

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

PART- A: Introduction			
Program: Bachelor in Life Sciences <i>(Honors)</i>		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: <ul style="list-style-type: none"> ▪ The interrelationship between organisms and environment. ▪ Methods to study vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography. ▪ Evolving strategies for sustainable natural resource management and biodiversity conservation. ▪ Climatic changes and its restoration ▪ Familiar with sustainable development 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Ecological Factors and Management : Climatic- light; temperature, air and water, topographic, edaphic, soil formation soil texture, type of soil, soil profile, classification, physio-chemical properties, soil organic matter, biotic factors, interrelationships, major soil type of the world. Ecological management: Concepts, sustainable development, sustainability indicators.		12
II	. Ecosystem Organization : Structure and function, primary production (methods of measurements, global pattern, controlling factors), energy dynamics, trophic organization, energy flow pathways, ecological efficiencies, litter fall and decomposition- mechanism, substrate quality and climate factors, global biogeochemical cycle of C, N, P, S, minerals cycle- pathways, processes, budgets in terrestrial and aquatic ecosystem.		11
III	Community and Eco-Stability Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, inter-specific associations, ordination, concept of ecological niche. Vegetation Development: Temporal changes (cyclic and non-cyclic), mechanism of ecological successions (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem properties during succession. Ecological Stability: Concept of resistance and resilience, ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystem, ecology of plant invasion, environmental impact assessment, ecosystem restoration.		11
IV	Phytogeography Pollution, Climatic Changes Phytogeographical regions of India with reference to Chhattisgarh. Pollution : Air, Water, Soil & Sound - kinds, sources, quality parameters, effect on plans and ecosystem. Climate change: Green house gases(CO ₂ , CH ₄ , N 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.	2.	3.	4.
5.	6.	7.	8.
9.	10.		

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

Online Resources–

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

Online Resources–

- e-Resources / e-books and e-learning portals
- <https://courses.lumenlearning.com/wm-biology2/chapter/community-structure-and-dynamics/>
- <https://education.nationalgeographic.org/resource/ecosystem/>
- <https://www.embibe.com/exams/ecological-factors/>
- [https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution#:~:text=Environmental%20pollution%20is%20unwarranted%20disposal,both%20quantitatively%20and%20qualitatively%20\(Hussain%2C](https://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	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 Rajiv
② Rendu
③ Arjun
④ M. S. Dhillon
⑤ Arjun
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 Sciences (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSC-07	
2	Course Title	Lab. Course – 07 (Ecology and Phytogeography)	
3	Course Type	Laboratory course	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ 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	<ol style="list-style-type: none"> 1. to determine minimum size and number of quadrates required for reliable estimate of biomass in grass land ecosystem. 2. To study the frequency, abundance and density of plants in the local ecosystem by quadrat method. 3. To determine gross and net productivity by light and dark bottle method. 4. To determine soil moisture content, porosity and bulk density of soil collected from different locations. 5. To determine the water holding capacity of various soils. 6. To determine the basal cover, or vegetational cover of one herbaceous community by quadrat method. 7. To determine IVI of the grass land. 8. To measure the above-ground plant biomass in a grassland. 9. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland. 10. Experiment on Physico-Chemical Analysis of Water (pH, Temperature, etc. 11. To determine transparency or turbidity of different water bodies. 12. To measure the amount of dissolved oxygen in pond water. 13. To determine the total dissolved solids (TDS) in water 14. To measure the amount of BOD in different types of water. 15. Ombrothermic diagram of your locality. 		30
Keywords	Quadrat, Productivity, Turbidity ,TDS.		
Signature of Convener & Members (CBoS) :			

① *R.P. Rao*
 ② *Neeraj*
 ③ *Mohini*
 ④ *M*
 ⑤ *A. S. Rao*
 ⑥ *A*
 ⑦ *K*
 ⑧ *Sanjay*
 ⑨ *A. S. Rao*
 ⑩ *U. S. Rao*

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 Wheeler , 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 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 R. B. Sivan
② S. S. Suresh
③ K. Anand
④ M. S. S. S. S.
⑤ A. S. S. S.
⑥ S. S. S. S.
⑦ S. S. S. S.
⑧ S. S. S. S.
⑨ S. S. S. S.
⑩ S. S. S. S.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE-05 T	
2	Course Title	Biosystematics and Biodiversity	
3	Course Type	Discipline Specific elective (DSE)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	<p><i>At the end of the course, the students will be able :</i></p> <ul style="list-style-type: none"> ➤ Understand different classification and nomenclature system in botany. ➤ Learn plant collection and preservation techniques . ➤ Get knowledge about the biodiversity and its importance. ➤ Analyse the different conservation practices for nature. 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)	No. of Period	
I	Definition and basic concepts of biosystematics taxonomy and classification. History and theories of biological Classification. Difference between botanical and zoological nomenclature system. Trends in biosystematics: Chemotaxonomy, cytotaxonomy and molecular taxonomy. Dimensions of speciation.	12	
II	Taxonomic procedures: Taxonomic collections, preservation, process of identification. Taxonomic keys, different types of keys, their merits and demerits. How to use flora, Species concepts: Typological, Nominalist and Biological species concepts. Subspecies and other infra-specific categories.	11	
III	Biodiversity : Concept and level, role of biodiversity in ecosystem, function and stability, speciation and extinction, IUCN categories of threat, distribution and global pattern, terrestrial biodiversity, hot spots. Plant biodiversity: Concept, status in India, utilization and concerns.	11	
IV	Principles of Conservation: <i>In-situ</i> 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. <i>Ex-situ</i> Conservation: Strategies for <i>Ex- situ</i> 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) :			

Biosystematics

Taxonomic Procedures

Biodiversity

Principles of conservation

① Rajeev

② Anand

③ Anurag

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) NBPGER, New Delhi.
5. Swaminathan, M. S. And Kochhar (1989) Plants and Society, MacMillan Publication Ltd. London.
6. Kothari, A. (1997) Understanding Bio-Diversity: Life Sustainability and Equity. Orient Longam
7. Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin
8. Singh, G. (2012) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi.
9. Bhojwani, SS. & Bhatnagar, SP (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Lid. 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-APhylogenetic Approach. Sinauer Associates Inc., U.S.A. 2 nd edition.
5. Simpson, M.G. (2006) Plant Systematics. Elsevier Academic Press, San Diego, CA, USA
6. Beck, C.B. (2010). An Introduction to Plant Structure and Development, II edition.
7. Heywood, V. (1995) Global Bio-Diversity Assessment, UNEP. Cambridge Univ. Press, Cambridge, U.K.
8. Heywood, V.H. and Wyse Jackson, P. S. (1991) Tropical Botanical Garden: Their Role in Conservation and Development. Academic Press, San Digo.
9. Barker, H. G. (1978) Plant and Civilization. C. A. Wadsworth, Belmont.
10. Frankel, O. H., Brown, A. H. D. and Burdon, J. J., (1995) Conservation, of Plant Diversity. Cambridge Univ. Press, Cambridge, U. K.
11. 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://efaidnbmnnnibpcajpcglefindmkaj/https://egyankosh.ac.in/bitstream/123456789/66166/2/Unit4.pdf>
- https://efaidnbmnnnibpcajpcglefindmkaj/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/spcdd>
- <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

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

Name and Signature of Convener & Members of CBoS:

- ① Riswan
- ② Arundh
- ③ Ms
- ④ [Signature]
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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honours)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE-05 P	
2	Course Title	Lab course -05 (Biosystematics and Biodiversity)	
3	Course Type	Laboratory course	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	At the end of this course, students will be able to: > Understand collection and preservation techniques for plants. > Learn use of flora for plant identification. > Understand about protected area of the country > Analyze various IUCN categories of threats.	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> • Herbarium technique. • Non destructive collection of plants • Preservation techniques for plants part . • Prepration of taxonomic keys • How to use flora and digital flora for plant identification. • Use of flora for identification of plants of college campus. • Cladogram and dendrogram • Visit of any botanical garden , national park/wildlife sanctuary/ protected area. • Learn about IUCN categories of threats. 1) Evaluation of alfa, beta and gama biodiversity of college campus.. 		30
Keywords	Herbarium, Flora, Protected area, IUCN categories.		
Signature of Convener & Members (CBoS) :			

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- ② Rencubg
- ③ Ruz
- ④ Ruz
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- ⑥ Ruz
- ⑦ Ruz
- ⑧ Ruz
- ⑨ Ruz
- ⑩ Ruz

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) Phant Systematics. Theory and Practice. Oxford & IBH Pvt. Ltd, New Delhi.
3. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.

