DEPARTMENT OF ZOOLOGY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. III, IV, V, VI Semester

ZOOLOGY

(Based on Choice Based Credit System)

SESSION : 2024-25

ESTD : 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Courses(With Practical) of 4Credit

3C for Theory + 1C for Practical

Four Year Undergraduate Program

Semester III & IV

Session 2024-25

Discipline Specific Course (DSC), Discipline Specific Elective (DSE)
and
General Elective Course (GEC)

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

DSC			DSE			GE		
Sem.	**Code**	**Title**	**Sem.**	**Code**	**Title**	**Sem.**	**Code**	**Title**
I	BZO-101	Animal Diversity - I	-	-	-	I	-	-
II	BZO-201	Animal Diversity - II	-	-	-	II	-	-
III	BZO-301	Comparative Anatomy and Physiology of Vertebrates	III	BZO302	Endocrinology	III	GEC03	Comparative Anatomy and Physiology of Vertebrates
IV	BZO-401	Cell Biology and Genetics	IV	BZO-402	Immunology	IV	GEC04	Cell Biology and Genetics
V	BZO-501	Biochemistry and Histology	V	BZO-502	Applied Zoology	V	GEC05	Biochemistry and Histology
				BZO-503	Animal Behaviour		GEC06	Evolution
VI	BZO-601	Reproductive and Developmental Biology	VI	BZO-602	Ecology	VI	GEC07	Reproductive and Developmental Biology
				BZO-603	Chronobiology		GEC08	Food, Nutrition and Health

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
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	7. Mr. Anurag Mishra

Govt. V.Y.T. PG Autonomous College, Durg (Chhattisgarh)

(Erstwhile: Govt. Arts & Science College, Durg)

Proposed Scheme For 4Yr UG Program in Zoology (UGCF)

Semester	Core Course (DSC)	Discipline Specific Elective	Generic Elective (GE)	Ability Enhancement Course (AEC)	SEC/Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Value Added Courses	Total Credits
I	DSC A1 (4) SDC B1 (4) DSC C1 (4)		Choose one from a pool of courses GE 1 (4)	Choose one from a pool of AEC courses (2)	Choose one f rom a pool of courses (2)	Choose one from a pool of courses (2)	22
II	DSC A2 (4) DSC B2 (4) DSC C2 (4)		Choose one from a pool of courses GE 2 (4)	Choose one from a pool of AEC courses (2)	Choose one from a pool of courses (2)	Choose one from a pool of courses (2)	22
Students exiting shall be awarded undergraduate certificate (in the field of study/discipline) after securing the minimum 40 credits in Semester I and II						**Total**	**44**
III	DSC A3 (4) DSC B3 (4) DSC C3 (4)	Choose one from a pool of courses DSE A/B/C (4) Or Choose one from a pool of courses GE 3 (4)		Choose one from a pool of courses AEC (2)	Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Choose one from a pool of courses (2)	22
IV	DSC A4 (4)	Choose one from a pool of courses DSE A/B/C (4)					22

	DSC B4 (4) DSC C4(4)	Or Choose one from a pool of courses GE 4 (4)	Choose one from a pool of courses AEC (2)	Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Choose one from a pool of courses (2)	
Students exiting shall be awarded undergraduate diploma (in the field of study/discipline) after securing the minimum 80 credits on completion of Semester IV					**Total**	**88**
V	DSC A5 (4) DSC B5 (4) DSC C5 (4)	Choose two from a pool of courses DSE A/B/C (4+4) Or Choose two from a pool of courses GE5 (4) & GE6 (4)		Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)		22
VI	DSC A6 (4) DSC B6 (4) DSC C6 (4)	Choose two from a pool of courses DSE A/B/C (4+4) Or Choose two from a pool of courses GE 7 (4) & GE 8 (4)		Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)		22
Students exiting shall be awarded Bachelor of (in the field of multidisciplinary study) in relevant Discipline after securing the minimum 120 credits on completion of Semester VI					**Total**	**132**
VII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 9, 10, 11 & 12 (4x4) (Total 16)				20
VIII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 13, 14, 15 & 16 (4x4)				20

		(Total 16)				
Students shall be awarded Bachelor of (in the field of Multidisciplinary Study) (Honours) in relevant Discipline after securing the minimum 160 credits on completion of Semester VIII					**Total**	**172**
VII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 9, 10, 11 & 12 (4x4) (Total 16)				20
VIII	DSC A/B/C (4)	Choose four DSE (1x4) course OR choose one GE (1x4) course	Research Project/Dissertation (12)			20
Students shall be awarded Bachelor of (in the field of Multidisciplinary Study) (Honours with Research) in relevant Discipline after securing the minimum 160 credits on completion of Semester VIII					**Total**	**172**

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

1. In 1st semester Hindi Language, 2nd semester English Language and Environmental studies in 3rd and 4th Semester will be offered as AEC.
2. Students are required to take Generic Specific courses (courses from other than A/B/C Disciplines)
3. DSC-1 to DSC-7 shall be core courses of either Discipline A or B or C.
4. If a student wishes to Major in Discipline A, then he/she should earn at least 60 credits from DSCs and DSEs, Research Methodology of Discipline A and dissertation writtenon a topic of Discipline A.
5. Minor in a Discipline will be awarded to a student if he/she earns 24 credits from GEs (other than B and C) along with major in A.
6. Completion of core courses from host institute is mandatory.
7. Students may take up SEC, GEC and DSEC of equivalent credits from any other institute/ online platforms/MOOC/ ODL from UGC recognized organizations.

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COURSE CURRICULUM 2024-25

COURSE CODE: BZO301 (DSC) Comparative Anatomy and Physiology of Vertebrates

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc.	**Semester** - III	**Session:**2024-2025
1	Course Code	**BZO 301**		
2	Course Title	Comparative Anatomy and Physiology of Vertebrates		
3	Course Type	Discipline Specific Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn and analyze the adaptive changes that have occurred in different group of vertebrates • Understand the process of development in different organ systems during the evolution in vertebrates • Comprehend the comparative anatomy of various organ systems of vertebrates • Evaluate the physiological functioning of different organs. • Explain the physiology of Biological Processes		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

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COURSE CURRICULUM 2024-25

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	Integument and its derivatives: Structure of Scales, Hair and Feathers. Alimentary canal and Digestive glands in Vertebrates Physiology of digestion	12
II	Endoskeleton – Axial Skeleton: Skull and vertebrae Appendicular skeleton: Limbs and Girdles	12
III	Respiratory organs: Gills and lungs, Air sac in birds. Mechanism and control of breathing. Circulatory System: Evolution of Heart and Aortic Arches. Cardiac cycle	10
IV	Urino-genital System: Kidney and Excretory ducts. Physiology of excretion and osmoregulation. Nervous system: General plan of Brain and Spinal Cord. Physiology of Nerve conduction and Synaptic transmission	14
V	Gonads and Genital ducts. Ear and Eye of human: Structure and function. Physiology of muscle contraction.	12

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

- Animal Physiology (W.H. Freeman) Eckest, R
- Analysis of Vertebrate structure, Hildbrand
- Outline of Comparative anatomy (Central Book Depot), Kingsley
- The Vertebrate body (Saunders), Rouer & Parsons.

Reference Books

- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw- Hill.
- Biology of the Vertebrates (Mac-Milan), Walta & Gyles

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks

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Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks

Name & Signature of Members of Board of Studies

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COURSE CURRICULUM 2024-25

Lab Course: BZOL 301 (DSC) Comparative Anatomy and Physiology of Vertebrates

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - III**		**Session:**2024-2025
1	Course Code	**BZOL301**		
2	Course Title	Comparative Anatomy and Physiology of Vertebrates		
3	Course Type	Discipline Specific Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn and analyze the adaptive changes that have occurred in different group of vertebrates • Remember the structure and function of different system of vertebrates. • Understand the importance of different body systems in vertebrates • Explain the need of adaptation in different groups of vertebrate animals.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Major dissection –Study of Cranial Nerves and efferent branchial arteries in Scoliodon by alternative method.
2.	Major dissection –Study of Efferent Branchial Arteries in Scoliodon by alternative method.
3.	Minor dissection –Study of Afferent branchial arteries and Internal ear in scoliodon by alternative method.
4.	Permanent mounting of fish scale (Placoid, Cycloid, and Ctenoid Scale).
5.	Spotting: Study of permanent slides and bones of vertebrates based on theory syllabus.

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : • Animal Physiology (W.H. Freeman) Eckest, R • Analysis of Vertebrate structure, Hildbrand • Outline of Comparative anatomy (Central Book Depot), Kingsley • The Vertebrate body (Saunders), Rouer & Parsons **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)**

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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COURSE CURRICULUM 2024-25

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COURSE CURRICULUM 2024-25

COURSE CODE: BZO302 (DSE01) Endocrinology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/ honors		**Class:** B. Sc. **Semester** - III		**Session:**2024-2025
1	Course Code	**BZO302**		
2	Course Title	Endocrinology		
3	Course Type	Discipline Specific Elective (DSE01)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand neurohormones and neurosecretions. • Learn about hypothalamo and hypophysial axis. • Understand about different endocrine glands and their disorders. • Understand the mechanism of hormone action. • Explain the cause and symptoms of hormonal disorder.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	Definition and classification of hormones. Endocrine, paracrine and autocrine modes of hormone's delivery, Feedback mechanism. Hormone receptors: Cell surface receptors and Cytoplasmic Receptors.	12
II	Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction. Structure of hypothalamus, Hypothalamic nuclei and their functions. Regulation of neuroendocrine glands and Feedback mechanisms.	12

III	Structure of pituitary gland, Its hormones and their functions. Hypothalamo-hypophysial portal system, Disorders of pituitary gland and Feedback mechanisms.	12
IV	Structure of Thyroid gland, Its Hormones, Functions and Regulation. Structure of Parathyroid Gland, Its Hormones, Functions and Regulation. Structure of Adrenal glands, Its Hormones and regulation.	12
V	Structure of Pancreas, Its Hormones, Functions and Regulation. Structure of Ovary, Its Hormones, Functions and Regulation. Structure of Testis, Its Hormones, Functions and Regulation. Disorders of endocrine glands.	12

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Turner, C. D. (1971) General Endocrinology, Pub- Saunders Toppan.
2. David, O.N. (2013) Vertebrate Endocrinology.
3. J. Larry Jameson .(2016). Harrison's Endocrinology, 4Ed, Publisher: McGraw-Hill Education / Medical.

