

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE

RAJNANDGAON (C.G.)



B.Sc. BOTANY FYUP

(Four Year Undergraduate Programme)

Semester I, II, III, IV, V, VI, VII, VIII

Course Curriculum

FOR

B.Sc. BOTANY

Semester VII and Semester VIII

SESSION – 2026-27

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

2026-27

Year	Sem.	Course Type	Course Code	Course Title	Credit	IA	ESE	Max Marks
First Year	I Sem.	DSC-01	BOSC01T	Elementary Botany	3+0+0	30	70	100
		DSC-01-LAB	BOSC01P	Elementary Botany –LAB	0+0+1	15	35	50
		GE-01	BOGE01T	Elementary Botany	3+0+0	30	70	100
		GE-01-LAB	BOGE01P	Elementary Botany –LAB	0+0+1	15	35	50
	II Sem.	DSC-02	BOSC02T	Microbes and Thallophyta	3+0+0	30	70	100
		DSC-02-LAB	BOSC02P	Microbes and Thallophyta - LAB	0+0+1	15	35	50
		GE-02	BOGE02T	Microbes and Thallophyta	3+0+0	30	70	100
		GE-02-LAB	BOGE02P	Microbes and Thallophyta - LAB	0+0+1	15	35	50
		SEC-01	BOSEC01	Gardening and Floriculture	0+0+2	10	40	50
Second Year	III Sem.	DSC-03	BOSC03T	Archegoniate and Fossils	3+0+0	30	70	100
		DSC-03-LAB	BOSC03P	Archegoniate and Fossils – LAB	0+0+1	15	35	50
		DSE- 01	BOSE01T	Natural resources and management	3+0+0	30	70	100
		DSE-01-LAB	BOSE01P	Natural resources and management- LAB	0+0+1	15	35	50
		VAC- 01	BOVAC01	Herbal Plants & Human Health	2+0+0	10	40	50
	IV Sem.	DSC- IV	BOSC04T	Angiosperms	3+0+0	30	70	100
		DSC- IV- LAB	BOSC04P	Angiosperms- LAB	0+0+1	15	35	50
		DSE-02	BOSE02T	Microbiology and Phytopathology	3+0+0	30	70	100
		DSE-02-LAB	BOSE02P	Microbiology and Phytopathology- LAB	0+0+1	15	35	50
		SEC- 02	BOSEC02	Flower Decoration	0+0+2	10	40	50

Third Year	V Sem.	DSC-05	BOSC05T	Cytology and Genetics	3+0+0	30	70	100
		DSC-05-LAB	BOSC05P	Cytology and Genetics - LAB	0+0+1	15	35	50
		DSE-03	BOSE03T	Phytopaleontology and Evolutionary Botany	3+0+0	30	70	100
		DSE-03-LAB	BOSE03P	Phytopaleontology and Evolutionary Botany - LAB	0+0+1	15	35	50
		VAC-02	BOVAC02	Academic Research and Report Writing	2+0+0	10	40	50
	VI Sem.	DSC-06	BOSC06T	Plant Physiology and Economic Botany	3+0+0	30	70	100
		DSC-06-LAB	BOSC06P	Plant Physiology and Economic Botany-LAB	0+0+1	15	35	50
		DSE-05	BOSE04T	Ethnobotany and Medicinal Plants	3+0+0	30	70	100
		DSE-05-LAB	BOSE04P	Ethnobotany and Medicinal Plants-LAB	0+0+1	15	35	50
	Fourth Year Bachel or of Honors	VII Sem.	DSC-07	UBSDCT-707	Ecology and Phytogeography	3+0+0	20	80
DSC-07-LAB			UBSDCL-707	Ecology and Phytogeography-LAB	0+0+1	10	40	50
DSE-07			UBSDET-707A	Instrumentation and Biochemical Technology	3+0+0	20	80	100
DSE-07-LAB			UBSDEL-707A	Instrumentation and Biochemical Technology-LAB	0+0+1	10	40	50
DSE-08			UBSDET-707B	Biosystematics and Biodiversity	3+0+0	20	80	100
DSE-08-LAB			UBSDEL-707B	Biosystematics and Biodiversity-LAB	0+0+1	10	40	50
DSE-09			UBSDET-707C	Plant Breeding and Seed Technology	3+0+0	20	80	100
DSE-09-LAB			UBSDEL-707C	Plant Breeding and Seed Technology-LAB	0+0+1	10	40	50
GE-707			UBSGET-707	Growth and Stress Physiology	3+0+0	20	80	100
GE-LAB			UBSGEL-707	Growth and Stress Physiology-LAB	0+0+1	10	40	50