Reference Books Recommended –

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

Online Resources–

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

- <https://www.worldfloraonline.org/>
- <https://bsi.gov.in/page/en/digital-resources>
- <https://indiaflora-ces.iisc.ac.in/FloraPeninsular/>
- <http://www.efloras.org/>
- <https://creately.com/guides/what-is-a-dichotomous-key/herpsteppp.inflibort.ac.in/Home/VirwSubject?catid=1pBOY7YTBC LSD2K>
- <https://eppp.inflibert.ac.in/Home/ViewSubjectPratid-10OYJVTRCLSDKUBW>
- <https://www.inflibnet.ac.in/Home/ViewSubjectPratid-1pbbzy1BCS02E>
- <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_452_articles_122070_submission_proof_122070-5365-335203-1-10-20150914%20(1).pdf)

Online Resources–

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

- www.swayam.ac.in
- www.ignou.ac.in
- www.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	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	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 *R. Bhowmik*
- ② *R. Kundu*
- ③ *M. S.*
- ④ *K. S.*
- ⑤ *S. S.*
- ⑥ *A. K.*
- ⑦ *P. S.*
- ⑧ *S. S.*
- ⑨ *S. S.*
- ⑩ *M. S.*

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE-06 T	
2	Course Title	Plant breeding and Seed technology	
3	Course Type	Discipline specific Elective (DSE)	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to > Gain knowledge and comprehension of the breeding systems > knowledge of reproductive biology in angiosperms to address real-world challenges related to plant breeding, crop production, and conservation. provide students with a comprehensive understanding of plant breeding principles and techniques.	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)	No. of Period	
I	Plant breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.	12	
II	Methods of crop improvement: Introduction: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and 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) :

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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. Acquah, 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	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. P. Singh
② S. K. Singh
③ M. Singh

④ S. K. Singh
⑤ S. K. Singh
⑥ S. K. Singh

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

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE-06 P	
2	Course Title	Lab. Course- 06 (Plant breeding and Seed Technology)	
3	Course Type	Laboratory course	
4	Pre-requisite (if, any)	As per program	
5	Course Learning Outcomes (CLO)	At the end of the course students will be - > Idea of seeds which carries a new generation. > Knowledge of plant breeding techniques. > Knowledge of breeding methods for stress tolerance. > Idea of seed processing and certification of seeds.	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Study of seed parts 2. Collection of different types of mature seeds 3. Techniques of hybridization- Emasculation. 4. Techniques of hybridization - Bagging and tagging. 5. Study of vegetatively grown plants part of your locality 6. Collection of seeds of different varieties of locally grown crops. 7. Inter-varietal cross in an ornamental plant. 8. Visit to state and national seed corporation companies and prepare a report.		30
Keywords	Seed, Emasculation, Bagging and tagging.		

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

- ① Shiver
- ② Kando
- ③ Ms
- ④ [Signature]
- ⑤ [Signature]
- ⑥ [Signature]

- ⑦ [Signature]
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- ⑨ [Signature]
- ⑩ [Signature]

Text Books, Reference Books and Others		
Text Books Recommended –		
<ol style="list-style-type: none"> Allard (1960) Principles of Plant Breeding. John Wikkey and Sons, Inc. New York. Hayes, Immer and Smith (1955) Methods of Plant Breeding, MacGraw- Hil Book Co. Inc. New York. Plant breeding by B.D Singh 		
Reference Books Recommended –		
<ol style="list-style-type: none"> Jonossy and Lupton (1976) Heatersis in Plant Breeding. Elsevier, Amsterdam. Poehlman and Borthakur (1969) Breeding Asian Field Crops With Special Reference To Crops I India. Oxford and IBH Publishing Company, New Delhi. 		
Online Resources–		
<ul style="list-style-type: none"> ➤ 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–		
<ul style="list-style-type: none"> ➤ 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 Rishwan
② Anand
③ Ms. [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: 2024-2025
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	<ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> Autoclave, Oven, Laminar air flow, Centrifuge. Colorimetry Spectrophotometry, Fermenters., Water bath, pH meter 		11
III	<ul style="list-style-type: none"> 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		

Microscopy

Instrumentation

Chromatography & Advance Techniques

Biochemical Technology & Genetic Engineering

Signature of Convener & Members (CBs) :

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

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

Name and Signature of Convener & Members of CBoS:

① R. S. Rao

② K. S. Rao

③ M. S. Rao

④ S. S. Rao

⑤ S. S. Rao

⑥ S. S. Rao

⑦ S. S. Rao

⑧ S. S. Rao

⑨ S. S. Rao

⑩ S. 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
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. S. S.
 ② R. S. S.
 ③ R. S. S.
 ④ R. S. S.
 ⑤ R. S. S.
 ⑥ R. S. S.

⑦ R. S. S.
 ⑧ R. S. S.
 ⑨ R. S. S.
 ⑩ R. S. S.

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. ExperimentsInMicrobiology,PlantPathologyAndBiotechnologyByK.R.Aneja.Publisher New Age International

Reference book recommended

1. Bioinstrumentation: Research, Development and Applications Hardcover Impert,31July 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](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.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	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 *[Signature]*
② *[Signature]*
③ *[Signature]*
④ *[Signature]*
⑤ *[Signature]*
⑥ *[Signature]*

⑦ *[Signature]*
⑧ *[Signature]*
⑨ *[Signature]*
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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE -08 T	
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	<i>Credit = 15 Hours - learning & Observation</i>
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	Planteco-physiology and Stress Physiology: ➤ Concept of Planteco-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. Sivas
 ② S. Sundar
 ③ M. S.

④ S. S.
 ⑤ S. S.
 ⑥ S. S.

⑦ S. S.
 ⑧ S. S.
 ⑨ S. S.
 ⑩ S. 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-physiology.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.iitkcp.ac.in

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): 70 (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	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): 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., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:

① R. B. S. / R. B. S.
② R. B. S. / R. B. S.
③ R. B. S. / R. B. S.
④ R. B. S. / R. B. S.

⑤ R. B. S. / R. B. S.
⑥ R. B. S. / R. B. S.

⑦ R. B. S. / R. B. S.
⑧ R. B. S. / R. B. S.
⑨ R. B. S. / R. B. S.
⑩ R. B. S. / R. B. S.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF BOTANY

COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science (Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BOSE-08 P	
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: <ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 Pooja
 ② Anandya
 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. Practical Plant Physiology Hardcover – 1 January 2015 by R. Sivakumar, Narendra Publishing
2. PRACTICALS IN PLANT PHYSIOLOGY AND BIOCHEMISTRY MANJU BALA, SUNITA GUPTA, N.K GUPTA & M.K. SANGHA Scientific Publishers
3. A Practical Manual on Fundamentals of Plant Physiology Paperback – 16 September 2022 by R. K. Samaiya Subrata Sharma, Gyanendra Tiwari, R. Shivraj krishnan, Sunil Pandey, Preeti Sagar Nayak (Author) BFC PUBLICATIONS PVT LTD

Reference Books Recommended –

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

Online Resources–

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

Online Resources–

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

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): 35 (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10	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): 15	Laboratory / Field Skill Performance: On spot Assessment	
	A. Performed the Task based on lab. work - 20 Marks	Managed by Course teacher as per lab. status
	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. Dinesh
② R. Dinesh
③ R. Dinesh
④ R. Dinesh
⑤ R. Dinesh
⑥ R. Dinesh

⑦ R. Dinesh
⑧ R. Dinesh
⑨ R. Dinesh
⑩ R. Dinesh

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Life Science <i>(Honors / Honors With Research)</i>		Semester - VII	Session: 2024-25
1	Course Code	ZOSC-07T	
2	Course Title	Biosystematics and Taxonomy	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p>After successfully completing this course the students will be able to -</p> <ul style="list-style-type: none"> ➤ Comprehend the basic concepts of Biosystematics and Txonomy. ➤ Understand and learn the Taxonomic Hierarchy in animal kingdom. ➤ Gain a basic knowledge and grasp the rules and philosophy of scientific nomenclature. ➤ Develop the critical understanding to identify the animals up to species level with the help of taxonomic keys. ➤ Learn the Newer trends in biosystematics and apply it in Research. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
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 systematic and classification: Definition & basic concepts of Biosystematics and Taxonomy. Historical resume of systematic. Taxonomic Hierarchy: Definition, Linnean hierarchy and categories. Classification: Purpose, use and basis. Theories of classification: Biological, artificial and natural classification. Levels of taxonomy: alpha, beta and gamma taxonomy. Micro and macro taxonomy. Scope and applications of biosystematics in biology. The relevance of systematics in conservation programs.		11
II	Taxonomic Characters and Scientific Nomenclature: Different types of taxonomic characters (morphological, physiological, ecological, ethological and geographical characters). Zoological nomenclature: binominal and trinomial system, Principles and rules of International Code of Nomenclature (ICN), type material, author citation, criteria for publication, types of names, principle of priority and its limitations.		11
III	Taxonomic Keys, Taxonomic treatment and Phylogenetics: Types of taxonomic key their merits and demerits. Type concept: Process of typification and different Zoological types and their applications. Taxonomic treatment of Allopatric variation, homology and Reproductive and geographical isolating mechanisms and their role in speciation process. Evolutionary taxonomy: Cladistics. Constructing trees/dendrograms: Phenogram, phylogram and cladogram and turning them into classifications. Mechanism of speciation in panmictic and apomictic species. Species concept: different species concepts, Species category: sub-species and other infra species categories.		12
IV	Taxonomic procedure and Newer trends in biosystematics: Taxonomic Collection, curation, preservation, identification and classification. Newer trends in biosystematics: Morphological, Embryological, Behavioral, Ecological, Cytological and Biochemical approach. Numerical taxonomy. Differential systematic. Molecular taxonomy. DNA bar coding for identification of species.		11
Keywords	<i>Systematic, classification, Linnean hierarchy, dendrograms, Nomenclature, Cladistics, Species category</i>		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- R.C. Dalella & R.S. Sharma, (2017) Animal Taxonomy & Museology. Jai Prakashnath & Co., Meerut.
- V.C. Kapoor (2019). Theory and practice of animal taxonomy and biodiversity, 8th Edn.

Reference Books Recommended –

- E. Mayer, (1991). Principles of Systematic Zoology.
- G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India
- E.O. Wilson, (1988). Biodiversity. John Wiley & Sons.
- Futuyama, D. J. (1986). Evolution, Systematics and Animal Behaviour. Evolutionary Biology. Sinauer Associates Inc.
- Mayr, E. & Ashlock, P. D. (1991) Principles of Systematic Zoology (2nd edition) McGraw Hill Int.