Reference Books

4. Nussey, S.S.; and Whitehead, S.A. (2001) Endocrinology: An Integrated Approach,Oxford: BIOS Scientific Publishers.
5. Hadley, M.E. and Levine J.E. (2007) Endocrinology (6th edition) Pearson Prentice-Hall,New Jersey.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. https://www.sciencedirect.com/topics/medicine-and-dentistry/endocrinology
2. https://my.clevelandclinic.org/health/articles/22691-endocrinologist

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Comprehensive Evaluation (CCE): **20 Marks**

Semester End Exam (SEE): **80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks

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Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks

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LAB COURSE: BZOL302 (DSE01) Endocrinology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. III	**Semester -**	**Session:**2024-2025
1	Course Code	**BZOL302**		
2	Course Title	Endocrinology		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** Learn neurohormones and neurosecretions. Understand about hypothalamo and hypophysial axis. Comprehend about different endocrine glands and their disorders. Describe the mechanism of hormone action.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Demonstration of Endocrine glands by alternative methods through clay/thermocol /drawing/model etc.
2.	Study of the permanent slides of all the endocrine glands.
3.	Separation of steroid hormones using paper chromatography
4.	Demonstration of Human chorionic gonadotropin hormone in human urine.

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Turner, C. D. (1971) General Endocrinology, Pub- Saunders Toppan. 2. Nussey, S.S.; and Whitehead, S.A. (2001) Endocrinology: An Integrated Approach,Oxford: BIOS Scientific Publishers. 3. Hadley, M.E. and Levine J.E. (2007) Endocrinology (6th edition) Pearson Prentice-Hall,New Jersey. 4. David, O.N. (2013) Vertebrate Endocrinology. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.cmcendovellore.org/handbook-of-endocrine-protocols/	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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COURSE CODE: GEC03 Comparative Anatomy and Physiology of Vertebrates

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree /honors		**Class:** B. Sc. III	**Semester -**	**Session:**2024-2025
1	Course Code	**GEC03**		
2	Course Title	Comparative Anatomy and Physiology of Vertebrates		
3	Course Type	General elective Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn and analyze the adaptive changes that have occurred in different group of vertebrates • Understand the process of development in different organ systems during the evolution in vertebrates • Comprehend the comparative anatomy of various organ systems of vertebrates • Evaluate the physiological functioning of different organs. • Explain the physiology of Biological Processes		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	Integument and its derivatives: Structure of Scales, Hair and Feathers. Alimentary canal and Digestive glands in Vertebrates Physiology of digestion	12
II	Endoskeleton – Axial Skeleton: Skull and vertebrae Appendicular skeleton: Limbs and Girdles	12
III	Respiratory organs: Gills and lungs, Air sac in birds. Mechanism and control of breathing. Circulatory System: Evolution of Heart and Aortic Arches. Cardiac cycle	10
IV	Urino-genital System: Kidney and Excretory ducts. Physiology of excretion and osmoregulation. Nervous system: General plan of Brain and Spinal Cord. Physiology of Nerve conduction and Synaptic transmission	14
V	Gonads and Genital ducts. Ear and Eye of human: Structure and function. Physiology of muscle contraction.	12

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

- Animal Physiology (W.H. Freeman) Eckest, R
- Analysis of Vertebrate structure, Hildbrand
- Outline of Comparative anatomy (Central Book Depot), Kingsley
- The Vertebrate body (Saunders), Rouer & Parsons.

Reference Books

- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw- Hill.
- Biology of the Vertebrates (Mac-Milan), Walta & Gyles

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks

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Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

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Lab Course: GEC03 Comparative Anatomy and Physiology of Vertebrates

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc.	**Semester** - III	**Session:**2024-2025
1	Course Code	**GEC03**		
2	Course Title	Comparative Anatomy and Physiology of Vertebrates		
3	Course Type	General Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn and analyze the adaptive changes that have occurred in different group of vertebrates • Remember the structure and function of different system of vertebrates. • Understand the importance of different body systems in vertebrates • Explain the need of adaptation in different groups of vertebrate animals.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Major dissection –Study of Cranial Nerves and efferent branchial arteries in Scoliodon by alternative method.
2.	Major dissection –Study of Efferent Branchial Arteries in Scoliodon by alternative method.
3.	Minor dissection –Study of Afferent branchial arteries and Internal ear in scoliodon by alternative method.
4.	Permanent mounting of fish scale (Placoid, Cycloid, and Ctenoid Scale).
5.	Spotting: Study of permanent slides and bones of vertebrates based on theory syllabus.

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Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
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Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : • Animal Physiology (W.H. Freeman) Eckest, R • Analysis of Vertebrate structure, Hildbrand • Outline of Comparative anatomy (Central Book Depot), Kingsley • The Vertebrate body (Saunders), Rouer & Parsons **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)**

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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COURSE CODE: BZO401 (DSC04) Cell Biology and Genetics

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - IV**		**Session:**2024-2025
1	Course Code	**BZO401**		
2	Course Title	Cell Biology and Genetics		
3	Course Type	Discipline Specific Course (DSC)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the importance of cell as a structural and functional unit of life • Understand the difference between prokaryoticand eukaryotic system • Comprehend the structure and function of different cell organelles with cell division • Understand the general idea about cellular immunity and cell transformation • Describe the process of DNA and RNA replication.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Prokaryotic and Eukaryotic cell** Structure and functions of cell organelles: Plasma membrane, Endoplasmic reticulum, Golgi body, Mitochondria, Lysosome, Ribosomes Structure and functions of Nucleus- Nuclear membrane, Nucleolus, Chromosome structure, Polytene chromosome, Lamp brush chromosome, Euchromatin, Heterochromatin, Barr body.	**12**

II	**Cell cycle and cell division** Cell Transformation – Characteristic of malignant cell, Types of Cancer, Factors responsible for cancer formation, Oncogenes, Tumour suppressor gene, symptoms and treatment of cancer.	**12**
III	Linkage and Linkage Maps, Sex determination, Crossing over, Mutation Mendel's law and **Gene interaction**: Incomplete dominance and Co-dominance, Supplementary gene, Complementary gene, Epistasis, Multiple alleles. **Chromosomal Aberration:** Down Syndrome, Edward syndrome, Patau syndrome, Turner syndrome, Klinefelter syndrome. **Single Gene Disorders:** Alkaptonuria, Phenylketonuria, Sickle cell anaemia, albinism, colour blindness, hemophilia.	**12**
IV	Structure of DNA and RNA, Replication of DNA Concept of gene (Fine structure of the Gene- Cistron, muton and recon.)	**12**
V	**Gene regulation:** Concept of operon: Lac operon, **Gene expression:** Transcription and post transcriptional modifications, (methylation, polyadenylation, RNA splicing.) Translation (Genetic code and its properties; process of translation Initiation, elongation and termination. Post-translational modifications of proteins)	**12**

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Unified Zoology by V.K. Tiwari
2. Unified Zoology by H.N. Baijal
3. Cell Biology by C.B. Powar
4. Karp's Cell Biology by Gerald Karp, Janet Iwasa, Wallace Marshall, Wiley Publishing.
5. P S Verma & V K Agarwal, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing House.

Reference Books

1. Benjamin Pierce (2019). Genetics: A Conceptual Approach 7th Edition. Published By W.H.Freeman & Co Ltd.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. https://sciencelearn.org.nz/resources/1989-cell-biology-and-genetics
2. https://www.dcu.ie/courses/undergraduate/school-biotechnology/genetics-and-cell-biology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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LAB COURSE: BZOL401 (DSC04) Cell Biology and Genetics

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - IV		**Session:**2024-2025
1	Course Code	**BZOL401**		
2	Course Title	Cell Biology and Genetics		
3	Course Type	Discipline Specific Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the importance of cell as a structural and functional unit of life. • Understand the difference between prokaryoticand eukaryotic system. • Comprehend the structure and function of different cell organelles with cell division. • Understand the general idea about cellular immunity and cell transformation. • Describe the process of DNA and RNA replication.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Culturing and Handling of Drosophila
2.	Morphology and Sexual dimorphism of Drosophila
3.	Study of at least five types of Drosophila: a) Body color mutant- Ebony body and Yellow body. b) Wing mutant- Curly wing and Vestigial wing. c) Eye color mutant- Bar eye, White eye, Sepia eye.
4.	Dissection of Salivary glands and Preparation of Polytene chromosome (comment on diagram)

5.	Vital staining of mitochondria (Genus green B staining)
6.	Staining of Barr body
7.	Squash preparation of onion root tip for study of mitosis.
8.	Study of meiosis in grasshopper testes.
9.	Study of permanent slides of mitosis and meiosis

Name & Signature of Members of Board of Studies

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : Cell Biology And Genetics Lab Manual by Dr. N Haraprasad and Dr. B.P. Hema **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.scientificpubonline.com/bookdetail/a-manual-practical-zoology-biodiversity-cell-biology-genetics-developmental-biology-part-1/9789388449076/86

