GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE

RAJNANDGAON (C.G.)

FYUP

(Four Year Undergraduate Programme)

Course Curriculum

FOR

B.Sc. BOTANY

Semester VII and Semester VIII
SESSION – 2025-26

Approved by

Central Board Of Studies & Board Of Studies

DEPARTMENT OF BOTANY

Govt. Digvijay Autonomous P.G. College, Rajnandgaon, C.G.
Bachelor of Science (B.Sc.) Four Years UG Programme (FYUP)

Botany

2025-26

Year	Sem.	Course Type	Course Title	Credit	IA	ESE	Max Marks
First Year	I Sem.	DSC-01	Elementary Botany	3+0+0	30	70	100
		DSC-01-LAB	Elementary Botany – LAB	0+0+1	15	35	50
		GE-01	Elementary Botany	3+0+0	30	70	100
		GE-01-LAB	Elementary Botany – LAB	0+0+1	15	35	50
	II Sem.	DSC-02	Microbes and Thallophyta	3+0+0	30	70	100
		DSC-02-LAB	Microbes and Thallophyta - LAB	0+0+1	15	35	50
		GE-02	Microbes and Thallophyta	3+0+0	30	70	100
		GE-02-LAB	Microbes and Thallophyta - LAB	0+0+1	15	35	50
		SEC-01	Gardening and Floriculture	0+0+2	10	40	50
Second Year	III Sem.	DSC-03	Archegoniate and Fossils	3+0+0	30	70	100
		DSC-03-LAB	Archegoniate and Fossils – LAB	0+0+1	15	35	50
		DSE- 01	Natural resources and management	3+0+0	30	70	100
		DSE-01-LAB	Natural resources and management- LAB	0+0+1	15	35	50
		VAC- 01	Herbal Plants & Human Health	2+0+0	10	40	50
	IV Sem.	DSC- IV	Angiosperms	3+0+0	30	70	100
		DSC-IV- LAB	Angiosperms- LAB	0+0+1	15	35	50
		DSE-02	Microbiology and Phytopathology	3+0+0	30	70	100
		DSE-02-LAB	Microbiology and Phytopathology- LAB	0+0+1	15	35	50
		SEC- 02	Flower Decoration	0+0+2	10	40	50

	V Sem.	DSC-05	Plant Physiology	3+0+0	20	80	100
		DSC-05-LAB	Plant Physiology- LAB	0+0+1	10	40	50
		DSE-03	Plant Metabolism	3+0+0	20	80	100
		DSE-03-LAB	Plant Metabolism- LAB	0+0+1	10	40	50
		DSE-04	Plant Diseases	3+0+0	20	80	100
		DSE-04-LAB	Plant Diseases-LAB	0+0+1	10	40	50
		SEC-03	Biofertilizer and Biopesticides	0+0+2	10	40	50
Third Year	VI Sem.	DSC-06	Plant Pathology	3+0+0	20	80	100
		DSC-06-LAB	Plant Pathology-LAB	0+0+1	10	40	50
		DSE-05	Molecular Biology and Plant Biotechnology	3+0+0	20	80	100
		DSE-05-LAB	Molecular Biology and Plant Biotechnology-LAB	0+0+1	10	40	50
		DSE-06	Economic Botany	3+0+0	20	80	100
		DSE-06-LAB	Economic Botany-LAB	0+0+1	10	40	50
		SEC-04	Mushroom Culture Technology-Project	0+0+2	10	40	50
Fourth Year **Bachelor of Honors**	VII Sem.	DSC-07	Ecology and Phytogeography	3+0+0	20	80	100
		DSC-07-LAB	Ecology and Phytogeography-LAB	0+0+1	10	40	50
		DSE-07	Research Methodology and Ethics	4+0+0	20	80	100
		DSE-08	Biosystematics and Biodiversity	3+0+0	20	80	100
		DSE-08-LAB	Biosystematics and Biodiversity-LAB	0+0+1	10	40	50
		DSE-09	Plant Breeding and Seed Technology	3+0+0	20	80	100
		DSE-09-LAB	Plant Breeding and Seed Technology-LAB	0+0+1	10	40	50
		GE-	Growth and Stress Physiology	3+0+0	20	80	100
		GE-LAB	Growth and Stress Physiology-LAB	0+0+1	10	40	50
	VIII Sem	DSC-08	Molecular Biology and Biostatistics	3+0+0	20	80	100
		DSC-08-LAB	Molecular Biology and Biostatistics- LAB	0+0+1	10	40	50
		DSE-10	Plant Biotechnology and	3+0+0	20	80	100

			Crop Improvement				
		DSE-10-LAB	Plant Biotechnology and Crop Improvement-LAB	0+0+1	10	40	50
		DSE-11	Applied Botany and Intellectual Property Right (IPR)	3+0+0	20	80	100
		DSE-11-LAB	Applied Botany and Intellectual Property Right (IPR)-LAB	0+0+1	10	40	50
		DSE-12	Biochemistry and Enzymology	3+0+0	20	80	100
		DSE-12-LAB	Biochemistry and Enzymology-LAB	0+0+1	10	40	50
		DSE-13	Bioinformatics and Gene Technology	3+0+0	20	80	100
		DSE-13-LAB	Bioinformatics and Gene Technology-LAB	0+0+1	10	40	50
Fourth Year **Bachelor of Honors with Research**	VII Sem.	DSC-07	Ecology and Phytogeography	3+0+0	20	80	100
		DSC-07-LAB	Ecology and Phytogeography-LAB	0+0+1	10	40	50
		DSE-07	Research Methodology and Ethics	4+0+0	20	80	100
		DSE-08	Biosystematics and Biodiversity	3+0+0	20	80	100
		DSE-08-LAB	Biosystematics and Biodiversity-LAB	0+0+1	10	40	50
		DSE-09	Plant Breeding and Seed Technology	3+0+0	20	80	100
		DSE-09-LAB	Plant Breeding and Seed Technology-LAB	0+0+1	10	40	50
		GE-	Growth and Stress Physiology	3+0+0	20	80	100
		GE-LAB	Growth and Stress Physiology-LAB	0+0+1	10	40	50
	VIII Sem	DSC-08	Molecular Biology and Biostatistics	3+0+0	20	80	100
		DSC-08-LAB	Molecular Biology and Biostatistics- LAB	0+0+1	10	40	50
		DSE-10	Plant Biotechnology and Crop Improvement	3+0+0	20	80	100
		DSE-10-LAB	Plant Biotechnology and Crop Improvement-LAB	0+0+1	10	40	50
		Research Project/ Dissertation		12			

B.Sc. – VII Semester

BOTANY

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Sciences *(Honors)*		**Semester - VII**	Session: **2024-2025**
1	Course Code	BOSC- 07 T	
2	Course Title	Ecology and Phytogeography	
3	Course Type	Discipline Specific course (DSC)	
4	Pre-requisite (if, any)	*As per program*	
5	Course Learning. Outcomes (CLO)	At the end of this course, students will be able to understand: ▪ The interrelationship between organisms and environment. ▪ Methods to study vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography. ▪ Evolving strategies for sustainable natural resource management and biodiversity conservation. ▪ Climatic changes and its restoration ▪ Familiar with sustainable development	
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Ecological Factors and Management : Climatic- light; temperature, air and water, topographic, edaphic, soil formation soil texture, type of soil, soil profile, classification, physio-chemical properties, soil organic matter, biotic factors, interrelationships, major soil type of the world. Ecological management: Concepts, sustainable development, sustainability indicators.	12
II	Ecosystem Organization : Structure and function, primary production (methods of measurements, global pattern, controlling factors), energy dynamics, trophic organization, energy flow pathways, ecological efficiencies, litter fall and decomposition- mechanism, substrate quality and climate factors, global biogeochemical cycle of C, N, P, S, minerals cycle- pathways, processes, budgets in terrestrial and aquatic ecosystem.	11
III	**Community and Eco-Stability** Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, inter-specific associations, ordination, concept of ecological niche. Vegetation Development: Temporal changes (cyclic and non-cyclic), mechanism of ecological successions (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem properties during succession. Ecological Stability: Concept of resistance and resilience, ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystem, ecology of plant invasion, environmental impact assessment, ecosystem restoration.	11
IV	**Phytogeography Pollution, Climatic Changes** Phytogeographical regions of India with reference to Chhattisgarh. Pollution : Air, Water, Soil & Sound - kinds, sources, quality parameters, effect on plans and ecosystem. Climate change: Green house gases(CO_2, CH_4, N_2O, CFCs) sources, trends and role, ozone layer and ozone hole, consequences of climate changes, (CO_2 fertilization, global warming, sea level rise, UV radiation).	11
Keywords	Ecological Factors community and continuum ecosystem ,Phytogeographical ,climate changes	

Signature of Convener & Members (CBoS) :

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Ecological factors & Management

Ecosystem organisation

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Brady, N. C. (1990) The Nature and Properties of Soil Macmillan, Sydney, Australia.
2. Begon, M, Harper, J. L. And Townsend, C. R. (1996) Ecology. Blackwell Science, Cambridge, USA
3. Chapman, J. L. and Raiss, M. J. (1988) Ecology: Principles and Applications. Cambridge Univ. Press, Cambridge, U.K.
4. Kumar, H. D. (1986) Modern Concept of Ecology, Vikas Publishing House Private Ltd., New Delhi.