Online Resources–

- <http://ndl.iitkgp.ac.in/he document/swayamprabha/swayam prabha/qtrdnp2xfxe?e=0/species%20concept|||>
- <http://ndl.iitkgp.ac.in/he document/swayam ugc moocs/214 21777 self learning>

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): (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):	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:

Shahabuddin

sh

engim

swk

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

PART- A: Introduction			
Program: Bachelor in Life Science <i>(Honors / Honors with Research)</i>		Semester -VII	Session: 2024-2025
1	Course Code	ZOSC- 07P	
2	Course Title	Biosystematics and Taxonomy	
3	Course Type	Discipline Specific Lab Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p style="text-align: center;">After successfully completing this course the students will be able to</p> <ul style="list-style-type: none"> ➤ Comprehend the basic concepts of Biosystematics and Taxonomy. ➤ Understand and learn the Taxonomic Hierarchy in animal kingdom. ➤ Gain a basic grasp on the rules and philosophy of scientific nomenclature. ➤ Develop the critical understanding to identify the animals up to species level with the help of taxonomic keys. ➤ Learn the Newer trends in biosystematics and apply it in Research. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> • Study and sketch of museum specimens of Invertebrates and Vertebrates on the basis of systematic and Taxonomic Hierarchy • Preparation of identification keys for select specimens of non chordate (e.g., insects) and chordates (e.g., birds). • Make a record of biodiversity of college campus. • Construct the dendrograms, through Interactive software for exploring phylogeny and analyzing character • Use DNA bar coding for identification of species. • General discussion, distinguishing characters and classification of selected animals. • Generation of a character-state matrix by selecting and scoring diagnostic taxonomic characters. • Distance-based methods of phylogenetic reconstruction using manual and computer methods. • Group discussion/Viva or Seminar presentation on two related topics. • An “animal album or Practical Record” containing sketches, photographs, cut outs, with appropriate writes up about the above mentioned taxa. • Study of some videos to develop understanding on the animals of different taxa. 	30
Keywords	<i>Museum specimens, dendrograms, bar coding, identification keys, phylogenetic</i>	

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- R.C. Dalella & R.S. Sharma, (2017) Animal Taxonomy & Museology. Jai Prakashnath & Co., Meerut.
- V.C. Kapoor (2019). Theory and practice of animal taxonomy and biodiversity, 8th Edn.
- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference Books Recommended –

- E. Mayer, (1991). Principles of Systematic Zoology.
- G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India

Online Resources–

- <http://ndl.iitkgp.ac.in/he document/swayamprabha/swayam prabha/qtrdnp2xfxe?e=0|speci es%20concept||>
- <http://ndl.iitkgp.ac.in/he document/swayam ugc moocs/214 21777 self learning>

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): (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):	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:

(Handwritten signatures in blue ink)

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

PART-A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		Semester - VII	Session: 2024-25
1	Course Code	ZOSE- 05T	
2	CourseTitle	Endocrinology	
3	CourseType	Discipline Specific Course	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	Course Learning Outcomes(CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Understand characters of hormones, their biochemical origin, functions and their role in physiology. ➤ Learn about the organization of endocrine glands and mechanism of hormone action. ➤ The learners will understand the hormonal disorders, and diseases. ➤ Comprehend about the role of hormone in healthy lifestyle. ➤ Develop insights on advancements in endocrinology. 	
6	CreditValue	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40
PART -B: Content oftheCourse			
Total No. of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Chemical Regulators and Gene action: General characters, chemical structure & properties of Hormones. Comparison between hormone and enzymes. Types of chemical regulators: Hormone, Neurotransmitters, Parahormones, Semiochemicals: Pheromones, Lumones & Chalones. Hormone Receptors: Mechanism of hormone action and cell signaling, Second messengers: types and features. Gene & Hormone Action, Hormone Responsive Element. Feedback system in Hormone action, hormone delivery. The Lesser Known Regulatory Substances (Somatomedins, Prostaglandin, Eicosanoids, Thromboxane etc.) Analytical techniques of Hormone Assay: Radioimmuno assay, Enzyme linked immune sorbent assay, Immune histochemistry. Hormone Replacement Therapy.		10
II	Neuro-endocrine system: Hypothalamus: Origin, Location, Gross Anatomy, and Structure. The Endocrine Hypothalamus: Hypothalamic Hormones, Hypothalamic Nuclei, General Functions of Hypothalamus, Hypothalamo-hypophysial portal system, Hypothalamo-hypophysial-gonadal axis. Pituitary Gland: Origin, Location, Structure, Hormones, Control of secretion & disorders. Regulation of pigmentation by Pars Intermedia in vertebrate chromatophores. Pineal Gland: Origin, Location, Structure, Hormones & Control of secretion, Overview of Biological Rhythm. Role of Oxytocin, Endorphin, Serotonin and Dopamine in temperament stability (Happiness Hormones & Mental Health). Neuro-endocrine system in Insects and its physiology.		11
III	Endocrine System & Physiology I: Thyroid Gland: Organization of Mammalian Thyroid Gland, Biosynthesis of Thyroid Hormones, Metabolism of Thyroid Hormones, Regulation of Thyroid hormone secretion, Physiological & Metabolic Roles of Thyroxine, disorders of Thyroid Functions. Parathyroid Gland and Calcium Regulation. Calcium and Phosphate homeostasis. Adrenal Gland: Organization of Mammalian Adrenal Gland. The Adrenal Steroid Hormones (Synthesis Pathway & Physiological Roles), The Renin Angiotensin System, The Adrenal Medulla & Catecholamines (Synthesis Pathway and Mechanism of action of Catecholamines). Disorders of Adrenal Gland.		12
IV	Endocrine System & Physiology II: The Endocrine Pancreas: Origin, Islet Cell Structure & cell types, Hormones of the endocrine pancreas, Insulin: Biochemistry, Synthesis, Mechanism of action and physiological role, Glucose Transporters in Mammals & Diabetes mellitus. Insulin Resistance. Hormones of Gonads: Gonadal steroid hormones, Biosynthesis, transport, metabolism and physiological effects. Role of hormones in ovarian cycle & Menopause. Hormones in Birth Control: Role of hormones in sex determination. Hormones of Gastrointestinal Tract: Action of Gastrointestinal Peptides in mammals. Hormonal control of feeding behaviour. Hormones and lifestyle disorders: Chronic stress, Blood Pressure & Obesity.		12
Keywords	Hormone, Pheromones, Biosynthesis, Thyroid Gland, Adrenal Gland, Pancreas, Catecholamines, Sex Determination, Diabetes, Obesity.		
SignatureofConvener&Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Chandra S. Negi: Introduction to Endocrinology, 2009, PHI
- Shastri V.K., Endocrinology and Reproductive Biology, Rastogi Publicatio

Reference Books Recommended –

- Hadley: Endocrinology (6th ed. 2009, Prentice Hall)
- Lodish et al :Molecular Cell Biology, W.H.Freeman& Co Ltd.
- Turner &Bagnara: General Endocrinology, 6th ed.1984, Saunders)
- Norris: Vertebrate Endocrinology, Fourth Edition, 2007, Academic Press

Online Resources–

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>
- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>

Online Resources–

- <http://ndl.iitkgp.ac.in/he document/cec/ gFN1zyU718 PLNspmbLKJ8KYPKieHeF3oC4jZYt8zBe4>
- <https://egyankosh.ac.in/bitstream/123456789/33320/1/Unit-4.pdf>
- <https://www.ncbi.nlm.nih.gov/books/NBK441576/>

PART -D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:

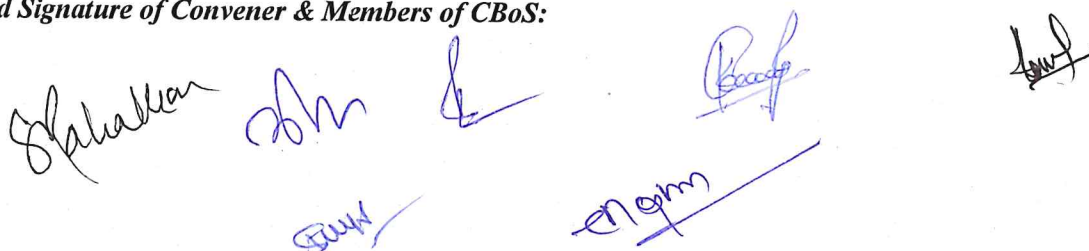
Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

EndSemester Exam(ESE): 70 Marks

Continuous Internal Assessment (CIA): (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):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts.,1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



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

PART-A: Introduction			
Program: Bachelor in Life Science <i>(Honors / Honors with Research)</i>		Semester - VII	Session: 2024-25
1	CourseCode	ZOSE-05P	
2	CourseTitle	Endocrinology	
3	CourseType	Discipline Specific Elective Lab Course	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ Develop understanding of histological study of endocrine glands ➤ Learn the role anatomical aspects of various endocrine glands. ➤ Attain the fundamentals of applied endocrinology. ➤ Explore the operation of basic medical kits of routine usage. ➤ Create awareness towards lifestyle disorders related to hormones. 	
6	CreditValue	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
PART -B: Content oftheCourse			
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)			
Module	Topics (Course contents)		No.ofPe riod
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> • Study of histological slides of the endocrine glands. • Demonstration of Endocrine Glands of Cockroach. (Alternative Methods) • Demonstration of Endocrine Glands in Rat (Alternative Methods) • Study of Glucose Tolerance Test. • Principle of HbA1c Test. • General procedures and demonstration of glucometer operation. • Study of working principle / demonstration of Urine Pregnancy Tests (UPT). (Principle, Procedure, Interpretation and Limitations) • General Study of Normal Blood Parameters of different hormones (From Pathological Reports) • Group discussion/ Seminar/ Quiz/ Projects on Endocrinology • Preparation of Practical Record. 		30
Keywords	<i>Endocrine Glands, Glucose Tolerance Test, HbA1c, Glucometer, Pregnancy</i>		
Signature of Convener & Members (CBoS):			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lal S.S. Practical Zoology Vertebrates; Rastogi Publications
- Islam Mofidul, Das Viblab Kumar : Endocrinology with Practicals; Mahaveer Publications
- Verma P.S : A Manual of Practical Zoology Chordates; S.Chand Publications
- Arumugam N : Practical Zoology; Saras Publications.