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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COURSE CODE: BZO402 (DSE02) Immunology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - IV		**Session:**2024-2025
1	Course Code	**BZO402**		
2	Course Title	Immunology		
3	Course Type	Discipline Specific Elective (DSE02)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the fundamental concepts of Immunology. • Gain knowledge on various immune cells, antigen and cytokines. • Elaborate the structure and functions of immunoglobulins and antibodies. • Describe the processes involved in immune system • Analyze the pathogenesis, clinical manifestations and therapeutic approaches of various immune disorders and diseases and experimental techniques in immunology.		
5	Credit Value	3C	1 credit =15 Hours – Learning and Observation	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	A brief introduction of immunology. Brief history of immunity, Concept and types of Immunity (Innate and Aquired). Introduction of Immune System. Primary and Secondary Lymphoid organs, lymphoid tissues. Thymic Selection: Self and Non-self recognition. Inflammation. Lymphocyte trafficking. Hematopoiesis.	**10**

II	Cells of Immune system. Structure and function of Macrophages, Granulocytes, NK cells, T and B Lymphocytes and Antigen presenting cells. T and B cell receptors, Maturation, Activation and Differentiation of T and B cells. Antigenicity versus Immunogenicity. Factors affecting immunogenicity, immunogen, Haptens, Super Antigen, Epitope, Paratope. Major Histocompatibility Complex (MCH) and HLA. Cytokines.	12
III	Nature and Primary structure of immunoglobulins. Enzymatic fragmentation of immunoglobulins, Domain structure of immunoglobulins and its significance. Types and sub types of immunoglobulins and its characteristics. Membranous Antibody, Antigenic determinants Isotype, Allotype, Idiotype). Theories of Antibody formation (instructive, selective, clonal selection theories and evidences). Immunological memory. Complement system. Hypersensitivity (Type 1 to type IV with example). CMI and Humoral Immune Response. Antigen-Antibody Interaction.	13
IV	Autoimmunity: Auto-recognition, Classes of autoimmune-diseases (Hashimoto disease, Thyrotoxicosis, systemic Lupus, Erythematosus, Rheumatoid arthritis). Transplantation: Autograph, Isograph, Allograph, Zeno graph, Immunological basis of transplantation reactions. Immune deficiencies: Primary and Secondary Immune Deficiencies (T cell and B cell, SCID, and AIDS). Types of Vaccines and Vaccination (1st, 2nd and 3rd Generation Vaccines).	13
V	Immunological Techniques: Precipitin Curve, Immunodiffusion (one and two dimentional, Single radial immune-diffusion, Double immune-diffusion). Immuno-electrophoresis (Different Types). Principal and Methodology of RIA and ELISA. Immuno-fluorescence. Hybridoma Techniques, Monoclonal Antibodies.	**12**

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Pravash Sen Gupta, Clinical Immunology. Oxford University Press. 2003.
2. N. Arumugam, Immunologyu, Saras Publication. 2014.
3. Fatima D, Arumugam, Immunology. Saras Publication

Reference Books

1. Janis Cuby, Immunology, 2nd Edition, W.H. Freeman and Company, New York, 1993.
2. Ivan M. Roitt, J.Brostoff and D. K. Male, Immunology, Gower Medical Publishing, London. 1993.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==
2. https://www.google.com/search?sca_esv=3f3107cf98d2d186&sxsrf=ADLYWIIqdJrjweAAlXDt7TZfoeztr1TrbA:1720167250778&q=https://ndl.iitkgp.ac.in/hedocument/swayamprabha/swayam+prabha/hdc5c5m6hkq?1%3Dimmunology&spell=1&sa=X&ved=2ahUKEwjSjb-vuo-HAxWuj68BHUmsCvIQBSgAegQIChAB

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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Lab Course: BZOL402 (DSE04 Lab Course) Immunology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree /honors		**Class:** B. Sc. **Semester** - IV		**Session:**2024-2025
1	Course Code	**BZOL402**		
2	Course Title	Immunology		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • 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. • Learn basic techniques in immunology. • Understand the process of the immune system to distinguish self from non self. • Comprehend the diseases and disorders related to immune system.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Study of permanent slides of organ of immune system.
2.	Eneumeration of total leucocytes from human blood samples.
3.	Eneumeration of differential leucocytes from human blood sample.
4.	Demonstration of agglutination reaction using human RBC.
5.	Estimation of total serum protein
6.	Group discussion/quiz/seminar/presentation onj related topics.

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Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Talwar G.P. and Gupta S.K., A handbook of practical and Clinical Immunology,. Volume:1. CBS Publications.
2. Zane Immunology: Theoratical and practical concepts in laboratory medicine, ELSEVIER.

REFERENCE BOOKS:

1. Goldsby, R.A. ; Kindt, T.J. and Cuby, J. (2006) Immunology (6th Edition)
2. Roitt, J. Brostoff and Male, D (2012) Immunology, 8th Edition

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==
2. https://www.google.com/search?sca_esv=3f3107cf98d2d186&sxsrf=ADLYWIlqdJrjweAAlXDt7TZfoeztr1TrbA:1720167250778&q=https://ndl.iitkgp.ac.in/hedocument/swayamprabha/swayam+prabha/hdc5c5m6hkq?1%3Dimmunology&spell=1&sa=X&ved=2ahUKEwjSjb-vuo-HAxWuj68BHUmsCvIQBSgAegQIChAB

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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COURSE CODE: GEC04 Cell Biology and Genetics

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - IV		**Session:**2024-2025
1	Course Code	**GEC04**		
2	Course Title	Cell Biology and Genetics		
3	Course Type	General Elective Course (GEC)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the importance of cell as a structural and functional unit of life • Understand the difference between prokaryoticand eukaryotic system • Comprehend the structure and function of different cell organelles with cell division • Understand the general idea about cellular immunity and cell transformation • Describe the process of DNA and RNA replication.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**Prokaryotic and Eukaryotic cell** Structure and functions of cell organelles: Plasma membrane, Endoplasmic reticulum, Golgi body, Mitochondria, Lysosome, Ribosomes Structure and functions of Nucleus- Nuclear membrane, Nucleolus, Chromosome structure, Polytene chromosome, Lamp brush chromosome, Euchromatin, Heterochromatin, Barr body.	12

II	**Cell cycle and cell division** Cell Transformation – Characteristic of malignant cell, Types of Cancer, Factors responsible for cancer formation, Oncogenes, Tumour suppressor gene, symptoms and treatment of cancer.	12
III	Linkage and Linkage Maps, Sex determination, Crossing over, Mutation Mendel's law and **Gene interaction**: Incomplete dominance and Co-dominance, Supplementary gene, Complementary gene, Epistasis, Multiple alleles. **Chromosomal Aberration:** Down Syndrome, Edward syndrome, Patau syndrome, Turner syndrome, Klinefelter syndrome. **Single Gene Disorders:** Alkaptonuria, Phenylketonuria, Sickle cell anaemia, albinism, colour blindness, hemophilia.	12
IV	Structure of DNA and RNA, Replication of DNA Concept of gene (Fine structure of the Gene- Cistron, muton and recon.)	12
V	**Gene regulation:** Concept of operon: Lac operon, **Gene expression:** Transcription and post transcriptional modifications, (methylation, polyadenylation, RNA splicing.) Translation (Genetic code and its properties; process of translation Initiation, elongation and termination. Post-translational modifications of proteins)	12

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

6. Unified Zoology by V.K. Tiwari
7. Unified Zoology by H.N. Baijal
8. Cell Biology by C.B. Powar
9. Karp's Cell Biology by Gerald Karp, Janet Iwasa, Wallace Marshall, Wiley Publishing.
10. P S Verma & V K Agarwal, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing House.

Reference Books

2. Benjamin Pierce (2019). Genetics: A Conceptual Approach 7th Edition. Published By W.H.Freeman & Co Ltd.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

3. https://sciencelearn.org.nz/resources/1989-cell-biology-and-genetics
4. https://www.dcu.ie/courses/undergraduate/school-biotechnology/genetics-and-cell-biology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

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DEPARTMENT OF ZOOLOGY
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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test -02 of 10 Marks each + 01 Assignment/Seminar of10 Marks	Better marks out of two tests+ Marks obtained in Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
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LAB COURSE: GECL04 Cell Biology and Genetics

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc.	**Semester** - IV	**Session:**2024-2025
1	Course Code	**GECL04**		
2	Course Title	Cell Biology and Genetics		
3	Course Type	General Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the importance of cell as a structural and functional unit of life. • Understand the difference between prokaryoticand eukaryotic system. • Comprehend the structure and function of different cell organelles with cell division. • Understand the general idea about cellular immunity and cell transformation. • Describe the process of DNA and RNA replication.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :50		Minimum Passing Marks:20

S.No.	**List of Experiments**
1.	Culturing and Handling of Drosophila
2.	Morphology and Sexual dimorphism of Drosophila
3.	Study of at least five types of Drosophila: a) Body color mutant- Ebony body and Yellow body. b) Wing mutant- Curly wing and Vestigial wing. c) Eye color mutant- Bar eye, White eye, Sepia eye.
4.	Dissection of Salivary glands and Preparation of Polytene chromosome (comment on diagram)

5.	Vital staining of mitochondria (Genus green B staining)
6.	Staining of Barr body
7.	Squash preparation of onion root tip for study of mitosis.
8.	Study of meiosis in grasshopper testes.
9.	Study of permanent slides of mitosis and meiosis

Name & Signature of Members of Board of Studies

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : Cell Biology And Genetics Lab Manual by Dr. N Haraprasad and Dr. B.P. Hema **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.scientificpubonline.com/bookdetail/a-manual-practical-zoology-biodiversity-cell-biology-genetics-developmental-biology-part-1/9789388449076/86	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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Courses(With Practical) of 4Credit

3C for Theory + 1C for Practical

Four Year Undergraduate Program

Semester V & VI

Session 2024-25

Discipline Specific Course (DSC), Discipline Specific Elective (DSE)

and

General Elective Course (GEC)