Reference books:

1. Hill, M. K. (1997) Understanding Environmental Pollution. Cambridge Univ. Press, Cambridge, U. K.
2. Odum, E. P. (1971) Fundamentals of Ecology. Saunders, Phildelphhia
3. Odum, E. P. (1983) Basic Ecology. Saunders, Philasephia

Online Resources–

- **e-Resources / e-learning portals**
- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

Online Resources–

- **e-Resources / e-books and e-learning portals**

- **https://courses.lumenlearning.com/wm-biology2/chapter/community-structure-and-dynamics/**
- https://education.nationalgeographic.org/resource/ecosystem/

- **https://www.embibe.com/exams/ecological-factors/**
- **https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution#:~:text=Environmental%20pollution%20is%20unwarranted%20disposal,both%20quantitatively%20and%20qualitatively%20(Hussain%2C**
- https://onlinecourses.nptel.ac.in/noc24_ce03/preview

- https://onlinecourses.swayam2.ac.in/nou24_ge10/preview

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts., **1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Sciences *(Honors)*	Semester - VII	Session: 2024-2025

1	Course Code	BOSC-07
2	Course Title	Lab. Course – 07 (Ecology and Phytogeography)
3	Course Type	Laboratory course
4	Pre-requisite (if, any)	*As per program*
5	Course Learning. Outcomes (CLO)	➢ Students will be able to determine frequency, abundance and density of any area ➢ Learn community relationships of plants. ➢ Understand IVI and biomass. ➢ Can determine diversity indices. ➢ Biodiversity of different ecosystems ➢ Interaction among different community ➢ Pollution and its effect
6	Credit Value	1 Credits — *Credit =30 Hours Laboratory or Field learning/Training*
7	Total Marks	Max. Marks: 50 — Min Passing Marks: 20

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. to determine minimum size and number of quadrates required for reliable estimate o biomass in grass land ecosystem. 2. To study the frequency, abundance and density of plants in the local ecosystem by quadrat method. 3. To determine gross and net productivity by light and dark bottle method. 4. To determine soil moisture content, porosity and bulk density of soil collected from different locations. 5. To determine the water holding capacity of various soils. 6. To determine the basal cover, or vegetational cover of one herbaceous community by quadrat method. 7. To determine IVI of the grass land. 8. To measure the above-ground plant biomass in a grassland. 9. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed an protected grassland. 10. Experiment on Physico-Chemical Analysis of Water (pH, Temperature, etc. 11. To determine transparency or turbidity of different water bodies. 12. To measure the amount of dissolved oxygen in pond water. 13. To determine the total dissolved solids (TDS) in water 14. To measure the amount of BOD in different types of water. 15. Ombrothermic diagram of your locality.	30

Keywords	*Quadrate, Productivity, Turbidity ,TDS.*

Signature of Convener & Members (CBoS) :

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Bendre and Kumar, 2018. A text book of botany practical , Vol-2
2. Raj Mandeep, 2022. Principles of ecology .
3. Rao K S, 1993 Practical Ecology
4. Ashok K. Rathoure Bioremediation: Current Research and Applications .

Text Books Recommended –

1. Penny A. Cook, James R. Bell , C. Philip Wheater , 2011.Practical Field Ecology: A Project Guide
2. D. D. Gilbertson , M. Kent , F. B. Pyatt, 1985. Practical Ecology for Geography and Biology
3. Masood, A.A. A text book of botany practical , Edn.-5
4. Gaurav Saxena Vineet Kumar and Maulin P. Shah . Bioremediation for Environmental Sustainability: Toxicity, Mechanisms of Contaminants Degradation, Detoxification and Challenges .

Online Resources–

- **e-Resources / e-books and e-learning portals**
- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://ecologicalprocesses.springeropen.com/articles/10.1186/s13717-022-00401-0
- https://www.internationalscholarsjournals.com/articles/applied-ecology-and-its-economical-applications-88784.html
- https://link.springer.com/book/10.1007/978-981-15-3372-3
- https://www.jstor.org/stable/2405009
- https://en.wikipedia.org/wiki/Bioremediation
- https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5026719/
- https://www.ysi.com/parameters/turbidity
- https://www.davidzeleny.net/wiki/doku.php/vegsurvey:materials:how_to_calculate_ivi

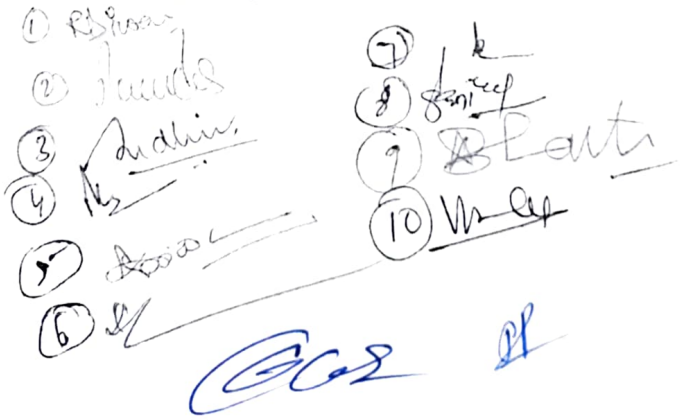
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024-2028)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

DSE-07

PART- A: Introduction		
Program: Bechlor in Life Science (Honors/Honors with Research	**Semester- VII**	**Session: 2025-26**
Course Title	**BOSE-07**	
Course Type	**Research Methodology and Ethics**	
Pre-requisite (if, any)	**As per program**	
Course Learning Outcomes (CLO)	Upon successful completion of the course "Research Methodology and Ethics", students will be able to: ➢ Understand the fundamental concepts, types, and processes involved in educational research. ➢ Develop skills to formulate research problems and design appropriate research strategies using both qualitative and quantitative methods. ➢ Acquire knowledge on data collection techniques, sampling strategies, and statistical tools for data analysis. ➢ Apply principles of ethical research conduct, publication ethics, and research integrity. ➢ Prepare comprehensive research reports and critically analyze scientific literature using technological tools and referencing standards. ➢ Learning outcome ➢ Define and explain the meaning, need, and nature of research in the context of education. ➢ Identify the steps in the research process and criteria for good research. ➢ Formulate a research problem and develop research questions. ➢ Design research including sampling strategy and sample size calculation. ➢ Understand the role and significance of literature review in research design. ➢ Apply sampling techniques and calculate sampling errors. ➢ Design data collection tools such as questionnaires and understand the process of test standardization. ➢ Use descriptive statistics (mean, median, mode) and correlation techniques for data analysis. ➢ Understand and apply inferential statistics including chi-square, t-test, z-test, ANOVA, and regression analysis. ➢ Interpret statistical outputs using SPSS and evaluate hypotheses through appropriate tests.	