Reference Books Recommended –

- Hadley: Endocrinology (6th ed. 2009, Prentice Hall)
- Lodish et al :Molecular Cell Biology, W.H.Freeman& Co Ltd.

Online Resources–

- <https://egyankosh.ac.in/bitstream/123456789/33320/1/Unit-4.pdf>

Online Resources–

- <https://www.ncbi.nlm.nih.gov/books/NBK532915/>
- <https://laboratorytests.org/urine-pregnancy-test/>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

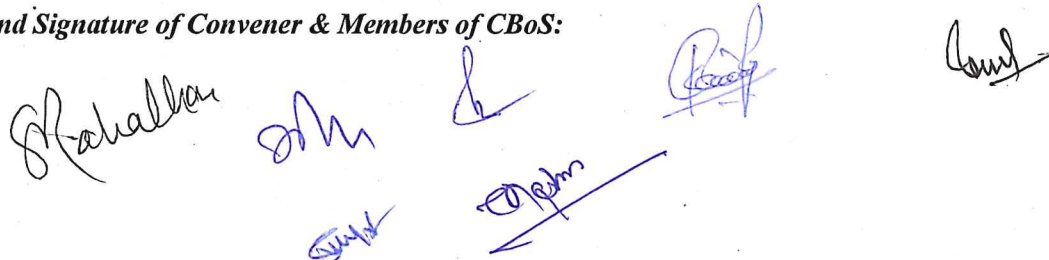
Maximum Marks: 50 Marks

Continuous Internal Assessment(CIA):15 Marks

End Semester Exam(ESE):35Marks

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

Name and Signature of Convener & Members of CBoS:



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

PART-A: Introduction			
Program: Bachelor in Life Sciences (Honors / Honors with Research)		Semester -VII	Session: 2024-2025
1	Course Code	ZOSE – 06T	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite(if, any)	As per Program	
5	Course Learning Outcomes(CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Understanding of fundamental concepts of immunology. ➤ Gain knowledge on various immune cells, antigens and cytokines. ➤ Understand the structure and functions of Immunoglobulins and antibodies. ➤ Students will be able to describe the processes involved in immune system. ➤ Students will analyse the pathogenesis, clinical manifestations, and therapeutic approaches of various immune disorders and diseases and experimental techniques in Immunology. 	
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	Understanding of Immunological Concepts: Immune System: Brief history of Immunity, Concept & Types of Immunity (Innate and Acquired or Adaptive), Origin and Evolution of Immune System. Primary and Secondary lymphoid organs, lymphoid tissues. Thymic Selection: Self and non-self-recognition. Inflammation. Lymphocyte trafficking. Hematopoiesis.		10
II	Components of Immune System- I: Cells of Immune System: Structure and functions of macrophages, granulocytes, NK cells, T and B lymphocytes and Antigen presenting cells. T & B Cell receptors, maturation, activation and differentiation of T& B Cell. Antigen: Antigenicity v/s immunogenicity, Factors affecting Immunogenicity, immunogen, haptens, super antigen, epitope, paratope. Adjuvants: Freund's complete and incomplete. Processing and presentation of Ag. Major histocompatibility complex (MHC) and HLA. Cytokines.		12
III	Components of Immune System- II: Immunoglobulins: Nature, Primary structure of immunoglobulins. Enzymatic fragmentation of Ig. Domain structure of Ig and its significance. Types and subtypes of Ig and its characteristics. Membranous antibody. Antigenic determinants: isotype, allotype, idiotype. Abzymes. Theories of Antibody Formation: Instructive, selective, clonal selection theories and evidences; Immunological memory. Complement System. Hypersensitivity (Type I to IV with example) CMI & humoral immune response. Antigen-Antibody interaction: affinity & avidity.		13
IV	Immune disorders & Immuno-techniques: Auto-immunity: Auto-recognition, classes of auto-immuno diseases. (Hashimoto disease, Thyrotoxicosis, Systemic lupus erythematosus, Rheumatoid arthritis).Transplantation: Autograft, Isograft, Allograft, Xenograft, Immunological basis of transplantation reactions. Immune Deficiencies: Primary and secondary immune deficiencies. T-cell, B-cell and SCID, AIDS. Vaccination and types of vaccines (First, Second & Third generation vaccines). Immunological techniques: Precipitin curve, Immuno-diffusion, one and two dimensional, single radial immuno-diffusion, Double (Ouchterlony) immune-diffusion. Immuno-electrophoresis: Rocket immuno-electrophoresis; CIE, Graber and William technique.Radio-immunoassay: ELISA–Principle, Methodology and applications. Immuno-fluorescence: Direct, indirect and Sandwich, in situ localization by techniques:FISH and GISH. Hybridoma, Monoclonal antibodies.		10
Keywords	Immunity, lymphocytes, Antigens, Immunoglobulins, Auto-immunity, Vaccination &Immuno-techniques.		
Signature of Convener & Members (CBoS):			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Pravash Sen. Gupta, Clinical Immunology. Oxford University Press. 2003.
- N Arumugam, Immunology, Saras Publication. 2014.
- Fatima D, Arumugam, Immunology, Saras Publication

Reference Books Recommended –

- Janis Kuby, Immunology, II edition. W. H. Freeman and Company, New York. 1993.
- Ivan M. Roitt, J. Brostoff and D. K. Male, Immunology, Gower Medical Publishing, London. 1993.

Online Resources–

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>
- http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/hdc5c5m6hkq?e=1|immunology|||
- <https://xvivo.com/examples/the-innate-immune-system/>
- <https://xvivo.com/examples/the-adaptive-immune-system/>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

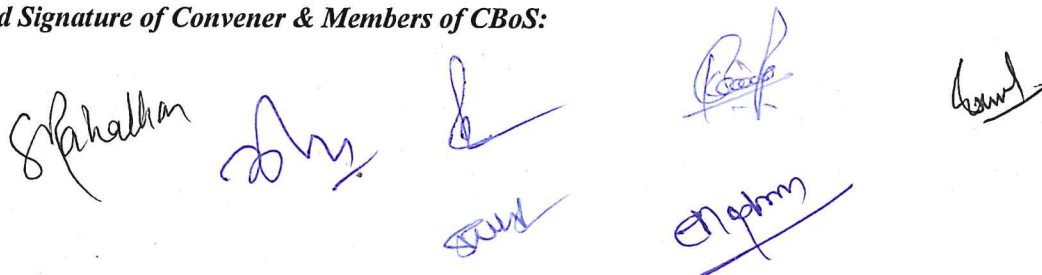
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (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):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40Marks	

Name and Signature of Convener & Members of CBoS:



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

PART- A: Introduction			
Program: Bachelor in Life Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	ZOSE-06P	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Elective Lab Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p style="text-align: center;">At the end of this course, the students will be able -</p> <ul style="list-style-type: none"> ➤ Gain practical knowledge on various immune cells, antigens and antibodies. ➤ Identify the major cellular and tissue components which comprise the innate and adaptive immune system. ➤ Students will experimental techniques in Immunology. ➤ Understand how does the immune system distinguish self from non-self. ➤ Gain experience at reading and evaluating the scientific literature in the area. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> • Study of permanent slides of organs of immune system • Enumeration of total leucocytes from human blood samples • Enumeration of differential leucocytes from human blood samples • Demonstration of agglutination reaction using human RBC • Demonstration of Ag-Ab precipitation by immunodiffusion technique • Antigen detection by radial immunodiffusion technique (RID) • Estimation of total serum protein • Estimation of serum gamma globulins/Separation of γ-globulin by salt precipitation. • Estimation of A/G ratio • Isolation of lymphocyte by using density gradient centrifugation • Paper and gel immuno-electrophoresis • Rocket immunoelectrophoresis • Counter current immunoelectrophoresis • ELISA • Group discussion/Quiz/ Seminar presentation on related topics. • Making of Practical record. 		30
Keywords	<i>Leucocytes, Rocket immunoelectrophoresis, ELISA, A/G ratio, RID</i>		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Talwar G.P. and Gupta S.K, A Handbook Of Practical And Clinical Immunology Volume 1, CBS Publication
- Zane, Immunology: Theoretical And Practical Concepts In Laboratory Medicine, ELSEVIER

Reference Books Recommended –

- Goldsby, R.A.; Kindt, T.J. and Kuby, J. (2006) Immunology (6th edition).
- Roitt, I.; Brostoff, J. and Male, D. (2012) Immunology (8th edition).

Online Resources–

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>
- <http://ndl.iitkgp.ac.in/he document/swayamprabha/swayam prabha/hdc5c5m6hkq?e=1immunology>
- <https://xvivo.com/examples/the-innate-immune-system/>
- <https://xvivo.com/examples/the-adaptive-immune-system/>

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): (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):	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:

Alahalla

[Signature]

