DSE)
Skill Enhancement Course (SEC)

Topics under CBCS in GENETICS.

Sem	Paper Code	Course
1	DSC GENT:101	CYTOGENETICS
	DSC GENP:102	Practical 1
2	DSC GENT:201	MENDELIAN GENETICS
	DSC GENP:202	Practical 2
3	DSC GENT:301	MOLECULAR BIOLOGY
	DSC GENP:302	Practical 3
4	DSC GENT:401	MOLECULAR GENETICS
	DSC GENP:402	Practical 4
5	DSE GENT:501A OR GENT:501B	GENERAL GENETICS OR BIostatISTICS AND BIOINFORMATICS
	DSE GENP:502 (Based on 501A+501B)	Practical 5 (Common for both DSE GENT: 501A and 501B)
	SEC GENP:503	Practical 6 CELL BIOLOGY TECHNIQUES
6	DSE GENT:601A OR GENT:601B	ADVANCED GENETICS OR GENETIC ENGINEERING
	DSE GENP:602 (Based on 601A+601B)	Practical 7 (Common for both DSE GENT: 601A and 601B)
	SEC GENP:603	Practical 8 APPLIED GENETICS

CBCS syllabus w.e.f. 2020-21
DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER I

PAPER – I : CYTOGENETICS

PAPER CODE : **DSC GENT:101**

(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs

Unit 1: Introduction and History: (02 Hrs.)

Cytology and Genetics. Cell as a basic unit of life, Prokaryotic and eukaryotic cell

Unit 2: Microscopy: (12 Hrs.)

Principle, Construction and Applications – Dissecting, Compound, Phase contrast, Fluorescent, Electron, Inverted microscopes.

Fixatives and Stains: Different types of fixatives and stains, composition, preparation and applications

Unit 3: Ultrastructure of Cell: (12 Hrs.)

Chemical composition, structure and functions of cell organelles – Cell wall, Plasma membrane, Endoplasmic reticulum, Centrosomes, Lysosomes, Peroxisomes, Ribosomes, Vacuoles, Cytosol, Golgi complex, Plastids, Mitochondria, Nucleus (Nuclear envelope, pore complex, chromatin and nucleolus), Cytoskeleton (Microtubules, Microfilaments and Intermediate filaments).

Cell inclusions

Unit 4: Chromosomes: (10 Hrs.)

Size, Number, Structure and Classification.

Topography – Ultrastructure of DNA, Chemical composition, DNA packaging and significance.

Unit 5: Chromosomal aberrations: (12 Hrs.)

Structural (Deletion, Duplication, Inversions and Translocations), Numerical (Euploidy, Aneuploidy, auto and allopolyploidy). Practical and evolutionary significance.

Special type chromosomes – Giant, salivary gland and supernumerary chromosomes.

Practical and Evolutionary significance.

Unit 6: Cell Reproduction: (12 Hrs.)

Cell cycle – Different phases, check points and significance.

Cell Division - Mitosis and Meiosis. Significance of cell division. Cancer and Apoptosis

Gametogenesis – Plants and Animals

SUGGESTED READINGS

- 1) Cell and Molecular Biology, 2nd Edition, P.K. Gupta .(2003). Rastogi, Meerut.
- 2) Cell Biology and Molecular Biology by EDP Robertis and EMF Robertis. Saunder College.
- 3) Cell Biology by C.B. Powar Himalaya Publication.
- 4) Plant Cell Biology: Structure and Function. Jones and Bartlett, Boston.
- 5) Cytology by Cibas Edmund S. Fourth Edition. Elsevier Health Sciences
- 6) Cytology Genetics and Molecular Genetics by PANDEY, McGraw Hill
- 7) Textbook of Cytology by P.S.Varma and V.K.Agarwal. S.Chand Publishers
- 8) Essentials of Cytology by C.B. Powar. Himalaya Publishers
- 9) Cell Biology, Genetics and Biotechnology by N. Arumugam, Saras Publication

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER I**

PRACTICAL – I : CYTOGENETICS

PAPER CODE: DSC GENP:102

Practicals

- 1) General laboratory rules, maintenance of laboratory, Hazards and safety measures.
- 2) Handling of microscopes and demonstration with onion peeling.
- 3) Preparation of different stains and other chemicals .
- 4) Mitosis: Preparation and observation of different stages in onion and *Aleo vera* root tips.
- 5) Meiosis : Preparation and observation of different stages in onion, Rheo flower buds and Grass-hopper testis.
- 6) Calculation of Chiasma frequency.
- 7) Polyploidy in wheat.

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER I**

PAPER – I : CYTOGENETICS

THEORY

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- From Unit – 1 : One Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : Two Sub question
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : Three Sub question

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- From Unit – 2 : Two Sub question
- From Unit – 3 : Two Sub question
- From Unit – 4 : One Sub question
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub question

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- From Unit – 2 : One Sub question
- From Unit – 3 : One Sub question
- From Unit – 4 : One Sub question
- From Unit – 5 : One Sub questions
- From Unit – 6 : One Sub question

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS

SEMESTER I

PAPER – I : CYTOGENETICS

THEORY

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Introduction and History	02	01	00	00	02
2.	2	Microscopy	12	02	02	01	24
3.	3	Ultrastructure of Cell	12	02	02	01	24
4.	4	Chromosomes	10	02	01	01	19
5.	5	Chromosomal aberrations	12	02	02	01	24
6.	6	Cell Reproduction	12	03	01	01	21
Total			60	12	08	05	114

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER I**

**PRACTICAL – I : CYTOGENETICS
PAPER CODE: DSC GENP:102**

Time : 03 Hours

Max. Marks: 40

- | | |
|---|----------|
| I.. Make a temporary micropreparation of the given sample A for _____ and show 2 stages with a neat labeled diagram to the examiner | 8 marks |
| II. Demonstrate handling of microscope with onion peeling B | 4 marks |
| III. Calculate chiasma frequency from the given chart C | 4 marks |
| IV. Identify given specimen D,E,F,G,H and comment | 10 marks |
| V. Viva - voce | 5 marks |
| VI. Class records | 5 marks |
| Submission of permanent slides | 4 marks |

Total 40 marks.