Fourth Year Bachelor of Honors with Research	VIII Sem	DSC-08	UBSDCT-807	Molecular Biology and Biostatistics	3+0+0	20	80	100
		DSC-08-LAB	UBSDCL-807	Molecular Biology and Biostatistics- LAB	0+0+1	10	40	50
		DSE-10	UBSDET-807A	Plant Biotechnology and Crop Improvement	3+0+0	20	80	100
		DSE-10-LAB	UBSDEL-807A	Plant Biotechnology and Crop Improvement-LAB	0+0+1	10	40	50
		DSE-11	UBSDET-807B	Applied Botany and Intellectual Property Right (IPR)	3+0+0	20	80	100
		DSE-11-LAB	UBSDEL-807B	Applied Botany and Intellectual Property Right (IPR)-LAB	0+0+1	10	40	50
		DSE-12	UBSDET-807C	Biochemistry and Enzymology	3+0+0	20	80	100
		DSE-12-LAB	UBSDEL-807C	Biochemistry and Enzymology-LAB	0+0+1	10	40	50
		DSE-13	UBSDET-807D	Bioinformatics and Genetic Technology	3+0+0	20	80	100
		DSE-13-LAB	UBSDEL-807D	Bioinformatics and Genetic Technology-LAB	0+0+1	10	40	50
	VII Sem.	DSC-07	UBSDCT-707	Ecology and Phytogeography	3+0+0	20	80	100
		DSC-07-LAB	UBSDCL-707	Ecology and Phytogeography-LAB	0+0+1	10	40	50
		DSE-07	UBSDET-707A1	Research Methodology and Ethics	4+0+0	20	80	100
		DSE-08	UBSDET-707B	Biosystematics and Biodiversity	3+0+0	20	80	100
		DSE-08-LAB	UBSDEL-707B	Biosystematics and Biodiversity-LAB	0+0+1	10	40	50
		DSE-09	UBSDET-707C	Plant Breeding and Seed Technology	3+0+0	20	80	100
		DSE-09-LAB	UBSDEL-707C	Plant Breeding and Seed Technology-LAB	0+0+1	10	40	50
		GE-707	UBSGET-707	Growth and Stress Physiology	3+0+0	20	80	100
		GE- LAB	UBSGEL-707	Growth and Stress Physiology-LAB	0+0+1	10	40	50
	VIII Sem	DSC-08	UBSDCT-807	Molecular Biology and Biostatistics	3+0+0	20	80	100
		DSC-08-LAB	UBSDCL-807	Molecular Biology and Biostatistics- LAB	0+0+1	10	40	50
		DSE-10	UBSDET-807A	Plant Biotechnology and Crop Improvement	3+0+0	20	80	100
		DSE-10-LAB	UBSDEL-807A	Plant Biotechnology and Crop Improvement-LAB	0+0+1	10	40	50
		Research Project/Dissertation	UBSRP-807		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 Periods
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 plants and ecosystem. Climate change: Green house gases(CO ₂ , CH ₄ , N ₂ O, 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) :			
1.	[Signature]		
2.	[Signature]		
3.	[Signature]		
4.	[Signature]		
5.	[Signature]		
6.	[Signature]		
7.	[Signature]		
8.	[Signature]		
9.	[Signature]		
10.	[Signature]		

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, Philadelphia.
3. Odum, E. P. (1983) Basic Ecology. Saunders, Philadelphia

Online Resources–

> e-Resources / e-learning portals

- > www.swavam.ac.in
- > www.ignou.ac.in
- > www.cgankosh.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://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. out of 2 from each unit-4x10=40 Marks

Name and Signature of Convener & Members of CBoS:

① *Rajiv*

② *Rajiv*

③ *Aradhna*

④ *Ms*

⑤ *Dr. S. S. S.*

⑥ *Dr*

⑦ *Dr*

⑧ *Dr*

⑨ *Dr*

⑩ *Dr*

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

PART- A: Introduction			
Program: Bachelor in Life Sciences (Honors)		Semester - VII	Session: ²⁰²⁶⁻²⁷ 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	- to determine minimum size and number of quadrates required for reliable estimate of biomass in grass land ecosystem. - To study the frequency, abundance and density of plants in the local ecosystem by quadrat method. - To determine gross and net productivity by light and dark bottle method. - To determine soil moisture content, porosity and bulk density of soil collected from different locations. - To determine the water holding capacity of various soils. - To determine the basal cover, or vegetational cover of one herbaceous community by quadrat method. - To determine IVI of the grass land. - To measure the above-ground plant biomass in a grassland. - To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland. - Experiment on Physico-Chemical Analysis of Water (pH, Temperature, etc. - To determine transparency or turbidity of different water bodies. - To measure the amount of dissolved oxygen in pond water. - To determine the total dissolved solids (TDS) in water - To measure the amount of BOD in different types of water. - Ombrothermic diagram of your locality.	30
Keywords	Quadrat, Productivity, Turbidity, TDS.	

Signature of Convener & Members (CBoS) :

① <i>R. S. Bhat</i> ② <i>Reena</i> ③ <i>Arjun</i> ④ <i>M. S.</i> ⑤ <i>Arjun</i> ⑥ <i>R.</i>	⑦ <i>k</i> ⑧ <i>h. n. t. e. p.</i> ⑨ <i>Blasht</i> ⑩ <i>Ur. See</i>
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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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05	
End Semester Exam (ESE): 35	Total Marks - 15	Managed by Course teacher as per lab. status
	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	

Name and Signature of Convener & Members of CBoS:

① R. Shrivastava
② R. Mandeep
③ K. S. Rao
④ K. S. Rao
⑤ A. K. Rathoure
⑥ A. K. Rathoure
⑦ K. S. Rao
⑧ K. S. Rao
⑨ K. S. Rao
⑩ K. S. Rao

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 2026-27
1	Course Code	BOSE-07 T	
2	Course Title	Instrumentation and biochemical 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 ➤ Develop a solid understanding of different analytical methods and instruments used in plant sciences. ➤ Acquire practical skills in sample preparation, data collection, and data analysis using analytical techniques. ➤ Understand the working principles of important instrumentation tools. ➤ Understand modern technologies in the field of Biochemistry	
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	- Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; - Use of fluorochromes in : (a) Flow cytometry (b) fluorescence microscopy: for Chromosome banding - Phase contrast, electron, scanning and transmission electron microscopy, - Single and double staining techniques for light microscopy for temporary and permanent slides - Stain techniques: Single and double staining.		12
II	Instruments: Salient features, Principle and applications. - Autoclave, - Oven, - Laminar air flow, - Centrifuge. - Colorimetry - Spectrophotometry, - Fermenters., - Water bath, - pH meter		11
III	- Chromatography: Principle and its application in biological research: Paper chromatography, Column chromatography, Affinity chromatography, TLC, GLC, HPLC. - Electrophoresis: AGE, PAGE, SDS-PAGE. - Radioisotopes: Principles and its application in biological research. - ELISA test		11
IV	Biochemical Technology, Biofuel, CRISPR Technology Genetic Engineering, Vaccine, Biodegradable plastics Gene Therapy, DNA fingerprinting, GMO food, Pest resistant crops.		11
Keywords		Microscope, biochemical technology	

Signature of Convener & Members (CBOS) :

① Ramesh
② Ramesh
③ Ramesh

④ Ramesh
⑤ Ramesh
⑥ Ramesh

⑦ Ramesh
⑧ Ramesh
⑨ Ramesh
⑩ Ramesh

Microscopy

Instrumentation

Chromatography & Staining Techniques

Biochemical Technology & Genetic Engineering

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended -

1. Bioinstrumentation by L. VEERAKUMARI

Reference Books Recommended -

1. Biological Instrumentation & Methodology by Bajpai P. K.

Online Resources-

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

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2103.pdf
2. [https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ZOO/PK%20\(4\).pdf](https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ZOO/PK%20(4).pdf)
3. <https://kanchiuniv.ac.in/coursematerials/Biomedical%20instrumentation.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.esniksha.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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
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:

- ① R. R. R.
- ② R. R. R.
- ③ R. R. R.
- ④ R. R. R.
- ⑤ R. R. R.
- ⑥ R. R. R.
- ⑦ R. R. R.
- ⑧ R. R. R.
- ⑨ R. R. R.
- ⑩ R. R. R.