	➢ Understand the structure and importance of report writing in research. ➢ Develop skills in citation, referencing, and bibliography compilation. ➢ Demonstrate awareness of ethical issues in research including falsification, fabrication, plagiarism, and conflict of interest. ➢ Understand the principles of publication ethics and maintain intellectual honesty in research.	
Credit Value	**4 Credits**	**Credit=15Hours- Learning & Observation**
Total Marks	**Max. Marks:100**	**Min. Passing Marks:40**

PART- B: Content of the Course

Total no. of Teaching-Learning Periods (01 Hr. per periods) 45 Periods (45 Hours)

UNIT	TOPICS (Course Contents)	No. of Periods
I	Meaning of Research, Definition, Educational Research as a scientific Process: Meaning, need and nature of research, Types of educational research: historical, experimental and descriptive, Qualitative and Quantitative Research, Research Process, steps of research process, Criteria for good research, Planning of Research, Selection of a problem for research. Formulation of the selected problems. Research Questions. Preparing the research design including sample Design, Sample size.	12
II	Role of related literature in educational Research. Literature search procedure. Sources of literature. Planning of review work. Sampling and Data Collection. Importance of sampling, Sample size, Sampling Error, Preparing a questionnaire. Test standardization Data Collection Type of data, Methods and techniques of data collection, Primary and Secondary Data, Testing validity of research outcomes, Suggestions and recommendations, identifying future scope.	11
III	Data Analysis, Measures of central tendency: Mean, median, mode; Correlation Analysis: Tests of Significance and Covariance - Test of Hypothesis: steps involved in hypothesis testing – Methods of hypothesis testing: chi-squired test, t-test and z-test. Percentile Correlation, Normal Probability and its applications, Regression Analysis– analysis of variance (ANOVA), Multiple Regression, Two way and Three way analysis of variance, Application of Statistical tools with SPSS.	11
IV	Planning of Report writing, Significance of report, Steps of report writing; Concepts of Bibliography and References; Application of Computer in Research; Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconducts: Falsification, Fabrication, and Plagiarism; Publication ethics: definition, introduction and importance; Conflicts of interest.	11

PART:- C- Learning Resources	
Text books/ Reference Books- [1] Legal Research- William P. Statesky. [2] A Guide to Legal Research- Erwine Sursency. [3] An Introduction to Legal Arguments-By Edward Lewi [4] Methodology & Techniques-Ts. Bodenkr & Milkinson. [5] Method in social Research- By William J. Goode & Paul K. Hatt. [6] Development of Research Tools- N.C.Gautewan. [7] Legal Research Methodology-S.R.Myneli.	
Part: D- Assessment and Evsluation	
Suggested Continuous Evaluation Methods: **Maximum Marks: 100 Marks** **Continuous Internal Assessment (CIA): 30 Marks** **End Semester Exam (ESE): 70 Marks**	
Continuous Internal Assessment (CIA): 30 Marks **(By Course Teacher)**	**Internal test/ Quiz: 20 Marks** **Assignment/ Seminar: 10 Marks** **Total Marks: 30 Marks**
End Semester Exam(ESE): 70 Marks	**Two section-A & B** **Section A:** **Q1 Objective- 10x1= 10 Marks;** **Q2 Short answer type- 5x4=20 Marks** **Section B:** **Q3 Descriptive answer types questions- 4x10= 40 Marks**

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**BOSE-05 T**		
2	**Course Title**	**Biosystematics and Biodiversity**		
3	**Course Type**	**Discipline Specific elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	*At the end of the course, the students will be able :* ➢ Understand different classification and nomenclature system in botany. ➢ Learn plant collection and preservation techniques . ➢ Get knowledge about the biodiversity and its importance. ➢ Analyse the different conservation practices for nature.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks:**	**100**	**Min Passing Marks:** **40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Definition and basic concepts of biosystematics taxonomy and classification. History and theories of biological Classification. Difference between botanical and zoological nomenclature system. Trends in biosystematics: Chemotaxonomy, cytotaxonomy and molecular taxonomy. Dimensions of speciation.	12
II	Taxonomic procedures: Taxonomic collections, preservation, process of identification. Taxonomic keys, different types of keys, their merits and demerits. How to use flora, Species concepts: Typological, Nominalist and Biological species concepts. Subspecies and other infra-specific categories.	11
III	Biodiversity : Concept and level, role of biodiversity in ecosystem, function and stability, speciation and extinction, IUCN categories of threat, distribution and global pattern, terrestrial biodiversity, hot spots. Plant biodiversity: Concept, status in India, utilization and concerns.	11
IV	Principal of Conservation: *In-situ* conservation: Strategies for In situ conservation, international efforts and Indian initiatives, protected areas in Indian sanctuaries, national parks, biosphere reserves, wetland, mangroves and coral reefs for conservation of wild biodiversity. Ex-situ Conservation: Strategies for *Ex- situ* conservation, Principles and practices, Botanical gardens, gene bank, seed in vitro repositories, cryo banks.	11
Keywords	***Chemotaxonomy, Cladogram, Biodiversity, Conservation.***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Kochar, S. L. (1998) Economic Botany of The Tropics. McMillan India Ltd , New Delhi.
2. Paroda, R. S. and Arora R. K. (1991) Plant Genetic Resources and Conservation and Management IPGRI (publications). South Asia Office, c/o NBPGR, Pusa Campus, New Delhi.
3. Scheri, R. W. (1972) Plants for Man. Englewood Cliffs, New Jersey, Prentice Hall.
4. Annonymous (1997) National Gene Bank. Indian Heritage on Plant Genetic Resources (Booklet) NBPGER, New Delhi.
5. Swaminathan, M. S. And Kocchar (1989) Plants and Society, MacMillan Publication Ltd. London.
6. Kothari, A. (1997) Understanding Bio-Diversity: Life Sustainability and Equity. Orient Longam
7. Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin
8. Singh, G. (2012) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi
9. Bhojwani, SS. & Bhatnagar, SP (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi 5 edition
10. Mauseth. J.1) (1988) Plant Anatomy. The Benjamin Cummings Publisher. USA
11. Pandey, B. P. (LatesEdt), Plant Anatomy
12. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
13. Saxena N.B. and Saxena S. (2012). Plant Taxonomy Pragati Prakashan.
14. Sharma O.P. (2013). Plant Taxonomy. MC GRAW HILL INDIA.
15. Sharma, M.K. (2013) Plant Structures (An Introduction to Plant Anatomy). VayuEducation of India.
16. Chopra G.L. (2005) Angiosperm, Pradeep Publication, Jalandhar.

Reference Books Recommended –

1. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.
2. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York
3. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press,Cambridge.
4. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-APhylogenetic Approach. Sinauer Associates Inc., U.S.A. 2 nd edition.
5. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, San Diego, CA, USA
6. Beck, C.B. (2010). An Introduction to Plant Structure and Development, II edition.
7. Heywood, V. (1995) Global Bio-Diversity Assessment, UNEP. Cambridge Univ. Press, Cambridge, U.K.
8. Heywood, V.H. and Wyse Jackson, P. S. (1991) Tropical Botanical Garden: Their Role in Conservation and Development Academic Press, San Digo.
9. Barker, H. G. (1978) Plant and Civilization. C. A. Wadsworth, Belmont
10. Frankel, O. H., Brown, A. H. D. and Burdon, J. J., (1995) Conservation, of Plant Diversity. Cambridge Univ. Press, Cambridge, U. K
11. Pinstrup- Anderson, P. Et Al (1999) World Food Prospects, Critical Issues for Early 21st Century. International Food Policy Research Institute, Washington D. C. USA.
12. Rogers, N. A. And Panwar, H. S. (1998) Planning A Wild Life Protected Area Network In India Vol. I The Report, Wildlife Institute Of India, Dehradun.

Online Resources–

e-Resources / e-books and e-learning portals

- **https://www.sciencedirect.com/topics/social-sciences/natural-resource**
- **https://efaidnbmnnnibpcajpcglclefindmkaj/https://egyankosh.ac.in/bitstream/123456789/66166/2/Unit4.pdf**
- **https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ers.usda.gov/webdocs/publications/41964/30289_biological.pdf?v=0#:~:text=16-,What%20Are%20Biological%20Resources%3F,forests%2C%20and%20other%20natural%20lands.**
- http://surl.li/spedd
- https://shorturl.at/ewyIP
- https://shorturl.at/cimoF

Online Resources–

e-Resources / e-books and e-learning portals

- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks: 100 Marks** **Continuous Internal Assessment (CIA): 30 Marks** **End Semester Exam (ESE): 70 Marks**		
Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honours)*		**Semester - VII**	Session: **2024-2025**	
1	**Course Code**	**BOSE-05 P**		
2	**Course Title**	**Lab course -05 (Biosystematics and Biodiversity)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to: ➢ Understand collection and preservation techniques for plants. ➢ Learn use of flora for plant identification. ➢ Understand about protected area of the country ➢ Analyze various IUCN categories of threats.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	• Herbarium technique. • Non destructive collection of plants • Preservation techniques for plarts part . • Prepration of taxonomic keys • How to use flora and digital flora for plant identification. • Use of flora for identification of plants of college campus. • Cladogram and dendrogram • Visit of any botanical garden , national park/wildlife sanctuary/ protected area. • Learn about IUCN categories of threats. 1) Evaluation of alfa, beta and gama biodiversitiy of college campus..	**30**
Keywords	***Herbarium, Flora, Protected area, IUCN categories.***	
Signature of Convener & Members (CBoS) :		

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Kothari, A. (1997) Understanding Bio-Diversity: Life Sustainability and Equity. Orient Longam
2. Singh, G. (2012) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi.
3. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.