* Student can ask an additional 30 minutes to complete the practical if necessary

Instructions to the Examiner

- Q. 1. Onion root tip for mitosis or onion / Rheo flower buds for meiosis may be given for A. Student has to must show any two divisional stages
- Q.2. Dissection or compound microscope may be given for B
- Q. 3. Meiotic slide or drawing may be given for C (calculation of chiasma frequency).
- Q. 4. Specimen / slide / Electron Micrographs may be given for spott identification D,E,F,G and H

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CBCS syllabus w.e.f. 2020-21
DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER II

PAPER II : MENDELIAN GENETICS

PAPER CODE: **DSC GENT:201**

(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs.

Unit 1: Introduction and history: (2 Hrs.)

Mendelian and post Mendelian genetics

Unit 2: Mendelism: (10 Hrs.)

Basic Principles and Mendel's experiments with pea plants. Monohybrid and dihybrid crosses, Law of dominance, Law of Segregation and Law of independent assortment. Test cross and back cross. Incomplete dominance and simple problems.

Unit 3: Extension of Mendelism: (10 Hrs.)

Interaction of genes: Epistasis- hypostasis, pleiotropism, polygenic traits, lethal genes. Penetrance-Expressivity. Dominance, Incomplete dominance, Co-dominance, Multiple Alleles Confer Drug Resistance in the Malaria Parasite and Sex linked traits. Application of Mendelian Principles in humans.

Unit 4: Gene Concepts: (6 Hrs.)

Genes, alleles and multiple-alleles, pseudoalleles, Complementaton test- Cistron, muton and recon.

Unit 5: Linkage and crossing-over: (6 Hrs.)

Construction of linkage maps in eukaryotes. X-linkage in *Drosophila*.

Unit 6: Sex determination: (8 Hrs.)

Different types of sex-determinations: Sex-linked, sex-influenced and sex-limited characters. Chromosomal basis of sex-determination in *Drosophila* and Humans. Dosage compensation – Lyon hypothesis Sex determination mechanism in plants.

Unit 7: Extra-chromosomal inheritance: (8 Hrs.)

Uniparental inheritance in *Chlamydomonas*, maternal inheritance in snails, cytoplasmic inheritance in *Neurospora*, petite mutants in yeast and plastid system, mitochondrial inheritance in humans.

Unit 8: Life-cycle of model organisms: (10 Hrs.)

Viruses- TMV, Bacteriophage and Lambda Phages; Bacteria - *E. coli*; Fungi- Yeast, *Neurospora*; Paramecium; *Ceonorhabdites*; *Drosophila*, *Arabidopsis*.

SUGGESTED READINGS

- 1) Atherly A. G., J.R. Girton and J.F. Me. Donald. 1999. The Science of Genetics. Saunders College Publishing, Harcourt Brace.College Publishers. NY.
- 2) Gardner E.J ., M.J. Simmons and D.P. Snustad. 1991 , Ptinciples of Genetics, John Wiley and Sons, Inc. NY.
- 3) Griffiths A.J.F., J. H. Miller., D.T. Suzuki., R.C. Lewontin and W.M. Gelbart, 1996. An Introduction to Genetic analysis, V. H. Freeman and Company, New York.
- 4) Snustad D.P. and M.J. Simmons, 1997, Principles of Genetics, John Wiley and Sons, Inc. NY.
- 5) Principles of genetics VI th Edn. by Robert H. Tamarin. McGraw-Hill Publications
- 6) Fundamentals of Genetics by R.P. Meyyan, Saras Publication
- 7) Genetics - 9th Edition by V. K. Aggarwal and P. S. Verma. S. Chand Pub.
- 8) Cell Biology Genetics Molecular Biology Evolution and Ecology by P. S. Verma. S. Chand Pub.

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER II

PRACTICAL – II : MENDELIAN GENETICS

PAPER CODE: DSC GENP:202

- 1) Floral Structure of Pea Plant, Maize and Arabidopsis.
- 2) Culture, technique and handling of fruit fly.
- 3) Morphology and life cycle of fruit fly.
- 4) Observation of mutants in drosophila.
- 5) Polytene chromosomes in Drosophila and chironomus larvae,
- 6) Supernumerary chromosomes in *Trigonella* and *Guizotia*.
- 7) Solving genetic problems related to monohybrid, dihybrid, multiple alleles, interaction of genes, linkage etc.

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER II
PAPER II : MENDELIAN GENETICS

(Credits: Theory-4, Practicals-2)

THEORY

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- | | | |
|---------------|---|-------------------|
| From Unit – 1 | : | One Sub questions |
| From Unit – 2 | : | Two Sub questions |
| From Unit – 3 | : | Two Sub questions |
| From Unit – 4 | : | Two Sub questions |
| From Unit – 5 | : | Two Sub questions |
| From Unit – 6 | : | One Sub questions |
| From Unit – 7 | : | One Sub questions |
| From Unit – 8 | : | One Sub questions |

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- | | | |
|---------------|---|-------------------|
| From Unit – 2 | : | One Sub questions |
| From Unit – 3 | : | One Sub questions |
| From Unit – 4 | : | One Sub questions |
| From Unit – 5 | : | One Sub questions |
| From Unit – 6 | : | One Sub questions |
| From Unit – 7 | : | One Sub questions |
| From Unit – 8 | : | Two Sub questions |

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- | | | |
|---------------|---|-------------------|
| From Unit – 2 | : | One Sub questions |
| From Unit – 3 | : | One Sub questions |
| From Unit – 6 | : | One Sub questions |
| From Unit – 7 | : | One Sub questions |
| From Unit – 8 | : | One Sub questions |

