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

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'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

## ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

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ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೊದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೊದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

Practical Subject

KARNATAK UNIVERSITY, DHARWAD

# 04 - Year B.Sc. (Hons.) Program

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## SYLLABUS

## Subject: Genetics

## [Effective from 2021-22]

## DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

## OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

## SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

## AS PER N E P - 2020

# Karnatak University, Dharwad

Four Years Under Graduate Program in Genetics for B.Sc. (Hons.)

Effective from 2021-22

| Sem | Type of Course | Theory/ Practical | Instruction hour per week | Total hours of Syllabus / Sem | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| I | DSCC 1 | Theory | 04hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | | Practical | 04 hrs | 52 | 03 hrs | 25 | 25 | 50 | 02 |
| | OEC-1 | Theory | 03 hrs | 42 | 02 hrs | 40 | 60 | 100 | 03 |
| | *SEC-1 | Practical | 03 hrs | 30 | 02 hrs | 25 | 25 | 50 | 02 |
| II | DSCC2 | Theory | 04 hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | | Practical | 04 hrs | 52 | 03 hrs | 25 | 25 | 50 | 02 |
| | OEC-2 | Theory | 03 hrs | 42 | 02 hrs | 40 | 60 | 100 | 03 |
| | **Details of the other Semesters will be given later** | | | | | | | | |

*** Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected**

## Name of Course (Subject): Genetics

### Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Genetics students will be able to:

**PSO 1 :** To instill in students an enthusiasm for classical genetics, an appreciation of its application in different contexts, and to involve them in an intellectually stimulating and satisfying experience of learning and studying.

**PSO 2 :** To provide students with broad and balanced knowledge and understanding of key concepts of cell biology and cytogenetics. Students will be technically sound with respect to the practical aspects of the subject and make them employable.

**PSO 3 :** To develop in students a range of practical skills in molecular biology so that they can understand and assess risks of handling microorganisms and work safely with pathogenic and transformed microbes competently in the laboratory.

**PSO 4 :** To develop in students the ability to apply standard methodology to the solution of problems in Microbial Genetics.

**PSO 5 :** To provide students with knowledge and skill towards employment or higher education in Genetics or multi-disciplinary areas involving computational biology and bio informatics.

**PSO 6 :** - To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes. Skills developed by the students in Genetic engineering or r-DNA technology make them employable.

**PSO 7 :** To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.

**PSO 8 :** To instill critical awareness of advances at the forefront of human genetics and cancer biology.

**PSO 9 :** To prepare students effectively for professional employment or research degrees in Genetics.

**PSO 10 :** To build confidence in the candidate to be able to work independently in Industries, Higher education and research Institutes with responsibility and work ethics.

# B.Sc. Semester – I

**Subject: Genetics**
**Discipline Specific Course (DSC)**
**Course No.1: Title of the Course (Theory): Cytogenetics**

**The course Cytogenetics in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.**

**Course No.-1 (Theory)**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **Course-01** | DSCC | Theory | 04 | 04 | 56 hrs | 2hrs | 40 | 60 | 100 |

**Course Outcome (CO):**

After completion of course (Theory), students will be able to:

**CO 1 :** Understand the structure and function of all the cell organelles.

**CO 2 :** Understand mechanism of cell division and insight in to cell cycle regulation

**CO 3 :** Understand chromosome number and abnormalities

| **Syllabus- Course 1(Theory): Title- Cytogenetics** | **Total Hrs: 56** |
|---|---|
| **Unit-I** | **14 hrs** |
| **Microscopy:** Introduction, and history, Principle and Optical Components.<br>**Types of microscopes:** Simple and Compound microscopes. Fluorescence, electron microscopy (transmission and scanning), Phase contrast, Confocal, inverted, Stereo microscopy, application in biological sciences.<br>**Cell membrane and cell wall:** Ultrastructure, chemical composition and functions of Plasma membrane and Plant cell wall.<br>**Ultrastructure and functions of Cytoplasmic organelles:** Chloroplast, Mitochondria, Endoplasmic reticulum, Ribosomes, Lysosomes, Peroxisomes, Golgi bodies and Cytoskeleton. | |
| **Unit-II** | **14 hrs** |
| **Nucleus:** Nuclear envelope, nucleoplasm, nucleolus and its role in ribosome assembly.<br>**Ultra-structure of Eukaryotic Chromosome:** Chromatin and its chemical nature, Centromeric DNA, telomere organization. Chromosome morphology and types, primary and Secondary constriction, SAT-bodies. Macro-molecular organization-Nucleosome model and DNA packaging and its importance. Special chromosomes – Salivary gland, lamp brush and accessory chromosomes. C value enigma.<br>**Cell cycle:** G1, S, G2 and M-phases, Checkpoints and its significance. | |
| **Unit-III** | **14 hrs** |
| **Mitosis:** Stages, mitotic apparatus, Karyokinesis and cytokinesis, Mitogens and cell cycle inhibitors, Significance of mitosis.<br>**Meiosis:** Stages, chromosomal synapsis, crossing over, chiasma formation, | |