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

PART-A: Introduction			
Program: Bachelor in Life Science (Honors/Honors with Research)		Semester - VII	
		Session: 2024-2025	
1	CourseCode	ZOSE- 07T	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<p>After successfully completing this course, the students will be able to-</p> <ul style="list-style-type: none"> ➤ Define the concept of recombinant DNA and genetic engineering. ➤ Understand the molecular techniques and their proficiencies. ➤ Apply the knowledge of gene manipulation techniques. ➤ Analyze different prospects and applications of genetic engineering and bioinformatics. ➤ Develop understanding of ethical, social and legal implications of genetic engineering. 	
6	CreditValue	3 Credits	Credit = 15 Hours -learning & Observation
7	TotalMarks	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 Biotechnology: An overview of Biotechnology: History, Definition, scope, applications and ethical issues in biotechnology. Recombinant DNA, Restriction Enzymes, Application of different enzymes in Recombinant DNA technology, Restriction and modification system, Linkers & Adaptors, Restriction mapping. Vectors (Cloning and Expression Vectors). Gene Recombination and Gene transfer: Transfection, Transduction, Microinjection, Electroporation and Ultrasonication. Antibiotic Resistant Gene and their mode of action. Polymerase chain reaction (PCR): Principle and applications of different types of PCR. DNA and RNA Purification.		11
II	Elementary Genetic Engineering: Preparation and comparison of Genomic and cDNA library, screening of recombinants, Genome: organization, coding and non-coding sequences & genome mapping, Comparative genome hybridization. Whole genome shotgun sequencing, Chromosome Banding. Gene tagging, DNA Cloning, DNA Sequencing methods, DNA profiling. Genetic Markers, Molecular markers: Types & Features. Stem Cells: Embryonic Stem Cells, Adult Stem Cells and Induced Pluripotent Stem Cells, Formation and selection of recombinant ES cells, Role of ES cells in gene targeting in mice, Gene Probe, Colony Hybridization, Blotting Techniques (Southern, Northern, Western and Eastern Blotting), Animal Cell Culture (Primary Cultures, Cell line, Transformation characteristics, Culture Media & Growth Cycle).		11
III	Advancements in Genetic Engineering: Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis. Gene Editing, Gene shuffling, Genetic Manipulation of Animal Cells (Transgenesis and transgenic animals), Gene Knockout, Nuclear Transfer Technology and Animal Cloning, Gene Therapy, Gene Delivery System (Virus mediated transduction & non-viral transduction methods). Molecular Farming (Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines), Microarrays and next generation sequencing technologies.		12
IV	Applications of Genetic Engineering & Bioinformatics: Cord blood banking, Genetically Modified Organism (GMO), Animals as bioreactors: Genetically engineered animals for research. Conditional knock outs using cre-loxP recombination; tissue specific promoters, CRISPR-Cas9 and its applications in treating genetic disorders. Genetic modification of livestock for improved productivity and disease resistance. Ethical, Legal, and Social Implications (ELSI) of genetic engineering. Bioinformatics: Overview and its relation with molecular biology. Biological Databases: Overview, Applications & Prospects. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software (RASMOL, Ligand Explorer), Data generation; Generation of large scale molecular biology data. (Through Genome sequencing) File Format (Genbank, DDBJ, FASTA, PDB, Swiss Prot). Sequence Alignments and Visualization, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum).		11
Keywords	Recombinant DNA, Genome, Gene, Mutagenesis, Microarray, Techniques, Biological Database.		
Signature of Convener & Members (CBoS):			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lehninger – Principles of Biochemistry, WH Freeman.
- Satyanarayan U - Biotechnology, Saras Publication
- Gupta P.K. – Elements of Biotechnology, Rastogi Publications.
- Gupta P.K. – Biotechnology and Genomics, Rastogi Publications.
- Kumar Pranav, Verma Praveen, Meena Usha – Biotechnology: A problem approach- Pathfinder Publications.
- Rastogi S.C., Rastogi P., Mendiratta N : Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI Learning.
- Bosu Orpita, Thukral S.K.- Bioinformatics: Experiments, Tools, Databases, and Algorithms – Oxford University Press

Reference Books Recommended –

- Lodish H et al., - Freeman
- Watson JD et al.-Macmillan - Recombinant DNA: Genes and Genomes, A Short Course.
- Alberts B et al., Molecular Biology of the Cell, - Garland
- Brown TA – Genomes, Garland

Online Resources–

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=31BI+Y/JyQo+vltwaZoj+g==>
- <http://ndl.iitkgp.ac.in/he document/swayamprabha/swayam prabha/ksrdg67pyn8?e=1|bioinformatics|||>
- <http://ndl.iitkgp.ac.in/he document/nptel/nptel/courses 102 106 102106065 video lec66?e=3|bioinformatics|||>
- [http://ndl.iitkgp.ac.in/he document/cec/cec/0F oDrArwTU PLNspmbLKJ8K5HAWWhRVvEHRBSI1XVO-oE?e=0|biotechnology%20:%20genome%20editing%20tools%20-%203%20\(crispr/cas9\)|||](http://ndl.iitkgp.ac.in/he document/cec/cec/0F oDrArwTU PLNspmbLKJ8K5HAWWhRVvEHRBSI1XVO-oE?e=0|biotechnology%20:%20genome%20editing%20tools%20-%203%20(crispr/cas9)|||)

Online Resources–

- <https://vlab.amrita.edu/?sub=3&brch=274&sim=1428&cnt=1>
- <http://ndl.iitkgp.ac.in/he document/cec/PRwJGpzUSYM PLNspmbLKJ8K5HAWWhRVvEHRBSI1XVO-oE>

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): (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):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40Marks	

Name and Signature of Convener & Members of CBoS:















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

PART-A: Introduction			
Program: Bachelor in Life Science (Honors/Honors with Research)		Semester - VII	Session: 2024-2025
1	CourseCode	ZOSE- 07P	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective Lab Course	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	Course Learning Outcomes(CLO)	<p style="text-align: center;">After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Learn to prepare aseptic techniques in laboratory for biotechnology experiments. ➤ Understand the fundamental experiments & techniques of biotechnology & genetic engineering. ➤ Develop practical skills in genetic engineering techniques and laboratory procedures. ➤ Learn characteristics of genetic material. ➤ Analyze applications of diverse genetic engineering protocols. 	
6	CreditValue	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
PART -B: Content of the Course			
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)			
Module	Topics(Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none"> • Sterilisation of glassware, media and laboratory. • Working principle and applications of- Hot Air Oven, Autoclave & Laminar flow hood. • Demonstration of cell culture techniques. • Demonstration of gene library and cDNA library. • Isolation of DNA from plant sample. • Isolation of plasmid DNA from E. coli cells. • Isolation of genomic DNA from whole blood. • Demonstration of Gel electrophoresis techniques. • Separation and visualization of DNA fragments using agarose gel electrophoresis. • Spectrophotometric estimation of isolated DNA. • Restriction digestion of plasmid DNA and genomic DNA. • Study related to working principle of PCR machine. • Preparation of Minimal Essential Growth medium. • Staining the cultured cells using dyes such as hematoxylin and eosin (H&E), and observe them under a light microscope to study cell morphology and structure. • Bioinformatics: Analyse DNA or protein sequences using online tools and databases. • Demonstration of online data bases for bioinformatics-based studies. • Demonstration of DNA band visualization techniques (e.g., Ethidium bromide staining, DNA intercalating dyes) • Group discussion/ Quiz/Project/Seminar presentation on related topics. • Practical Record <p style="text-align: center;"><i>Note: Virtual mode of demonstration can be opted if required.</i></p>		30
Keywords	Sterilization, Autoclave, Electrophoresis, Restriction, PCR, Plasmid, Genomic, Bioinformatics		
Signature of Convener & Members (CBoS):			

PART-C: Learning Resources

Text Books Recommended -

- Aneja K.R.; Laboratory manual of microbiology and biotechnology; Medtech.
- Ramdass P; Practical Biotechnology; JaypeeBrothers Medical Publishers; First Edition.

Reference Books Recommended -

- Wilson, K., & Walker, J. Principles and Techniques of Biochemistry and Molecular Biology (8th ed.). Cambridge University Press.
- Kurian K. Noble; A complete lab manual for Biotechnology; Notion Press.
- Borah Debajit; Biotechnology Lab Practices; Global Vision Publishing House.
- Portner Ralph; Animal Cell Biotechnology: Methods and Protocols: Humana Press Springer Protocols

Online Resources-

- <https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>
- https://webstor.srmist.edu.in/web_assets/downloads/2021/20BTC502J-lab-manual.pdf

Online Resources-

- <https://learn.genetics.utah.edu/content/labs/>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

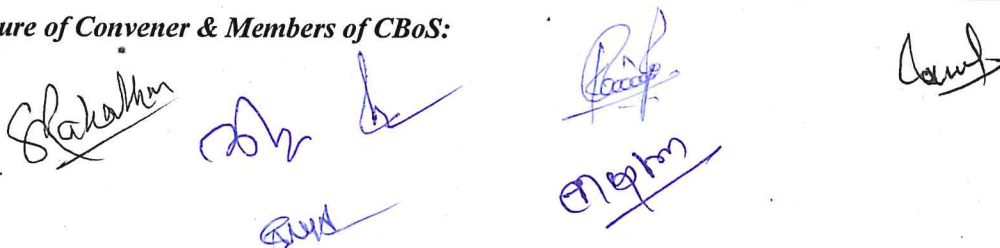
Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (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):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) - 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:



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

PART- A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research Degree)		Semester -VII	Session: 2024-2025
1	Course Code	ZOSE- 08T	
2	Course Title	Applied Zoology	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Understand the culture techniques of prawn, pearl and fish, Lac culture. ➤ Understand silkworms rearing and their products. ➤ Understand the Bee keeping equipments and apiary management. ➤ Understand dairy animal's management. ➤ Learn the testing of egg and milk quality. ➤ Apply this knowledge for Setting up a self-employment venture in the field. 	
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	<p>Aquaculture: Prawn culture: Culture of fresh water prawn and marine prawn. Preparation of farm for Prawn culture. Preservation and processing of prawn. Export of prawn. Pearl Culture: pearl formation, protocol followed, Fresh Water Fish Culture: Qualities or Characters of Cultivable Fishes, Construction of Fish Farm. Fish Breeding: bundh and induced. Fish Seed: Types, Seed collection: Benchi jal (Shooting net), hatching Hapa. Transport of Seed: Open and closed system, Causes of mortality in transport. Use of chemicals in live fish transport: Anesthetic drugs. Antiseptics and Antibiotics. Harvesting of fish: By hooks and nets (Triangular net, Dip net and Cast net). Fish preservation. Fish diseases and their control.</p>		12
II	<p>Apiculture and Sericulture: Apiculture: Species of honey bees. Morphology and life cycle of <i>Apis indica</i>. Social behaviour of honey bees: Colony organization, division of labour and communication. Methods of Bee keeping: Indigenous and Modern method, appliances used for bee keeping, management of honey bees and their hives, Extraction of honey from the comb and processing, bee Products and their economic importance. Natural enemies & diseases of Bee and their management. Sericulture: Types of silk, Silkworms and their host plants, Life history of <i>Bombyx mori</i> Rearing of <i>Bombyx mori</i>: Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages. Harvesting of cocoons, Silkworm diseases and their control: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis. Silkworm pests and parasites and their management: Uzi fly, Dermestid beetles. Silk reeling techniques. Quality assessment of silk fibre.</p>		11
III	<p>Lac Culture and Vermiculture: Lac Culture History of lac. Cultivation of lac: Host plants, Lac insect and its life cycle. Control of lac insect pests processing and collection of lac. Lac composition, products and uses. Vermiculture: Biology of <i>Eisenia foetida</i>. Rearing of earthworms. Equipments, devices used in vermiculture. Vermicompost Technology: Methods and products, Vermiwash Collection, Composition and use.</p>		11
IV	<p>Dairy management and Poultry farming: Dairy: Introduction to common dairy animals. Techniques of dairy management: System of housing. Milk and milk products. Cattle Diseases and control measures. Poultry: Types of breeds. Methods of brooding and Rearing. Housing and Equipment, Deep litter System, Laying cages, Debeaking, Incubation and hatching of eggs. Management of growers, Layers, Broilers. Feed formulations for chicks, Diseases and control measures. Nutritive value of egg and meet.</p>		11
Keywords	Aquaculture, Apiculture, Sericulture, Poultry farming, Dairy Farming, Vermiculture		
Signature of Convener & Members (CBoS) :			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Srivastava, C. B. L. (1999). *Fishery Science and Indian Fisheries*. Kitab Mahal publications, India.
- Sardar Singh, *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.
- Dhyan Singh Bisht, *Apiculture*, ICAR Publication.
- Shukla G.S., Upadhyay V.B. *Economic Zoology*, Rastogi Publication
- Ahasan J, Sinha, S.P. (2010) *Handbook of Economic Zoology*, S Chand Publication
- Jabde, P. *Text book of Applied Zoology* (2008), Discovery Publishing Pvt. Ltd

Reference Books Recommended –

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Sericulture, *FAO Manual of Sericulture*.
- Hafez, E. S. E. (1962). *Reproduction in Farm Animals*, Lea and Fabiger Publishers.
- Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction*, Vol. 2, Elsevier Publishers.

Online Resources–

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf
- <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20sericultureapiculture%20lac%20culture%20and%20sericulture%20upload.pdf>
- https://kvk.icar.gov.in/API/Content/PPupload/k0160_11.pdf
- <https://dahd.nic.in/sites/default/files/Excerpts%20of%20Poultry%20Farmn%20Manual.pdf>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

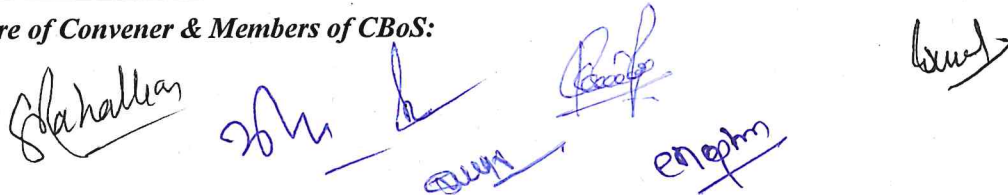
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

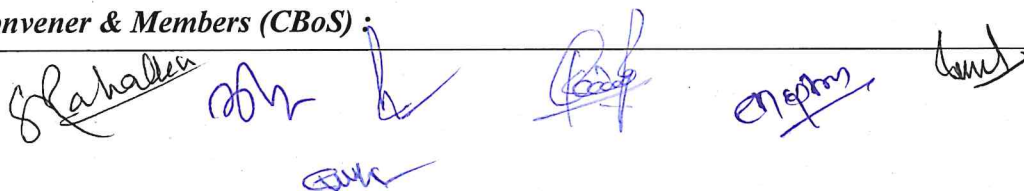
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: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

Name and Signature of Convener & Members of CBoS:



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

PART- A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		Semester - VII	Session: 2024-2025
1	Course Code	ZOSE-08P	
2	Course Title	Applied Zoology	
3	Course Type	Discipline Specific Elective Lab Course	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p>After successfully completing this course, the students will be able to:</p> <ul style="list-style-type: none"> ➤ Know common species of carps, prawn, oyster. ➤ Understand and learn the culture techniques of prawn, pearl, fish, honey bee, silkworm, lac, vermicompost. ➤ Understand and Learn division of labor and identification of Honey bees ➤ Identify Lac insect, male female morphology,. ➤ Understand dairy management, breeds of Cow & diseases and learn to analyze to good quality of milk, egg and vermicompost. 	
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	<ul style="list-style-type: none"> ➤ Morphological characterization of common edible fish species. ➤ Identification of major carps. ➤ Morphology of Freshwater and Marine Prawn ➤ Pearl oyster, pearl forming species ➤ Identification of castes of Honey bee and life cycle (through charts/specimens). ➤ Mounting of the sting apparatus. ➤ Worker honey bee with emphasis on leg modifications (through specimens/charts) and whole mount preparation of the 3 pairs of legs, Mouth parts. ➤ Life cycle of mulberry silkworm, <i>Bombyx mori</i> (model/chart/specimens) and life cycle of tasar silkworm, <i>Antheraea mylitta</i>. ➤ Identification of dairy animals ((model/chart/Photographs). ➤ Milk testing: Qualitative test of milk, Determination of the specific gravity of milk by using a mercury lactometer. ➤ External morphology of poultry birds (model). ➤ Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized eggs (Light test, Cracking test). ➤ Project report on visit to Fish farm/dairy farm/ Poultry farm/.etc ➤ Group discussion/quiz/seminar on related topics. ➤ Preparation of practical record or Album. 		30
Keywords	Aquaculture, Apiculture, Sericulture, Poultry farming, Dairy Farming		
Signature of Convener & Members (CBoS) :			



PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Upadhyay, Economic Zoology
- Salvamani B R, & Mahadevan R K, Aquaculture Trends and Issues
- Jabde V, Applied Zoology Pradeep
- Shukla Prasad Economic Zoology, Biostatistics and Animal Behaviour

Online Resources–

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf
- <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

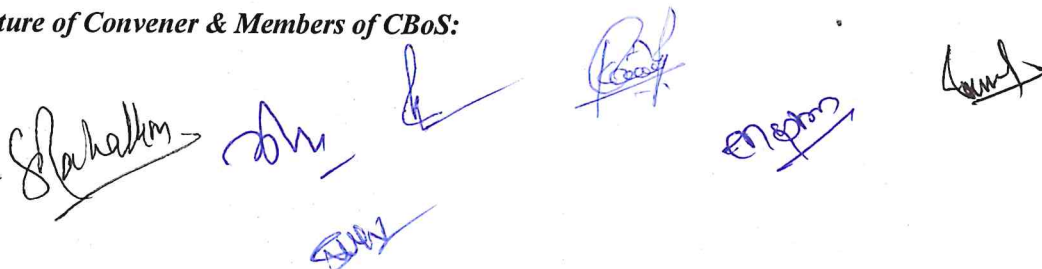
Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (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):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science (Degree / Honors)		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-07 T	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Course (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Differentiate between innate and adaptive immunity and also between humoral and cell mediated immunity. ➤ Explain the primary and secondary response and the irrelevance to immunizations. ➤ Identify the role of antigen presenting cells, lymphocytes, and phagocytic cells in immune responses. ➤ Apply immunochemical techniques used in pathological laboratories. ➤ Discriminate the nature of antigens and antibodies. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
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	Cell and Organs of Immune System: Innate immune mechanism and characteristics of adaptive immune response. Cells of immune system: Hematopoiesis and differentiation, mononuclear cells and granulocytes. Antigen presenting cells. Primary and Secondary lymphoid organs and tissues. Ontogeny and phylogeny of lymphocytes. Lymphocyte traffic.		12
II	Antigens: nature of antigens, factor affecting immunogenicity, Haptens and super antigens. Antigenic determinants. Recognition of antigens by T and B cell. Antigen processing. Role of MHC molecules in antigen presentation and co-stimulatory signals. Antigen and antibody interaction. Antigen receptor molecules: B-cell receptor complex, Immunoglobulin- structure types and functions. T-cell receptor complex. Clonal selection theory- concept of antigen specific receptor. Organization and expression of immunoglobulin genes. Generation of antibody diversity. Light and heavy chain gene recombination. Recombination Signal Sequences. Heavy chain constant region genes. Class switching. T-cell receptor diversity.		11
III	Immune Response: Cell mediated and Humoral immune response and its regulation. Cytokines and interleukins- structure and function. Hypersensitive reactions and their types. Immunodeficiency disorders. Autoimmunity. Major Histocompatibility Complex- types, structural organization, function and distribution. Transplantation and Rejection. Complements in immune function.		11
IV	Immune response to infectious diseases: viral, bacterial and protozoal. Cancer and immune system. Nutrition and Immune response. Principles of vaccination. Immunization practices. Passive immunization (immunotherapy). Role of vaccine in prevention of diseases: vaccines against important viral, bacterial, protozoan and parasitic diseases. DNA vaccines; Antiviral, antibacterial agents.		11
Keywords	Recognition, Response, Antibody, Antigen, Cancer, Disease.		