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER II**

**PAPER II : MENDELIAN GENETICS
(Credits: Theory-4, Practicals-2)**

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1.	Introduction and history	02	01	00	00	02
2.	2.	Mendelism	10	02	01	01	19
3.	3.	Extension of Mendelism	10	02	01	01	19
4.	4.	Gene Concepts	07	02	01	00	09
5.	5.	Linkage and crossing-over	07	02	01	00	09
6.	6.	Sex determination	08	01	01	01	17
7.	7.	Extra-chromosomal inheritance	08	01	01	01	17
8.	8.	Life-cycle of model organisms	08	01	02	01	22
Total			60	12	08	05	114

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS

SEMESTER II

PRACTICAL - II : MENDELIAN GENETICS

PAPER CODE: DSC GENP:202

(Credits: Theory-4, Practicals-2)

PRACTICAL

Time : 3 Hours

Max. Marks: 40

- | | |
|---|-----------|
| 1. Demonstrate staining of Salivary glands from the given specimen A for the presence of polytene chromosomes. | 10 marks |
| 2. Solve the Genetic problem B | 5 marks |
| 3. Solve the Genetic problem C | 5 marks |
| 4. Identify given specimen D,E,F,G & H and comment | 10 marks. |
| 5. Viva- voce | 5 marks |
| 6. Practical record | 5 marks |

Total 40 marks

* Student can ask an additional 30 minutes to complete the practical if necessary

Instructions to the Examiner

- Q. 1. Drosophila /Chironomous larvae. (Preparation – 2 mark, Observation – 2 marks, diagram – 3 marks, explanation – 3 mark)
- Q. 2. Genetic problem on Mendel hypothesis
- Q. 3. Genetic problem on gene interaction
- Q. 4. Specimen/slide/poster from practicals
- Q. 5. Viva- voce from practicals/theory

CBCS syllabus w.e.f. 2021-22
DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER III

PAPER III : MOLECULAR BIOLOGY OF GENES

PAPER CODE: DSC GENT:301
(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs.

Unit 1: Introduction : (2 Hrs.)

History, Development and Relation to other fields

Unit 2: Hereditary Material : (10 Hrs.)

DNA-as genetic material : Discovery of transformation in Bacteria, experimental proof that DNA mediates transformation, proof that DNA stores genetic information in Bacteriophage T2 ; experimental proof that RNA stores the genetic information in some viruses.

Unit 3: Nucleic Acids Structure: (10 Hrs.)

DNA- Chemical composition, Watson and Crick model, types of DNA, pro and eukaryotic DNA, extra nuclear DNA, functions of DNA. RNA- Chemical composition, structure of mRNA, tRNA, rRNA and SnRNA, functions of RNA.

Unit 4: Nucleic Acids Synthesis: (10 Hrs.)

DNA Synthesis- Brief account of cell cycle, concept of C-value enigma, methods of DNA replication, Meselson-Stahl's experiment, enzymes required for DNA replication in pro and eukaryotes. RNA Synthesis: Enzymes involved in RNA synthesis, transcription, post-transcriptional modifications.

Unit 5: Genetic Code: (08 Hrs.)

Discovery, Flow of genetic information, types of RNA, Codon concept, important features, initiator and terminator codons. Genetic Code Dictionary of RNA, Wobble hypothesis, Evolution of Genetic Code

Unit 6: Proteins and protein synthesis: (10 Hrs.)

Composition, structural organization, classification and functions. Protein synthesis: translation- initiation, elongation and termination, post-translational modifications.

Unit 7: Molecular organization of genes: (10 Hrs.)

Split genes, Mobile genetic elements in Bacteria, Drosophila, Maize and Humans. Genomics and proteomics - Genomic Tools, Restriction Mapping, Polymerase Chain Reaction, DNA Sequencing, Practical Benefits from Gene Cloning.

SUGGESTED READINGS

- 1) Benjamin Lewin 2005 : Genes VIII, Oxford University Press, Oxford.
- 2) Stanley R. Maloy, John E. Cronan, Jr., David Frejfeldar 1994: Microbial Genetics. Jones and Vartlett Publishers, Boston.
- 3) Gunther S . Stent and · Richard Calender, 2002 : Molecular Genetics , CBS publishers and distributors.
- 4) Gerald Karp 2002 : Cell and Molecular Biology, Concepts and experiments. John Wiley and Sons, Inc. N.Y.
- 5) Gupta P. K. 2005 : Cytogenetics, Rastogi Publication

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS SEMESTER III

PRACTICAL- III : MOLECULAR BIOLOGY OF GENES

PAPER CODE: DSC GENP:302

PRACTICALS

- 1) Study of different bacterial media.
- 2) Preparation of L.B Medium.
- 3) Study of antibiotic sensitivity in *E. coli* DH5 α .
- 4) Study of bacterial growth using Spectrophotometer.
- 5) Localization of DNA.
- 6) Isolation of Plasmid DNA.
- 7) Bacterial staining.

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS

SEMESTER III

PAPER III : MOLECULAR BIOLOGY OF GENES

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- From Unit – 1 : One Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : Two Sub questions
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : Two Sub questions
- From Unit – 7 : One Sub questions

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- From Unit – 2 : One Sub question
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub questions
- From Unit – 7 : Two Sub questions

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 6 : One Sub questions
- From Unit – 7 : One Sub questions

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER III
PAPER III : MOLECULAR BIOLOGY OF GENES

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1.	Introduction	02	01	00	00	02
2.	2.	Hereditary Material	10	02	01	01	19
3.	3.	Nucleic Acids Structure	10	02	01	01	19
4.	4.	Nucleic Acids Synthesis	10	02	01	01	19
5.	5.	Genetic Code	08	02	02	00	14
6.	6.	Proteins and protein synthesis	10	02	01	01	19
7.	7.	Molecular organization of genes	10	01	02	01	22
Total			60	12	08	05	114

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER III**

PRACTICAL- III : MOLECULAR BIOLOGY OF GENES

PAPER CODE: **DSC GENP:302**

Time : 3 Hours

Max. Marks: 40

- Q. 1. Carry out Differential staining technique of the given sample A and comment.....10 marks
- Q. 2. Prepare ____ml of Nutrient Agar/Nutrient Broth B.....5 marks
- Q. 3. Carry out localization of DNA in the given sample C..... 5 marks
- Q. 4. Identify given specimen D,E,F,G,H and comment.....10 marks.
- Viva - voce.....5
- Class records.....5

Total 40 marks.