| | |
|---|---|
| Synaptonemal complex and Significance of meiosis. Spermatogenesis and oogenesis<br>**Cell senescence and Cell death:** Cellular features of Senescence-spontaneous and induced, Apoptosis – mechanism and significance.<br>**Structural Changes in chromosomes:** Duplications, deletions, inversions and translocations-types, origin, induction and its practical significance. | |
| **Unit-IV** | **14 hrs** |
| **Numerical changes in chromosomes:** Euploidy-monoploidy, diploidy & polyploidy. Aneuploidy- Hypoploidy (monosomic & nullisomic) and hyperploidy (trisomic and tetrasomic), origin, occurrence, production, cytological behavior, evolutionary importance and practical applications.<br>**Karyotype:** Karyotype and Ideogram, Karyotype analysis in plants, animals and humans. Chromosome evolution – symmetric and asymmetric karyotypes. Chromosome nomenclature.<br>**Chromosome analysis:** Chromosome staining techniques fluorescent and non-fluorescent staining. Banding- G, R, C, Q, NOR banding techniques, chromosome painting and its applications. | |

Books recommended.


1. Singh, S. P., & Tomar, B. S. (2008). Cell biology. Rastogi Publications, Meerut, India.
2. Gupta, P.K. (2010). Cytogenetics. Rastogi Publications, Meerut, India.
3. Singh, R. J. (2016). Plant cytogenetics. CRC press.
4. Karp, G. (2009). Cell and molecular biology: concepts and experiments. John Wiley & Sons
5. Russell, P. J., Hertz, P. E., McMillan, B., & Benington, J. (2020). Biology: the dynamic science. Cengage Learning.
6. Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). The cell: a molecular approach (Vol. 4). Washington, DC: ASM press.
7. Lewin, B., Krebs, J., Kilpatrick, S. T., & Goldstein, E. S. (2011). Lewin's genes X. Jones & Bartlett Learning.

# B.Sc. Semester – I

**Subject: Genetics**
**Discipline Specific Course (DSC)**
**Course No.-1 (Practical)**
**Title of the Course (Practical): Cytogenetics**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **Course-01** | DSCC | Practical | 02 | 04 | 52 hrs | 3hrs | 25 | 25 | 50 |

## Course Outcome (CO):

After completion of course (Practical), students will be able to:

**CO 1 :** Learn preparation of chemicals and reagents used for cytogenetics analysis

**CO 2 :** Carryout hands-on techniques in cytogenetics

**CO 3 :** Prepare and analyse the karyotype of plants and assess the evolutionary significance.

### List of the Experiments for 52 hrs / Semesters

1. Preparation of pre-treating agents / fixatives / stains, dehydration grades 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 *Chironomus & Drosophila* larvae
5. Chromosome counting & Karyotype analysis in plants-Allium cepa, Aloe vera
6. Identification of B chromosomes in Guizotia / Carthamus
7. Chromosome banding - Q banding
8. Induction of polyploidy in plants
9. Characterization of polyploids (wheat)
10. Study of translocation heterozygotes in Rheo discolar / Tradescantia.

**Each student must submit 5 permanent slides (mitosis/meiosis, at least two from each) for practical examination*

**General instructions:**

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

1. **Major Question ---------- 6 Marks**
2. **Minor Question---------- 4 Marks**
3. **Identification(A-E) ---------- 8 Marks**
4. **Viva----------2 Marks**
5. **Journal----------5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

Books recommended.


