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

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<u>Courses(With Practical) of 4Credit</u> <u>3C for Theory + 1C for Practical</u>

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

SomCodeTitleSem.CodeTitleCodeTitle1 $BZO-101$ Animal Diversity -1 $ -$ 11 $BZO-201$ Animal Diversity -11 $ -$ 11 $BZO-201$ Animal Diversity -11 $ -$ 11 $BZO-201$ Animal Diversity -11 $ -$ 11 $BZO-201$ Animal Diversity -11 $ -$ 11 $BZO-201$ Animal Diversity -11 $ -$ 11 $BZO-201$ Physiology of Vertebrates 111 $BZO-302$ Endocrinology 111 $GEC03$ Physiology of Vertebrates11 $BZO-401$ Cell Biology and Genetic 111 $BZO-402$ Immunology 111 $GEC03$ Biochemistry and Histology11 $BZO-401$ Biochemistry and Histology V $BZO-502$ Applied Zoology $1V$ $GEC05$ Biochemistry and Histology11 $BZO-501$ Biochemistry and Histology V $BZO-502$ Applied Zoology V $GEC05$ Biochemistry and Histology11 $BZO-601$ Biochemistry and Histology V $BZO-602$ Ecology O O O 12 $BZO-603$ V O O O O O O 13			DSC			DSE			GE
BZO-101Animal Diversity -11BZO-201Animal Diversity -111111 <td< th=""><th>Sem.</th><th>Code</th><th>Title</th><th>Sem.</th><th>Code</th><th>Title</th><th>Sem.</th><th>Code</th><th>Title</th></td<>	Sem.	Code	Title	Sem.	Code	Title	Sem.	Code	Title
BZO-201Animal Diversity - II \cdot $ -$	-	BZO-101	Animal Diversity - I	٢	ĸ		-	9	1
BZ(0-301Comparative Anatomy and Physiology of VertebratesIIBZ(0302EndocrinologyIIIGE(03IIBZ(0-401Cell Biology of Vertebrates $1V$ BZ(0-402Immunology $1V$ GE(04BiBZ(0-401Cell Biology and Genetics $1V$ BZ(0-502Applied Zoology $1V$ GE(04BiBZ(0-501Biochemistry and Histology V BZ(0-503Animal Behaviour V GE(05BiBZ(0-501Biochemistry and Histology V BZ(0-503Animal Behaviour V GE(05BiBZ(0-601Brooductive and V_1 BZ(0-602Ecology V_1 GE(07BcBZ(0-601Developmental Biology V_1 BZ(0-603Chronobiology V_1 GE(07Bc	=	BZ0-201	Animal Diversity - II	1	ĩ	12	П	1	а.
BZO-401 Cell Biology and Genetics IV BZO-402 Immunology IV GEC04 Biology BZO-501 BZO-502 Applied Zoology V GEC05 Biology BZO-501 BZO-503 Animal Behaviour V GEC06 Ev GEC06 Ev BZO-601 BZO-602 Evology V BZO-602 Evology V BZO-602 Evology V GEC07 De Poelopmental Biology V BZO-603 Chronobiology V GEC08 Fo GEC08 Ev BZO-601 Evology V BZO-603 Evology V Evology Evology Evology V Evology E	Ξ	BZ0-301	Comparative Anatomy and Physiology of Vertebrates	III	BZ0302	Endocrinology	Ш	GEC03	Comparative Anatomy and Physiology of Vertebrates
BZO-501 Biochemistry and Histology V BZO-502 Applied Zoology V BZO-503 Animal Behaviour V GEC06 BZO-601 Biochemistry and Histology V BZO-503 Animal Behaviour C GEC06 BZO-601 BZO-601 BZO-601 Povelopmental Biology V BZO-603 Chronobiology V GEC07 GEC08 VI BZO-603 Chronobiology V GEC08 VI GEC08 VI BZO-603 Chronobiology VI GEC08 VI C GEC08 V	2	BZO-401		2	BZO-402	Immunology	1V	GEC04	Cell Biology and Genetics
BZO-501 Biochemistry and Histology V BZO-503 Animal Behaviour V GEC06 BZO-601 Reproductive and V1 BZO-602 Ecology V1 GEC07 BZO-601 Developmental Biology V1 BZO-603 Chronobiology V1 GEC08					BZO-502	Applied Zoology		GEC05	Biochemistry and Histology
BZO-601 Reproductive and V1 BZO-603 Ecology VI GEC07 VI Developmental Biology VI BZO-603 Chronobiology GEC08	>	BZ0-501	Biochemistry and Histology	>	BZ0-503	Animal Behaviour	>	GEC06	Evolution
BZ(0-601 Developmental Biology VI BZ(0-603 Chronobiology GEC08			Renroductive and	;	BZO-602	Ecology	1/1	GEC07	Reproductive and Developmental Biology
	1>	BZO-601	Developmental Biology	7	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)