Name and Signature of Convener & Members of CBOS:

PART-C: Learning Resources								
Text Books, Reference Books and Others								
<i>Text Books Recommended –</i>								
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male ➤ Fundamentals of Immunology William Paul ➤ Immunology Tizard ➤ Immunology Abbas et al 								
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): (By Course Teacher)	<table border="0"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	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
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	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:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Degree/Honors)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-07 P	
2	Course Title	Immunology	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Apply the techniques to test various clinical conditions. ➤ Perform immunological techniques. ➤ Analyze the different blood cell counting. ➤ Perform qualitative and quantitative test for proteins. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Identification of cells of immune system ➤ Identification of Lymphocytes and their subsets ➤ Lymphoid organs and their microscopic organization ➤ Isolation and purification of Antigens ➤ Purification of IgG from serum ➤ Estimation of Levels of gamma globulins and A/G ratio in blood ➤ Antigen antibody interaction 		30
Keywords	Immunoglobulin, Cell, Antibody, Antigen		

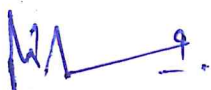
Name and Signature of Convener & Members of CBoS:




PART-C: Learning Resources
Text Books, Reference Books and Others
Text Books Recommended –
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male

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): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>10 & 10</td> </tr> <tr> <td>Assignment/Seminar +Attendance -</td> <td>05</td> </tr> <tr> <td>Total Marks -</td> <td>15</td> </tr> </table>	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		
Internal Test / Quiz-(2):	10 & 10									
Assignment/Seminar +Attendance -	05									
Total Marks -	15									
End Semester Exam (ESE):	<table border="1"> <tr> <td colspan="2">Laboratory / Field Skill Performance: On spot Assessment</td> </tr> <tr> <td>A. Performed the Task based on lab. work</td> <td>- 20 Marks</td> </tr> <tr> <td>B. Spotting based on tools & technology (written) –</td> <td>10 Marks</td> </tr> <tr> <td>C. Viva-voce (based on principle/technology)</td> <td>- 05 Marks</td> </tr> </table>	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
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									

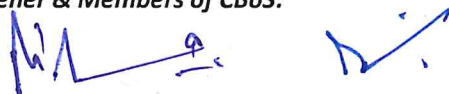
Name and Signature of Convener & Members of CBoS:




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

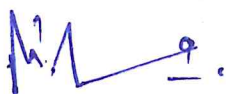
PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-05 T	
2	Course Title	Human Physiology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand mechanism of signal transduction by steroid and polypeptide hormones and the role of second messengers in signal transduction. ➤ Explain the process of gaseous exchange in tissues and lungs, respiratory adaption to high altitude and the difference between hemoglobin and myoglobin. ➤ Explain muscular dystrophies, the role of steroids in muscle building and the use of hormones in cattle and poultry industry. ➤ Explain role of kidney in erythropoiesis. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
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	<p>Neurotransmission: Types of neurons, generalized structure of multi polar neuron. Resting membrane potential, Action potential, Transmission of nerve impulse along anaxon and across synapse. Neurotransmitters and inhibitors of neurotransmission.</p> <p>Muscle: Types of muscles and structure. Ultra structure of skeletal muscle. Contractile and regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction.</p> <p>Bone: Composition and structure of long bone, growth and remodeling of long bone. Factors affecting its growth.</p>		12
II	<p>Excretory system: Structure of the nephron, formation of urine – Glomerular filtration, tubular re-absorption and secretions.</p> <p>Body fluids: Blood volume, composition and functions, RBC, WBC and platelets, the structure and functions. Mechanism of blood coagulation. Biochemical events in transport of CO₂ and O₂ in blood. Cerebrospinal fluid, lymph and its function. Blood brain barrier.</p>		11
III	<p>Heart and lungs–Structure and function of cardiac tissue and lungs Acid-base balance: Maintenance of normal pH of the body fluids. Blood buffers. Role of lungs And kidney in acid base balance.</p> <p>GIT and Liver: Structure and function of gastrointestinal tract, Structure of a lobule, functions–metabolic, storage and detoxification.</p>		11
IV	<p>Endocrine system: Endocrine organs, classification of hormones. Dynamic balance and regulation of hormone secretions. Functions of the hormones of hypothalamus, pituitary, adrenal, thyroid, pancreas and gonads. General mechanism of hormone action. Concept of messengers eg: cAMP, DAG, IP₃.</p>		11
Keywords	Heart, Liver, Kidney, Bone, Brain, Neurons		

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PART-C: Learning Resources								
Text Books, Reference Books and Others								
<i>Text Books Recommended –</i>								
<ul style="list-style-type: none"> ➤ Concise Medical Physiology– Choudhary – New Central Book Agency–Calcutta. ➤ Text Book of Medical Physiology–Guyton–Prism Books Pvt. Ltd.–Bangalore. ➤ Harper’s Biochemistry–Murray, Granner, Mayes, and Rod well – Prentice Hall International Inc. ➤ Text book of medical physiology: A. C. Gyton , and J.E Hall Saunders Elsevier. ➤ Human Physiology, Vol. I & II,-C. C. Chatterjee – Medical Allied Agency–Calcutta. 								
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): (By Course Teacher)	<table border="1"> <tr> <td>Internal Test / Quiz-(2):</td> <td>20 +20</td> </tr> <tr> <td>Assignment / Seminar -</td> <td>10</td> </tr> <tr> <td>Total Marks -</td> <td>30</td> </tr> </table>	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
Internal Test / Quiz-(2):	20 +20							
Assignment / Seminar -	10							
Total Marks -	30							
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks							

Name and Signature of Convener & Members of CBoS:




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PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-05 P	
2	Course Title	Human Physiology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Understand Qualitative and quantitative analysis of biological molecules and their estimation using multiple methods ➤ Demonstrate the process of gaseous exchange in tissues and lungs, respiratory adaption to high altitude and the difference between hemoglobin and myoglobin. ➤ Explain muscular dystrophies, the role of steroids in muscle building. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Preparation of blood smear and differential leukocyte count. ➤ RBC and WBC counting, Calculation of blood Indices. ➤ Estimation of hemoglobin ➤ Colorimetric estimation of Protein by Lowry's method. ➤ Estimation of Uric acid. ➤ Urea by DAMO method. ➤ Creatinine by Jaffe's method. ➤ Phosphorous by Fiske and Subbarow's method. ➤ Iron by Wong's method. ➤ Qualitative analysis of urine-detection of urea, uric acid and creatinine. 		30
Keywords	RBC, WBC, Serum Protein, Estimation, plasma minerals.		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Text Book of Medical Physiology–Guyton–Prism Books Pvt.Ltd.–Bangalore. ➤ Harper’s Biochemistry–Murray, Granner,Mayes,andRodwell– Prentice Hall International Inc. ➤ Text book of medical physiology:A.C.Gyton,andJ.E Hall Saunders Elsevier. 		
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): (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):	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




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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
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Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-06 T	
2	Course Title	Cell Biology	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Describe the chemical and molecular foundations of cell and the role in biological systems. ➤ Define the structure, properties and roles of nucleus. ➤ Explain the protein sorting and its transport in biological system. ➤ Discuss cell signaling mechanism through various pathways. ➤ Classify the cell cycle, its regulation and 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	Molecular organization of membranes - asymmetrical organization of lipids, proteins and carbohydrates. Osmosis, ion channels, membrane pumps and electrical properties of membranes. Active transport by ATP-powered pumps: types, properties and mechanisms.		12
II	Cell Trafficking- Transport of proteins into mitochondria, chloroplast and endoplasmic reticulum. Transport of proteins into and out of nucleus. Transport by vesicle formation: exocytosis, endocytosis and its molecular mechanism.		11
III	Cell signalling: Signalling via G-protein linked and enzyme linked cell surface receptors, MAP kinase pathways. Eukaryotic cell division cycle: different phases and molecular events, regulation and control of cell cycle. Apoptosis. Oncogenes and tumor suppressor genes: viral and cellular Oncogenes, retinoblastoma, E2F and p53 proteins.		11
IV	Organization of chromosomes: Structure of chromosomes, centromere and telomere. States of chromosomes during cell cycle. Mitotic chromosome. Organization of genes in chromosomes. Banding pattern of chromosomes. Lampbrush and Polytene chromosomes. Chromatin, nucleosomes, DNA packaging, heterochromatin and euchromatin.		11
Keywords	Membrane transport, cell signals, chromosomes		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Lodish, A. Berk, S L Zipursky, P. Matsudaira Molecular Cell Biology ➤ Alberts, D. Bray, K. Hopkin, A. Johnson Essential of Cell Biology ➤ Lodish, A. Berk, C. A. Kaiser & M. Krieger Molecular cell Biology ➤ Gerald Karp Cell and Molecular Biology Concepts and experiments 		
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): (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):	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	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

Department of Biochemistry

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PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE-06 P	
2	Course Title	Cell Biology	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Examine various cell organelles through micrograph techniques. ➤ Analyze various nucleic acids through staining techniques. ➤ Examine ployploidy through onion root with various treatments. ➤ Analyze various stages of mitosis. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Study of chromosome behavior during Mitosis and meiosis (Onion / Garlic root tips, Onion buds, human lymphocytes, rat or bird testis /grass hopper testis or any other materials). ➤ Calculation of mitotic index in growing Onion / Garlic root tips ➤ Squash preparation: Polytene chromosome (in chironomus / Drosophila or other insect salivary gland) and Barr body (in buccal epithelial cells). ➤ Demonstration of secretory granules in the salivary gland cells of insect. ➤ Demonstration of mitochondria by vital staining. ➤ Study of permanent slides. ➤ Estimation of DNA ➤ Estimation of RNA ➤ Study of the effect of chemical agents on chromosomes plant cells. ➤ Preparation of Karyotype of metaphase plate. ➤ Preparation of Meiotic plate and determination of phases. 		30
Keywords	Chromosome, Cell division, DNA, RNA Estimation		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Text Book of Medical Physiology–Guyton–Prism Books Pvt.Ltd.–Bangalore. ➤ Harper’s Biochemistry–Murray, Granner,Mayes,andRodwell– Prentice Hall International Inc. ➤ Text book of medical physiology:A.C.Gyton,andJ.E Hall Saunders Elsevier. 		
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): (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):	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