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 ²⁰²⁶⁻²⁷
1	Course Code	BOSE-07 P	
2	Course Title	Lab. course -07(Instrumentation and Biochemical 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, the students will be able to get. ➤ Knowledge about Bio Instruments. ➤ Understand different parameters of instrumentation. ➤ Operation and handling of latest equipments	
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. Calibration of microscope. 2. Handling of microscope and other instruments. 3. Safety measures in laboratory 4. Principle and application of microscope 5. Principle and application of laboratory instruments-Autoclave, Oven, Laminar air flow, Centrifuge. Colorimetry and Spectrophotometry, Water bath, pH meter 6. Concept of pH and buffer formation 7. Separation of chlorophyll pigment by paper chromatography 8. Separation of chlorophyll pigment by thin layer chromatography (TLC) 9. Study of amino acid and calculation of Rf values by paper chromatography. 10. SDS -PAGE analysis of proteins 11. Quantitative analysis of DNA using colorimeter 12. Preparation of different types of solutions normal, molal and molar. 13. Visit to a nearby well equipped Scientific lab and prepare report.		30
Keywords	microscope, pH, chromatography, solutions, Rf		

Signature of Convener & Members (CBOS) :

① R. P. Singh
 ② R. P. Singh
 ③ R. P. Singh
 ④ R. P. Singh
 ⑤ R. P. Singh
 ⑥ R. P. Singh

⑦ R. P. Singh
 ⑧ R. P. Singh
 ⑨ R. P. Singh
 ⑩ R. P. Singh

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Experiments In Microbiology, Plant Pathology And Biotechnology By K.R. Anuja. Publisher New Age International

Reference book recommended

1. Bioinstrumentation: Research, Development and Applications Hardcover Import, 31 July 1990 by Donald L. Wise

Online Resources–

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

1. <https://www.lumentum.com/en/commercial-lasers/applications/biomedical-and-analytics-instrumentation>
2. <https://www.rgcb.res.in/instraining>
3. https://admin/uploads/3/PG_M.Sc._Botony_34631%20MICROBIOLOGY%20AND%20PLANT%20PATHOLOGY.pdf

Online Resources–

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

- www.swavam.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
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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:

① *[Signature]*
② *[Signature]*
③ *[Signature]*
④ *[Signature]*
⑤ *[Signature]*
⑥ *[Signature]*
⑦ *[Signature]*
⑧ *[Signature]*
⑨ *[Signature]*
⑩ *[Signature]*

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: ²⁰²⁶⁻²⁷ 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, cytotoxonomy 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	Principles 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) :			

Systematics

taxonomic Procedures

biodiversity

principles of conservation

① Rajeev

② Shreya

③ Anshu

④ Anshu

⑤ Anshu

⑥ Anshu

⑦ Anshu

⑧ Anshu

⑨ Anshu
10 Anshu

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. Anonymous (1997) National Gene Bank. Indian Heritage on Plant Genetic Resources (Booklet) NBPGR, 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 Longman
7. Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin
8. Singh, G. (2012) Plant 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. 1.1 (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-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd 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. Pinstrip- 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://efaidnbmnnnibpcajpcgclefindmkaj/https://egyankosh.ac.in/bitstream/123456789/66166/2/Unit4.pdf>
- https://efaidnbmnnnibpcajpcgclefindmkaj/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

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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 - 30Better 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., 1 out of 2 from each unit-4x10=40 Marks

Name and Signature of Convener & Members of CBoS:

- ① R. S. Rao
- ② Dr. S. S. Rao
- ③ Dr. S. S. Rao
- ④ Dr. S. S. Rao
- ⑤ Dr. S. S. Rao
- ⑥ Dr. S. S. Rao
- ⑦ Dr. S. S. Rao
- ⑧ Dr. S. S. Rao
- ⑨ Dr. S. S. Rao
- ⑩ Dr. S. S. Rao

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 2026-27
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 plants part . - Preparation 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 biodiversity of college campus..		30
Keywords	Herbarium, Flora, Protected area, IUCN categories.		
Signature of Convener & Members (CBoS) :			

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 ② Shree
 ③ Shree
 ④ Shree
 ⑤ Shree
 ⑥ Shree
 ⑦ Shree
 ⑧ Shree
 ⑨ Shree
 ⑩ Shree