Reference Books Recommended –

1. . flora of India by Botanical Survey of India
2. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-APhylogenetic Approach. Sinauer Associates Inc., U.S.A. 2 nd edition.
3. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, San Diego, CA, USA

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://www.worldfloraonline.org/
- https://bsi.gov.in/page/en/digital-resources
- https://indiaflora-ces.iisc.ac.in/FloraPeninsular/
- http://www.efloras.org/
- https://creately.com/guides/what-is-a-dichotomous key/herpsteppp.inflibort.ac.in/Home/VirwSubject?catid=1pBOY7YTBCLSD2K
- https://eppp.inflibert.ac.in/Home/ViewSubjectPratid-1OOYJVTRCLSDKUBW
- . httpssivproinflibnet.ac.in/Home/View Subject catid-1pbbyZY1BCS02E
- https://www.amazon.in/Plant-Taxonomy-past-present-future-chook/dp/B016021014
- https://www.instructables.com/How-to-Make-a-Cladogram/
- file:///C:/Users/user/Downloads/ajol-file-journals_452_articles_122070_submission_proof_122070-5365-335203-1-10-20150914%20(1).pdf

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VII**		Session: **2024-2025**
1	**Course Code**	**BOSE-06 T**		
2	**Course Title**	**Plant breeding and Seed technology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to ➢ Gain knowledge and comprehension of the breeding systems ➢ knowledge of reproductive biology in angiosperms to address real-world challenges related to plant breeding, crop production, and conservation. provide students with a comprehensive understanding of plant breeding principles and techniques		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Plant breeding**: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.	**12**
II	**Methods of crop improvement:** Introduction: Centers of origin and domestication of crop plants, plant genetic resources;Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetativelypropagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations. Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.	**11**
III	**Breeding Methods for Stress Resistance:** Breeding for drought, salinity, heat, cold, disease and insect resistance, breeding forprotein and oil quality. Heterosis and inbreeding depression, hybrid and synthetic varieties.Hardy-Weinberg law, systems of mating.	**11**
IV	**Seed Technology**: Principle & Concept of Seed Technology. Quality seeds, Indian seed act. Classes of quality seeds - breeder, foundation, registered and certified seeds, operations essential for seed production, seed processing, certification and maintenance storage of improved seeds, seed productions organizations- national and state seed corporations and private seed companies. Artificial seeds, terminator seeds	**11**
Keywords	**Breeding,Heterosis, Self incompatibility, Hybridization.**	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Plant breeding by B.D Singh.
2. BD Singh (2003) Plant Breeding. Kalyani Publishers
3. PLANT BREEDING: PRINCIPLE AND METHODS B D SINGH - IN HINDI
4. Sharma JR (1994) Principles and Practices of Plant Breeding. Tata McGraw-Hill Pub. Co. New Delhi
5. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH.
6. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing
7. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

Reference Books Recommended –

1. Allard (1960) Principles of Plant Breeding. John Wikkey and Sons, Inc. New York.
2. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co. Inc. New York
3. Jonossy and Lupton (1976) Heaterosis in Plant Breeding. Elsevier, Amsterdam.
4. Poehlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India Oxford and IBH Publishing Company, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**

1. **https://chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://courseware.cutm.ac.in/wp-content/uploads/2020/05/Download-Notes-8.pdf**
2. **https://chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://www.eagri.org/eagri50/GBPR211/lec16.pdf**
3. **https://efaidnbmnnnibpcajpcglclefindmkaj/http://www.eagri.org/eagri50/GBPR211/lec16.pdf**
4. **https://www.sciencelearn.org.nz/resources/77-pollination-and-fertilisation**
5. **https://www.crops.org/about-crops/seed-technology#:~:text=What%20is%20seed%20technology%3F,that%20people%20and%20livestock%20eat.**
6. **https://plantbreeding2010.blogspot.com/2020/12/seed-and-seed-technology-introduction.html**
7. **https://www.nature.com/articles/s41477-018-0309-4**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20** Marks Section B: Descriptive answer type qts., **1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VII**	Session: 2024-2025	
1	**Course Code**	**BOSE-06 P**		
2	**Course Title**	**Lab. Course- 06 (Plant breeding and Seed Technology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	At the end of the course students will be - ➢ Idea of seeds which carries a new generation. ➢ Knowledge of plant breeding techniques. ➢ Knowledge of breeding methods for stress tolerance. ➢ Idea of seed processing and certification of seeds.		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	1. Study of seed parts 2. Collection of different types of mature seeds 3. Techniques of hybridization- Emasculation. 4. Techniques of hybridization - Bagging and tagging. 5. Study of vegetatively grown plants part of your locality 6. Collection of seeds of different varieties of locally grown crops. 7. Inter-varietal cross in an ornamental plant. 8. Visit to state and national seed corporation companies and prepare a report.	**30**
Keywords	Seed, Emasculation, Bagging and tagging.	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Allard (1960) Principles of Plant Breeding. John Wikkey and Sons, Inc. New York.
2. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co Inc. New York.
3. Plant breeding by B.D Singh

Reference Books Recommended –

1. Jonossy and Lupton (1976) Heaterosis in Plant Breeding. Elsevier, Amsterdam.
2. Pochlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India. Oxford and IBH Publishing Company, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **https://www.merriam-webster.com/dictionary/emasculate**
- **https://agritech.tnau.ac.in/crop_improvement/crop_imprv_emasculation_cereals.html**
- **https://www.toppr.com/guides/biology/reproduction-in-organisms/vegetative-propagation/#:~:text=Vegetative%20Propagation%20by%20Roots,example%2C%20Sweet%20potato%20and%20Dahlia.**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VII**		Session: **2024-2025**
1	**Course Code**	~~**BOSE -08 T**~~ BOGE-03T		
2	**Course Title**	**Growth and Stress Physiology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to 1. understand the role of Physiological and metabolic processes for plant growth and development under stress. 2. Assimilate about biochemical constitution of plant diversity. 3. Get acquired the students with complex interaction between organism and environment 4. Understand about the role of hormones in plant development		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks:** **100**	**Min Passing Marks:** **40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**PlantGrowth and Phytohormone** ➢ Plant growth curve,sigmoid and J shaped growth.Lag,Log and steady stage. Developmental roles of phytohormones ➢ Auxins, ➢ Gibberellins, ➢ Cytokinins, ➢ ABA, ➢ Ethylene,	12
II	**Movements, Dormancy & Responses** ➢ Photoperiodism (SDP, LDP, Day neutral plants); ➢ Phytochrome (discovery.structure and functions), ➢ Seedand bud Dormancy causes and breaking, ➢ Vernalization ➢ Senescence, ➢ Plant movements	11
III	**Planteco-physiologyand Stress Physiology:** ➢ Concept of Planteco-physiology. ➢ Plant perception, ➢ physiology of ecological considerations. ❖ Hydrophytic, xerophytic morphological and anatomical adaptations in plants	11
IV	**StressPhysiology:** Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic tolerance, HR (Hypersensitive Response) and SAR Systemic Acquired Resistance), water deficit and ❖ Drought resistance, ❖ Salinity stress, ❖ metal toxicity, ❖ freezing and heat stress, ❖ oxidative stress.	11
Keywords	Growth, Phytohormone, Eco-physiology, Vernalization.	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

TextBooksRecommended-

1. Galston,A.W.,(1989)LifeProcessesinPlants,ScientificAmericanLibrary.Springer-Verlag,NewYork, USA.
2. Hopkins,W.G.,(1995)IntroductiontoPlantPhysiology,JohnWilleyandSons,Inc.NewYork,USA.
3. Salisbury,F.B.andRoss,C.W.,(1992)PlantPhysiology.WadsworthPublishingCo.,California,USA.
4. Denis,D.T.,Turpin,D.H.Lefebvre,D.D.&Layzell,D.B.(1997)PlantMetabolism.Longaman,Essex, England.