Semeste	Core Course	Discipline Specific Elective	Generic	Ability	CFC/Intounchin/A		
r	(DSC)		Flective (CF)	Thomas and		Value	Total
				ъщапсетепт	renticeship/Project/D	Added	Credits
				Course (AEC)	issertation/Communi	Courses	
					ty Outreach (2)		
	USC A1 (4)		Chonse and	Choose one		Choose one	
Ι	SDC B1 (4)		from a nool of	from a pool of	Choose one from a	from a pool	
	DSC C1 (4)		courses GE 1 (4)	AEC courses	pool of courses (2)	of courses	22
	DSC A2 (A)			(7)		(2)	
	(+) 74 767		Choose one	Choose one		Choose one	
ţ	DSC B2 (4)		from a nool of	from a pool of	Choose one from a	from a pool	
Π	DSC C2 (4)		Colirees GF 2 (4)	AEC courses	pool of courses (2)	of courses	22
-			(L) 7 70 000000	2 (2)		(2)	
Students	exiting shall be av	graduate certificate	(in the field of study/discipline) after securing the	discipline) after	securing the		
minimum	minimum 40 credits in Semester I and II			•	D	Total	44
	DSC A3 (4)			Choose one	Choose one SEC or		
Ĩ	DSC B3 (4)	Choose one from a pool of courses DSE A/B/C (4)	DSE A/B/C (4)	from a pool of	Internship/Apprentice	Choose	
III		Or		courses AEC	ship/Project/Dissertati		22
	DSC C3 (4)	Choose one from a pool of courses GE 3 (4)	GE 3 (4)	(2)	on/Community	pool of	
TX7					Outreach (2)	courses (2)	
IV	USC A4 (4)	Choose one from a pool of courses DSE A/B/C (4)	DSE A/B/C (4)				22
			1				

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	Choose one from a pool of courses (2)	Total									n	Total						
Choose one SEC or	Internship/Apprentice ship/Project/Dissertati on/Community Outreach (2)	curing the minimum	Choose one SEC or	Internship/Apprentice	ship/Project/Dissertati	on/Community Outreach (2)	Choose one SEC or	Internship/Apprentice	ship/Project/Dissertati	on/Community	Outreach (2)	in relevant Discipline						
	Choose one from a pool of courses AEC (2)	iscipline) after se										ciplinary study) i Semester VI	one GE (1x4)	urse Or All			one GE (1x4) urse Or All	
Or	Choose one from a pool of courses GE 4 (4)	80 credits on completion of Semester IV	Choose two from a pool of contrees DSF A /B/C (A+A)	Or	Choose two from a pool of courses GE5 (4) & GE6	(4)	Choose two from a nool of conness DSE A /B /C /A / A/	Or	Choose two from a pool of courses GE 7 (4) & GE 8	(4)		after securing the minimum 120 credits on completion of Semester VI	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)	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)	
DSC B4 (4)	DSC C4(4)	80 credits on completion of Semester IV	DSC A5 (4)	DSC B5 (4)	DSC C5 (4)		DSC A6 (4)	DSC B6 (4)		DSC C6 (4)	Students evitin	af			DSC A/B/C (4)		DSC A/B/C (4)	
	Students	80 credit:		^		1		NI						1111	ΠΛ		IIIA	

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	(Total 16)			
hall be awarde	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	ant Discipline after	Total	172
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)			50
DSC A/B/C (4)	Choose four DSE (1x4) course OR choose one GE (1x4) course	Research Project/Dissertation (12)		20
shall be awarde Disciplin	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	earch) in relevant I	Total	172