Instructions to the Examiner

- Q. 1. Bacterial culture.
- Q. 2. A minimum quantity of 100ml.
- Q. 3. Onion root tips/Rheo flower buds.
- Q. 4. Specimen/slide/poster from practicals
- Q. 5. Viva- voce from practicals/theory

CBCS syllabus w.e.f. 2020-21
DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER IV

PAPER IV : MOLECULAR GENETICS

PAPER CODE: **DSC GENT:401**

(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs.

Unit 1: Introduction to Molecular Genetics : (2 Hrs.)

Unit 2: Mutation : (10 Hrs.)

Historical account, chromosomal and gene mutations, spontaneous and induced mutations, frame shift and point mutation. Molecular basis of mutation, types of mutations, transition and transversion; reverse mutations, non-sense mutations, mutagens- physical and chemical, DNA damage and repair mechanisms. Significance of mutations and examples.

Unit 3: Bacterial Genetics: (10 Hrs.)

Bacterial chromosome and its structure. Plasmids and their genetic constitution, Conjugation, transformation and transduction in bacteria. Gene mutation in bacteria. Bacteriophages, Transposable genetic elements, Gene transfer technology, Bacterial chromosome, gene mapping.

Unit 4: Genetics of Viruses : (10 Hrs.)

Discovery, origin, structure, virulence and pathogenicity, Types of viruses, mapping of phage genome. T4 phage, TMV, HIV, Covid-19. Plant and animal viral diseases

Unit 5: Genetic Recombination: (10 Hrs.)

Physical basis of recombination, molecular basis of general recombination and site specific recombination, enzymes involved in recombination: chromosome mapping, recombination and evolution.

Unit 6: Gene Regulation: (18 Hrs.)

- a. **In prokaryotes**- inducible and repressible gene regulation, positive and negative control of gene expression; operon concept- Lac-operon, Trp-operon, His operon.
- b. **In Eukaryotes**- spatial and temporal regulation of gene expression, environmental and biological factors, molecular control of transcription, translational and post-translational control of gene expression and chromosome organization, gene silencing, inactivation of chromosome.

SUGGESTED READINGS

- 1) .. Watson J.D., N.H. Hopkins, J. W. Roberts; J. A. Steitz and A.M. .Weiner, 1987 : Molecular Biology of Genes. The Benjamin Cummings Publishing Company, Inc., Tokyo.
- 2) Atherly A. G., J. R. Girton and J. F. Me Donald 1999 : The Science of Genetics. Saunders College Publishing., Harcourt Brace College Publishers, N.Y.
- 3) Brooker J. 1999: Genetics: Analysis and Principles. Benjamin Cummings, Longman Inc .
- 4) Fairbanks D. J. and W. R. Anderson, 1999 : Genetics - The continuity of life. Brooks/Cole publishing Company ITP., N.Y. Toranto.
- 5) Gtiffiths A. J. F., J. H. Miller, D. T. Suzuki, R . C. Lewontin and W. M. Gelbert . 1996: An introduction to Genetic analysis W . H. Freeman and Company, N.Y.
- 6) Gupta P. K. 2004 : Genetics. Rastogi Publishers.

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS

SEMESTER IV

PRACTICAL – IV : MOLECULAR GENETICS

PAPER CODE: **DSC GENP:402**

- 1) Study of conjugation in bacteria.
- 2) Study of barr body.
- 3) *D. melanogaster*: Normal characters, sex comb, genital plate, wing structure.
- 4) Study of effect of mutagens on plants.
- 5) Study of Bacterial transform1 ation in *E. coli* DH5á.
- 6) Observation of mutant *Drosophila* flies.

**DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER IV**

PAPER IV : MOLECULAR GENETICS

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

From Unit – 1	:	One Sub questions
From Unit – 2	:	Two Sub questions
From Unit – 3	:	Two Sub questions
From Unit – 4	:	Two Sub questions
From Unit – 5	:	Two Sub questions
From Unit – 6	:	Three Sub questions

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

From Unit – 2	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	Two Sub questions
From Unit – 6	:	Three Sub questions

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

From Unit – 2	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub questions

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER IV

PAPER IV : MOLECULAR GENETICS

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Introduction to Molecular Genetics	02	01	00	00	02
2.	2	Mutation	10	02	01	01	19
3.	3	Bacterial Genetics	10	02	01	01	19
4.	4	Genetics of Viruses	10	02	01	01	19
5.	5	Genetic Recombination	10	02	02	01	24
6.	6	Gene Regulation	18	03	03	01	31
Total			60	12	08	05	114

DISCIPLINE SPECIFIC COURSE (DSC) UNDER CBCS- GENETICS
SEMESTER IV
PRACTICAL – IV : MOLECULAR GENETICS
PAPER CODE: DSC GENP:402

Time : 3 Hours

Max. Marks: 40

1. Show the effect of UV (mutagen) on the pollen viability by *in-vitro* germination on **sample A** **10 marks**
 2. Demonstrate Staining of Buccal epithelial smear (**sample B**) for the presence of Barr body **5 marks**
 3. Mount Sex comb/ Genital plate/ Wing of the given Drosophila fly (**sample C**) **5 marks**
 4. Identify given specimen **D,E,F,G,H** and comment **10 marks.**
- Viva- voce** **5 marks**
- Practical record** **5 marks**

Total 40 marks

* Student can ask an additional 30 minutes to complete the practical if necessary

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Instructions to the Examiner

- Q. 1. Flower buds of Catheranthus, Dattura, and Hibiscus.
- Q. 2. Female buccal smear
- Q. 3. *Drosophila melanogasture*.
- Q. 4. Specimen/slide/poster from practicals
- Q. 5. Viva- voce from practicals/theory

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

(Candidate shall choose either Paper- DSE GENT 501A or 501B)

SEMESTER V

PAPER – VA : GENERAL GENETICS

PAPER CODE: DSE GENT: 501A

(Credits: Theory-4, Practicals-2)

THEORY

Duration: 60 Hrs.