Reference Books Recommended –

1, Taiz,L.andZeiger,E.((1998) Plant Physiology.SinaverAssociations,Inc.Pub.,Masssachusetts, USA.
2. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Online Resources–

- **e-Resources / e-books and e-learning portals**
  https://link.springer.com/book/10.1007/978-3-030-78420-1
  https://uou.ac.in/sites/default/files/slm/MSCBOT-601.pdf
  https://www.researchgate.net/publication/347908867_Stress_Physiology_in_Plants
- **https://www.esalq.usp.br/lepse/imgs/conteudo_thumb/Plant-stress-physiology.pdf**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA):70 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 30	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	~~BOSE-08 P~~ BOGE-03 P		
2	**Course Title**	Lab. Course -08 (Growth and stress physiology)		
3	**Course Type**	Laboratory course		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	After the completion of the course the students will be able to: 1. Understandthe role of Physiological and metabolic processes for plant growth and development under stress. 2. Assimilate about biochemical constitution of plant diversity 3. Effect of phytohormones on plants. 4. Understand different physiological processes of plants.		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	1. *Avena* curvature test of Auxin. 2. Expression of bolting in cabbage. 3. Induction of lateral branches by cytokinin. 4. Demonstration of plasmolysis and deplasmolysis in plant cell. 5. Potato osmoscope for osmosis. 6. Demonstration of transpiration. 7. Measurement of transpiration rate by Farmers/ Ganong's potometer. 8. Extraction of seed proteins depending upon solubility. 9. Fractionation of proteins using gel filtration chromatography 10. Principle of colorimetry, spectrophotometry and fluorimetry.	**30**
Keywords	*Bolting, chlorophyll, osmosis, chromatography.*	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Practical Plant Physiology Hardcover – 1 January 2015 by R. Sivakumar, Narendra Publishing
2. PRACTICALS IN PLANT PHYSIOLOGY AND BIOCHEMISTRY MANJU BALA, SUNITA GUPTA, N.K GUPTA & M.K. SANGHA Scientific Publishers
3. A Practical Manual on Fundamentals of Plant Physiology Paperback – 16 September 2022 by R. K. Samaiya Subrata Sharma, Gyanendra Tiwari, R. Shivraj krishnan, Sunil Pandey, Preeti Sagar Nayak (Author) BFC PUBLICATIONS PVT LTD

Reference Books Recommended –

1. **Practical Manual Experimental Plant Physiology and Biochemistry Manual** Paperback – 1 January 2023 by Rajesh Kumar Asok Kumar Bera, Bandana Bose (Author) Publisher- Science Technology

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **https://www.britannica.com/science/transpiration**
- **https://www.frontiersin.org/articles/10.3389/fagro.2022.765068/full**
- **https://www.sciencedirect.com/science/article/abs/pii/S0176161796802872**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 35 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 15	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

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B.Sc. – VIII Semester

BOTANY

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF BOTANY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Sciences *(Honors)*	Semester - VIII	Session: 2024-2025

1	Course Code	BOSC –VIII T		
2	Course Title	Molecular biology and Biostatistics		
3	Course Type	Discipline Specific course (DSC)		
4	Pre-requisite (if, any)	*As per program*		
5	Course Learning. Outcomes (CLO)	➢ Students shold know about cellular and gene regulation to understand genomic functions ➢ Understand the concept of 'one gene one enzyme hypothesis' along with the molecular mechanism of mutation ➢ Students will be familiar with the genetic material DNA structure its role and defects and repairing ➢ Students will be familiar with the RNA structure its role ➢ Students will be familiar with data handling.		
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Nucleic acids:** Carriers of genetic information. Introduction, DNA as the carrier of genetic information (Griffith's, McLeod & McCarty experiment). The Structures of DNA and RNA / Genetic Material DNA Structure. Watson and Crick model, Salient features of double helix, Organization of DNA Prokaryotes, Viruses, Eukaryotes. Types- A-DNA, B-DNA C- DNA Z- DNA RNA Structure –mRNA, tRNA and rRNA Organelle DNA -- mitochondria and chloroplast DNA. The replication of DNA Chemistry of DNA synthesis General principles – bidirectional, semiconservative and semi discontinuous replication Enzymes involved in DNA replication.	12
II	**Mutation and DNA repair** Structural and numerical changes in the chromosomes- chromosomal aberration- duplication, deletion, inversion, translocation, gene mutation- transition and transversion, polyploidy- euploidy and aneuploidy. DNA damage and repair	11
III	**Protein synthesis and gene regulation** Genetic code Genetic code (deciphering and salient features) Transcription Concept of central dogma, Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation, Prokaryotes. Regulation of lactose metabolism and tryptophan synthesis in E.coli. Gene silencing. Processing and modification of RNA Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' polyA tail). Translation Ribosome structure and assembly, mRNA; aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides, Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.	11
IV	**Biostatistics** : Graph, central tendancy (Mean, median and mode) Standard Deviation, Standard error Chi square test, regression, degree of freedom	11
Keywords	*DNA, RNA, protein synthesis, gene regulation, central tendancy*	

Signature of Convener & Members (CBoS) :

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc , U.S.A. 5th ed.
3. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
4. Sharma A.K. 2005. Text Book Of Biostatistics I, Discovery Publishing House.
5. Annadurai, B. 2007. Text Book of Biostatistics. New Age International.
6. Gurumani, N. 2010. An Introduction to Biostatistics (2nd Edn). MJP Publishers.

Reference books:

1. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
2. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
3. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. 6. W. H. Freeman and Co., U.S.A. 10th edition.
4. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

Online Resources–

- **e-Resources / e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- https://www.springer.com/gp/book/9789811391767
- https://www.springer.com/gp/book/9789811550720
- https://www.asct.com/ASCTWeb/Content/Cytopreparation_Online_Course.aspx
- https://www.mooc-list.com/tags/genetics
- https://www.coursera.org/learn/genetics-evolution
- https://www.my-mooc.com/en/mooc/introduction-to-genetics-and-evolution/

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- 5x4 =**20 Marks** Section B: Descriptive answer type qts., **1out of 2** from each unit=**4x10**=40 **Marks**	

Name and Signature of Convener & Members of CBoS:

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Sciences *(Honors)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**BOSC -08**		
2	**Course Title**	**Lab. Course-08 (Molecular biology and Biostatics)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	After the completion of the course the students will be able to: ➢ Isolate DNA from plant cell and *E.Coli*. ➢ Learn chimera formation in various plants. ➢ Understand the functioning and application of spectrophotometer. ➢ Understand the interpretation of data with the help of statistical data.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Isolation of DNA from plant cells. ➢ Quantitative measurement of DNA by Spectrophotometric method. ➢ Feulgen or hydrolytic staining of DNA. ➢ Chimera formation in Bougainvillea and other ornamental and other different plants. ➢ Isolation of plasmid DNA from *E. coli* . ➢ Isolation of *Rhizobium* from root nodules of leguminous plants. ➢ Isolation of *Agrobacterium tumifaciens* from tumours of dicot plants. ➢ Preparation of LB medium and raising E. Coli. ➢ DNA estimation by diphenylamine reagent/UV Spectrophotometry. ➢ Analysis of statistical data: Statistical tables, Central tendency - mean mode, median, standard deviation and standard error (using seedling population /leaflet size etc). ➢ Calculation of correlation coefficient values and finding out the probability. ➢ Computer application in biostatistics - MS Excel and SPSS	**30**
Keywords	***Spectrophotometer, Plasmid, colchicine, E.Coli, Central tendencies.***	

Signature of Convener & Members (CBoS) :

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. . Raghvan, V. (1997) Molecular Biology of Flowering Plants. Cambridge Univ. Press, New York, USA.
2. Biotechnology by B.D. Singh
3. Biotechnology by R.S.Singh
4. Practical Biotechnology: Principles and Protocols by Swagat Kumar Das Hrudayanath Thatoi, Supriya Dash.