Name & Signature of Members of Board of Studies

Subject Expert I. Dr. Divya K. Minj Subject Expert R. P. Minj Subject Expert 2. Dr. Neeru Agrawal VC Nominee 3. Ms. Mausumi Dey VC Nominee 3. Ms. Mausumi Dey Member of other Department 4. Dr. Sanju Sinha Industrial Representative 5. Dr. Alka Mishra Student Nominee 20 Jury cut Student Nominee 20 Jury cut 7. Mr. Anurag Mishra 7. Mr. Anurag Mishra	Chair person/HOD: Dr. Usha Sahu	Departmental Members	
Null 2. Dr. Neeru Agrawal 3. Ms. Mausumi Dey 3. Ms. Mausumi Dey 4. Dr. Sanju Sinha 7. Mr. Sudesh Sahu 4. Mr. Anurag Mishra	Subject Expert	1. Dr. Divya K. Minj	1 min
ufsau Bril	-	2. Dr. Neeru Agrawal	A THIN
ufsau Bril	VC Nominee	3. Ms. Mausumi Dey	I'm with
olysam Brilt	Member of other Department	4. Dr. Sanju Sinha	Condo
Dollysam	Industrial Representative	5. Dr. Alka Mishra	No sure -
7. Mr. Anurag Mishra		6. Mr. Sudesh Sahu	not the of
	D	7. Mr. Anurag Mishra	1 autor

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- 1. In 1st semester Hindi Language, 2nd semester English Language and Environmental studies in 3rd and 4th Semester will be offered as AEC.
 - Students are required to take Generic Specific courses (courses from other than A/B/C Disciplines) 2
 - DSC-1 to DSC-7 shall be core courses of either Discipline A or B or C. ы.
- 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. 4.
 - 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. 5. 6.
 - Completion of core courses from host institute is mandatory.
- Students may take up SEC, GEC and DSEC of equivalent credits from any other institute/ online platforms/MOOC/ ODL from UGC recognized organizations. 2.

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

Name & Signature of Members of Board of Studies

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

Par	t A: Introduction		1000 E				
Sc	gram: Bachelor in ience (Bio Group) fificate/diploma/deg ree/honors	Class: B. Sc.	Semester - III	Session:2024-2025			
1	Course Code		BZO 301				
2	Course Title	Со	mparative Anatomy and Physiol	ogy of Vertebrates			
3	Course Type	Discipline Specific Course					
4	Course Learning Outcome (CLO)	 Learn and group of ve Understand the evolution Comprehen vertebrates Evaluate the 	I the process of development in c on in vertebrates ad the comparative anatomy c e physiological functioning of di e physiology of Biological Proces	different organ systems during of various organ systems of different organs.			
5	Credit Value	3C	1 credit =15 Hours –	Learning and Observation			
6	Total Marks	Maximum Ma	rks :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
Ι	Integument and its derivatives: Structure of Scales, Hair and Feathers.	12
	Alimentary canal and Digestive glands in Vertebrates Physiology of digestion	
II	Endoskeleton –	12
	Axial Skeleton: Skull and vertebrae	
	Appendicular skeleton: Limbs and Girdles	
III	Respiratory organs: Gills and lungs, Air sac in birds. Mechanism and control of	10
	breathing.	
	Circulatory System: Evolution of Heart and Aortic Arches. Cardiac cycle	
IV	Urino-genital System: Kidney and Excretory ducts. Physiology of excretion and	14
	osmoregulation.	
	Nervous system: General plan of Brain and Spinal Cord. Physiology of Nerve	
	conduction and Synaptic transmission	
V	Gonads and Genital ducts.	12
	Ear and Eye of human: Structure and function.	
	Physiology of muscle contraction.	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj Omjor
Subject Expert R-P-X-X-SC	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 Dallysan	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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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: Assessm	ent and Evaluation	
	inuous Evaluation Methods:	
Maximum Mar	ks: 100 Marks	
Continuous Con	nprehensive Evaluation (CCE): 20 Marks	
Semester End E	xam (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	Pattern -FOUR Section A, B, C, D	
Exam (SEE)	Each section will consist of questions from all 5 Units, Se internal choices.	ction C and D will have
	Section-A & B: Very short answer type question- 02x02 =	= 04 x 5 unit = 20 Marks
	Section-C: Short answer type question	$05 \ge 5$ unit = 25 Marks
	Section-D: Long answer type question	$07 \ge 5$ unit = 35 Marks
		Total = 80 Marks

Name & Signature of Members of Board of Studies

Departmental Members
1. Dr. Divya K. Minj
2. Dr. Neeru Agrawal NAY
3. Ms. Mausumi Dey
4. Dr. Sanju Sinha
5. Dr. Alka Mishra
6. Mr. Sudesh Sahu
7. Mr. Anurag Mishra