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 Longman
2. Singh, G. (2012) Plant 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-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd 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=1pBOY7YTCLSD2K>
- <https://eppp.inflibert.ac.in/Home/ViewSubjectPratid-100YJTRCLSDKUBW>
- <https://proinfoinlibnet.ac.in/Home/ViewSubjectcatid-1pbbzy18CS02E>
- <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](file:///C:/Users/user/Downloads/ajol-file-journals%20452%20articles%20122070%20submission%20proof%20122070-5365-335203-1-10-20150914%20(1).pdf)

Online Resources–

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

- www.swayam.ac.in
- www.ignou.ac.in
- www.egvankosh.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:

① 21/11/20
② 11/11/20
③ 11/11/20
④ 11/11/20
⑤ 11/11/20
⑥ 11/11/20
⑦ 11/11/20
⑧ 11/11/20
⑨ 11/11/20
⑩ 11/11/20

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: ²⁰²⁶⁻²⁷ 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 vegetatively propagated 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 for protein 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) :

① R. P. Singh
② S. K. Singh
③ M. Singh
④ S. Singh
⑤ S. Singh
⑥ S. Singh

⑦ S. Singh
⑧ S. Singh
⑨ S. Singh
⑩ S. Singh

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 Wiley and Sons, Inc. New York.
2. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hill Book Co. Inc. New York.
3. Jonossy and Lupton (1976) Heatersis 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:

1) P. Singh
2) Singh
3) Singh

4) Singh
5) Singh
6) Singh

7) Singh
8) Singh
9) Singh
10) Singh

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: ²⁰²⁶⁻²⁷ 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

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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. 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		
➤ 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.egvankosh.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:

① Rhoen
② hundo
③ hz
④ Shafm
⑤ daniel
⑥ Blaitz

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FOUR YEAR UNDERGRADUATE PROGRAM (2024-2028)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

DSE-07

PART- A: Introduction		
Program: Bachelor in Science (<i>Honors with Research</i>)	Semester- VII	Session: 2026-27
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 research. ➤ Develop skills to formulate research problems and research design. ➤ Acquire knowledge on data collection techniques, sampling strategies, and statistical tools for data analysis. ➤ 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. ➤ Know the data collection tools. ➤ Use descriptive statistics (mean, median, mode) and correlation techniques for data analysis. ➤ Understand and apply inferential statistics including chi-square, t-test.. ➤ Evaluate hypotheses through appropriate tests. ➤ Understand the structure and importance of report writing in research. ➤ Develop skills in citation, referencing, and bibliography compilation. ➤ Understand the writing of research report and research ethics.	

Credit Value	4 Credits	Credit=15 Hours- 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) 60 Periods (60 Hours)		
UNIT	TOPICS (Course Contents)	No. of Periods
I	Research: Meaning, Definition, Objectives, Significance; Types of Research; Difference between Research methods and Research methodology. Research Process, Steps of research process, Criteria for good research, Research problem: Definition, Components of research problem, Selection of the research problem.	15
II	Research Design: Meaning, Definition, Important concepts relation to research design. Developing a research plan. Sampling Design: Meaning, Steps in sample design, Criteria of selecting a sampling procedure, Sample size, sampling error, Characteristics of a good sample design, Literature search procedure. Sources of literature. Data Collection: Data Collection: Type of data, Primary and Secondary Data, Methods of data collection.	15
III	Data Analysis, Types of Analysis, Measures of central tendency: Mean, median, mode; Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of relationship, Test of Hypothesis: What is Hypothesis, Characteristics of hypothesis, procedure for hypothesis testing, Tests of hypothesis: t-test and chi-squared test.	15
IV	Report writing, Significance of report, Steps of report writing, Concepts of Bibliography and References, Layout of research report, Mechanics of writing a research report. Ethics with respect to science and research, IPR, Plagiarism, Publication ethics: definition, introduction and importance.	15

PART:- C- Learning Resources

Text books/ Reference Books-

- [1] Research methodology: Methods and techniques- By C.R. Kothari
- [2] Research methodology- By Dr. R.N. Trivedi and Dr. D.P. Shukla
- [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.
- [8] Legal Research- William P. Statesky.
- [9] A Guide to Legal Research- Erwine Sursency.