Reference Books Recommended –

1. ***Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.***
2. Brown, T. A. (1999) Genomes. John Willey and Sons Asia Pvt. Ltd., Singapore.
3. Callow, J. A. Ford-Loyd, B. V. and Newbury, H. J. (1997) Biotechnology and Genetic Resources: Conservation and Use. Cab International, Oxon, UK.
4. Glazer, A. N. and Nikaido, H. (1995) Microbial Biotechnology. Freman and Company, New York, USA.
5. Hennery, R. J. (1997) Practical Applications of Plant Molecular Biology. Chapman and Hall, London UK.
6. Jolles, O. And Jornvali, H. (2000) Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
7. Old, R. W. Primerose, S. B. (1989) Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford UK.
8. Primrose, S. B. (1995) Principles of Genome Analysis, Blackwell Scientific Publications. Oxford, UK

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4890884/
- https://www.k-state.edu/wgrc/electronic_lab/feul_stain_prot.html
- https://www.westga.edu/academics/research/vrc/assets/docs/spss_basics.pdf
- https://www.analyticsvidhya.com/blog/2021/11/a-comprehensive-guide-on-microsoft-excel-for-data-analysis/
- https://handelsmanlab.discovery.wisc.edu/wp-content/uploads/2018/01/Arapidmethod1989.pdf
- https://byjus.com/maths/central-tendency/

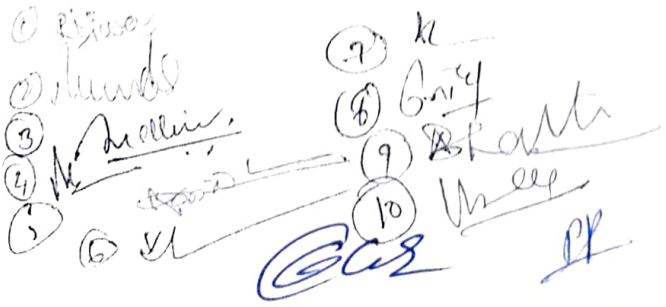
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester -VIII**	Session: **2024-2025**	
1	**Course Code**	**BOSE -09 T**		
2	**Course Title**	**Plant Biotechnology and Crop Improvement**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	□ At the end of this course, the students will be able to ➢ The basic concept,scope and significance of Biotechnology. ➢ Micropropagation using meristem and shoot cultureto produce large number of identical individuals. ➢ The role of biotechnology in crop improvement. ➢ Various applications of Biotechnology in different fields.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Fundamentals of Biotechnology:** Basic concepts, principles and scope. **Plant Cell and Tissue Culture:** General concept, history, scope, totipotency, concept of cellular differentiation, tissue culture media and explants. Applications of Plant Biotechnology.	12
II	**Organogenesis and Embryogenesis:** Concept of morphogenesis, organogenesis and embryogenesis; Fundamental aspects of organogenesis in plant tissue culture, factors influencing organogenesis; somatic embryogenesis and androgenesis - mechanism, techniques and utility	11
III	**Somatic Hybridization:** Concept of somatic fusion and hybridization; Protoplast isolation, fusion and culture, hybrid selection and regeneration; progress, possibilities, achievements and limitations of protoplast research.	11
IV	**Application of Plant Tissue Culture in crop improvement:** Clonal propagation, artificial seed, production of hybrids and soma clones, Soma clonal variation – cause & advantages and its application in crop improvement; production of secondary metabolites / natural products, cryopreservation and germplasm storage	11 (11Hr))
Keywords	Biotechnology, Tissue Culture, Crop improvement, Clonal propagation	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Bhojwani, S. S and Razdan, N.K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Publishers, New York, USA
2. .Kartha, K.K. (1985) Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida, USA.
3. Vasil, I. K. and Thorbe, T. A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, Netherlands.

Reference Books Recommended –

1. Smith, R. H. (2000) Plant Tissue Culture; Techniques and Experiments, Academic Press,New York.
2. Collins, H.A. and Edwards, S. (1998) Plant Cell Culture, Bios. Scientific Publisher Oxford, U.K.

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant-biotechnology#:~:text=Plant%20Tissue%20Culture%2DBased%20Industries&text=Plant%20tissue%20culture%20in%20agricultural,into%20next%20step%20of%20commercialization.**
- **https://www.nifa.usda.gov/grants/programs/biotechnology-programs/plant-biotechnology**
- **https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-022-00369-2**
-

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA):30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VIII**	Session: **2024-2025**	
1	**Course Code**	**BOSE-09 P**		
2	**Course Title**	**Lab. Course -09 (Plant biotechnology and crop improvement)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to understand- ➢ The basic techniques of Plant Tissue Culture. ➢ Screening programmes of cells, rather than plants, for advantageous characters. ➢ The biochemical and physiological aspects of plant growth. ➢ How to explore entrepreneurship avenues in this field.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Familiarization with basic equipments in tissue culture. 2. Preparation of tissue culture (MS) medium. 3. Study of techniques of tissue culture: sterilization of glass wares and plant materials, transfer of explants on culture media, incubation.Up to callus formation 4. Initiation of organogenesis and embryogenesis using appropriate explants. 5. Isolation of plant protoplast by mechanical and enzymatic method 6. Test of viability by tetrazolium chloride (TZ) method. 7. Counting of protoplast in the suspension by haemocytometre method 8. Effect of physical and chemical factors in protoplast yield. 9. Demonstration of protoplast fusion employing PEG. 10. Visit to any tissue culture lab of your locality and a prepare project report.	**30**
Keywords	Medium, protoplast, tissue culture, TZ	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. "Plant Tissue and Organ Culture fundamental Methods" by Gamburg OL and Philips GC, Publisher – Springer- verlag Heidelberg GmbH & Co. K
2. Practical Biotechnology by Ramadass Jaypee Brothers Medical Publishers

Reference Books Recommended

1. Biotechnology : fundamental and application by Ashok Ganguli, Publisher- Oxford book company

Online Resources–

- **e-Resources / e-books and e-learning portals**
- https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant-biotechnology#:~:text=Plant%20Tissue%20Culture%2DBased%20Industries&text=Plant%20tissue%20culture%20in%20agricultural,into%20next%20step%20of%20commercialization.
- https://www.nifa.usda.gov/grants/programs/biotechnology-programs/plant-biotechnology
- https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-022-00369-2

Online Resources–

- **e-Resources / e-books and e-learning portals**
- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** A. **Performed the Task based on lab. work - 20 Marks** B. **Spotting based on tools & technology (written) – 10 Marks** C. **Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VIII**	Session: 2024-2025	
1	**Course Code**	BOSE -10 T		
2	**Course Title**	Applied Botany and Intellectual property right (IPR)		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of the course,the students will be able to: ➢ Understand the scope and importance of Social forestry and establishment of orchard. ➢ Learn silvics of some important timber plants of India. ➢ Learn post-harves tmanagement,marketing and value additionof commercial ornamental plants. ➢ Develop a deep understanding of different forms of intellectual property Rights (IPR)		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Social forestry**: Introduction, Definition, scope and objectives of social forestry. Classification of social forestry, Economic importance of social forestry, important scheme, choice of species for reclamation of waste land, over damp area, saline and alkaline area .**Layout and Establishment of Orchards**:Pruning and training; propagation, Climatic requirement and cultivation ffruits likeMango,Banana,Citrus, Guava.	12
II	**Sliviculture:**Definition,objective and scope of silviculture. Status of forest in India and their role.Trees and their distinguishing features.Regeneration:Natural,artificial and factors Affecting it.Regeneration Survey.Tending operation:Weeding,cleaning,thinning and improvement felling. Silivcs of important forest tree species e.g. Teak, Shorea, Sheesam .	11
III	**Floriculture;**History of Floriculture. Importance and scope of floriculture in India. Flower production -water and nutrient management, weed management, thinning and pruning, disbudding, use of growth regulators, physiological disorders and remedies,Harvesting techniques,post-harvest handling, pre-cooling,pulsing,packing, storage & transportation. Prolonging the vase life of flowers. Marketing and export potential of flowers, institutional support.	11
IV	IPR: Definition and significance of intellectual propertyrights(IPR), Overview of different types of IPR,including patents and it's filingprocess, copyrights. trademarks their registration and infringement, trade secrets,Historical development and international frame works forprotecting IPR,Salient feature of Patent Act 1970.	11
Keywords	***Social forestry, Orchard, Harvesting technique,Trademark***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended–

1. S, S, Negi: Social forestry
2. S.A.Shah & K .M .Tiwari: Forestry and people
3. G P D.Vyas: Social forestry and rural development
4. Jyoti Rattan 2024.Intellectual Property Rights

Reference Books Recommended –

1. Khanna,L.S.(1984).Principles and Practice of Silviculture,Khanna Bhandu,DehraDun.
2. Ram Prakash and L.S.Khanna.(1991)Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun.
3. Champman ,G.W.and Allan,T.G.(1978).Establishment Techniques for Forest Plantation F.A.O Forestry Paper No.8. F.A.O Rome.
4. Anonymous.(1976)Indian forest utilization.Volume Iand III CFRE Publication,Dehradun.
5. Mehta,T.(1981)A hand book of forest utilization.Periodical Expert Book Agency,Delhi.298