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

Par	rt A: In	troduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degre e/honors		Class: B. Sc.		Semester - III	Session:2024-2025	
1	Course	e Code			BZOL301	
2	Course	e Title	Comparative Anatomy and Physiology of Vertebrates			
3	Course	е Туре		I	Discipline Specific Lab	. Course
4	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	Credi	t Value	1C		1 credit =15 Hours -	Learning and Observation
6	Total	Marks	Maximum Mar	ks :50		Minimum Passing Marks:20
S.N	No.		List of Experiments			
1. Major disser alternative n			Cranial N	Verves and efferent bra	nchial arteries in Scoliodon by	
2. Major dissec		ction – Study of Efferent Branchial Arteries in Scoliodon by alternative method.				
3. Minor disse alternative m		ection –Study of Afferent branchial arteries and Internal ear in scoliodon by nethod.				
4. Permanent n		nounting of fish scale (Placoid, Cycloid, and Ctenoid Scale).				
5. Spotting: Stu			udy 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	1. Dr. Divya K. Minj
Subject Expert R-V-D-VR	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Senha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySal	6. Mr. Sudesh Sahu
	7. 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:

50 Marks

(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)

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

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
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Subject Expert R-P.T-V.R	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Senha .
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySall	6. Mr. Sudesh Sahu
V	7. Mr. Anurag Mishra
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COURSE CODE: BZO302 (DSE01) Endocrinology

Part A: Introduction							
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/		Class: B. Sc.	Semester - III	Session:2024-202	25		
	hon	ors					
1	Cour	se Code		BZO302			
2	Cour	se Title		Endocrinology			
3	Cour	se 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	Cre	dit Value	3C 1 credit =15 Hours – Learning and Observation				
6 Tota		al Marks	Maximum Marks :100 Minimum Passing N		Marks:40		
Part B: Content of the Con			urse				
		Total no	. of Teaching/ I	Learning Periods = 60 Periods (60 Hours)		
Unit		Topics	s (COURSE CONTENTS)		No. of Periods		
modes		modes of horm	d classification of hormones. Endocrine, paracrine and autocrine mone's delivery, Feedback mechanism. eptors: Cell surface receptors and Cytoplasmic Receptors.			12	
and reproducti Structure of hy		ineal gland, Secretions and their functions in biological rhythms ion. ypothalamus, Hypothalamic nuclei and their functions. f neuroendocrine glands and Feedback mechanisms.			12		

_						
	III	Structure of pituitary gland, Its hormones and their functions.	12			
		Hypothalamo-hypophysial portal system, Disorders of pituitary gland and				
		Feedback mechanisms.				
	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.				
1	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.				

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 Dollysour	6. Mr. Sudesh Sahu
v.	7. Mr. Anurag Mishra
	- Ansil

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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.
- J. Larry Jameson .(2016). Harrison's Endocrinology, 4Ed, Publisher: McGraw-Hill Education / Medical.

Reference Books

- 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:

Continuous Comprehensive Evaluation (CCE): 20 Marks

Semester End Exam (SEE):

80 Marks

100 Marks

Internal	Internal Test -02 of 10 Marks each +	Better marks out of
Assessment:		two tests+ Marks
	01 Assignment/Seminar of10 Marks	obtained in
Continuous	2 ·	Assignment shall be
Comprehensive		considered against 20
Evaluation(CCE)		e
		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 5 unit = 20 Marks		
	Section-C: Short answer type question	$05 \ge 5$ unit = 25 Marks		
	Section-D: Long answer type question	$07 \ge 5$ unit = 35 Marks		
		Total = 80 Marks		

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R-P-T2-XT	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Senha.
Industrial Representative	5. Dr. Alka Mishra
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	7. Mr. Anurag Mishra
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LAB COURSE: BZOL302 (DSE01) Endocrinology

Par	t A: Int	roduction					
Program: Bachelor in			Class: B. Sc.		Semester -	Session:2024-2025	
Se	cience (E	Bio Group)	III				
Cer	tificate/o	diploma/deg	×				
	ree/h	onors					
1	Course	Code			BZOL302		
2	Course	Title			Endocrinology		
3	Course	Туре		Disci	oline Specific Elective	Lab. Course	
4	Course	Learning	This Course	will enab	le the students to:		
	Outcon	ne (CLO)	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	Credi	t Value	1C	1 credit =15 Hours – Learning and Observation			
6	Total	Marks	Maximum Ma	rks :50		Minimum Passing Marks:20	
S.No.		List of Experiments					
		Demonstrati	ion of Endocrine glands by alternative methods through clay/thermocol odel etc.				
2.		Study of the permanent slides of all the endocrine glands.					
3.		Separation of	on of steroid hormones using paper chromatography				
4. Demonstr		Demonstrati	tion of Human chorionic gonadotropin hormone in human urine.				
	Name	& Signature	of Members of	Board o	f Studies		

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

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
WIAXIIII UIII	wars.

