KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ 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 & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ 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.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. in Genetics

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SYLLABUS

With Effect from 2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM V & VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM V SEM

AS PER NEP - 2020

Karnatak University, Dharwad

B.Sc. in **Genetics**

Effective from 2023-24

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	035 GEN 011	Gene Regulation and DNA repair	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	035 GEN 012	Gene Regulation and DNA repair	04 hrs	56	03 hrs	25	25	50	02
	DSCC-11	Theory	035 GEN 013	Genes and Development	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	035 GEN 014	Genes and Development	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	035 GEN 61	Seed Science and Technology	04hrs	56	03 hrs	25	25	50	02
	Total										**26**
VI	DSCC-13	Theory	036 GEN 011	Population and Evolutionary Genetics	04hrs	56	02 hrs	40	60	100	04
	DSCC-4	Practical	036 GEN 012	Population and Evolutionary Genetics	04 hrs	56	03 hrs	25	25	50	02
	DSCC-15	Theory	036 GEN 013	Plant cell and Tissue culture Technology	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	036 GEN 014	Plant cell and Tissue culture Technology	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	Internship-1		036 GEN 091					50	0	50	02
	Total										**26**

B.Sc. Semester – V

Discipline Specific Course (DSC)-9

Course Title: Gene Regulation and DNA repair

Course Code: 035 GEN 011

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
DSCC-9	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: To Comprehend the DNA repair mechanisms and the associated diseases

CO 2: To Understand the gene regulation through epigenetic mechanism

CO 3: To Study the gene expression at transcription level

CO 4: To Learn the analysis of gene expression through technique

Unit	Title:	56.hrs/ sem
Unit I	**DNA repair:** Single strand and double strand DNA damage; Direct DNA repair- Photoreactivation, 3'-5' exonuclease activity of DNA polymerase(proof reading),methy guanine, methyl transferase; Excision repair- Base excision repair, Nucleotide excision repair, Mismatch repair , SOS repair Mitochondrial DNR repair.; Repair defects- Gene defect, symptoms and incidence involved in Xeroderma pigmentosum, Ataxia Telengetasia, Fanconi anemia and Cocyane syndrome	14 hr
Unit II	**Epigenetic Gene regulation:** a. Introduction to Epigenetic Gene regulation and its types trancsriptional and transalational regulation. b. DNA Modification- Cytosine modification-CpG island, role of DNA methyl transferases (DNMTS) in DNA methyation, DNA methyl binding proteins, DNA demethyl transferases. c. Histones and epigenetic modification- process of Histone methylation, acetylation and phosphorylation nucleosome remodelling d. RNA based epigenetic modification.-Role of small noncoding RNAs –miRNA , si RNA, sno RNA in translational regulation, Role of Long non –coding RNA in gene regulation. Mechanism of X chromosome inactivation in human female, Genomic imprinting.	14hr
Unit III	**Regulation of gene expression:** a. Spatial and temporal gene regulation of gene expression b. Transcriptional control: RNA polymerases, cis-elements, transcription factors, Post transcriptional control: RNA –editing – Adenosine to inosine , cytoplasmic control of mRNA stability Environmental impact on transcription: Heat shock genes c. RNA interference: mechanisms and enzymology; RISC complex formation; regulation of gene expression by miRNP pathway d. Antisense RNA technology, RNA sequencing	14Hr

Unit IV	**Gene expression analysis:** a. RNA expression analysis-DNA microarray, RT-PCR method b. Promoter Analysis- Expression of Reporter gene/ promoter fusion in host cells, chromatin Immunoprecipitation method c. Protein expression analysis: Western blotting, 2D-Gel Electrophoresis d. Methylation sensitive restriction enzymes and Flourescent insitu hybridization	14hr

References:

1. Molecular Cell Biology, Lodish H et al., - Freeman
2. The Cell: A Molecular Approach, Cooper GM - Sinauer
3. Molecular Biology of the Cell, Alberts B et al., - Garland
4. Genomes, Brown TA – Garland
5. Human Molecular Genetics, Strachan T and Read AP – Garland Science
6. Modern Genetic Analysis, Griffiths AJF et al., - Freeman

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSC)-10

Course Title: Gene Regulation and DNA repair

Course Code: 035 GEN 012

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
DSCC-10	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Isolate DNA from different tissues