OnlineResources –

e-Resources/e-books and e-learning portals

www.ipindia.gov.in

www.wipo.int/aboutip/en/

www.india.gov.in /topics/agriculture/floriculture

https://byjus.com/free-ias-prep/ipr-in-india-upsc notes/

https://vikaspedia.in/agriculture/farm-based-enterprises/floriculture

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): 30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VIII**		Session: **2024-2025**
1	**Course Code**	**BOSE-10 P**		
2	**Course Title**	**Lab. Course -10 (Applied Botany and Intellectual Property Rights)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to: ➢ Understand forest structure and composition. ➢ Get knowledge about phenology of various species. ➢ Learn nursery bed preparation technique. ➢ Analyze the density and moisture content of wood		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Study of forest composition. • Recording the observations on phenological characteristics of different tree species. • Study of the natural and artificial regeneration. • Lay outing of nursery bed and soil preparation, types of seed sowing in nursery bed. • Study of gross features of different types of wood; straight interlocked, spiral and wavy grain, texture, lusture, etc. • Study ofcharacteristics of trees/shrubs/grasses for agroforestry. • Volume and biomass estimation. • Crown measurement. • Study of vase life extension in cut flower using chemicals. • Study and description of botanical features of floricultural plants studied in theory paper. • Drafting a patent application: Students can learn how to draft a patent application for a new invention . • Trademark registration process: Students can learn how to register a trademark in India.	**30**
Keywords	*Phenological, Wood grain,Nnursery bed, Regeneration*	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Chundawat D S and Gautam SK (2010) Textbook of agroforestry. Oxford and IBH publishing co pvt. Ltd.
2. . Nair, P.K.R. (1993) An introduction to agroforestry. Kluwer Academic Publishers. 499 p. 4. Huxley, P. (1999) Tropical agroforestry. Blackwell Science, Oxford.
3. Khosla, P.K. and Khurana, D.K. (1987) Agroforestry for rural needs. Vol. I and II, ISTS, Solan, H.P.
4. Ong, C.K. and Huxley, P.K. (1996) Tree crop interactions - A physiological approach. ICRAF, Kenya.
5. . Ramakrishnan, P.S. (1992) Shifting agriculture and sustainable development. Man and biosphere series. The Parthenon Publishing Group.
6. . SenSarma, P.K. and Jha, L.K. (1993) Agroforestry. Indian Perspectives. Ashish Publishers, Delhi.5. Khanna, L. S. (1984). Principles and Practice of Silviculture, KhannaBhandu. Dehra Dun.
7. 7 . Ram Prakash and L.S. Khanna. (1991) Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun.

Reference Books Recommended –

1. Champman, G.W. and Allan, T.G. (1978). Establishment Techniques for Forest Plantation F.A.O Forestry Paper No.8. F.A.O Rome.
2. Anonymous. (1976) Indian forest utilization. Volume I and II ICFRE Publication, Dehradun.
3. Mehta, T.(1981) A handbook of forest utilization. Periodical Expert Book Agency, Delhi. 298
4. "Floriculture Principles and Species" by Dhiman Mukherjee
5. "Floriculture in India" by Jyotsna Singh and Ramesh Chandra
6. "Floriculture: A Basic Guide" by K.V. Peter
7. "Handbook of Flowering" by Jitendra Kumar
8. "Commercial Floriculture: Principles and Practices" by A.P. Misra and V.P. Singh
9. Intellectual Property Rights and Biotechnology by Shashikala Gurpur and Sreenivasulu N.S.
10. Intellectual Property Rights and Plant Biotechnology by Ramanujam Srinivasan
11. Intellectual Property Rights: An Overview by Arul George Scaria

Online Resources–

- **e-Resources / e-books and e-learning portals**
- https://ipindia.gov.in/form-and-fees.htm
- https://www.indiafilings.com/trademark-registration?matchtype=e&device
- https://www.youtube.com/watch?v=S7F6bCRBUDg&t=111s
- https://www.youtube.com/watch?v=SrWcYWzJJJ8
- https://www.youtube.com/watch?v=tYysC0dwtU0
- https://www.youtube.com/watch?v=U5_nynPVdTY
- https://www.youtube.com/watch?v=7faqx7N-pS4
- https://www.youtube.com/watch?v=AQdEXkVFGEw
- https://www.youtube.com/watch?v=uDWilCvc3lQ

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- www.ndl.iitkgp.ac.in

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** A. Performed the Task based on lab. work - **20 Marks** B. Spotting based on tools & technology (written) – **10 Marks** C. Viva-voce (based on principle/technology) - **05 Marks**	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester - VIII**	Session: 2024-2025	
1	**Course Code**	BOSE -11 T		
2	**Course Title**	**Biochemistry and Enzymology**		
3	**Course Type**	**Discipline specific Elective (DSE)**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, the students will be able to ➢ Basic idea of life building block biomolecules. ➢ Energy status of the cell ➢ Basic carbohydrates, lipids and proteins structure ➢ Biocatalyst enzymes		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	• Structure of atoms, molecules and chemical bonds. • Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). • Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).. • Composition, structure and function of biomolecules (carbohydrates,).	12
II	• Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. • Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and function of ATP.	11
III	• Lipids : structure and function, alpha and beta oxidation and anabolism. • Nucleic acids : DNA, RNA, Conformation of nucleic acids (helix (A, B,C, Z), t-RNA, mRNA, rRNA, HnRNA micro-RNA).hoogestein bridge, hairpin DNA	11
IV	• Proteins- amino acids, primary, secondary, tertiary and quaternary structure. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). • Fundamentals of Enzymology: General aspect, classification, nature of enzymes, mode of enzyme action, allosteric mechanism, feedback method of inhibition, regulatory and active sites, isoenzymes, Ribozyme,Abzymes, kinetics of enzymatic catalysis, Michaelis – Menton equation and its significance.	11

Keywords reaction kinetics, inhibition. active sites, Conformation, ATP

Signature of Convener & Members (CBoS) :

Biophysical Chemistry

Bioenergetics

Lipids
Nucleic acid
Protein
Enzymology

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books recommended:

1. Galaston, A. W., (1989) Life Processes in Plants. Scientific American Library, Springer- Verlag, New York, USA.
2. Hopkins, W. G. (1995) Introduction to Plant Physiology John Willey and Sons, Inc. New York, USA.
3. Dennis D. T., Turpin, D. H., Lefebvre D. D. and Layzell, D. B. (1997) Plant Metabolism. Longman, Essex, England.
4. Moore, T. C. (1989) Biochemistry and Physiology of Plant Hormone. Springer Verlog, New York.
5. Nobel, P. S. (1999) Physiochemical and Environmental Plant Physiology. Academic Press, San Diego, USA.
6. Thomas, B. and Vince-Prue(1997) Photoperiodism in Plants. Academic Press, San Diego, USA.

Reference Books Recommended-

1. Taiz, L. and Zeiger, E., (1989) Plant Physiology. Sinaver Associations, Inc. Publishers, Massachusetts, USA.
2. Salisbury F. B. and Ross, C. W., (1992) Plant Physiology Wadsworth Publishing Co., California, USA
3. Lehninger : Principles Of Biochemistry by David L Nelson, Michael M Cox 2021

Online Resources–

- **e-Resources / e-books and e-learning portals**

1. https://www.mdpi.com/journal/biomolecules
2. https://www.news-medical.net/life-sciences/An-Overview-of-Enzymology.aspx#:~:text=Enzymology%20is%20the%20study%20of,products%20controlled%20by%20equilibrium%20properties.
3. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/06%3A_Metabolism/6.02%3A_Energy_and_Metabolism_-_Types_of_Energy
4. https://www.thoughtco.com/dna-versus-rna-608191

Online Resources–

- **e-Resources / e-books and e-learning portals**
- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA):30 **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts., **1out of 2** from each unit-**4x10= 40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors)*		**Semester -VIII**	Session: 2024-2025	
1	**Course Code**	**BOSE -11 P**		
2	**Course Title**	**Lab. Course -11 P (Biochemistry and enzymology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	***As per program***		
5	**Course Learning. Outcomes (CLO)**	➢ Students will be familiar with the common biobuilding block ➢ Biochemical analysis of common biomolecules ➢ Enzyme kinetics and its role ➢ Characterization of light harvesting molecule chlorophyll.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1) Biochemical test of carbohydrates, sucrose, glucose proteins, lipids 2) Biochemical test of Catalase, dehydrogenase, peroxidase test 3) Preparation of chlorophyll extract 4) Separation of chlorophyll by paper chromatography. 5) Separation of chlorophyll amino acids by paper chromatography. 6) Effect of temperature on enzyme activity 7) Effect of pH on enzyme activity	**30**
Keywords	Biochemical test, Catalase, dehydrogenase, chlorophyll, enzyme	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Practical Biochemistry by Damodaran Geetha K (Author) Jaypee Brothers Medical Publishers
2. *Practical Manual of Biochemistry,* CBS Publishers & Distributors Pvt. Ltd. (1 January 2020); CBS Publishers & Distributors Pvt. Ltd.