50 Marks

(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)

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

Name & Signature of Members of Board of Studies

0 ,	
Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert & Phi-12	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 Dollysah	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra

COURSE CODE: GEC03 Comparative Anatomy and Physiology of Vertebrates

Pa	rt A: Introduction				
S	ogram: Bachelor in cience (Bio Group) ificate/diploma/degree /honors	Class: B. Sc. III		Semester -	Session:2024-2025
1	Course Code			GEC03	
2	Course Title	Сс	omparative An	atomy and Physio	logy 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 Ma	rks :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)				
Ι	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

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

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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 Conti	nuous Evaluation Methods:		
Maximum Mar			
Continuous Comprehensive Evaluation (CCE): 20 Marks			
Semester End E	xam (SEE): 80 Marks		
Internal	Internal Test -02 of 10 Marks each +	Better marks out of	
Assessment:	01 Aggigg mont/Sominon of 10 Martin	two tests+ Marks	
Continuous	01 Assignment/Seminar of10 Marks	obtained in	
Comprehensive		Assignment shall be	
Evaluation(CCE)		considered against 20	
· · · ·		marks	

Semester End	Pattern -FOUR Section A, B, C, D	
Exam (SEE)	Each section will consist of questions from all 5 Ur internal choices.	nits, Section C and D will have
	Section-A & B: Very short answer type question- 0 Section-C: Short answer type question Section-D: Long answer type question	2x02 = 04 x 5unit = 20 Marks 05 x 5 unit = 25 Marks 07 x 5 unit = 35 Marks
	2 2	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 R - r. D. + 102	9. Dr. Neeru Agrawal NAV
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee Do lysal	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra
	Carrie F

Lab Course: GEC03 Comparative Anatomy and Physiology of Vertebrates

S	cience (tificate/	Bachelor in Bio Group) diploma/degr	Class: B. Sc.		Semester - III	Session:2024-2025
1	-	se Code			GEC03	
2	Cours	se Title	C	omparative	Anatomy and Physiolo	ogy of Vertebrates
3	Cours	se Туре			eneral Elective Lab. C	
4	Outco	te Learning ome (CLO) it Value	 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. 			
	Total	Marks	Maximum Ma	rks :50		Learning and Observation 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	1.	Permanent mounting of fish scale (Placoid, Cycloid, and Ctenoid Scale).				
5	5.	Spotting: Study of permanent slides and bones of vertebrates based on theory syllabus.				

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 R-N9V	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 DollySour	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	Laboratory performance: As per Dept. (LOCF)
Exam (SEE)	

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 Rogers	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Suba '.
Industrial Representative	12. Dr. Alka Mishra
Student Nominee DollySall	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra
	A J

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COURSE CODE: BZO401 (DSC04) Cell Biology and Genetics

Par	rt A: In	ntroduction		
S	cience (tificate	: Bachelor in (Bio Group) c/diploma/deg /honors	Class: B. Sc. Semester - IV Session:2024-202	25
1	Cours	se Code	BZO401	
2	Cours	se Title	Cell Biology and Genetics	
3	Cours	se Туре	Discipline Specific Course (DSC)	
4 5 6 Par	Outeo	it Value I Marks	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. 3C 1 credit =15 Hours - Learning and Observation Maximum Marks :100 Minimum Passing Marks:40	
		Total no	o. of Teaching/ Learning Periods = 60 Periods (60 Hours)	
Uni	nit Topics (COURSE CONTENTS)		No. of Periods	
]	IProkaryotic and Eukaryotic cell1Structure 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.1		12	

П	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

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert 12-19-1-11	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sila '.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee S.Ollysoch	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
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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.
- P S Verma & V K Agarwal, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing House.

Reference Books

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

100 Marks

80 Marks

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

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:

Continuous Comprehensive Evaluation (CCE): 20 Marks

Semester End Exam (SEE):

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	01 Assignment/Seminar of10 Marks two of A	etter marks out of vo tests+ Marks btained in ssignment shall be onsidered against 20 arks	
Semester End Exam (SEE)			
	internal choices. Section-A & B: Very short answer type question- $02x02 = 04x$		
		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	1. Dr. Divya K. Minj
Subject Expert R. P. Dord	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 Dollysour	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	A. L

LAB COURSE: BZOL401 (DSC04) Cell Biology and Genetics

Pa	art A:	Introduction	the protocy and Genetics
	Science ertifica	m: Bachelor in e (Bio Group) te/diploma/deg e/honors	Semester - IV Session:2024-2025
1	Cou	rse Code	BZOL401
2	Cou	rse Title	Cell Biology and Genetics
3	Cou	rse Type	
4		se Learning	Discipline Specific Lab. Course
		ome (CLO)	This Course will enable the students to:
	Cred	it Value	 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.
			1C 1 credit =15 Hours – Learning and Observation
		Marks	Maximum Marks :50 Minimum Passing Marks:20
S.No	D.		List of Experiments
1	•	Culturing and	Handling of Drosophila
2	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 diagram)	Salivary glands and Preparation of Polytene chromosome (comment on