Unit I: Genes and Behaviour: (12 Hrs.)

Genetic analysis of behaviour in experimental animals-Nest cleaning behaviour in honey bee. Biological rhythms in *Drosophila* and Mice, Sexual preference in *Drosophila*, Nutritional behavior in mice, Chemotaxis in *E. Coli*. Chromosomal abnormalities and insights into Human behavior. Single gene mutations and human behavior-phenylketonuria, Lesch-Nyhan syndrome, Huntington's disease, Complex human behavior-intelligence, personality.

Unit II: Genome organization: (10 Hrs.)

Differences between pro- and eukaryotic genomes, genome size in eukaryotes, Evolutionary complexity, C-value enigma, genome size diversity and significance, Repetitive DNA- LINES, SINES, heterochromatin, Special type chromosomes-Giant, Lamp brush and B-chromosomes. Centromere and telomere, Extra-chromosomal genomes- Plasmid, Cosmid, mitochondria and chloroplast.

Unit III: Developmental genetics : (10 Hrs.)

Genes in development and differentiation. Genetic analysis of development in model organisms like *Drosophila*, *Cenorhabditis* and *Arabidopsis*. Molecular analysis of genes involved in development: Maternal gene activity in development- determination of dorso-ventral and postero-anterior axes in *Drosophila* embryos, Zygotic gene activity in development.

Unit IV: Quantitative genetics: (10 Hrs.)

Quantitative traits in plants and animals. Multiple factor hypothesis, polygenic inheritance, role of environment in quantitative inheritance, components of genetic variance, estimation of genetic variance, heritability, heterosis, inbreeding depression, out-breeding, line-breeding.

Unit V: Population genetics and evolution : (10 Hrs.)

Darwinism and Neo-darwinism with an emphasis on Hardy-Weinberg law of genetic equilibrium and exceptions: The evolutionary forces which can alter them- Natural selection, Random genetic drift and speciation. A brief account of Human evolution.

Unit VI: Application of Genetic principles in plant and animal improvement:(08 Hrs.)

Selection and breeding programs for productivity. Biotic and abiotic stresses which affect plant growth and productivity. Breeding for disease resistance, stress tolerance, Draught tolerance.

SUGGESTED READINGS

- 1) Atherly A.G., J.R. Girton and J. F. McDonald, 1999. The Science of Genetics Saunders College Publishing., Harcourt Brace College Publishers N.Y.
- 2) Brooker R.J. 1999. Genetics; Analysis and Principles. Benjamin/Cummings Longman Inc.
- 3) Griffith .A.J.F., J.H .Miller., D.T.Suzuki .,R.C.Lewontin and W.M.Gelbert. 1996.
- 4) An introduction to Genetic Analysis. W.H.Freeman and Company. N.Y.
- 5) Snustad D.P and M.J. Simmons. 1997. Principles of Genetics, John Wiley and Sons, Inc. N.Y.

**DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V**

PAPER – VA :GENERAL GENETICS

PAPER CODE: DSE GENT: 501A

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : Two Sub questions
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : Two Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub questions

Q. III. Answer any **THREE** of the following: 3 x 10 = 30 Marks

- From Unit – 1 : One Sub questions
- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub questions

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

SEMESTER V

PAPER – VA : GENERAL GENETICS

PAPER CODE: DSE GENT: 501A

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Genes and Behaviour	12	02	02	01	24
2.	2	Genome organization	10	02	01	01	19
3.	3	Developmental genetics	10	02	01	01	19
4.	4	Quantitative genetics	10	02	01	01	19
5.	5	Population genetics and evolution	10	02	02	01	24
6.	6	Application of Genetic principles in plant and animal improvement	08	02	01	00	09
Total			60	12	08	05	114

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

(Candidate shall choose either Paper- DSE GENT 501A or 501B)

SEMESTER V

PAPER – VB : BIOSTATISTICS AND BIOINFORMATICS

PAPER CODE: DSE GENT:501B

(Credits: Theory-4, Practicals-2)

THEORY

Duration: 60 Hrs

Unit I: Introduction to Biostatistics and Bioinformatics: (10 Hrs.)

Basic concepts, central tendency, measures of Biology and statistics. Definition and applications of correlation, Linear regression and Chi-square test and dispersion, goodness of fit, students t- test and test for homogeneity.

Unit II: Definition of Probability: (08 Hrs.)

Law of probability, discrete and continuous, distribution, binomial Poisson and normal distribution.

Unit III: Parametric and Non-parametric test: (10 Hrs.)

Introduction to one sample binomial or sign test, analysis of variance, one way analysis, two way analysis, degree of freedom for ANOVA.

Unit IV: Biological databases: (10 Hrs.)

Introduction to database concept DNA sequence databases-GenBank, EMBL and DDBJ; Protein sequence databases- SWISS-PROT, UniProt, Prosite; Structure databases-PDB and SCOP, Literature databases.

Unit V: Sequence analysis: (10 Hrs.)

Similarity search- BLAST algorithm, Sequence alignment-scoring of alignments and matrices. Pair-wise and multiple sequence alignments. Phylogenetic analysis.

Unit VI: Genomics and Proteomics Tools: (12 Hrs.)

Restriction Analysis –NEBCUTTER. Gene-finding -Genescan, ORF finding-NCBI ORF finder, Protein structure-visualization- Rasmol, Cn3D; Protein structure prediction.