Reference Books Recommended –

1. Introductory Practical Biochemistry Paperback – 2 January 2001by S.K. Sawhney (Editor), R. Singh (Editor) Narosa Publishing House
2. Practical Enzymology Author(s): Prof. Dr. Hans Bisswanger First published:23 February 2011Print ISBN:9783527320769 |Online ISBN:9783527659227 |DOI:10.1002/9783527659227 Copyright © 2011 Wiley-VCH Verlag GmbH & Co. KGaA

Online Resources–

- **e-Resources / e-books and e-learning portals**

1) **https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=KAUSHIK+G+G&search-alias=stripbooks**
2) **https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.mlsu.ac.in/econtents/1616_Biochemical%20Tests%20of%20Carbohydrate,%20protein,%20lipids%20and%20salivary%20amylase.pdf**
3) **https://alevelbiology.co.uk/notes/tests-for-carbohydrates/**
4) **https://alevelbiology.co.uk/notes/test-for-proteins/**
5) **https://studymind.co.uk/notes/test-for-lipids-and-proteins/**
6) **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4121948/**

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** A. Performed the Task based on lab. work - **20 Marks** B. Spotting based on tools & technology (written) – **10 Marks** C. Viva-voce (based on principle/technology) - **05 Marks**	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Science *(Honors)*	Semester - VIII	Session: 2024-2025

1	Course Code	BOSE- 12 T Genetic	
2	Course Title	Bioinformatics and Gene Technology	
3	Course Type	Discipline specific Elective (DSE)	
4	Pre-requisite (if, any)	*As per program*	
5	Course Learning. Outcomes (CLO)	*At the end of the course, the students will be able :* ➢ Understand basics of bioinformatics and it's tools. ➢ Learn application of bioinformatics in various areas. ➢ Analyse and perform RAPD,RFLP,PCR etc. ➢ Understand GMO and ethics behind the cloning.	
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction to Bioinformatics:**Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Biological Databases,Basic bimolecular concepts: Protein, and amino acid, DNA & RNA, Sequence Classification format ofBiological Databases.. National Center for Biotechnology Information (NCBI),Examples of related tools(FASTA, BLAST, BLAT, RASMOL), databases(GENBANK, Pubmed, PDB .	12
II	**Applications of Bioinformatics** :Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, protein sequencing, gene sequencing, Crop improvement.	11
III	**Genetic technology** :Recombinant DNA technology; restriction endonuclease, cloning vectors. Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting;Molecular DNA markers i.e. RAPD, RFLP. DNA sequencing, PCR and ReverseTranscriptase-PCR.	11
IV	**Application of genetic technology**: Genetically modified organism; bt cotton and btbrinjal.Transgenic crop; Golden rice. *Agrobacterium* transformation,Hybridomaand monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy, social, legal and ethical aspect of cloning.	11

Keywords ***Bioinformatics, Durg design, Crop improvement, ELISA***

Signature of Convener & Members (CBoS) :

1 2 3 4 5 6 7 8 9 10

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
4. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A

Reference Books Recommended –

1. Mount D., Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, New York (2004).
2. Baxevanis, A.D. and Francis Ouellellette, B.F., Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins. Wiley India Pvt Ltd. (2009).
3. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
4. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley- Blackwell.
5. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://pubmed.ncbi.nlm.nih.gov/24272431/#:~:text=Bioinformatics%20is%20an%20interdisciplinary%20field,a%20computational%20point%20of%20view.
- https://byjus.com/biology/bioinformatics/
- https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200329161234l467kuaum_yadav_Bioinformatics.pdf
- https://www.geeksforgeeks.org/types-of-biological-database-in-bioinformatics/
- https://www.umass.edu/microbio/rasmol/techintr.htm#:~:text=RasMol%20is%20a%20molecular%20graphics,generation%20of%20publication%20quality%20images.
- https://www.intechopen.com/chapters/88596
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9696050/#:~:text=Bioinformatics%2C%20next%2Dgeneration%20sequencing%2C,improving%20crop%20quality%20%5B87%5D
- https://www.enzolifesciences.com/science-center/technotes/2017/march/what-are-the-differences-between-per-rt-pcr-qpcr-and-rt-qpcr?/
- https://education.nationalgeographic.org/resource/genetically-modified-organisms/

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): 30 (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE): 70	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honours)*		**Semester - VIII**	Session: **2024-2025**	
1	**Course Code**	**BOSE -12 P**		
2	**Course Title**	**Lab. Course -12 (Bioinformatics and Gene Technology)**		
3	**Course Type**	**Laboratory course**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	At the end of this course, students will be able to: ➢ Retrieve gene and protein from gene bank. ➢ Understand steps of production of GMO. ➢ Learn the isolation of plasmid DNA. ➢ Understand use and application of PCR.		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Retrieve the gene from Gene bank and to save the sequence in FASTA format. • Retrieve the protein from Gene bank and to save the sequence in FASTA format. • Find the similarity of sequence for the given nucleotide or protein sequence • Find the similarity of sequence for the given protein sequence. • Study of steps of genetic engineering for production of Bt cotton, Golden rice through photographs. • Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, micro projectile, bombardment. • Isolation of plasmid DNA. • Restriction digestion and gel electrophoresis of plasmid DNA. • Demonstration of PCR.	**30**
Keywords	***Gene bank , FASTA, Agrobacterium, PCR***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Baxevanis, A.D. and Francis Ouellellette, B.F., Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins. Wiley India Pvt Ltd. (2009).
4. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.

Reference Books Recommended –

1. Sarma,P V G K , 2021.A Practical Textbook of Genetic Engineering in Bacteria .
2. Yves Tourte, 2003. Genetically Modified OrganismsTransgenesis in Plants

Online Resources–

- **e-Resources / e-books and e-learning portals**

- https://vvvcollege.org/dbt/LabManual-Bioinformatics.pdf
- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BI0505%20LAB%20MANUAL.pdf
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7712542/#:~:text=Transfer%20the%20supernatant%20that%20contains,the%20purity%20of%20the%20DNA.
- https://miteshshrestha.wordpress.com/wp-content/uploads/2018/03/flavr-savr-tomato-golden-rice-bt-cotton.pdf
- https://www.deshbandhucollege.ac.in/pdf/resources/1589512616_Z(H)-VI-Biotech-1.pdf
- https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1.12%3A_Restriction_Digest_with_Gel_Electrophorisis
- https://www.youtube.com/watch?v=matsiHSuoOw

Online Resources–

- **e-Resources / e-books and e-learning portals**
- **www.swayam.ac.in**
- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): 15 **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE): 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FYUGP, HONOURS WITH RESEARCH

(Students who scores 7.5 CGPA and above in the first 6 Semesters and wish to Undertake research at the UG level can choose a research stream in the 4th Year)

COURSE TITLE: PROJECT/DISSERTATION

COURSE CREDIT: 12

MM -300

Course Objective and Outcome

After completion of the course the learners will be able to:

- The course allows the student to explore a narrow topic in greater depth than a traditional module
- The student works with a single supervisor chosen from their departmental faculty, and this individual provides guidance and support throughout the course of the research.
- The aim of the research project is to test the independent research skills students have acquired during their time at college.
- The students learn to do research and present their finding independently.
- The course is very helpful for students who would pursue academics as a career

COURSE GUIDELINE

- The students undertaking this course shall be allotted a supervisor/ mentor at the beginning of the semester.
- The student shall select a topic for dissertation from any field of related major discipline with help from the supervisor/ mentor
- The work completed within the stipulated time and written in standard academic format shall be submitted at the end of the semester.
- The research outcome of their project work may be published peer- reviewed journal /presented conference/patented.
- The work shall be evaluated on the basis of the written document submitted by the student and a viva-voce conducted on the same.

MARKS DISTRIBUTION:

PROJECT REPORT/DISSERTATION SUBMISSION (External)	**-120**
PROJECT REPORT/DISSERTATION SUBMISSION (Internal)	**-30**
SEMINAR PRESENTATION	**-50**
VIVA –VOCE	**-50**
PRESENTATION ANY CONFERENCE / PUBLICATION/ COMMUNICATED	**-50**