)

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

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R-P-P-4	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollybour	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
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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-biodiversitycell-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 EndLaboratory performance: As per Dept. (LOCF)Exam (SEE)

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 R-p-J Z	2. Dr. Neeru Agrawal NAV
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Sollysal	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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COURSE CODE: BZO402 (DSE02) Immunology

Par	rt A: Introduction				
S	ogram: Bachelor in cience (Bio Group) tificate/diploma/de ree/honors		Semester - IV	Session:2024-202	5
1	Course Code		BZO402		
2	Course Title		Immunology		
3	Course Type		Discipline Specific Elective	e (DSE02)	
4	Course Learning Outcome (CLO)	 Understan Gain know Elaborate Describe ti Analyze approache 	e will enable the students to: d the fundamental concepts of Im vledge on various immune cells, a the structure and functions of immune he processes involved in immune the pathogenesis, clinical ma s of various immune disorders a s in immunology.	antigen and cytokine munoglobulins and a system nifestations and t	antibodies. herapeutic
5	Credit Value	3C	1 credit =15 Hours -	- Learning and Obse	rvation
6	Total Marks	Maximum M	Maximum Marks :100 Minimum Passing Marks:		Marks:40
Pa	rt B: Content of th	e Course			
	To	al no. of Teaching	g/ Learning Periods = 60 Periods	s (60 Hours)	
Uı	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		

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
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
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 (1 st , 2 nd and 3 rd Generation Vaccines).	13
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
	 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. 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. Autoimmunity: Auto-recognition, Classes of autoimmune-diseases (Hashimoto disease, Thyrotoxicosis, systemic Lupus, Erythematosus, Rheumatoid arthritis). 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). 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

Name & Signature of Members of Board of Studies

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1. Dr. Divya K. Minj
2. Dr. Neeru Agrawal NAV
3. Ms. Mausumi Dey
4. Dr. Sanju Sinha
5. Dr. Alka Mishra
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. <u>https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==</u>
- 2. <u>https://www.google.com/search?sca_esv=3f3107cf98d2d186&sxsrf=ADLYWIIqdJrjweAAIXDt</u> <u>7TZfoeztr1TrbA:1720167250778&q=https://ndl.iitkgp.ac.in/hedocument/swayamprabha/sw</u> <u>ayam+prabha/hdc5c5m6hkq?1%3Dimmunology&spell=1&sa=X&ved=2ahUKEwjSjb-vuo-HAxWuj68BHUmsCvIQBSgAegQIChAB</u>

Part D: Assessment and EvaluationSuggested Continuous Evaluation Methods:Maximum Marks:100 MarksContinuous Comprehensive Evaluation (CCE):20 MarksSemester End Exam (SEE):80 Marks

Internal Assessment: Continuous Comprehensive Evaluation(CC E)	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 internal choices. Section-A & B: Very short answer type question- 02x0 Section-C: Short answer type question Section-D: Long answer type question 	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj Dig
Subject Expert Rup Port	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 Dollysan	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	Marine

Lab Course: BZOL402 (DSE04 Lab Course) Immunology

Dr	ogram	Pachelor in	Classe D. Ca	_	Constant IV	Sec. 2024 2025
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree /honors		Class: B. Sc. Semester - IV Session:2024-2025			Session:2024-2025	
1	Cours	e Code			BZOL402	
2	Cours	e Title			Immunology	
3	Cours	е Туре		Disci	pline Specific Elective	Lab. Course
4	Course Learning Outcome (CLO)		 Gain pracantibodies. Identify the innate and Learn basi Understand self. Comprehention 	etical kno ne major adaptive c techniqu d the proc	cellular and tissue con immune system. ues in immunology. cess of the immune syste seases and disorders rela	immune cells, antigens and nponents which comprise the em to distinguish self from nor ated to immune system.
5	Cred	it Value	1C		1 credit =15 Hours –	Learning and Observation
6	Total	Marks	Maximum Ma	rks :50		Minimum Passing Marks:20
S.]	No.			L	ist of Experiments	
	1.	Study of peri	nanent slides o	f organ o	f immune system.	
	2. Eneumeratio		on of total leucocytes from human blood samples.			
	3. Encumeration of differential leucocytes from human blood sample.			ample.		
	4.	Demonstratio	on of agglutinat	tion react	ion using human RBC.	
	5.	Estimation o	f total serum pr	otein		
_	6. Group discussion/quiz/seminar/presentation onj related topics.					