1. Singh, R. J. (2017). Practical manual on plant cytogenetics. CRC press.
2. Lavania, U. C. (2018). Practical manual on Plant Cytogenetics. Springer.
3. Arsham, M. S., Barch, M. J., & Lawce, H. J. (Eds.). (2017). The AGT cytogenetics laboratory manual. John Wiley & Sons.
4. Singh, R. J. (2016). Plant cytogenetics. CRC press.
5. Sybenga, J. (2012). Cytogenetics in plant breeding (Vol. 17). Springer Science & Business Media.
6. Ashburner, M. (1989). *Drosophila* - A laboratory handbook. Cold spring harbor laboratory press.
7. Gupta, Pramod K., and Takumi Tsuchiya, eds. Chromosome engineering in plants: genetics, breeding, evolution. Newnes, 1991.

# B.Sc. Semester – I

**Subject: Genetics**
**Open Elective Course (OEC-1)**
**(OEC for other students)**
**OEC-1: Title of the Course: Introduction to Cell Biology**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **OEC-1** | OEC | Theory | 03 | 03 | 42 hrs | 2hrs | 40 | 60 | 100 |

**Course Outcome (CO):**

After completion of course, students will be able to:

**CO 1 :** Use microscopes to study the events inside cell

**CO 2 :** Understand functioning of cell organelles

**CO 3 :** Have insight chromosome abnormalities and its implication in human health

| **Syllabus- OEC: Title-: Introduction to Cell Biology** | **Total Hrs: 42** |
|---|---|
| **Unit-I** | **14 hrs** |
| **Microscopy -** Introduction, and history, Principle and Optical Components. Types of microscopes - Simple and Compound microscopes. Fluorescence, electron microscopy (transmission and scanning), Phase contrast, Confocal, inverted, Stereo microscopy, application in biological sciences.<br>**Cell membrane and cell wall:** Ultrastructure, chemical composition and functions of Plasma membrane and Plant cell wall.<br>**Ultrastructure and functions of Cytoplasmic organelles**: Chloroplast, Mitochondria, Endoplasmic reticulum, Ribosomes, Lysosomes, Peroxisomes, Golgi bodies, nucleus, and Cytoskeleton. | |
| **Unit-II** | **14 hrs** |
| **Cell cycle**: G1, S, G2 and M-phases, Checkpoints and its significance.<br>**Mechanism of Cell Division**:<br>**Mitosis:** Stages, mitotic apparatus, Karyokinesis and cytokinesis, Mitogens and cell cycle inhibitors, Significance of mitosis.<br>**Meiosis:** Stages, chromosomal synapsis, crossing over, chiasma formation, Synaptonemal complex and significance of meiosis. Spermatogenesis and oogenesis. | |
| **Unit-III** | **14 hrs** |

| | |
|---|---|
| **Ultra-structure of Eukaryotic Chromosome**: Chromatin and its chemical nature, Centromeric DNA, telomere organization. Chromosome morphology and types, primary and Secondary constriction, SAT-bodies. Macromolecular organization-Nucleosome model and DNA packaging and its importance. Special chromosomes – Salivary gland, lamp brush and accessory chromosomes. C value enigma.<br>**Structural Changes in chromosomes:** Duplications, deletions, inversions and translocations-types, origin, induction and its practical significance.<br>**Numerical changes in chromosomes:** Euploidy-monoploidy, diploidy & polyploidy. Aneuploidy- Hypoploidy (monosomic & nullisomic) and hyperploidy (trisomic and tetrasomic), origin, occurrence, production, cytological behaviour, evolutionary importance and practical applications. | |

Books recommended.


1. Rastogi V. B. (2014). Genetics. KNRN publishers
2. Verma, P. S., & Agarwal, V. K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology: Evoloution and Ecology. S. Chand Publishing.
3. Hartl, D. L., & Jones, E. W. (2009). Genetics: analysis of genes and genomes. Jones & Bartlett Learning.
4. Pierce, B. A. (2012). Genetics: a conceptual approach. Macmillan.
5. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M. A., & Ward, S. M. (2009). Concepts of genetics (pp. 463-464). Pearson.
6. Trun, N., & Trempy, J. (2009). Fundamental bacterial genetics. John Wiley & Sons.
7. Streips, U. N., & Yasbin, R. E. (Eds.). (2004). Modern microbial genetics. John Wiley & Sons.