SUGGESTED READINGS

- 1) Bioinformatics computing-Bryan, I MD. Pearsons Education.
- 2) Bioinformatics- C.S.V. Murthy, Himalaya Publishing House.
- 3) Introduction to Bioinformatics-Attwood and Parry-Smith, Pearson Education. Asia.
- 4) D.J.Finney (1978):Statistical Methods in Biological Assays,Charles Griffics & Co.
- 5) A.P.Gore and S.A. Paranjpe (2000): A course in Mathematical & Statistical Ecology, Kluwer.
- 6) R.C.Elandt Johnson (1975): Probability Models and Statistical Methods in Genetics Wiley.
- 7) C.C.Li (1976): First course in Population Genetics, Boxwood Press.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V
PAPER – VB : BIOSTATISTICS AND BIOINFORMATICS

PAPER CODE: DSE GENT:501B

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : Two Sub questions
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : Two Sub questions

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub questions

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub questions
- From Unit – 6 : One Sub questions

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

SEMESTER V

PAPER – VB : BIOSTATISTICS AND BIOINFORMATICS

Time : 3 Hours

Max. Marks: 80

PAPER CODE: DSE GENT:501B

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Introduction to Biostatistics and Bioinformatics	10	02	02	00	14
2.	2	Definition of Probability	08	02	01	01	19
3.	3	Parametric and Non-parametric test	10	02	01	01	19
4.	4	Biological databases	10	02	01	01	19
5.	5	Sequence analysis	10	02	02	01	24
6.	6	Genomics and Proteomics Tools:	12	02	01	01	19
Total			60	12	08	05	114

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V
PRACTICAL – V : GENERAL GENETICS / BIostatISTICS AND
BIOINFORMATICS

PAPER CODE: **DSE GENP:502A**
(Common for both papers DSE GENT : 501A and 501B)

(SET – A)

- 1) Root tip squash preparation (permanent slides).
- 2) Karyotype analysis and chromosome evolutionary studies.
- 3) Study of inheritance of PTC in Human and pedigree analysis.
- 4) Identification of blood group and calculation of allelic frequencies.
- 5) Pedigree analysis in human with simple Mendelian traits.
- 6) Chromosome banding pattern; Onion/chaironomous larvae or other plant materials.

PAPER CODE: **DSE GENP: 502B (SET – B)**

- 7) Sequence Similarity searching using BLAST.
- 8) Multiple Sequence & alignment using Clustal-W.
- 9) Restriction analysis using NEBCUTTER.
- 10) ORF finding using NCBI ORF-finder.
- 11) Protein structure visualization using Rasmol or Cn3D.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V
**PRACTICAL – V : GENERAL GENETICS / BIostatISTICS AND
BIOINFORMATICS**

**PRACTICAL
QUESTION PAPER**

PAPER CODE: **DSE GENP:502A**

Time : 3 Hours

Max. Marks: 40

- I. Plot the Idiogram from the given karyotype of **sample A** and discuss evolutionary significance **10 marks**
- II. Calculate the Allelic frequency and Genotype frequency from the given data in the genetic problem **B**. **5 marks**
- III. From the given Pedigree **C** find the pattern of inheritance of the affected trait/ Carry out identification of blood group and comment. **5 marks**
- IV. Identify given specimen D,E,F,G,H and comment. **(5x2)=10 marks**
- V. Viva-voce. **5 marks**
- VI. Class records. **5 marks**

Total 40 marks.

* Student can ask an additional 30 minutes to complete the practical if necessary

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Instructions to the Examiner

- Q. 1. Permanent Karyotype slide/diagram of Onion or *Aleo vera*.
- Q. 2. Genetic problem to calculate Allelic frequency and Genotype frequency.
- Q. 3. Pedigree diagram or blood samples of their own.
- Q. 4. Specimen/slide/poster from practicals
- Q. 5. Viva- voce from practicals/theory

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V
PRACTICAL – V : GENERAL GENETICS / BIOSTATISTICS AND
BIOINFORMATICS

PRACTICAL
QUESTION PAPER

PAPER CODE: **DSE GENP:502B**

- I. Perform sequence analysis of **A** by multiple sequence alignment between any five mammalian insulin proteins. **10 marks**

- II. Perform sequence analysis of **B** by pair wise alignment between human and rat beta-globin, via p-blast interface. **5 marks**

- III. Display 3-D structure of porin protein using iCn3D. Make observations with regard to atomic/molecular Pattern. Also co-relate structure with sequence alignments. **5 marks**

- IV. Identify given specimen D,E,F,G,H and comment. **(5x2)=10 marks.**

- V. Viva voce. **5 marks**

- VI. Class records. **5 marks**

Total 40 marks.

CBCS syllabus w.e.f. 2022-23
B.Sc. FIFTH SEMESTER
Skill Enhancement Course(SEC) in GENETICS (SEC-GENP:503)
CELL BIOLOGY TECHNIQUES
(Credits: -02) Total practical Teaching hours: 60 Hours

- 1) Preparation of various reagents for cytology (Stains, Pre-treating agents, fixatives etc.)
- 2) Preparation of cytological slides for karyotypic studies from plant/animal material
- 3) Preparation of permanent slides.
- 4) Karyotype analysis and assessment of chromosome evolution
- 5) Study of translocation heterozygotes using plant samples
- 6) Induction of chromosomal mutations and analysis
- 7) Study of special type chromosomes (Salivary gland, B-chromosomes)
- 8) Chromosome painting (Q-banding)
- 9) Identification of chromosome anomalies using idiograms –X-linked disorders (Kleinfelters, Down's, Turner's syndromes)

Note: 1. Experiments of four hours duration.
2. Minimum of Eight experiments to be performed.
3. Any new experiment may be added to the list with the prior approval from the BOS.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

(Candidate shall choose either Paper- DSE GENT 601A or 601B)

SEMESTER VI

PAPER – VIA : ADVANCED GENETICS

PAPER CODE: DSE GENT: 601A

(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs.

Unit I: Immunogenetics: (08Hrs.)

The immune response; An overview, components of mammalian immune system. Structure and types of antibodies, antibody genes, antibody diversity, histocompatibility genes, monoclonal antibodies, autoimmune diseases.

Unit II: Cancer Genetics: (10 Hrs.)

Genetic basis of cell-cycle, types of cancer, properties of cancerous cells. Oncogenes: Tumor-inducing retroviruses and viral tumor suppressor genes; pRB, p53, pAPC, pMSH2 etc, Genetic pathway of cancer molecular basis of cancer, theories on cancer.

Unit III: Human Genetics: (10 Hrs.)