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 R-B-Dan	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Senha .
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dolysau	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	4

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=ADLYWIIqdJrjweAAIXDt 7TZfoeztr1TrbA:1720167250778&q=https://ndl.iitkgp.ac.in/hedocument/swayamprabha/sw ayam+prabha/hdc5c5m6hkq?1%3Dimmunology&spell=1&sa=X&ved=2ahUKEwjSjb-vuo-HAxWuj68BHUmsCvIQBSgAegQIChAB

 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 EndLaboratory performance: As per Dept. (LOCF)Exam (SEE)

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 NAV
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DolyBan	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra
	Man 1

COURSE CODE: GEC04 Cell Biology and Genetics

Pa	rt A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc. Semester - IV Session:2024-202	25	
1	Course Code	GEC04		
2	Course Title	Cell Biology and Genetics		
3	Course Type	General Elective Course (GEC)		
4 5 6 Par	Course Learning Outcome (CLO) Credit Value Total Marks t B: Content of the	This Course will enable the students to: • Learn the importance of cell as a structural and functional unit of lift • Understand the difference between prokaryoticand eukaryotic system • Comprehend the structure and function of different cell organelles were cell division • Understand the general idea about cellular immunity and transformation • Describe the process of DNA and RNA replication. 3C 1 credit =15 Hours – Learning and Observation Maximum Marks :100 Minimum Passing Marks:40		
	Total ne	o. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Uni	nit Topics (COURSE CONTENTS)			
Structure and reticulum, Go functions of N Polytene cl		and Eukaryotic cell I functions of cell organelles: Plasma membrane, Endoplasmic olgi body, Mitochondria, Lysosome, Ribosomes Structure and Nucleus- Nuclear membrane, Nucleolus, Chromosome structure, hromosome, Lamp brush chromosome, Euchromatin, atin, Barr body.	12	

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

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.
- P S Verma & V K Agarwal, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing House.

Reference Books

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

100 Marks

80 Marks

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

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:

Continuous Comprehensive Evaluation (CCE): 20 Marks

Semester End Exam (SEE):

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)	Section D. Langer	

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 RCV. D	9. Dr. Neeru Agrawal NAV
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Senha .
Industrial Representative	12. Dr. Alka Mishra
Student Nominee Dallysour	13. Mr. Sudesh Sahu
LA	14. Mr. Anurag Mishra
	Marin K

LAB COURSE: GECL04 Cell Biology and Genetics

Program: Bachelor in Science (Bio Group) Certificate/diploma/deg		Bio Group)	Class: B. Sc.	Semester - IV	Session:2024-2025
		ionors			
1	Course	e Code		GECL04	1
2	Course	e Title	(Cell Biology and Ger	netics
3	Course	е Туре	G	eneral Elective Lab.	Course
4		e Learning me (CLO)	This Course will enable	e the students to:	
 Learn the importance of cell as a structural and functiona Understand the difference between prokaryoticand eukary Comprehend the structure and function of different cell of cell division. Understand the general idea about cellular immutation transformation. Describe the process of DNA and RNA replication. 			voticand eukaryotic system. different cell organelles wit cellular immunity and cel		
5	Credi	it Value	1C	1 credit =15 Hours –	- Learning and Observation
5	Total	Marks	Maximum Marks :50		Minimum Passing Marks:20
S.]	No.		List	of Experiments	1
1. Culturing and Handling of Drosophila					
	2. Morphology and Sexual dimorphism of Drosophila				
	 Study of at least five types of Drosophila: a) Body color mutant- Ebony body and Yello 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) 				

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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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Subject Expert R. r. D. Col	9. Dr. Neeru Agrawal NAyl.
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee DollySour	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra
	W -1

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Part C - Learnin	ng Resource
	Text Books, Reference Books, Other Resources
TEXT BOOKS Rec	ommended :
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.scien cell-biology-gene	tificpubonline.com/bookdetail/a-manual-practical-zoology-biodiversity- tics-developmental-biology-part-1/9789388449076/86
	Part D: Assessment and Evaluation
Suggested Cont	inuous Evaluation Methods:
Maximum Mar	ks: 50 Marks
(Will include In	ternal 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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4	14. Mr. Anurag Mishra

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<u>Courses(With Practical) of 4Credit</u> <u>3C for Theory + 1C for Practical</u>