Part: D- Assessment and Evsluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 20 Marks****End Semester Exam (ESE): 80 Marks**

Continuous Internal Assessment (CIA): 20 Marks (By Course Teacher)	Internal test/ Quiz: 10 Marks Assignment/ Seminar: 10 Marks Total Marks: 20 Marks
End Semester Exam(ESE): 80 Marks	Two section-A & B Section A: Q1 Objective- 10x2= 20 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 2026-27
1	Course Code	BOSE -08 T	
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	Plant Growth 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), ➤ Seed and bud Dormancy causes and breaking, ➤ Vernalization ➤ Senescence, ➤ Plant movements		11
III	Plant eco-physiology and Stress Physiology: ➤ Concept of Plant eco-physiology. ➤ Plant perception, ➤ physiology of ecological considerations. ❖ Hydrophytic, xerophytic morphological and anatomical adaptations in plants		11
IV	Stress Physiology: 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):			

① R. Diver
② Shunda
③ M

④ S. K. S.
⑤ K. S.
⑥ A. S. K.

⑦ A. S. K.
⑧ S. K.
⑨ S. K.
⑩ M. S.

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

1. Galston, 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 Wiley and Sons, Inc. New York, USA.
3. Salisbury, F.B. and Ross, C.W., (1992) Plant Physiology. Wadsworth Publishing Co., California, USA.
4. Denis, D.T., Turpin, D.H. Lefebvre, D.D. & Layzell, D.B. (1997) Plant Metabolism. Longman, Essex, England.

Reference Books Recommended -

1. Taiz, L. and Zeiger, E. (1998) Plant Physiology. Sinauer Associates, Inc. Pub., Massachusetts, 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-phvsiology.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

End Semester Exam (ESE): 70 Marks		Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
Continuous Internal Assessment (CIA): 70 (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	
	Assignment / Seminar - 10 Total Marks - 30	
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:

① R. R. R.

② R. R. R.

③ R. R. R.

④ R. R. R.

⑤ R. R. R.

⑥ R. R. R.

⑦ R. R. R.

⑧ R. R. R.

⑨ R. R. R.

⑩ R. R. R.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: ²⁰²⁶⁻²⁷ 2024-2025
1	Course Code	BOSE-08 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. Understand the 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. <i>Avena</i> 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) :

① *RD*
 ② *blumby*
 ③ *h*
 ④ *h*
 ⑤ *h*
 ⑥ *h*

⑦ *judlin*
 ⑧ *h*
 ⑨ *h*
 ⑩ *h*

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.eschiksha.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:

① R. K. Samaiya
② R. K. Samaiya
③ R. K. Samaiya
④ R. K. Samaiya
⑤ R. K. Samaiya
⑥ R. K. Samaiya

⑦ R. K. Samaiya
⑧ R. K. Samaiya
⑨ R. K. Samaiya
⑩ R. K. Samaiya

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 ²⁰²⁶⁻²⁷
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 should 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 tendency (Mean, median and mode) Standard Deviation, Standard error Chi square test, regression, degree of freedom		11
Keywords	DNA, RNA, protein synthesis, gene regulation, central tendency		
Signature of Convener & Members (CBoS) :			

1. R. Kumar
 2. Kumar
 3. Anil Kumar
 4. M. S.
 5. H.

6. [Signature]
 7. [Signature]
 8. [Signature]
 9. [Signature]
 10. [Signature]

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.swavam.ac.in
- www.ignou.ac.in
- www.egvankosh.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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
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:

① R. K. Singh
② Anand
③ S. K. Singh
④ M. Singh
⑤ Anand
⑥ H.
⑦ H.
⑧ B. Singh
⑨ B. Singh
⑩ M. Singh

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 2026-27
1	Course Code	BOSC -08	
2	Course Title	Lab. Course-08 (Molecular biology and Biostatistics)	
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 <i>E. Coli</i> . > 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 <i>E. coli</i>. > Isolation of <i>Rhizobium</i> from root nodules of leguminous plants. > Isolation of <i>Agrobacterium tumefaciens</i> from tumours of dicot plants. > Preparation of LB medium and raising <i>E. Coli</i>. > 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, <i>E. Coli</i> , Central tendencies.		
Signature of Convener & Members (CBoS) :			

① *R. Sivas*
 ② *Handy*
 ③ *Subin*
 ④ *...*

⑤ *...*
 ⑥ *...*
 ⑦ *...*
 ⑧ *...*
 ⑨ *...*
 ⑩ *...*

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.