Historical background, Mendelian disorders, dominant and recessive gene disorders, inborn errors of metabolism, chromosome based disorders-autosomal and sex chromosomal disorders. Genetic screening and pedigree analysis. Human genome project, Eugenics., Karyotyping and its significance, C-,G-,Q-Banding techniques and their applications in detecting human cytogenic disorders. Aneuploid analysis in Humans.

Unit IV: Principles and methods of Plant breeding: (10 Hrs.)

Objectives of selection, Mass selection, Progeny selection, Recurrent selection, Clonal selection merits and demerits. Methods of asexually propagated crops. Hybridization- Interspecific and intergeneric hybridization.

Unit V: Breeding methods for crop improvement: (10 Hrs.)

Disease resistance-concepts, genetics of pathogenecity, disease development, disease escape, mechanisms of disease resistance, genetic basis of disease resistance, sources of disease resistance, breeding methods for disease resistance. Insect-resistance: Nature of insect resistance, genetics of insect resistance, sources of resistance, Breeding methods for insect resistance.

Unit VI: Polyploidy in plant breeding: (12 Hrs.)

Numerical chromosomal changes- classification. Aneuploidy- Morphological and cytological features, application in plant breeding. Autopolyploidy- origin and production, morphological and cytological features. Segregation in autotetraploids- role in evolution, limitations, application in plant breeding. Allopolyploids-origin and production, morphological and cytological features-role in evolution, limitations, in applications in crop improvement.

SUGGESTED READINGS

- 1) Atherly, A.G., J.R.Girton and J.F.Mc Donald, 1999, The Science of Saunders College Publishing, Harcourt Brace College Publishers. N.Y.
- 2) Brooker R.J. 1999, Genetic Analysis and Principles, Benjamin/Cummings;Longman Inc.
- 3) Griffith A.J.F., J.H.Miller., D.T.Suzuki., R.C.Lewontin andW.M.Gelbert. 1996. An Introduction to Genetic Analysis. W.H.Freeman and Company. New York.
- 4) Snaustad D.P. and M.J.Simmonss 1997, Principles of Genetics, John Wiley and Sons Inc. NY.
- 5) Lewin. B.2000. Gene VII. Oxford University Press, Oxford New York, Tokyo.
- 6) Watson J.D, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner, 1987. Molecular Biology of Genes. The Benjamin/Cummings Publishing Company. Inc.,Tokyo.
- 7) Lodish A. Berk, S.L.Zipursky, P.Mastsudaira, D.Baltimore and J Damell 1999. Molecular Cell Biology. W.H.Freeman and Company.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER V
PAPER – VIA : ADVANCED GENETICS

PAPER CODE: **DSE GENT: 601A**

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : Two Sub questions
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : Two Sub questions

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub questions
- From Unit – 6 : Two Sub questions

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub questions
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub questions
- From Unit – 6 : One Sub questions

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

SEMESTER V

PAPER – VIA : GENERAL GENETICS

PAPER CODE: DSE GENT: 601A

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Immunogenetics	08	02	02	00	14
2.	2	Cancer Genetics	10	02	01	01	19
3.	3	Human Genetics	10	02	01	01	19
4.	4	Principles and methods of Plant breeding	10	02	01	01	19
5.	5	Breeding methods for crop improvement	10	02	01	01	19
6.	6	Polyploidy in plant breeding	12	02	02	01	24
Total			60	12	08	05	114

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

(Candidate shall choose either Paper- DSE GENT 601A or 601B)

SEMESTER VI

PAPER – VIB : GENETIC ENGINEERING

PAPER CODE: DSE GENT: 601B

(Credits: Theory-4, Practicals-2)

THEORY

Duration : 60 Hrs.

Unit I: Introduction and key concepts of Recombinant DNA technology: (12 Hrs.)

Cloning and expression vectors: Plasmids- types, classification and general characters. Cloning vectors based on bacterial plasmids, Bacteriophage vectors for E.coli, cosmids, virus vectors for animal cells, vectors for plant cells, Mu chromosomes, YAC, BAC, HAC. Transposons- Binary and Shuttle vectors.

Unit II: Restriction endonucleases and other DNA modifying enzymes: (12 Hrs.)

Restriction endonuclease- types nomenclature, classifications, target sites, nature of cut, applications of REN in genetic engineering, DNA modifying enzyme ligases, alkaline phosphatase, polynucleotide kinase, termin deoxynucleotidyl transferase, SI Nuclease, DNA polymerases, RNase, DNase reverse transcriptase., etc.

Unit III: Gene isolation and cloning: (10 Hrs.)

Isolation of total cellular DNA, Nucleic acid hybridization, construction of rDNA, products-Isolation of human insulin.

Unit IV: Basic Molecular Biology Techniques: (12 Hrs.)

Polymerase Chain Reaction (PCR), Electrophoresis, RFLP, RAPD, DNA sequence in Autoradiography and Southern blotting. DNA fingerprinting and applications.

Unit V: Applications of genetic engineering in plant and animal improvement:(10 Hrs.)

Plant tissue culture, somaclonal variations, isolation of haploids, transgenic plants. Animal cloning, transgenic animals. Bacterial genetically modified bacteria for human insulin.

Unit VI: Socio-biological and ethical issues of genetic engineering: (04 Hrs.)

concepts of Intellectual property right and patenting.