# B.Sc. Semester - I

**Subject: Genetics**

**SKILL ENHANCEMENT COURSE (SEC)-I**

**Title of Course: Cytogenetic Techniques**

| Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Mode of Examination | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| SEC-I | Theory + Practical | 02 | 03hrs | 30 | Practical | 2hr | 25 | 25 | 50 |

**Course Outcome (CO):**

After completion of Skill Enhancement course, students will have:

**CO 1** : Hands on experience of preparation of chemicals and reagents used for cytogenetics analysis

**CO 2** : Knowledge of techniques in cytogenetics

**CO 3** : Proficiency of carrying out cytogenetic techniques independently.

**List of the Experiments for 52 hrs / Semesters**

1. Preparation of pre-treating agents / fixatives / stains, dehydration grades for
2. cytological studies.
3. Study of Mitosis using root tips – *Allium cepa / Aloe vera*
4. Study of Meiosis using flower buds / grasshopper testes
5. Preparation of salivary gland chromosomes in *Drosophila and Chironomous* larvae
6. Preparation of salivary gland chromosomes in larvae
7. Chromosome counting & Karyotype analysis in freshly prepared slides
8. Preparation of Human karyotype
9. Identification of B chromosomes in *Guizotia / Carthamus*
10. Chromosome banding – G/R/Q banding

**General instructions:**

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

1. **Major Question ---------- 6 Marks**
2. **Minor Question---------- 4 Marks**
3. **Identification(A-E) ---------- 8 Marks**
4. **Viva----------2 Marks**
5. **Journal----------5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

Books recommended.


1. Singh, R. J. (2017). Practical manual on plant cytogenetics. CRC press.
2. Lavania, U. C. (2018). Practical manual on Plant Cytogenetics. Springer.
3. Arsham, M. S., Barch, M. J., & Lawce, H. J. (Eds.). (2017). The AGT cytogenetics laboratory manual. John Wiley & Sons.
4. Singh, R. J. (2016). Plant cytogenetics. CRC press.
5. Sybenga, J. (2012). Cytogenetics in plant breeding (Vol. 17). Springer Science & Business Media.
6. Ashburner, M. (1989). *Drosophila* - A laboratory handbook. Cold spring harbor laboratory press.
7. Gupta, Pramod K., and Takumi Tsuchiya, eds. Chromosome engineering in plants: genetics, breeding, evolution. Newnes, 1991.

**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks**

| Type of Assessment | Weight age | Duration | Commencement |
|---|---|---|---|
| Written test-1 | 10% | 1 hr | 8th Week |
| Written test-2 | 10% | 1 hr | 12th Week |
| Seminar | 10% | 10 minutes | -- |
| Case study / Assignment / Field work / Project work/ Activity | 10% | ------ | -- |
| Total | 40% of the maximum marks allotted for the paper | | |

**Faculty of Science**
**04 - Year UG Honors programme:2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC**
**(60 marks for semester end Examination with 2 hrs duration)**

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

**Part-B**

**2.** Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

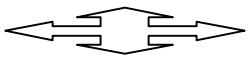
**Part-C**

**3.** Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.**



# B.Sc. Semester – II

**Subject: Genetics**
**Discipline Specific Course (DSC)**
**Course: No.2: Title of the Course: Transmission Genetics (Theory)**

**The course Transmission Genetics in II semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **Course-02** | DSCC | Theory | 04 | 04 | 56 hrs | 2hrs | 40 | 60 | 100 |

**Course Outcome (CO):**

After completion of course (Theory), students will be able to:

**CO 1 :** Learn historical overview genetics and laws Inheritance.

**CO 2** : Understand Mendel's principles and deviations.

**CO 3** : Gene interactions and their outcome through gene mapping.

| **Syllabus- Course 2(Theory): Title- Transmission Genetics** | **Total Hrs: 56** |
|---|---|
| **Unit-I** | **14 hrs** |
| **History of Genetics:** Pre-Mendelian, Mendelian and Post-Mendelian genetic concepts; Concepts of Phenotype and Genotype; Heredity, variation, Pure lines and Inbred lines.<br>**Mendelism:** Mendel's work with Pea plant - Law of Dominance, Segregation, Independent Assortment, Mono hybrid and dihybrid cross, Back cross and Testcross, Genetic Problems related.<br>**Multiple Allelism:** Definition, ABO blood groups and Rh factor in Human, Genetic Problems related. | |
| **Unit-II** | **14 hrs** |
| **Gene Interactions:** Deviations from Mendelism: Incomplete inheritance dominance and co-dominance, Complementary gene interaction (9:7) Ex: Lathyrus odoratus. Supplementary gene interaction (9:3:4) Ex: Grain color in Maize, Recessive Epistasis - Dominant Ex.: Fruit color in Cucurbita pepo, Recessive - Ex.: Coat color in Mice., Non-Epistasis - Comb pattern in Poultry.<br>**Gene mapping:** Linkage - Definition, Linkage group- *Drosophila and* man;<br>**Types of linkage**-complete linkage and incomplete linkage, Significance of linkage.<br>**Linkage maps:** Crossing over - definition; recombination and recombination frequency, Mechanism of crossing over: Chiasma Interference and coincidence; Coupling and Repulsion hypothesis. | |

| **Unit-III** | **14 hrs** |
|---|---|
| **Sex Determination:** Chromosome theory of Sex determination: XXXY, XX-XO, ZZ-ZW; Intersexes and Super sexes in *Drosophila*, Y chromosome in sex determination of *Melandrium*.<br>**Genetic and Hormonal control of Sex determination:** Genic balance theory of Bridges, Gynandromorphs, Environment and sex determination.<br>Diecious/monecious plants and mechanism of sex determination in plants<br>**Sex chromosomes**: Allosomes and Dosage compensation, Lyon hypothesis and Barr body in humans. | |
| **Unit-IV** | **14 hrs** |
| **Extra Chromosomal Inheritance:** Characteristic features of Cytoplasmic Inheritance; Inheritance of- Mitochondrial DNA in budding yeast, Chloroplast DNA in leaf variegation in *Croton*, Kappa particles in *Paramecium*, uniparental inheritance in *Chlamydomonas reinhardtii*, Shell coiling in snail.<br>**Jumping Genes:** Transposable elements, LINES, SINES, Alu family and their application in genome mapping<br>**Genetic Model Organisms:** Life cycle and application in genetic research of – T4 Phage, λ phage and *E. Coli, Arabidopsis thaliana, Caenorhabditis elegans, Drosophila melanogaster, Danio rerio* and *Xenopus laevis.* | |

Books recommended.


1. Advanced Genetics. G. S. Miglani. Alpha Science International, Ltd. 2012.
2. Theory and Problems of Genetics. W. D. Stansfield. 2002. Mc Graw Hill Publications.
3. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha, VikasPublishing House Private, Limited, 1998.
4. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.
5. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.
6. Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.
7. Principles of Genetics by E.J.Gardener, M.J.Simmons and D.P.Snustad.J.Wiley and Sons pubs (1998).

# B.Sc. Semester – II

**Subject: Genetics**
**Discipline Specific Course (DSC)**

**Course No.-2: Transmission Genetics (Practical)**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **Course-02** | DSCC | Practical | 02 | 04 | 52 hrs | 3hrs | 25 | 25 | 50 |

## Course Outcome (CO):

After completion of course (Practical), students will be able to:

**CO 1 :** Handle Drosophila and carryout Genetic experiments

**CO 2** : Understand Mendel's principles experimentally.

**CO 3** : Gene interactions and their outcome through gene mapping.

### List of the Experiments for 52 hrs / Semesters

1. Preparation of fruit fly media and handling of fruit flies
2. Morphology of adult fruit fly.
3. Study of life cycle of fruit fly.
4. Mounting of sex comb in fruit fly.
5. Study of mutant fruit fly.
6. Collection of virgin flies.
7. Validation of Mendelian laws using fruit fly.
8. Linkage analysis in fruit fly.
9. Preparation of media and culturing of *Neurospora & Ascobolus*
10. Analysis of tetrads in *Neurospora & Ascobolus*

**General instructions:**

**Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination**

1. **Major Question ---------- 6 Marks**
2. **Minor Question---------- 4 Marks**
3. **Identification(A-E) ---------- 8 Marks**
4. **Viva----------2 Marks**
5. **Journal----------5 Marks**

**Total 25 marks**

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

Books recommended.