1. Zar, J.H. (2012). *Biostatistical Analysis*. Pearson Publication. U.S.A. 4th edition.

1. Zar, J.H. (2012). *Biostatistical Analysis*. Pearson Publication. U.S.A. 4th edition.
2. Brown, T. A. (1999) *Genomes*. John Wiley 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*. Freeman and Company, New York, USA.
5. Hennerly, 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

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

- www.swayam.ac.in
- www.ignou.ac.in
- www.cgypankosh.ac.in
- www.iit.ac.in
- www.eskillindia.org
- www.eskiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.jitkep.ac.in

➤ 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/>

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:

① River
 ② clouds
 ③ rolling
 ④ hills
 ⑤ valley
 ⑥ sky
 ⑦ lake
 ⑧ city
 ⑨ forest
 ⑩ meat

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 2026-27
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 culture to 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) :

① R. S. S. S.
 ② S. S. S.
 ③ S. S. S.
 ④ S. S. S.
 ⑤ S. S. S.
 ⑥ S. S. S.
 ⑦ S. S. S.
 ⑧ S. S. S.
 ⑨ S. S. S.
 ⑩ S. S. S.

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,info%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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
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:

① Prof. Dr. S. S. Bhojwani
② Prof. Dr. K. K. Kartha
③ Dr. T. A. Thorbe
④ Dr. R. H. Smith
⑤ Dr. H. A. Collins
⑥ Dr. S. Edwards

⑦ Prof. Dr. S. S. Bhojwani
⑧ Prof. Dr. K. K. Kartha
⑨ Dr. T. A. Thorbe
⑩ Dr. R. H. Smith

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VIII	Session: ²⁰²⁶⁻²⁷ 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) :

① *R. Singh*
 ② *Arundh*
 ③ *h*
 ④ *h*
 ⑤ *h*
 ⑥ *Arundh*
 ⑦ *h*
 ⑧ *h*
 ⑨ *h*
 ⑩ *h*

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,info%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.egvankosh.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

End Semester Exam (ESE): 35 Marks		Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
Continuous Internal Assessment (CIA): 15 (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance - 05 Total Marks - 15	
	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

Name and Signature of Convener & Members of CBOS:

① R. Shree
② P. K. S.
③ M. S.
④ S. S.
⑤ S. S.
⑥ S. S.

⑦ S. S.
⑧ S. S.
⑨ S. S.
⑩ S. S.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VIII	Session: 2026-27 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-harvest management, marketing and value addition of 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 of fruits like Mango, Banana, Citrus, Guava.		12
II	Silviculture: 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. Silvics 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 property rights (IPR), Overview of different types of IPR, including patents and its filing process, copyrights, trademarks their registration and infringement, trade secrets, Historical development and international frame works for protecting IPR, Salient feature of Patent Act 1970.		11
Keywords: Social forestry, Orchard, Harvesting technique, Trademark			

Signature of Convener & Members (CBOS) :

① *[Signature]*
 ② *[Signature]*
 ③ *[Signature]*
 ④ *[Signature]*
 ⑤ *[Signature]*
 ⑥ *[Signature]*

⑦ *[Signature]*
 ⑧ *[Signature]*
 ⑨ *[Signature]*
 ⑩ *[Signature]*

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](http://www.india.gov.in/topics/agriculture/floriculture)

[https://byjus.com/free-ias-prep/ipr-in-india-upsc notes/](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.swavam.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:

① R.P. Rao
② S. S. Negi
③ S. S. Negi
④ S. S. Negi
⑤ S. S. Negi
⑥ S. S. Negi

⑦ S. S. Negi
⑧ S. S. Negi
⑨ S. S. Negi
⑩ S. S. Negi

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 2026-27
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 outting 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 of characteristics 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, Nursery bed, Regeneration		

Signature of Convener & Members (CBoS) :

① R. P. Rao
② R. P. Rao
③ R. P. Rao
④ R. P. Rao
⑤ R. P. Rao
⑥ R. P. Rao

⑦ R. P. Rao
⑧ R. P. Rao
⑨ R. P. Rao
⑩ R. P. Rao

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. . 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=SrWcYwZJJ8>
- <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=uDWiCvc3lQ>