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DSC			DSE			GE		
Sem.	**Code**	**Title**	**Sem.**	**Code**	**Title**	**Sem.**	**Code**	**Title**
I	BZO-101	Animal Diversity - I	-	-	-	I	-	-
II	BZO-201	Animal Diversity - II	-	-	-	II	-	-
III	BZO-301	Comparative Anatomy and Physiology of Vertebrates	III	BZO302	Endocrinology	III	GEC03	Comparative Anatomy and Physiology of Vertebrates
IV	BZO-401	Cell Biology and Genetics	IV	BZO-402	Immunology	IV	GEC04	Cell Biology and Genetics
V	BZO-501	Biochemistry and Histology	V	BZO-502	Applied Zoology	V	GEC05	Biochemistry and Histology
				BZO-503	Animal Behaviour		GEC06	Evolution
VI	BZO-601	Reproductive and Developmental Biology	VI	BZO-602	Ecology	VI	GEC07	Reproductive and Developmental Biology
				BZO-603	Chronobiology		GEC08	Food, Nutrition and Health

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Govt. V.Y.T. PG Autonomous College, Durg (Chhattisgarh)

(Erstwhile: Govt. Arts & Science College, Durg)

Proposed Scheme For 4Yr UG Program in Zoology (UGCF)

Semester	Core Course (DSC)	Discipline Specific Elective	Generic Elective (GE)	Ability Enhancement Course (AEC)	SEC/Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Value Added Courses	Total Credits
I	DSC A1 (4) SDC B1 (4) DSC C1 (4)		Choose one from a pool of courses GE 1 (4)	Choose one from a pool of AEC courses (2)	Choose one f rom a pool of courses (2)	Choose one from a pool of courses (2)	22
II	DSC A2 (4) DSC B2 (4) DSC C2 (4)		Choose one from a pool of courses GE 2 (4)	Choose one from a pool of AEC courses (2)	Choose one from a pool of courses (2)	Choose one from a pool of courses (2)	22
Students exiting shall be awarded undergraduate certificate (in the field of study/discipline) after securing the minimum 40 credits in Semester I and II						**Total**	**44**
III	DSC A3 (4) DSC B3 (4) DSC C3 (4)	Choose one from a pool of courses DSE A/B/C (4) Or Choose one from a pool of courses GE 3 (4)		Choose one from a pool of courses AEC (2)	Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Choose one from a pool of courses (2)	22
IV	DSC A4 (4)	Choose one from a pool of courses DSE A/B/C (4)					22

	DSC B4 (4) DSC C4(4)	Or Choose one from a pool of courses GE 4 (4)	Choose one from a pool of courses AEC (2)	Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)	Choose one from a pool of courses (2)	
Students exiting shall be awarded undergraduate diploma (in the field of study/discipline) after securing the minimum 80 credits on completion of Semester IV					**Total**	**88**
V	DSC A5 (4) DSC B5 (4) DSC C5 (4)	Choose two from a pool of courses DSE A/B/C (4+4) Or Choose two from a pool of courses GE5 (4) & GE6 (4)		Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)		22
VI	DSC A6 (4) DSC B6 (4) DSC C6 (4)	Choose two from a pool of courses DSE A/B/C (4+4) Or Choose two from a pool of courses GE 7 (4) & GE 8 (4)		Choose one SEC or Internship/Apprenticeship/Project/Dissertation/Community Outreach (2)		22
Students exiting shall be awarded Bachelor of (in the field of multidisciplinary study) in relevant Discipline after securing the minimum 120 credits on completion of Semester VI					**Total**	**132**
VII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 9, 10, 11 & 12 (4x4) (Total 16)				20
VIII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 13, 14, 15 & 16 (4x4)				20

		(Total 16)				
Students shall be awarded Bachelor of (in the field of Multidisciplinary Study) (Honours) in relevant Discipline after securing the minimum 160 credits on completion of Semester VIII					**Total**	**172**
VII	DSC A/B/C (4)	Choose four DSE (4x4) **Or** Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course **Or** All four GE 9, 10, 11 & 12 (4x4) (Total 16)				20
VIII	DSC A/B/C (4)	Choose four DSE (1x4) course OR choose one GE (1x4) course	Research Project/Dissertation (12)			20
Students shall be awarded Bachelor of (in the field of Multidisciplinary Study) (Honours with Research) in relevant Discipline after securing the minimum 160 credits on completion of Semester VIII					**Total**	**172**

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	**Departmental Members**
Subject Expert	1. Dr. Divya K. Minj
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	7. Mr. Anurag Mishra

1. In 1st semester Hindi Language, 2nd semester English Language and Environmental studies in 3rd and 4th Semester will be offered as AEC.
2. Students are required to take Generic Specific courses (courses from other than A/B/C Disciplines)
3. DSC-1 to DSC-7 shall be core courses of either Discipline A or B or C.
4. If a student wishes to Major in Discipline A, then he/she should earn at least 60 credits from DSCs and DSEs, Research Methodology of Discipline A and dissertation writtenon a topic of Discipline A.
5. Minor in a Discipline will be awarded to a student if he/she earns 24 credits from GEs (other than B and C) along with major in A.
6. Completion of core courses from host institute is mandatory.
7. Students may take up SEC, GEC and DSEC of equivalent credits from any other institute/ online platforms/MOOC/ ODL from UGC recognized organizations.

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COURSE CODE: BZO301 (DSC-05) Biochemistry and Histology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc.	**Semester** - V	**Session:** 2024-2025
1	Course Code	**BZO501**		
2	Course Title	Biochemistry and Histology		
3	Course Type	Discipline Specific Course (DSC05)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Know about the importance and scope of biochemistry. • Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids. • Understand the histological structure and function of different tissues. • Comprehend the concept of enzyme, its mechanism of action and regulation. • Learn the preparation of models of biomolecules.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Biochemistry of Carbohydrates:** Introduction, scope and importance of Biochemistry. **Carbohydrate:** Structure and biological importance. Classification: Monosaccharides, Oligosaccharides (Disaccharides), Polysaccharides. Metabolism of carbohydrates, Glycolysis, Krebs cycle, Electron transport chain and ATP synthesis. Gluconeogenesis, Glycogenolysis and Glycogenesis.	12
II	**Biochemistry of Lipids:** Lipid structure and Biological significance. **Fatty acids:** Types and Classification- Triglycerides, Phospholipids, Sphingolipids, Cholesterol, β- oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms. Ketogenesis.	12
III	**Biochemistry of proteins:** Structure and biological significance of proteins. **Amino acids:** Structure, classification and properties, Essential and non-essential amino acids. Catabolism of amino acids: Transamination, Deamination, Urea cycle. **Enzymes:** General properties, Nomenclature and classification: specificity, cofactors, isozymes, Mechanism of enzyme action, Regulation of enzyme activity	12
IV	**Histology:** Introduction to tissues. **Epithelial tissue:** types, structure and characteristics. **Connective tissue:** Structure and function of loose, dense and adipose tissue. Structure and function of Blood plasma, blood cells, lymph and Stem cell. **Cartilage and bone:** classification, and fine structure.	12
V	**Muscular tissue:** Ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. **Nerve Tissue:** Structure and classification of neurons. Types of supporting (glial) cells and their function. Myelin sheath and its formation. Types of sensory nerve endings. Degeneration and regeneration of neurons. Membranes of the brain and spinal cord.	12

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition)Worth.
2. Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry(5th edition) Wiley.
3. Sangeeta M., Varalakshmi K.L. and Jyothi N. Nayak (2023) Text Book of Histology for Undergraduate. (2nd Edition) Medone Media.

Reference Books :

1. Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman.
2. Zubay, G. (2017) Biochemistry (4th edition) McGraw-Hill.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/biochemistry

https://www.kenhub.com/en/library/anatomy/introduction-to-histology

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **75 Marks** **Continuous Comprehensive Evaluation (CCE):** **15 Marks** **Semester End Exam (SEE):** **60 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

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Lab Course: BZOL501 (DSC-05) Biochemistry and Histology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - V**		**Session:**2024-2025
1	Course Code	**BZOL501**		
2	Course Title	Biochemistry and Histology		
3	Course Type	Discipline Specific Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Know about the importance and scope of biochemistry. • Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids. • Understand the histological structure and function of different tissues. • Comprehend the concept of enzyme, its mechanism of action and regulation. • Learn the preparation of models of biomolecules.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S. No.	**List of Experiments**
1.	Study of permanent slides of different tissues.
2.	Biochemical detection of Carbohydrate, Protein and Lipid.
3.	Determination of acid value of oil.
4.	Blood group detection (A, B, AB, O)
5.	R. B. C. and W.B.C count

6.	Blood coagulation time
7.	Preparation of hematin crystals from blood sample

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Practical Biochemistry By Damodaran Geetha K. Publisher: Jaypee Brothers Ltd Pvt.
2. Essentials of Practical Biochemistry by Gupta Prem Prakash. Jaypee Brothers Medical Publishers.
3. Histological Techniques A Practical Manual by K. Lakshminarayanan (2020). Bhalani Publishing House

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.amazon.in/PRACTICAL-BOOK-BIOCHEMISTRY-CLINICAL-PATHOLOGY/dp/B0D44Q89MD

https://bookforest.in/products/histology-practical-manual-3rd-edition?sku_id=50937951&gad_source=1&gclid=Cj0KCQjw-ai0BhDPARIsAB6hmP4gpkRECVQOelavluya7prcQcetWqfJBNZvcMJhqylCK8K3dOHCw2UaAgEJEALw_wcB

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Course Code: BZO502 (DSE03) Applied Zoology