CO 2: Stain and observe DNA and RNA in cells

CO 3: Understand the methodology involved in DNA and RNA blotting

CO 4: Analyse the effects of mutations in Human beings

Expt. No,	Title:	56.hrs/ sem
1	Isolation of RNA from blood/ tissue sample	
3	Expression of heat shock protein and induction of puffs in polytene chromosome of Drosophila	
4	Study of mutant s in Drosophila. 4. DNA specific staining – Feulgen/ Toludine blue staining of fixed cells	
5	RNA specific staining- pyroninestaining	
6	Agarose gel electrophoresis for DNA sepapration & visualization	
7	Protein Profiling-SDS PAGE	
8	Demonstration of Western Blotting Technique	
9	Study of 2D-gel electrophoresis	
10	FISH Demonstration	
11	Chromatin Immunoprecipitation-Principle and applications	
12	Study of Mutation involved in Xeroderma Pigmentosum, Ataxia Telengetasia, Fanconi Anemia	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Major experiment	06
Minor Experiment	04
Spotting	10
Viva	02
Journal	03
Total	**25 Marks**
Formative Assessment as per guidelines.	

The same shall be used for semester end Examination

B.Sc. Semester – V

Discipline Specific Course (DSC)-11

Course Title: Genes and Development

Course Code: 035 GEN 013

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
DSCC-13	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Understand the concepts of early development in animals.

CO 2: Learn the molecular and cellular mechanisms controlling early development of organisms.

CO 3: To understand the role of the genes and proteins involved in regulating the processes of cell differentiation and determination, morphogenesis and growth.

CO 4: To describe the role of paracrine factors and the main signalling pathways that play important roles in development.

Unit	Title:	56 hrs/ sem
Unit I	**History and basic concepts:** Model organisms for genetic analysis of development: Insect-*Drosophila melanogaster*, amphibians-*Xenopus levis*, birds-chick, mammals-mouse, Worm-identifying developmental genes. **Patterning of the vertebrate body plan:** Axes and germ layers-settling of the body axes mesoderm and early nervous system-somite formation and patterning, neural induction and the role of the organizer.	14 Hrs
Unit II	**Development of fruit fly body plan:** Setting up the body axes, Patterning the early embryo polarization of body axes during oogenesis, zygotic gene activity in early embryo, segmentation-activation of pair rule genes, selector and homeotic genes, segment polarity genes and compartments. **Morphogenesis**: change in form in the early embryo, Differentiation of Cell and stem cells, Organogenesis, Sex determination in animal kingdom, Growth and post embryonic development, Regeneration, Evolution and development.	14 Hrs
Unit III	**Genetics of embryonic development in plant:** Early events in embryogenesis, gene expression in embryo, genetics of embryogenesis-embryolethal mutants, apical-basal axis mutants, segment deletion mutant, radial axis mutants. Cell fate maps in embryo development. **Genetics of seedling development:** Photomorphogenesis, shoot development, leaf development and root development. Genetics of flowering, seed and fruit development: Transition from vegetative to floral development, ABC model and homeotic genes, mad box genes. Genetics of anther development and pollen formation.	14 Hrs

Unit IV	Seed development- Endosperm, endosperm balance number, maturation stage, LEA protein and control of seeds dormancy and germination. Fruit development and control of ripening. Root and Shoot development in plants: Molecular basis of Root and Shoot development. Genetics of aging and Senescence in animals and plants.	14 Hrs

References:

1. Bhojawani, S.S, and Bhatnagar, S.P. (2000): The embryology of Angiosperms Vikas Publication House, New Delhi.
2. Carlson, B.M. (1996): Pattern's foundation of embryology. McGraw Hill Inc. N.Y.
3. Howell, S.H. (1998): Molecular genetics of plant development. Cambridge University
4. Press, Cambridge. • Lewin. B. (2001): Genes VII. Oxford University Press. Oxford.
5. Russo, V.E.A., Brody, S., Cove. D. And Okkolenghi (1992): Development. The • Molecular genetic approach.Springer Verlag Berlin.
6. Snustad, D.P., and Simmons, M.J. (2003): Principles of Genetics, 3 Edn. John Wiley and
7. Sons, inc. N.Y. • Tamarin, R.H. (2000): Principles of Genetics 6 Edn. W.C. Brown Publishers, London

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSC)-12

Course Title: Genes and Development

Course Code: 035 GEN 014

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
DSCC-14	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: To make direct and daily visual observations of living embryos of different organisms

CO 2: To describe the anatomy and physiology of the egg and embryos

CO 3: To understand that chicken embryos are more readily available and less expensive to use than frogs in the study of embryology, anatomy and physiology.