1. Das, D. (2017). Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology: A Laboratory Manual. Academic Publishers.
2. Ashburner, M. (1989). Drosophila - A laboratory handbook. Cold spring harbor laboratory press.
3. Burke, D., Dawson, D., & Stearns, T. (2000). Methods in Yeast Genetics: A Cold Spring Harbor Laboratory Course Manual (2000 Edition). Plainview, NY: Cold Spring Harbor Laboratory Press.
4. Celis, J. E., Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (Eds.). (2005). Cell biology: a laboratory handbook. Elsevier
5. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.
6. Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.

# B.Sc. Semester – II

**Subject: Genetics**
**Open Elective Course (OEC-2)**
**(OEC for other students)**
**OEC-2: Title of the Course: Basic Genetics**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **OEC-2** | OEC | Theory | 03 | 03 | 42 hrs | 2hrs | 40 | 60 | 100 |

**Course Outcome (CO):**

After completion of course, students will be having basic knowledge of:

CO 1 **:** Mendelian genetics and inheritance of characteristics

CO 2 : Sex determination in plants animals and humans

CO 3 : Extranuclear inheritance

| **Syllabus- OEC: Title- Basic Genetics** | **Total Hrs: 42** |
|---|---|
| **Unit-I** | **14 hrs** |
| **History of Genetics:** Overview of Pre-Mendelian, Medndelian and Post-Mendelian genetic concepts; Concepts of Phenotype and Genotype; Heredity, variation, Pure lines and Inbred lines<br>**Mendelism:** Mendel's work with Pea plant - Law of Dominance, Segregation, independent Assortment, Mono hybrid and dihybrid cross, back cross and Testcross, Genetic Problems related.<br>**Multiple Alleles:** Definition, ABO blood groups and Rh factor in Human, Genetic Problems related. | |
| **Unit-II** | **14 hrs** |
| **Gene Interactions:** Deviations from Mendelism: Incomplete inheritance dominance and co-dominance, Complementary gene interaction (9:7) Ex: *Lathyrus odoratus*. Supplementary gene interaction (9:3:4) Ex: Grain color in Maize, Recessive Epistasis - Dominant Ex.: Fruit color in Cucurbita pepo, Recessive - Ex.: Coat color in Mice., Non-Epistasis - Comb pattern in Poultry.<br>**Gene mapping:** Linkage - Definition, Linkage group- *Drosophila and* man; Types of linkage-complete linkage and incomplete linkage, Significance of linkage.<br>**Linkage maps:** Crossing over - definition; recombination and recombination frequency, Mechanism of crossing over: Chiasma Interference and coincidence; Coupling and repulsion hypothesis.<br>**Sex Determination:** Chromosome theory of Sex determination: XXXY, XX-XO, ZZ-ZW; Intersexes and Super sexes in *Drosophila*, Y chromosome in sex determination of *Melandrium*. Dosage compensation and Lyon hypothesis and Barr body. | |
| **Unit-III** | **14 hrs** |

| | |
|---|---|
| **Extra Chromosomal Inheritance:** Characteristic features of Cytoplasmic Inheritance; Inheritance of- Mitochondrial DNA, Chloroplast DNA, Kappa particles in *Paramecium*, uniparental inheritance in *Chlamydominas*, Shell coiling in snail.<br>**Behavioral Genetics:** Introduction to Genetics and Behaviour, Mating behavior in *Drosophila*, Hygienic behavior in Honey bee, Nesting behavior in Ants, Territoriality and conflict behavior in Primates.<br>**Microbial Genetics:** Transformation, Conjugation, Transduction, Lytic and Lysogenic cycle, Gene mapping by Conjugation and Transduction. | |

Books recommended.


1. Advanced Genetics. G. S. Miglani. Alpha Science International, Ltd. 2012.
2. Theory and Problems of Genetics. W. D. Stansfield. 2002. Mc Graw Hill Publications.
3. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha, VikasPublishing House Private, Limited, 1998.
4. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.
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**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks**

| Type of Assessment | Weight age | Duration | Commencement |
|---|---|---|---|
| Written test-1 | 10% | 1 hr | 8th Week |
| Written test-2 | 10% | 1 hr | 12th Week |
| Seminar | 10% | 10 minutes | -- |
| Case study / Assignment / Field work / Project work/ Activity | 10% | ------ | -- |
| Total | 40% of the maximum marks allotted for the paper | | |

**Faculty of Science**
**04 - Year UG Honors programme:2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC**
**(60 marks for semester end Examination with 2 hrs duration)**

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

**Part-B**

**2.** Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

**Part-C**

**3.** Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.**