<table>
<tr><td colspan="5">Part A: Introduction</td></tr>
<tr><td colspan="2">Program: Bachelor in Science (Bio Group)
Certificate/diploma/degree/honors</td><td colspan="2">Class: B. Sc. Semester - V</td><td>Session:2024-2025</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="3">BZO502</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Applied Zoology</td></tr>
<tr><td>3</td><td>Course Type</td><td colspan="3">Discipline Specific Elective</td></tr>
<tr><td>4</td><td>Course Learning Outcome (CLO)</td><td colspan="3">This Course will enable the students to:
• Understand the basic information about fishery, culture and harvesting methods of fishes, prawn and pearls
• Learn about beekeeping and managing beehives for honey production and pollination.
• Understand the biology and varieties of silkworms and the basic techniques of harvesting of cocoons and silk production.
• Gain knowledge of poultry rearing and vermicompost technology and its applications.
• Comprehend the economic perspectives of applied zoology.</td></tr>
<tr><td>5</td><td>Credit Value</td><td>3C</td><td colspan="2">1 credit =15 Hours – Learning and Observation</td></tr>
<tr><td>6</td><td>Total Marks</td><td colspan="2">Maximum Marks :100</td><td>Minimum Passing Marks:40</td></tr>
<tr><td colspan="5">Part B: Content of the Course</td></tr>
<tr><td colspan="5">Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)</td></tr>
<tr><td>Unit</td><td colspan="3">Topics (COURSE CONTENTS)</td><td>No. of Periods</td></tr>
<tr><td>I</td><td colspan="3">Aqua Culture: General Introduction. Prawn culture: Culture of fresh water prawn; culture of marine prawn; preparation of farm. preservation and processing of prawn. Export of prawn. Pearl Culture. Fish Culture: Breeding Pond, Hatchery, Fish Seed, Harvesting, preservation of fish. Composite fish farming. Common fish diseases.</td><td>14</td></tr>
</table>

II	**Apiculture:** Species of honey bees in India. Life history of *Apis*. Methods of Bee keeping, Extraction of honey, Bee products and their uses. Natural enemies and their control. Medicinal value of honey; bee products.	12
III	**Lac culture:** Lac insect and its life cycle. Cultivation of lac insect, host plants, processing and uses of lac. **Sericulture:** Silkworms and their host plants, Life Cycle of silkworm, Mulberry silkworm culture, Types of silk, Natural enemies and their control.	12
IV	**Poultry:** Types of breeds. Rearing method. Incubation and hatching of eggs. Methods of brooding and Rearing, Debeaking. Feed formulations for chicks, Nutritive value of egg and meet. Diseases and control measures.	12
V	**Vermiculture:** Biology of *Eisenia foetida*. Rearing of earthworms, Equipments and devices used in vermiculture, Vermicompost Technology. Methods and products, Vermiwash Collection, Composition and use.	10

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Shukla, G.S. and Upadhyaya, V.B. (1999-2000). Economic Zoology (Rastogi Publishers).
2. Mani, M.S. (2006). Insects, NBT, India.
3. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
4. Shrivastava, C.B.L. (1999). Fishery Science and Indian Fisheries. Kitab Mahal Publication.
5. Sardar Singh, Bee keeping in India, Indian Council of Agricultural research, New Delhi.
6. Dhyansingh Bisht, Apiculture, ICAR Publication.
7. Ahasan J., Sinha S.P. (2010). Handbook of Economic Zoology, S. Chand publication.

Reference Books :

1. Prost, P.J. (1962) Apiculture. Oxford and IBH, New Delhi
2. Sericulture, FAO Manual of Sericulture. And Habiger Publishers.
3. Knobil, E. and Neill, J.D (2006). The physiology of Reproduction, Vol. II, ELSVIER Publisher.
4. Hafez, E.S.E (1962). Reproduction in Farm animals, Lea

Online Resources: (e- Resources/ e- Books/ e- Learning Portals):

1. https://sist.sathyabama.ac.in/sist_coursematerial/upload/SVT1608.pdf
2. https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf.

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **75 Marks** **Continuous Comprehensive Evaluation (CCE):** **15 Marks** **Semester End Exam (SEE):** **60 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Course Code: BZOL502 (DSE03) Applied Zoology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - V**		**Session:**2024-2025
1	Course Code	**BZOL502**		
2	Course Title	Applied Zoology		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the basic information about fishery, culture and harvesting methods of fishes, prawn and pearls • Learn about beekeeping and managing beehives for honey production and pollination. • Understand the biology and varieties of silkworms and the basic techniques of harvesting of cocoons and silk production. • Gain knowledge of poultry rearing and vermicompost technology and its applications. • Comprehend the economic perspectives of applied zoology.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S. No.	**List of Experiments**
1.	Morphological characterization of common fish species.
2.	Mounting of the sting apparatus.
3.	Castes (through charts/specimens) study of bees
4.	Worker honey bee with emphasis on leg modifications (through specimens/charts)
5.	Life cycle of mulberry silkworm, *Bombyx mori* (model/chart/specimens)

6.	Test for good quality eggs (Floating test, cracking test) and for fertilized andunfertilized eggs (Light test, Cracking test).
7.	External morphology of poultry birds (model).
8.	Project report on visit to Poultry farm (Poultry management and Poultry breeds).

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Upadhyay, Economic Zoology 2. Salvamani, V.R. Mahadevan, R.K. Aquaculture Trends and Issues. 3. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 1. https://sist.sathyabama.ac.in/sist_coursematerial/upload/SVT1608.pdf 2. 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:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
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FOUR YEAR UNDERGRADUATE PROGRAM
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Course Code: BZO503 (DSE04) Animal Behaviour

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc.	**Semester - V**	**Session:**2024-2025
1	Course Code	**BZO503**		
2	Course Title	Animal Behaviour		
3	Course Type	Discipline Specific elective		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the concept and principles of biological evolution. • Understand types of animal behaviour and their importance to the organisms. • Enhance their observation, analysis, interpretation and documentation skills by taking short projects pertaining to Animal behaviour. • Relate animal behaviour with other subjects such as Animal biodiversity, Evolutionary biology, Ecology, Conservation biology and Genetic basis of the behaviour.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	Scope and importance of animal behaviour study. Ethology: History and branches. Stimulus: Definition, Types of stimuli (internal and external). Pattern of behaviuor: Foreging, aggressive, territorial, stereotype (taxis, kinesis and reflexes). Types of Reflexes. Neural and hormonal control of behavior.	12

II	Innate or instinctive behaviour: Definition and characteristics, innate releasing mechanism and action specific energy. Biological clocks:Advantages of biological rhythms.Bird migration, navigation and orientation.	10
III	Learning Behaviour: Classical conditioning (Pavlov experiment). Types of conditioning: forward, backward, simultaneous and temporal conditioning. Properties of conditioning: generalization, discrimination, extinction, recovery from extinction, acquisition, reinforce, positive and negative. Habituation. Instrumental learning (trial and error). Fillial and sexual Imprinting. Reasoning and insight learning. Neural mechanism of learning.	14
IV	Social behaviour: Social organi9sation in honey bee and primates. Elements of socio-biology: Eusociolity, Selfishness, co-operation, Altruism and kingship, Communication: Chemical, visual, light, tactile and audio.	12
V	Evolutionary aspects of behaviour: Feeding straitagies, mimicry and coloration, evolution of reproductive behaviour. Theory of sexual selection, Mate selection and courtship behaviour Secondary sex characteritics, parental care in fish and amphibia.	12

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Reena Mathur. Animal Behaviour: A text Book for University Student, Sixth Edition, 2021, Rastogi Publication.
2. Harjindra Singh. A Text Book of Animal Behaviour. 3rd Edition (2003). Anmol Publication.
3. M.M. Ranga, Animal Behaviour. Published by Student Edition.
4. McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited,London, UK.
5. Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6th edition) Cambridge, University Press, UK.
6. Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA.

Reference Books :

1. Sherman, P. W. and Alcock, J. (2013) Exploring Animal Behaviour (6th edition) Sinauer Associate Inc., Massachusetts, USA.
2. Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and BarlettPublishers.
3. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.bbau.ac.in/dept/dz/TM/ZL%20202%20Animal%20Behaviour.pdf

https://www.khanacademy.org/science/ap-biology/ecology-ap/responses-to-the-environment/a/intro-to-animal-behavior

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **75 Marks**

Continuous Comprehensive Evaluation (CCE): **15 Marks**

Semester End Exam (SEE): **60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

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Course Code: BZOL503 (DSE04) Animal Behaviour

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - V**		**Session:**2024-2025
1	Course Code	**DSE04**		
2	Course Title	Animal Behaviour		
3	Course Type	Discipline Specific Elective Lab. Course (DSE08)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn the concept and principles of biological evolution. • Understand types of animal behaviour and their importance to the organisms. • Enhance their observation, analysis, interpretation and documentation skills by taking short projects pertaining to Animal behaviour. • Relate animal behaviour with other subjects such as Animal biodiversity, Evolutionary biology, Ecology, Conservation biology and Genetic basis of the behaviour.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	List of Experiments
1.	Nests and nesting habits of the birds and social insects
2.	To study geotaxis behaviour in earthworm.
3.	To study the phototaxis behaviour in insect larvae/earth worm.
4.	Study of conditioning behaviour in fishes.
5.	Study of habituation in milliped.
6.	Study of circadian functions in humans (daily eating, sleep and temperature patterns).

7.	Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park/Zoo to study Animal behaviour and prepare a short report.