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PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 07 T	
2	Course Title	Microbial Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Explain the structure of bacteria and their microscopic examinations. ➤ Analyze the types bacterial toxins and the toxicology. ➤ Apply the knowledge of fermentation technology in production of antibiotics, enzymes etc. ➤ Apply the knowledge of enzyme technology in enzymes-based production in industry. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
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	FUNGI: General characteristics of fungi, classification of fungi, life cycle of selected fungal genus (Aspergillus, Pencillium, Fusarium and Mucor). Economic importance of fungi. Fungi and bioremediation, parasitism, mutualism and symbiosis with plants and animals. Heterothallism, sex hormone in fungi, Mycorrhiza, VAM. Algae: Distribution, classification, reproduction, ecology and importance.		12
II	BACTERIA: Morphology and ultra structure of bacteria, morphological types, cell wall of archaeobacteria, gram negative, gram positive eubacteria, eukaryotes. Cell membranes – structure, composition and properties. Structure and function of flagella, cilia, pili, gas vesicles. Cyanobacteria, protozoa, mycoplasma and Rickettsia. Gene transfer mechanisms, transformation, transduction, conjugation and transfection. Plasmids F: factors colicins and col factors, plasmids as a vector for gene cloning.		11
III	NUTRITION IN MICROORGANISM: Nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs), growth curves, measurement of growth, factors affecting growth, generation time, growth kinetics. Batch and continuous culture, asynchronous, synchronous culture. Basis of microbial classification, classification and salient feature of bacteria according to Bergey's manual of determinative bacteriology, cyanobacteria, prochlorons and cyanelles.		11
IV	VIRUSES: Structure and classification of viruses; morphology and ultra-structure; capsids and their arrangements, types of envelopes, viral genome, their types and structure, virus related agents (viroids, prions). General feature of virus reproductions, early events in virus multiplication, virus restriction and modification of host, virus mRNA. General overview of bacterial viruses, RNA and DNA bacteriophages (MS2, ϕ X174, M13, T3, T4). Lysogeny and Lytic phase. General account of plant and animal viruses (TMV, HIV and other oncogenic virus, Hepatitis virus).		11
Keywords		Fungi, Bacteria, Virus, nutrition, Infection, Disease	

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Microbiology L.M. Prescott, J.P. Harley and D.A. Klein ➤ General Microbiology RY Stanier, J L Ingrahamana, ML Wheelis& P. R. Painter ➤ Principles of Microbiology R.M. Atlas 		
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): (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):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4= 20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:




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PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 07 P	
2	Course Title	Microbial Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Demonstrate the techniques of pure culture of bacteria or fungi. ➤ Interpret the motility of the microbes. ➤ Interpret the biochemical activities of microbes by various tests. ➤ Understand about the impact of antibiotics on microbial survival. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Glassware preparation and sterilization techniques- wet heat- dry heat- ➤ Filter types- laminar flow chamber types- CDC- safety levels. ➤ Preparation of liquid & solid media, plating, pouring, inoculation and incubation for growth of microorganism ➤ Methods of obtaining pure culture of microorganisms (a) streak plate (b) Pour plate, and (c) spread plate methods ➤ Microscopic examination of the microorganisms, identification and staining methods ➤ Study of bacterial growth by turbidimetry / spectrophotometry ➤ Biomass measurement for fungi ➤ Isolation and enumeration of microorganisms from soil by serial dilution agar plating method. ➤ Enumeration of viruses by plaque assay technique. ➤ Motility of bacteria by hanging drop technique. 		30
Keywords	Sterlization, Growth, identification		


Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Microbiology L.M. Prescott, J.P. Harley and D.A. Klein ➤ General Microbiology RY Stanier, J L Ingrahamana, ML Wheelis& P. R. Painter ➤ Principles of Microbiology R.M. Atlas ➤ Microbiology Peleczar, Chan & Krieg. ➤ General Virology Luria, Darnell, Baltimore and Campell. ➤ Introduction to Mycology CJ Alexopoulos and CW Mims 		
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): (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):	Laboratory / Field Skill Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:




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PART- A: Introduction			
Program: Bachelor in Science <i>(Honors / Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 08 T	
2	Course Title	Nutritional and Environmental Biochemistry	
3	Course Type	Discipline Specific Elective (Theory)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Explain the basic components of food stuff and balance diet. ➤ Analyze the food vitamins and minerals with nutritional disorder. ➤ Analyze the effect of toxic substances on environment. ➤ Interpret the effect of toxic chemicals on body parts and their cure. 	
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	Composition of balanced vegetarian and non-vegetarian diets; recommended dietary allowance (RDA) for different categories of the human beings. Food preservation standards, food adulterations and precautions, government regulations on preservation and quality of food. Food processing and loss of nutrients during processing and cooking. Basal metabolism and methods of measuring basal metabolic rate (BMR); energy requirements during growth, pregnancy, lactation and various physical activities.		12
II	Nutritional aspects of Food: carbohydrates, lipids and protein: nutritive value, requirements, and functions. Nutritional aspects of the vitamins and minerals: requirement and functions Malnutrition, its implications, relationship with dietary habits and prevention. Disorders related to the nutrition: Protein energy malnutrition, Starvation, Obesity.		11
III	Environmental Pollution: Types, Outdoor and indoor Air pollution, sources, structure and control strategies. Water and Soil Pollution. Eco-toxicology and its environmental significance. Xenobiotic metabolism, Phase I reaction – oxidation – reduction, hydrolysis and hydration. Phase II reaction – conjugation and methylation.		11
IV	Pesticide toxicity – insecticides, fungicides, herbicides and biopesticides. Toxicology of food additives. Metal toxicity – arsenic, mercury, lead and cadmium. Toxicity testing – Test control, genetic toxicity testing. Occupational toxicology: Occupational hazards and their assessment.		11
Keywords	Food, BMR, Nutrition, Pollution, toxicity		

Name and Signature of Convener & Members of CBoS:

PART-C: Learning Resources**Text Books, Reference Books and Others****Text Books Recommended –**

- LG Corkerhem and BSS Shane Basic Environmental Toxicology
- T Shibamoto & L F Bzeidan Introduction to Food Technology
- M. Stipanuk Biochemical, Phys. & Mol. Aspects of Human Nutrition
- Tom Brody Nutritional Biochemistry
- DA Bender Nutritional Biochemistry of the Vitamins

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): (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):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	




Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSE - 08 P	
2	Course Title	Nutritional and Environmental Biochemistry	
3	Course Type	Discipline Specific Elective (Practical)	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<i>On successful completion of the course, the student shall be able to:</i> <ul style="list-style-type: none"> ➤ Analyse the contents of mineral and vitamin in food samples. ➤ Analyse the chemical and microbial contents in various effluents. ➤ Demonstrate TLC for different food components. ➤ Analyse the adulterants present in food samples. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
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	<ul style="list-style-type: none"> ➤ Separation and purification of sub-cellular organelles and assay of marker enzymes. ➤ Protein fractionation - salt, solvent and isoelectric precipitation. ➤ Identification and assay of certain toxicants. ➤ Effect of various toxicants on serum enzymes and proteins ➤ Effect of various toxicants on liver and kidney metabolism ➤ Estimation of carbohydrate, protein and fat in food materials. ➤ Titrimetric method of ascorbic acid estimation in fruit. ➤ Separation of casein protein from milk 		30
Keywords	Toxins, metabolism, Separation		




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PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text Books Recommended –		
<ul style="list-style-type: none"> ➤ DA Bender Nutritional Biochemistry of the Vitamins ➤ R.L. Pike and M.L. Brown Nutrition: An integrated approach - ➤ G.P. Talwar Text book of Biochemistry and Human Biology ➤ DWS Wong Mechanism and theory in food chemistry ➤ M.S. Banji N P. Rao & V. Reddy Text book of Human Nutrition ➤ Linten Nutritional Biochemistry and Metabolism 		
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): (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):	Laboratory / Field Skill Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	BCSC-08 P	
2	Course Title	Nutraceutical Biochemistry and Functional Foods	
3	Course Type	Discipline Specific Course (Practical)	
4	Pre-requisite (if, any)	As per the Program	
5	Course Learning Outcomes (CLO)	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> ➤ Student will be skilled with basic Research on bioactive compounds. ➤ Understand the concept of functional foods and their role in the human health and well-being. ➤ Apply the diet and dietary components in the modulation of risk factors associated with chronic diseases (e. g cardiovascular diseases) and human health; 	
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	<ul style="list-style-type: none"> ➤ Extraction, purification and evaluation of activity of any one digestive enzyme (e.g. Beta amylase from sweet potato) ➤ Estimation of ascorbic acid from lemon & amla juice by titration method ➤ Reactions of mono, di and polysaccharides and their identification in unknown mixtures ➤ Determination of Acid value, Saponification and Iodine number of natural fats & oils. ➤ Estimation of proteins with Bradford's and other methods. ➤ Extraction and estimation of total sugars from food products (dairy product, fruit juices, bread). ➤ Identification using characteristic features of nutraceutically important plants like; Phyllanthusemblica, Curcuma longa, Zinziberofficinalis, Solanaceae (Withaniasomnifera), Aloe vera, Lilliacae (Aliumsativum), Lamiaceae (Ocimum sanctum), Apiaceae (Coriandrumsps) and Liliaceae (Asparagus sps.), Centellaasiatica. 		30
Keywords	Beta amylase, Acid value, ascorbic acid, Bioactive Compound		

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PART-C: Learning Resources		
Text Books, Reference Books and Others		
<i>Text Books Recommended –</i>		
<ul style="list-style-type: none"> ➤ Kuby's Immunology R.A. Goldsby, T. J Kindt and B. A. Osborne ➤ Immunology- A short Course E. Benjamini, R. Coico and G. Sunshine ➤ Immunology Roitt, Brostoff and Male 		
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): (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):	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

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