CO 4: To demonstrate mounting of imaginal discs and cell death using cancer cells

Expt. No,	Title:	56.hrs/ sem
1	1. Types of eggs and cleavage patterns 3. 4. 5.. 6.	
3	Dissection and observation of the 4-14 somite chick embryo (24-34 hours embryo).	
4	Invitro culture of Early chick embryo	
5	Study of Development in Arabidopsis/drosophila/fish/frog/mammals.	
6	Mounting of imaginal discs in fruit fly	
7	Demonstration of cell death in cancer cell lines 8.	
8	Study of Gametogenesis using chart/model	
9	Study of embryogenesis using chart/model	
10	Study of seed development using chart/model	
11	Study of shoot differentiation in plants	
12	Study of shoot differentiation in plants	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Major experiment	06
Minor Experiment	04
Spotting	10
Viva	02
Journal	03
Total	**25 Marks**
Formative Assessment as per guidelines.	

The same shall be used for semester end Examination

B.Sc. Semester – V

Skill Enhancement Course: SEC-3

Course Title: Seed Science and Technology

Course Code: 035 GEN 61

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
SEC-3	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Understand seed sampling and collection

CO 2: Perform seed testing techniques

CO 3: Perform breeding procedure for hybrid seed production

CO 4: Have insight of seed certification Procedure

Expt. No	Title: Seed Science and Technology	56.hrs/ sem
1	Seed sampling procedures and principles	
2	Seed germination testing	
3	Seed viability testing	
4	Seed dormancy and breaking methods	
5	Identification and symptoms of important seed borne pathogens	
6	Floral morphology of important monocot crops	
7	Floral morphology of important dicot crops	
8	Pollen viability test	
9	Hybridation techniques- emasculation, pollen collection and cross pollination	
10	Seed certification methods	
11	Visit to seed production plots	
12	IPR related to seed production and certification	

References:

1. A Practical Manual of Seed Science and Technology For Under Graduate student Seed Production: Principles and Practices. Chapman & Hall. Singhal, N.C. 2003.
2. Hybrid Seed Production in Field Crops. Kalyani Publishers.
3. Anonymous. 1992. Legislation on Seeds. NSC Ltd., Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.
4. Nema, N.P. 1986. Principles of Seed Certification and Testing. Allied Publishers. Tunwar, N.S. and Singh, S.N. 1988.
5. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Major experiment	06
Minor Experiment	04
Spotting	10
Viva	02
Journal	03
Total	**25 Marks**
Formative Assessment as per guidelines.	

The same shall be used for semester end Examination

B.Sc. in Genetics

VI Semester

W. e. f.: 2023-24

B.Sc. Semester – VI

Discipline Specific Course (DSC)-13

Course Title: Population and Evolutionary Genetics

Course Code: 036 GEN 011

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
DSCC-13	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: To understand basic principles of evolution