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Reena Mathur. Animal Behaviour: A text Book for University Student, Sixth Edition, 2021, Rastogi Publication.
2. Harjindra Singh. A Text Book of Animal Behaviour. 3rd Edition (2003). Anmol Publication.
3. M.M. Ranga, Animal Behaviour. Published by Student Edition.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.bbau.ac.in/dept/dz/TM/ZL%20202%20Animal%20Behaviour.pdf

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

COURSE CODE: GEC05 Biochemistry and Histology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - V		**Session:** 2024-2025
1	Course Code	**GEC05**		
2	Course Title	Biochemistry and Histology		
3	Course Type	General Elective Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Know about the importance and scope of biochemistry. • Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids. • Understand the histological structure and function of different tissues. • Comprehend the concept of enzyme, its mechanism of action and regulation. • Learn the preparation of models of biomolecules.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

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DEPARTMENT OF ZOOLOGY
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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Biochemistry of Carbohydrates:** Introduction, scope and importance of Biochemistry. **Carbohydrate:** Structure and biological importance. Classification: Monosaccharides, Oligosaccharides (Disaccharides), Polysaccharides. Metabolism of carbohydrates, Glycolysis, Krebs cycle, Electron transport chain and ATP synthesis. Gluconeogenesis, Glycogenolysis and Glycogenesis.	12
II	**Biochemistry of Lipids:** Lipid structure and Biological significance. **Fatty acids:** Types and Classification- Triglycerides, Phospholipids, Sphingolipids, Cholesterol, β- oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms. Ketogenesis.	12
III	**Biochemistry of proteins:** Structure and biological significance of proteins. **Amino acids:** Structure, classification and properties, Essential and non-essential amino acids. Catabolism of amino acids: Transamination, Deamination, Urea cycle. **Enzymes:** General properties, Nomenclature and classification: specificity, cofactors, isozymes, Mechanism of enzyme action, Regulation of enzyme activity	12
IV	**Histology:** Introduction to tissues. **Epithelial tissue:** types, structure and characteristics. **Connective tissue:** Structure and function of loose, dense and adipose tissue. Structure and function of Blood plasma, blood cells, lymph and Stem cell. **Cartilage and bone:** classification, and fine structure.	12
V	**Muscular tissue:** Ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. **Nerve Tissue:** Structure and classification of neurons. Types of supporting (glial) cells and their function. Myelin sheath and its formation. Types of sensory nerve endings. Degeneration and regeneration of neurons. Membranes of the brain and spinal cord.	12

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

4. Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition)Worth.
5. Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry(5th edition) Wiley.
6. Sangeeta M., Varalakshmi K.L. and Jyothi N. Nayak (2023) Text Book of Histology for Undergraduate. (2nd Edition) Medone Media.

Reference Books :

3. Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman.
4. Zubay, G. (2017) Biochemistry (4th edition) McGraw-Hill.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/biochemistry

https://www.kenhub.com/en/library/anatomy/introduction-to-histology

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **75 Marks** **Continuous Comprehensive Evaluation (CCE):** **15 Marks** **Semester End Exam (SEE):** **60 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Lab Course: GECL05 Biochemistry and Histology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - V**		**Session:**2024-2025
1	Course Code	**GECL05**		
2	Course Title	Biochemistry and Histology		
3	Course Type	General elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Know about the importance and scope of biochemistry. • Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids. • Understand the histological structure and function of different tissues. • Comprehend the concept of enzyme, its mechanism of action and regulation. • Learn the preparation of models of biomolecules.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S. No.	**List of Experiments**
1.	Study of permanent slides of different tissues.
2.	Biochemical detection of Carbohydrate, Protein and Lipid.
3.	Determination of acid value of oil.
4.	Blood group detection (A, B, AB, O)
5.	R. B. C. and W.B.C count

6.	Blood coagulation time
7.	Preparation of hematin crystals from blood sample

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
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	14. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

4. Practical Biochemistry By Damodaran Geetha K. Publisher: Jaypee Brothers Ltd Pvt.
5. Essentials of Practical Biochemistry by Gupta Prem Prakash. Jaypee Brothers Medical Publishers.
6. Histological Techniques A Practical Manual by K. Lakshminarayanan (2020). Bhalani Publishing House

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.amazon.in/PRACTICAL-BOOK-BIOCHEMISTRY-CLINICAL-PATHOLOGY/dp/B0D44Q89MD

https://bookforest.in/products/histology-practical-manual-3rd-edition?sku_id=50937951&gad_source=1&gclid=Cj0KCQjw-ai0BhDPARIsAB6hmP4gpkRECVQOelavluya7prcQcetWqfJBNZvcMJhqylCK8K3dOHCw2UaAgEJEALw_wcB

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Course Code: GEC06 Evolution

<table>
<tr><td colspan="4">Part A: Introduction</td></tr>
<tr><td colspan="2">Program: Bachelor in Science (Bio Group)
Certificate/diploma/degree/honors</td><td>Class: B. Sc. Semester - V</td><td>Session:2024-2025</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="2">GEC06</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="2">Evolution</td></tr>
<tr><td>3</td><td>Course Type</td><td colspan="2">General Elective Course</td></tr>
<tr><td>4</td><td>Course Learning Outcome (CLO)</td><td colspan="2">This Course will enable the students to:
• Acquire an in-depth knowledge on the diversity and relationships in animalworld.
• Develop a holistic appreciation on the phylogeny and adaptations in animals.
• Enable the students to understand the evolution of universe and life.
• Understanding on the process and theories in evolutionary biology.
• Develop an interest in the debates and discussion taking place in the field ofevolutionary biology.</td></tr>
<tr><td>5</td><td>Credit Value</td><td>3C</td><td>1 credit =15 Hours – Learning and Observation</td></tr>
<tr><td>6</td><td>Total Marks</td><td colspan="2">Maximum Marks :100</td><td>Minimum Passing Marks:40</td></tr>
</table>

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DEPARTMENT OF ZOOLOGY
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Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Life's Beginnings: Big-bang, Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes; Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism. Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesising machinery, three domains of life, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c; Sources of variations: Heritable variations and their role in evolution.	12
II	Hardy-Weinberg Law, Evolutionary forces upsetting H-W equilibrium: Natural selection Genetic Drift, Role of Migration and Mutation in changing allele frequencies.	10
III	Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches; Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction	14
IV	Phylogenetic tree: Introduction, Types of phylogenetic tree, Methods and Steps (Character based method and distance based method) of Phylogenetic tree construction and interpretation of trees. Significance and limitations of phylogenetic tree.	14
V	Origin and evolution of man and Horse	**10**

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Ridley, M (2004) Evolution (3rd edition) Blackwell publishing
2. Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and BarlettPublishers
3. Campbell, N.A. and Reece J.B (2011) Biology (9th edition) Pearson, Benjamin,Cummings
4. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates.
5. Pevsner, J. (2009) Bioinformatics and Functional Genomics (2nd edition) Wiley-Blackwell.

Reference Books :

1. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates.
2. Pevsner, J. (2009) Bioinformatics and Functional Genomics (2nd edition) Wiley-Blackwell.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://evolution.berkeley.edu/evolution-101/mechanisms-the-processes-of-evolution/

https://www.ncbi.nlm.nih.gov/books/NBK230201/

https://byjus.com/biology/evolution-brief-account/

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
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Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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Lab Course: GECL06 Evolution

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester - V**		**Session:**2024-2025
1	Course Code	**GECL06**		
2	Course Title	Evolution		
3	Course Type	General Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Acquire an in-depth knowledge on the diversity and relationships in animalworld. • Develop a holistic appreciation on the phylogeny and adaptations in animals. • Enable the students to understand the evolution of universe and life. • Understanding on the process and theories in evolutionary biology. • Develop an interest in the debates and discussion taking place in the field ofevolutionary biology.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Study of fossils from models/ pictures.
2.	Study of evolution from models/pictures.
3.	Study of homology and analogy from suitable specimens/picture/models.
4.	Study and verification of Hardy-Weinberg Law by chi square analysis.

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COURSE CURRICULUM 2024-25

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Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. Ridley, M (2004) Evolution (3rd edition) Blackwell publishing 2. Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and BarlettPublishers 3. Campbell, N.A. and Reece J.B (2011) Biology (9th edition) Pearson, Benjamin,Cummings 4. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates. 5. Pevsner, J. (2009) Bioinformatics and Functional Genomics (2nd edition) Wiley-Blackwell. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.ncbi.nlm.nih.gov/books/NBK230201/ https://byjus.com/biology/evolution-brief-account/

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COURSE CURRICULUM 2024-25

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Course Code: BZO601 (DSC06) Reproductive and Developmental Biology

<table>
<tr><td colspan="4">Part A: Introduction</td></tr>
<tr><td colspan="2">Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors</td><td>Class: B. Sc. Semester - VI</td><td>Session:2024-2025</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="2">BZO601</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="2">Reproductive and Developmental Biology</td></tr>
<tr><td>3</td><td>Course Type</td><td colspan="2">Discipline Specific Course (DSC)</td></tr>
<tr><td>4</td><td>Course Learning Outcome (CLO)</td><td colspan="2">This Course will enable the students to:
• Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology.
• Describe the gonadal hormones and the mechanism of hormones action in reproduction.
• Explain the development of multicellular organisms from a single cell zygote.
• Describe the history and different stages of embryonic development and its implications.
• Identify the various developmental stages and the possible defects in growth.</td></tr>
<tr><td>5</td><td>Credit Value</td><td>3C</td><td>1 credit =15 Hours – Learning and Observation</td></tr>
<tr><td>6</td><td>Total Marks</td><td>Maximum Marks :100</td><td>Minimum Passing Marks:40</td></tr>
<tr><td colspan="4">Part B: Content of the Course</td></tr>
<tr><td colspan="4">Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)</td></tr>
<tr><td colspan="2">Unit</td><td colspan="1">Topics (COURSE CONTENTS)</td><td>No. of Periods</td></tr>
<tr><td colspan="2">I</td><td colspan="1">Structure and function of Male reproductive system
Structure and function of Female reproductive system</td><td>12</td></tr>
</table>

II	**Oogenesis:** Origin of germ primordial cell in mammal, yolk formation, physico-chemical nature of yolk, function of yolk, Types of eggs. Process of oogenesis **Spermatogenesis:** Origin of germ primordial cell in mammal, formation of spermatids, spermiogenesis. **Fertilization:** mechanism of fertilization, activation of ovum, amphimixis, post fertilization changes in egg, types and significance if fertilization.	12
III	**Cleavage:** types and patterns. Peculiarities of cell division involved in cleavage, significance of cleavage. **Morulation and Blastulation:** Blastulation in Amphioxus, Frog and Chick. Fate Map.	12
IV	**Gastrulation:** Germ layer differentiation. Epiboly, emboly/ invagination, involution. **Extraembryonic membrane in chick.** **Tubulation.**	12
V	**Embryonic induction:** Experimental evidences to induction, Characteristics of organizer, Types of organizers, Genic and Gradient theory of induction. **Competence:** Molecular biology of competence.	12

Name & Signature of Members of Board of Studies

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Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,Williams & Wilkins, Baltimore.
2. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's HumanEmbryology (5th edition) Elsevier.
3. Gilbert, S.F. (2016) Developmental Biology (11th edition) Sinauer.
4. Sastry, K.V. and Shukla Vinita (2018) Developmental Biology (2nd Revised Edition) Rastogi Publication.
5. Verma, P.S. and Agrawal V.K. (2014) Chordate Embryology (Developmental Biology) 4th Edition. S. Chand Publication.