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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05	
Total Marks - 15		
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:

① P. K. Singh
② Anurag

③ [Signature]

④ [Signature]

⑤ [Signature]

⑥ [Signature]

⑦ [Signature]

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VIII	Session: 2026-27 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

① R. P. Singh
② R. P. Singh
③ R. P. Singh
④ R. P. Singh
⑤ R. P. Singh

⑥ R. P. Singh
⑦ R. P. Singh
⑧ R. P. Singh
⑨ R. P. Singh
⑩ R. P. Singh

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 Verlag, 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](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3AGeneral_Biology_(Boundless)/06%3AMetabolism/6.02%3AEnergy_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.egvankosh.ac.in
- > www.iitm.ac.in
- > www.eskillindia.org
- > www.eskiksha.nip.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:

① R. P. Rao
② M. R. Rao
③ K. R. Rao
④ K. R. Rao
⑤ K. R. Rao
⑥ K. R. Rao

⑦ K. R. Rao
⑧ K. R. Rao
⑨ K. R. Rao
⑩ K. R. Rao

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester -VIII	Session: ²⁰²⁶⁻²⁷ 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) :			

① R.D. Singh
 ② R. Singh
 ③ R. Singh
 ④ R. Singh
 ⑤ R. Singh
 ⑥ R. Singh

⑦ R. Singh
 ⑧ R. Singh
 ⑨ R. Singh
 ⑩ R. Singh

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 2001 by S.K. Sawhney (Editor), R. Singh (Editor) Narosa Publishing House
2. Practical Enzymology Author(s): Prof. Dr. Hans Bisswanger First published: 23 February 2011 Print 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://efaidnbmnnnibpcajpcglefindmkaj/https://www.mlsu.ac.in/econtents/1616 Biochemical%20Tests%20of%20Carbohydrate,%20protein,%20lipids%20and%20salivary%20amylase.pdf](https://efaidnbmnnnibpcajpcglefindmkaj/https://www.mlsu.ac.in/econtents/1616%20Biochemical%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:

① *Ramesh*
② *Arundel*
③ *[Signature]*
④ *[Signature]*
⑤ *[Signature]*
⑥ *[Signature]*
⑦ *[Signature]*
⑧ *[Signature]*
⑨ *[Signature]*
⑩ *[Signature]*

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VIII	Session: 2026-27 2024-2025
1	Course Code	BOSE- 12 T <i>Genetic</i>	
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 *R. Shree*
 ② *Ramdas*
 ③ *M. S. S.*
 ④ *A. S. S.*
 ⑤ *R. S. S.*
 ⑥ *Blant*
 ⑦ *Madhu*
 ⑧ *S. S.*
 ⑨ *S. S.*
 ⑩ *V. S.*

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 Ouellette, B.F., Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins. Wiley India Pvt Ltd. (2009).
3. Ghosh Z. and Bibeknand 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/202003291612341467kuaum_yadav_Bioinformatics.pdf
- <https://www.gecksforged.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.swavam.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:

① R.P. Rao
② R. K. Singh
③ R. K. Singh
④ R. K. Singh
⑤ R. K. Singh
⑥ R. K. Singh
⑦ R. K. Singh
⑧ R. K. Singh
⑨ R. K. Singh
⑩ R. K. Singh

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honours)		Semester - VIII	Session: ²⁰²⁶⁻²⁷ 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) :

① <u>APR</u>	⑦ <u>Mullins</u>
② <u>Heun</u>	⑧ <u>bit</u>
③ <u>13</u>	⑨ <u>h</u>
④ <u>W</u>	⑩ <u>Viney</u>
⑤ <u>Spide</u>	
⑥ <u>SPaid</u>	

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 Ouellette, 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 Organisms Transgenesis in Plants

Online Resources–

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

- <https://vvvcollge.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://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_Electrophoresis
- <https://www.youtube.com/watch?v=matsilHsuoOw>

Online Resources–

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

- www.swayam.ac.in
- www.ignou.ac.in
- www.egvankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.cshiksha.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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar + Attendance - 05	
End Semester Exam (ESE): 35	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	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	

Name and Signature of Convener & Members of CBoS:

① Prof. ...
② ...
③ ...

④ ...
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⑦ ...
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⑨ ...
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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