SUGGESTED READINGS

- 1) Atherly, A.G., J.R.Girton and J.F.Mc Donald, 1999, The Science of Saunders College Publishing, Harcourt Brace College Publishers. N.Y.
- 2) Brooker R.J. 1999, Genetic Analysis and Principles, Benjamin/Cummings;Longman Inc.
- 3) Griffith A.J.F., J.H.Miller., D.T.Suzuki., R.C.Lewontin and W.M.Gelbert. 1996. An Introduction to Genetic Analysis. W.H.Freeman and Company. New York.
- 4) Snaustad D.P. and M.J.Simmonss 1997, Principles of Genetics, John Wiley and Sons Inc. NY.
- 5) Lewin. B.2000. Gene VII. Oxford University Press, Oxford New York, Tokyo.
- 6) Watson J.D, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner, 1987. Molecular Biology of Genes. The Benjamin/Cummings Publishing Company. Inc.,Tokyo.
- 7) Lodish A. Berk, S.L.Zipursky, P.Mastsudaira, D.Baltimore and J Damell 1999. Molecular Cell Biology. W.H.Freeman and Company.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER VI
PAPER – VIB : GENETIC ENGINEERING
PAPER CODE: DSE GENT:601B

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following:

10 x 2 = 20 Marks

- | | | |
|---------------|---|---------------------|
| From Unit – 1 | : | Two Sub questions |
| From Unit – 2 | : | Three Sub questions |
| From Unit – 3 | : | Two Sub questions |
| From Unit – 4 | : | Three Sub questions |
| From Unit – 5 | : | Two Sub questions |

Q. II. Answer any **SIX** of the following:

6 x 05 = 30 Marks

- | | | |
|---------------|---|-------------------|
| From Unit – 1 | : | Two Sub questions |
| From Unit – 2 | : | One Sub questions |
| From Unit – 3 | : | One Sub questions |
| From Unit – 4 | : | Two Sub questions |
| From Unit – 5 | : | One Sub questions |
| From Unit – 6 | : | One Sub questions |

Q. III. Answer any **THREE** of the following:

3 x 10 = 30 Marks

- | | | |
|---------------|---|-------------------|
| From Unit – 1 | : | One Sub questions |
| From Unit – 2 | : | One Sub questions |
| From Unit – 3 | : | One Sub questions |
| From Unit – 4 | : | One Sub questions |
| From Unit – 5 | : | One Sub questions |

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS

SEMESTER VI

PAPER – VIB : GENETIC ENGINEERING

PAPER CODE: DSE GENT:601B

Time : 3 Hours

Max. Marks: 80

BLUE PRINT OF THE THEORY QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Introduction and key concepts of Recombinant DNA technology	12	02	02	01	24
2.	2	Restriction endonucleases and other DNA modifying enzymes	12	03	01	01	21
3.	3	Gene isolation and cloning	10	02	01	01	19
4.	4	Basic Molecular Biology Techniques	12	03	02	01	26
5.	5	Applications of genetic engineering in plant and animal improvement	10	02	01	01	19
6.	6	Socio-biological and ethical issues of genetic engineering	04	00	01	00	07
Total			60	12	08	05	114

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER VI
PRACTICAL – VI: ADVANCED GENETICS / GENETIC
ENGINEERING

(Common for both papers DSE GENT : 601A and 601B)

PAPER CODE: DSE GENP:602A (SET – A)

- 1) Plant tissue culture technique.
- 2) Micropropagation of plants.
- 3) Synthesis of artificial seeds.
- 4) Hybridization methods.
- 5) Pollen viability test.
- 6) Compulsory study tour will be conducted to visit premier research institutions. The tour report (a part of the class records) carries 10 marks.

PAPER CODE: DSE GENP: 602B (SET – B)

- 7) Isolation of Plant and Animal DNA.
- 8) Purification and estimation using UV-Spectro photometer.
- 9) Isolation of Plant and Animal RNA.
- 10) Restriction analysis of DNA.
- 11) Agarose gel electrophoresis of restriction endonuclease digests.

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER VI
PRACTICAL – VI : ADVANCED GENETICS / GENETIC
ENGINEERING

(Common for both papers DSE GENT : 601A and 601B)

QUESTION PAPER

PAPER CODE: **DSE GENP:602A**

***Duration : 03 (Hrs.)**

Max. Marks: 40

1. Inoculate the given **sample A** following sterile technique for plant tissue culture. Describe the procedure for the preparation of 100 ml of MS medium.

OR

Estimate the pollen viability for the given **specimen A** and discuss its reproductive adaptability. **10 marks**
2. Perform emasculation in the given **specimen B** required for hybridization **5 marks**
3. Demonstrate the given **specimen C** for Synthetic seeds / vegetative propagation **5 marks**
4. Identify and comment on given specimens **D,E,F,G & H** **10 marks**
5. **Viva- voce** **5 marks**
6. **Practical record** **5 marks**

Total 40 marks

* Student can ask an additional 30 minutes to complete the practical if necessary

DISCIPLINE SPECIFIC ELECTIVE (DSE) UNDER CBCS – GENETICS
SEMESTER VI
PRACTICAL – VI : ADVANCED GENETICS / GENETIC
ENGINEERING

(Common for both papers DSE GENT : 601A and 601B)

QUESTION PAPER

PAPER CODE: **DSE GENP:602B**

***Duration : 03 (Hrs.)**

Max. Marks: 40

1. Isolate DNA from given **sample A** by rapid method or CTAB method
OR
Isolate RNA from the given **sample A** **10 marks**
2. Calculate the purity of isolated DNA from the given data **B** and comment **5 marks**
3. Write the principle and demonstrate the separation of **sample C** by Agarose Gel Electrophoresis **5 marks**
4. Identify given specimen **D,E,F,G,H** and comment **10 marks.**
5. **Practical record** **5 marks**
6. **Study tour report** **5 marks**

Total 40 marks

* Student can ask an additional 30 minutes to complete the practical if necessary

CBCS syllabus w.e.f. 2022-23
B.Sc. SIXTH SEMESTER
Skill Enhancement Course (SEC) in GENETICS(SEC-GENP:603)
APPLIED GENETICS
(Credits: -02) Total practical Teaching hours: 60 Hours

- 1) Extraction of genomic DNA from plant and animal samples
- 2) Quantification of DNA by spectrophotometer/migration on agarose gel
- 3) Estimation of DNA by DPA method
- 4) Electrophoretic separation of DNA using agarose gel
- 5) Extraction of RNA from plant and animal samples
- 6) Estimation of RNA by orcinol method
- 7) Extraction of proteins from plant and animal samples
- 8) Estimation of proteins by CBB method

Note: 1. Experiments of four hours duration.
2. Minimum of Eight experiments to be performed.
3. Any new experiment may be added to the list with the prior approval from the BOS.