Reference Books :

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2. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's HumanEmbryology (5th edition) Elsevier.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=254

https://www.sciencedirect.com/topics/medicine-and-dentistry/reproductive-biology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern **-FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

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Lab Course: BZOL601 (DSC) Reproductive and Developmental Biology

Part A: Introduction				
Internal Assessment: Continuous Comprehensive Evaluation(CCE)		Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks		Best of test and Assignment shall be considered against 15 marks
1	Course Code	**BZOL601**		
2	Course Title	Reproductive and Developmental Biology		
3	Course Type	Discipline Specific Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology. • Describe the gonadal hormones and the mechanism of hormones action in reproduction. • Explain the development of multicellular organisms from a single cell zygote. • Describe the history and different stages of embryonic development and its implications. • Identify the various developmental stages and the possible defects in growth.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Identification of stages of oogenesis & spermatogenesis.
2.	Histological study of gonads through permanent slides in vertebrates.
3.	Study of extra-embryonic membrane in chick.
4.	Study of embryological slides of Amphioxus/frog/chick.

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,Williams & Wilkins, Baltimore.
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5. Verma, P.S. and Agrawal V.K. (2014) Chordate Embryology (Developmental Biology) 4th Edition. S. Chand Publication.

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https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=254
https://www.sciencedirect.com/topics/medicine-and-dentistry/reproductive-biology

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2024-25

Course Code: BZO602 (DSE05) Ecology

<table>
<tr><td colspan="4">Part A: Introduction</td></tr>
<tr><td colspan="2">Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors</td><td>Class: B. Sc. Semester - VI</td><td>Session:2024-2025</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="2">BZO602</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="2">Ecology</td></tr>
<tr><td>3</td><td>Course Type</td><td colspan="2">Discipline Specific Elective (DSE</td></tr>
<tr><td>4</td><td>Course Learning Outcome (CLO)</td><td colspan="2">This Course will enable the students to:
1. Know the evolutionary and functional basis of animal ecology.
2. Understand what makes the scientific study of animal ecology a crucial and exciting endeavor.
3. Engage in field-based research activities to understand well the theoretical aspectstaught besides learning techniques for gathering data in the field.
4. Analyse a biological problem, derive testable hypotheses and then design experimentsand put the tests into practice.
5. Solve the environmental problems involving interaction of humans and naturalsystems at local or global level.</td></tr>
<tr><td>5</td><td>Credit Value</td><td>3C</td><td>1 credit =15 Hours – Learning and Observation</td></tr>
<tr><td>6</td><td>Total Marks</td><td>Maximum Marks :100</td><td>Minimum Passing Marks:40</td></tr>
</table>

<table>
<tr><td colspan="3">Part B: Content of the Course</td></tr>
<tr><td colspan="3">Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)</td></tr>
<tr><td>Unit</td><td>Topics (COURSE CONTENTS)</td><td>No. of Periods</td></tr>
<tr><td>I</td><td>Introduction and scope of Ecology. Multidisciplinary relevance in current perspective. Structure and function of ecosystem; Major ecosystems of the world. Energy flow in ecosystem, food chain and food web. Productivity.</td><td></td></tr>
</table>

II	Ecology of populations: Characteristics and attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves. Unique and group attributes of population: mortality, age ratio, sex ratio, dispersal. Factors regulating population dispersal and growth: Exponential and logistic growth. Population regulation: density-dependent and independent factors; r and K strategies.	
III	Community characteristics: stratification; Dominance, diversity, species richness, abundance,Evenness, Similarity. Ecotone and edge effect; Types of interaction: Positive interactions: Commensalism, proto-cooperation and mutualism. Negative interactions: parasitism and allelopathy; predation and predator-prey dynamics.Interspecific competition and coexistence, Inter and intra-specific; abundance.Niche overlap and segregation. Gause's Principle with laboratory and field examples.	
IV	Ecological succession: Definition, Process, types, theories of succession. Pollution: Air, water and noise pollution and their control; Naturalresources: Mineral, water and forest, their significance and conservation; Types of biodiversity, Hotspots, threat and conservation strategies of biodiversity.	
V	Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Environmental ethics; Environmental movements: Bishnois. Chipko, Silent valley, Big dam movements. Environmental education and public awareness,	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Colinvaux, P. A. (1993) Ecology (2nd edition) Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001) Ecology (6th edition) Benjamin Cummings.
3. Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole.
4. Ricklefs, R.E. (2000) Ecology (5th edition) Chiron Press.
5. Southwood, T.R.E. and Henderson, P.A. (2000) Ecologial Methods (3rd edition)Blackwell Sci.
6. Kendeigh, F C. (1984) Ecology with Special Reference to Animal and Man. PrenticeHall Inc.
7. Stiling, P. D. (2012) Ecology Companion Site: Global Insights and Investigations.McGraw Hill Education.

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Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://byjus.com/biology/ecology/

https://www.merriam-webster.com/dictionary/ecology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **75 Marks**

Continuous Comprehensive Evaluation (CCE): **15 Marks**

Semester End Exam (SEE): **60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

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Lab Course: BZOL602 Ecology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - VI		**Session:**2024-2025
1	Course Code	**BZOL602**		
2	Course Title	Ecology		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Know the evolutionary and functional basis of animal ecology. • Understand what makes the scientific study of animal ecology a crucial and exciting endeavor. • Engage in field-based research activities to understand well the theoretical aspectstaught besides learning techniques for gathering data in the field. • Analyse a biological problem, derive testable hypotheses and then design experimentsand put the tests into practice. • Solve the environmental problems involving interaction of humans and naturalsystems at local or global level.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Constructing a food web by observing and collecting organisms from a given area.
2.	Estimation of Population Density, Frequency, and abundance in given habitat.
3.	Studying animal diversity in a habitat.
4.	Study of Ecosystem through models/ pictures/field visit.
5.	Study of pollution of different ecosystem through personal observation.
6.	Study of pollution indicator species in given samples.

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COURSE CURRICULUM 2024-25

Name & Signature of Members of Board of Studies

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https://www.merriam-webster.com/dictionary/ecology

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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Course Code: BZO603 (DSE06) Chronobiology

<table>
<tr><td colspan="4">Part A: Introduction</td></tr>
<tr><td colspan="2">Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors</td><td>Class: B. Sc. Semester - VI</td><td>Session:2024-2025</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="2">BZO603</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="2">Chronobiology</td></tr>
<tr><td>3</td><td>Course Type</td><td colspan="2">Discipline Specific Elective (DSE06)</td></tr>
<tr><td>4</td><td>Course Learning Outcome (CLO)</td><td colspan="2">This Course will enable the students to:
• Learn about the Biological Clocks and its importance.
• Study how Biological Rhythm influence animal behaviour.
• Interpreting the cause and effect of lifestyle disorders.
• Understand Social and Sexual Behaviour of animals.
• Comprehend the Behaviour Patterns of human and animals.</td></tr>
<tr><td>5</td><td>Credit Value</td><td>3C</td><td>1 credit =15 Hours – Learning and Observation</td></tr>
<tr><td>6</td><td>Total Marks</td><td>Maximum Marks :100</td><td>Minimum Passing Marks:40</td></tr>
<tr><td colspan="4">Part B: Content of the Course</td></tr>
<tr><td colspan="4">Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)</td></tr>
</table>

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Introduction to Chronobiology. Historical developments in chronobiology, Biological Oscillation: the concept of Average, amplitude, phase and period. Adaptive significance of biological clocks. Scope of Chronobiology.	12
II	Biological Rhythm, Characteristics of biological rhythms; Short-and Long-term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Supra-chaismatic nucleus as mammalian circadian clock.	14

III	Concept of synchronization and masking; Photic and nonphotic zeitgebers; Circannual rhythms; Photoperiod and regulation of seasonal reproduction of vertebrates; Role of melatonin.	14
IV	Hormonal biorhythms and their significance: adrenocortical, pineal and prolactin. Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep-wakefulness cycle. Body temperature rhythm. Time keeping genes. Jet-lag and shift work	14
V	Chronopharmacology: General history, significane and Applications Chronotherapeutics, Chrnokinetics, Chronesthesy, Chronergy and Chronotoxicity. Chronomedicine.	06

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended:

1. Insect Photoperiodism: Stanley D. Beck, Academic Press, New York and London
2. Chapter 1, The Clocks that Time Us, Moore-Ede, MC, Sulzman, FM and Fuller, CA (1982) Harvard University Press, Cambridge.
3. C. S. Pittendrigh, S. Daan (1976c) A functional analysis of circadian pacemakers in nocturnal rodents. V. Pacemaker structure: a clock for all seasons. J. Comp. Physiol. [A]106:333-355.
4. M. Menaker (1968) Extraretinal light perception in the sparrow. I. Entrainment of the biological clock. Proc. Natl. Acad. Sci. 59:414-421.
5. J.C. Dunlap (1999) Molecular bases for circadian clocks. Cell 96:271-290.