CO2. To Calculate changes in gene frequencies in natural population

CO3. To Understand genetic variation in natural population

CO4. To Learn molecular phylogenetics

Unit	Title:	56 hrs/ sem
Unit I	**History and Basic concepts:** Origin of earth, Geological time scale; Origin of life; Formation and types of fossils; Evolutionary evidences- Fossils records, comparative anatomy and embryology, biogeography and molecular (chemical) evidences **Theories of Evolution:** Fixism and Creationism, Catastropism, Lamarckism, neo- Lamarckism, Darvinism, neo-Darwinism (Modern Synthetic Theory- Variation, natural selection, genetic drift, isolation and mutation as underlying mechanisms of evolution), Evolutionary analysis of form and function.	14 Hrs
Unit II	**Gene frequencies and equilibrium:** Gene pool, genotype frequency and gene frequency (allele frequency), Hardy-Weinberg equilibrium: principle, derivation, conditions and applications. **Changes in gene frequencies:** Mutation rate, selection, fitness, gametic and zygotic selection, heterozygous advantage. Unstable equilibrium, equilibrium between mutation and selection. Mutation rate and equilibrium frequencies estimation, migration, Random genetic drift	14 Hrs
Unit III	**Inbreeding and Heterosis:** Measurement of inbreeding -inbreeding coefficient, effect of inbreeding on gene frequency, Panmictic index; Assortative and Disruptive mating; Cross breeding & Heterosis- examples and mechanism **Genetic Structure of Population:** Optimum phenotype and selection pressure, types of selection, Fischer's theorem on natural selection, genetic variability in natural populations, Canalization, genetic homoeostasis, genetic load and genetic drift. Evolutionary process: Race formation, Isolating mechanisms, modes of speciation.	14 Hrs
Unit IV	**Genetic Polymorphism:** Types of Polymorphism, Maintaining polymorphisms, sampling the genome, Multilocus selection models, neutral alleles, Molecular evolutionary clock. **Molecular phylogenies and evolution:** Amino acid sequences, DNA and repetitive DNA sequences, DNA-DNA hybridization, Restriction enzyme sites. Molecular Polymorphism and its evolutionary implications Nucleotide sequence homologies, rate of molecular changes, regulating genes and evolutionary consequences.	14 Hrs

References:

1. Strickberger's Evolution, Hall & Halgrimson, Jones & Bartlett publishers.
2. Organic Evolution (Evolutionary Biology), VB Rsstogi, Medtech Science Press.
3. Evolution, Douglas J. Futuyma and Mark Kirkpatrick, Oxford University, Press.
4. Evolutionary Genetics : Concepts, Analysis, and Practice, Glenn-Peter Saetre & Mark Ravinet, Oxford university Press.
5. An Introduction to Biological Evolution, Kenneth V. Kardong, McGraw-Hill Publishing Company
6. Genetics, Strickberger, Pearson Education India.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSC)-14

Course Title: Population and evolutionary genetics

Course Code: 036 GEN 012

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
DSCC-14	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1. Analyze genotype and gene frequency in natural population
CO 2. Identify genetic variation in natural population
CO 3. Understand mechanism of evolution
CO4. Analyze role of biomolecules in evolutionary perspective

Expt. No,	Title:	56.hrs/ sem
1	Study of fossils	
3	Estimation of allelic frequency in natural population – PTC Loci	
4	Genetic variation in natural population- Beak Shape in birds, colour pattern in lady bird beetle	
5	Mimicry – Butterfly and orchid flowers	
6	Metroglyph analysis	
7	Mechanism of speciation in wheat by Polyploidy	
8	Genetic analysis of inbreeding	
9	Problems solving using Hardy-Weinberg law	
10	Analysis of nucleic acid sequences and generation of dendrogram	
11	Analysis of protein sequences and generation of dendrogram	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Major experiment	06
Minor Experiment	04
Spotting	10
Viva	02
Journal	03
Total	**25 Marks**
Formative Assessment as per guidelines.	

The same shall be used for semester end Examination

B.Sc. Semester – VI

Discipline Specific Course (DSC)-15

Course Title: Plant cell and Tissue culture Technology

Course Code: 036 GEN 013

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
DSCC-15	**Theory**	**04**	**04**	**56 hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: To Understand the concepts plant cell and tissue culture

CO 2. To Learn the techniques used in plant tissue culture industry

CO 3. To understand the role harmones in plant tissue culture.

CO 4. To describe the role plant tissue culture in agriculture, industry and medicine.

Unit	Title:	56 hrs/ sem
Unit I	**Introduction to Plant Tissue culture:** Definition, Concept of cellular totipotency, history, present status and future prospects of plant tissue culture, Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures. **Tissue Culture Media Composition:** Composition- macronutrients, micronutrients, vitamins, amino acids or other nitrogen supplements, sugar, solidifying agents, adsorbents and growth regulators (Hormones). Solid and liquid media.	10hrs
Unit II	**Types of Media and Their Application in Plant Tissue Culture**: Murashige and Skoog (MS) medium, & Linsmaier and Skoog (LS) medium- for organogenesis, callus culture, cell suspension, and micropropagation; Gamborg (B5) medium-for protoplast culture; Nitsch & Nitsch (NN) medium-For in vitro anther culture; and White's Medium-for Shoot and callus culture. **Methods in Plant Tissue Culture:** Fumigation, wet and dry sterilization, ultraviolet sterilization, ultrafiltration and surface sterilization. Laminar flow hood. Maintenance of axenic cultures. **Explants for Tissue Culture**: Explants selection, sterilization and inoculation of Shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs. Callus culture - initiation and maintenance of callus, Protoplast isolation, culture and fusion	16hrs
Unit III	**Callus Culture Techniques:** Introduction, principle, protocol, morphology and internal structure, genetic variations, applications. Organogenesis- Introduction, principle, protocol, applications. **Organ Culture Technique:** Introduction, principle, protocol, applications, with respect to root tip culture, leaf culture, ovary and ovule culture. Anther & Pollen Culture Technique- Introduction, principle, protocol, factors affecting, applications **Suspension Culture Technique:** Introduction, principle, protocol, types, growth measurement, viability test, synchronization, applications. Plant Protoplast Culture and Fusion :-History, Principle, protocol for isolation- Mechanical and Enzymatic, protoplast culture methods, viability test Applications	16hrs

Unit IV	**Somatic embryogenesis**: Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis; production of artificial seeds; Cryopreservation **Somaclonal Variation:** Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and limitations. somaclonal variations for Biotic & Abiotic stress **Micropropagation**: Introduction, stages of Micropropagation, factors affecting, advantages and applications. Different Pathways of Micropropagation- Axillary bud proliferation, organogenesis, meristem culture. Agrobacterium mediated transformation for agriculture, Industrial and medicinal applications.	14 hrs

References:

1. Introduction to Plant Tissue Culture 3Ed, MK Razdan, Oxford and IBH Publisher.
2. Practical Biotechnology and Plant Tissue Culture, Santosh Nagar and Madhavi Adhav, S. Chand Publisher.
3. Plant Tissue Culture: Techniques and Experiments, Robert Smith, Academic Press.
4. Plant Tissue Culture: Theory and Practice, Bhojwani & Razdan, Elsweir publishers.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSC)-15

Course Title: Plant cell and Tissue culture Technology

Course Code: 036 GEN 014

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
DSCC-16	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Learn the media preparation for plant tissue culture

CO 2. Understand aseptic techniques practiced in plant tissue culture laboratory

CO 3. Culture various explants on tissue culture media

CO 4. Understand the concept of *Agrobacterium* mediated plant transformation

Expt. No,	Title:	56.hrs/ sem
1	Instruments used in tissue culture laboratory	
3	Sterilization techniques used in plant tissue culture	
4	Preparation plant tissue culture (MS) media	
5	Seed culture for generation of aseptic explants	
6	Callus culture	
7	Rooting in callus	
8	Shooting in callus	
9	Somatic embryogenesis	
10	Preparation of synthetic seeds	
11	Hardening and acclimatization of tissue culture generated plants (demonstration)	
12	*Agrobacterium* mediated transformation (Demonstration)	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Major experiment	06
Minor Experiment	04
Spotting	10
Viva	02
Journal	03
Total	**25Marks**
Formative Assessment as per guidelines.	

The same shall be used for semester end Examination

B.Sc. Semester – VI

INTERNSHIP

Course Title: Internship

Course Code: 036 GEN 091

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
INTERNSHIP	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**50**	**0**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Learn basic concept of project designing

CO 2: Understand research methodology

CO 3: handle instruments independently

CO 4: Have insight in to recent developments in Genetics and allied subjects

Expt. No	Title:	56.hrs/ sem
1	Minor project in with genetic principles involved in Agriculture or industrials or Microbial or medical aspects (Lab/Survey/field work)	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Project/ Survey/ field report submission	25
IA marks based on the performance of the work	10
Presentation of the work	15
Total	**50Marks**
Formative Assessment as per guidelines.	

Internship:

A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry, local governments (such as panchayats, municipalities)or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note;

1. 1 credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during last 1-2 weeks before closure of the semester or weekly 4 hrs in the academic session for 13-14 weeks). College shall decide the suitable method for programme wise but not subject wise.
4. Internship mentor/supervisor shall avail work allotment during 6^{th} semester for a maximum of 20 hours.
5. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
6. Method of evaluation: Presentations/Report submission/Activity etc.

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE 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 : 10 marks

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