Reference Books:

1. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
2. The Physiological Clock (3rd edition), Erwin Bunning, The English Universities Press Ltd. London, Springer- Verlag New York, Berlin Heidelberg
3. Circadian Physiology: Roberto Refinetti, CRC Press (3rded) 2016.
4. Introducing Biological Rhythms: Willard L. Koukkari, Robert B. Sothern, 2006, Springer
5. Biological Timekeeping: Clock, Rhythms and Behaviour, Vinod Kumar (ed. 2017) Springer India Pvt Limited.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.sciencedirect.com/topics/neuroscience/chronobiology

https://www.sciencedirect.com/topics/neuroscience/chronobiology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **75 Marks**

Continuous Comprehensive Evaluation (CCE): **15 Marks**

Semester End Exam (SEE): **60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

Name & Signature of Members of Board of Studies

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COURSE CURRICULUM 2024-25

Lab Course: BZOL603 (DSE06)

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - VI		**Session:**2024-2025
1	Course Code	**BZOL602**		
2	Course Title	Chronobiology		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Learn about the Biological Clocks and its importance. • Study how Biological Rhythm influence animal behaviour. • Interpreting the cause and effect of lifestyle disorders. • Understand Social and Sexual Behaviour of animals. • Comprehend the Behaviour Patterns of human and animals.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Circadian changes in the volume of nuclei in onion peel (Allium cepa) cells (microscopic observation)
2.	Observation of leaf movement of a plant on circadian and longitudinal time scales
3.	Study of circadian functions in human (daily eating, sleep and temperature patterns).

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. Insect Photoperiodism: Stanley D. Beck, Academic Press, New York and London 2. Chapter 1, The Clocks that Time Us, Moore-Ede, MC, Sulzman, FM and Fuller, CA (1982) Harvard University Press, Cambridge. 3. C. S. Pittendrigh, S. Daan (1976c) A functional analysis of circadian pacemakers in nocturnal rodents. V. Pacemaker structure: a clock for all seasons. J. Comp. Physiol. [A]106:333-355. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.sciencedirect.com/topics/neuroscience/chronobiology https://www.sciencedirect.com/topics/neuroscience/chronobiology
Part D: Assessment and Evaluation
Suggested Continuous Evaluation Methods: **Maximum Marks: 25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**

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Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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Course Code: GEC07 Reproductive and Developmental Biology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - VI		**Session:**2024-2025
1	Course Code	**GEC07**		
2	Course Title	Reproductive and Developmental Biology		
3	Course Type	General Elective Course (GEC)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology. • Describe the gonadal hormones and the mechanism of hormones action in reproduction. • Explain the development of multicellular organisms from a single cell zygote. • Describe the history and different stages of embryonic development and its implications. • Identify the various developmental stages and the possible defects in growth.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	Structure and function of Male reproductive system Structure and function of Female reproductive system	12

II	**Oogenesis:** Origin of germ primordial cell in mammal, yolk formation, physico-chemical nature of yolk, function of yolk, Types of eggs. Process of oogenesis **Spermatogenesis:** Origin of germ primordial cell in mammal, formation of spermatids, spermiogenesis. **Fertilization:** mechanism of fertilization, activation of ovum, amphimixis, post fertilization changes in egg, types and significance if fertilization.	12
III	**Cleavage:** types and patterns. Peculiarities of cell division involved in cleavage, significance of cleavage. **Morulation and Blastulation:** Blastulation in Amphioxus, Frog and Chick. Fate Map.	12
IV	**Gastrulation:** Germ layer differentiation. Epiboly, emboly/ invagination, involution. **Extraembryonic membrane in chick.** **Tubulation.**	12
V	**Embryonic induction:** Experimental evidences to induction, Characteristics of organizer, Types of organizers, Genic and Gradient theory of induction. **Competence:** Molecular biology of competence.	12

Name & Signature of Members of Board of Studies

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

6. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,Williams & Wilkins, Baltimore.
7. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's HumanEmbryology (5th edition) Elsevier.
8. Gilbert, S.F. (2016) Developmental Biology (11th edition) Sinauer.
9. Sastry, K.V. and Shukla Vinita (2018) Developmental Biology (2nd Revised Edition) Rastogi Publication.
10. Verma, P.S. and Agrawal V.K. (2014) Chordate Embryology (Developmental Biology) 4th Edition. S. Chand Publication.

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3. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,Williams & Wilkins, Baltimore.
4. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's HumanEmbryology (5th edition) Elsevier.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=254

https://www.sciencedirect.com/topics/medicine-and-dentistry/reproductive-biology

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

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Lab Course: GECL07 Reproductive and Developmental Biology

Part A: Introduction			
Internal Assessment: Continuous Comprehensive Evaluation(CCE)		Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
1	Course Code	**GECL07**	
2	Course Title	Reproductive and Developmental Biology	
3	Course Type	General Elective Lab. Course	
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology. • Describe the gonadal hormones and the mechanism of hormones action in reproduction. • Explain the development of multicellular organisms from a single cell zygote. • Describe the history and different stages of embryonic development and its implications. • Identify the various developmental stages and the possible defects in growth.	
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**
6	Total Marks	Maximum Marks :25	Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Identification of stages of oogenesis & spermatogenesis.
2.	Histological study of gonads through permanent slides in vertebrates.
3.	Study of extra-embryonic membrane in chick.
4.	Study of embryological slides of Amphioxus/frog/chick.

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Name & Signature of Members of Board of Studies

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Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

6. Thomas W.S. (2014) Langman's Medical Embryology (13th edition) Lippincott,Williams & Wilkins, Baltimore.
7. Gary C.S.; Steven B.B.; Philip R.B. and Philippa H.F. (2014) Larsen's HumanEmbryology (5th edition) Elsevier.
8. Gilbert, S.F. (2016) Developmental Biology (11th edition) Sinauer.
9. Sastry, K.V. and Shukla Vinita (2018) Developmental Biology (2nd Revised Edition) Rastogi Publication.
10. Verma, P.S. and Agrawal V.K. (2014) Chordate Embryology (Developmental Biology) 4th Edition. S. Chand Publication.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.eshiksha.mp.gov.in/mpdhe/course/view.php?id=254
https://www.sciencedirect.com/topics/medicine-and-dentistry/reproductive-biology

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
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COURSE CURRICULUM 2024-25

Course Code: GEC08 Food Nutrition and Health

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - VI		**Session:**2024-2025
1	Course Code	**GEC08**		
2	Course Title	**Food Nutrition and Health**		
3	Course Type	General Elective Course (GEC)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the role of food and nutrients in health and disease. • Provide culturally competent nutrition services for diverse individuals. • Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients andgroups. • Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas. • Understand the principles and practices of food safety to prevent foodborne illnesses.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Basic concept of Food:** Components and nutrients. Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing, mothers, infants, school children, adolescents and elderly people.	**12**

II	**Nutritional Biochemistry:** Macronutrients. Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Micronutrients. Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals viz., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.	12
III	**Definition and concept of health:** Common nutritional deficiency diseases- Protein malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention and government initiatives, if any.	12
IV	**Life style dependent diseases-** hypertension, diabetes mellitus, and obesity- their causes and prevention. Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention. Other ailments viz., cold, cough, and fever, their causes and treatment.	12
V	**Food hygiene:** Potable water- sources and methods of purification at domestic level. Food and Water-borne infections: Bacterial diseases: cholera, dysentery; typhoid fever, viral diseases: Hepatitis, Poliomyelitis etc., Protozoan diseases: amoebiasis, giardiasis; Parasitic diseases: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. Causes of food spoilage and its prevention.	**12**

Name & Signature of Members of Board of Studies

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Subject Expert	1. Dr. Divya K. Minj
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Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed;; New Age International Publishers
2. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
3. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
4. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition;Oxford & IBH Publishing Co. Pvt Ltd.
5. Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing.

Reference Books :

1. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
2. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed;McGraw Hill.
3. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.
4. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New AgeInternational (P) Ltd.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.who.int/news-room/fact-sheets/detail/healthy-diet

https://www.nhsinform.scot/healthy-living/food-and-nutrition/eating-well/health-benefits-of-eating-well/

https://www.health.harvard.edu/topics/nutrition

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **75 Marks**

Continuous Comprehensive Evaluation (CCE): **15 Marks**

Semester End Exam (SEE): **60 Marks**

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Section** A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 01x02 = 02 x 5unit = 10 Marks Section-C: Short answer type question 03 x 5 unit = 15 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks **Total = 60 Marks**	

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Lab Course: GECL08 Food, Nutrition and Health

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		**Class:** B. Sc. **Semester** - VI		**Session:**2024-2025
1	Course Code	**GECL08**		
2	Course Title	Food, Nutrition and Health		
3	Course Type	General elective Lab. Course (GECL)		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the role of food and nutrients in health and disease. • Provide culturally competent nutrition services for diverse individuals. • Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients andgroups. • Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas. • Understand the principles and practices of food safety to prevent foodborne illnesses.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

S.No.	**List of Experiments**
1.	Datecting adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric.
2.	Estimation of Lactose in milk.
3.	Titrimetric method for Ascorbic acid estimation.
4.	Estimation of Calcium in foods by titrimetry.

5.	Study of the stored grain pests from slides/ photograph (Sitophilus oryzae, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition andDiet Therapy; Fifth Ed;; New Age International Publishers
2. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
3. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
4. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition;Oxford & IBH Publishing Co. Pvt Ltd.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.who.int/news-room/fact-sheets/detail/healthy-diet
https://www.nhsinform.scot/healthy-living/food-and-nutrition/eating-well/health-benefits-of-eating-well/

https://www.health.harvard.edu/topics/nutrition

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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