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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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			•	Ι	ì	1
I	BZO-201	Animal Diversity - II	(j			Π	ĩ	
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
		-	;	BZO-502	Applied Zoology	11	GEC05	Biochemistry and Histology
>	BZO-501	Biochemistry and Histology	>	BZO-503	Animal Behaviour	V	GEC06	Evolution
		Renroductive and	;	BZO-602	Ecology	7,1	GEC07	Reproductive and Developmental Biology
	BZO-601	Developmental Biology	7	BZO-603	Chronobiology	1	GEC08	Food, Nutrition and Health
N	Circus	Man of Mombous of Roard of Studies	Studies		22			

Name & Signature of Members of Board of Studies

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Subject Expert	1. Dr. Divya K. Minj
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VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Do Juyour	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
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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)

Semeste	Core Course	Discipline Specific Elective	Generic	Ability	SEC/Internship/App	Value	Total
5	(DSC)	4	Elective (GE)	Enhancement	renticeship/Project/D	Added	Credits
4				Course (AEC)	issertation/Communi	Courses	
					ty Outreach (2)		
	DSC A1 (4)		Choose one	Choose one		Choose one	
Þ	SDC B1 (4)		from a pool of	from a pool of	Choose one f rom a	from a pool	22
-	DSC C1 (4)		courses GE 1 (4)	AEC courses	pool of courses (2)	of courses	
				(7)		(i)	
	DSC A2 (4)			Choose one		Choose one	
	DSC R2 (4)	-		from a pool of	Choose one from a	from a pool	22
11			Irom a pool of	AEC courses	pool of courses (2)	of courses	1
1	DSC C2 (4)		courses GE 2 (4)	(2)		(2)	
Students	exiting shall be aw	Students exiting shall be awarded undergraduate certificate (ir	te (in the field of study/discipline) after securing the	/discipline) after	securing the	Total	44
minimum	minimum 40 credits in Semester I and II	ester I and II					
	DSC A3 (4)			Choose one	Choose one SEC or	Choose	
		Choose one from a pool of courses DSE A/B/C (4)	DSE A/B/C (4)	from a pool of	Internship/Apprentice	one from a	
III	DSC B3 (4)	Or		courses AEC	ship/Project/Dissertati	bool of	22
		Choose one from a pool of courses GE 3 (4)	GE 3 (4)	(2)	on/Community	contrses (2)	
	(+) (-) (4)				Outreach (2)		
N	DSC A4 (4)	Choose one from a pool of courses DSE A/B/C (4)	DSE A/B/C (4)				22
•			#1				

	88	22	ę	22	132	20	20
Choose one from a pool of courses (2)	Total				Total		
Choose one SEC or Internship/Apprentice ship/Project/Dissertati on/Community Outreach (2)	uring the minimum	Choose one SEC or Internship/Apprentice ship/Project/Dissertati on/Community	Choose one SEC or Internship/Apprentice	ship/Project/Dissertati on/Community Outreach (2)	n relevant Discipline		
Choose one from a pool of courses AEC (2)	iscipline) after sec				sciplinary study) i f Semester VI	id one GE (1x4) ourse <b>Or</b> All	id one GE (1x4) course <b>Or</b> All
Or Choose one from a pool of courses GE 4 (4)	Students exiting shall be awarded undergraduate diploma (in the field of study/discipline) after securing the minimum 80 credits on completion of Semester IV	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 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)	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	Choose four DSE (4x4) <b>Or</b> Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course <b>Or</b> All four GE 9, 10, 11 & 12 (4x4) (Total 16)	Choose four DSE (4x4) <b>Or</b> Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course <b>Or</b> All four GE 13, 14, 15 & 16 (4x4)
DSC B4 (4) DSC C4(4)	Students exiting shall be awarded under 80 credits on completion of Semester IV	DSC A5 (4) DSC B5 (4) DSC C5 (4)	DSC A6 (4) DSC B6 (4)	DSC C6 (4)	Students exiting aft	DSC A/B/C (4)	DSC A/B/C (4)
	Students 80 credits	>		V1		IIA	NIII

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	172	20	20	172
	Total		-	Total
The second secon	vant Discipline atter		Research Project/Dissertation (12)	esearch) in relevant 7111
(Total 16)	securing the minimum 160 credits on completion of Semester VIII	Choose four DSE (4x4) <b>Or</b> Choose three DSE (3x4) and one GE (1x4) course OR choose one DSE (1x4) and three GE (3x4) course <b>Or</b> All four GE 9, 10, 11 & 12 (4x4) (Total 16)	Choose four DSE (1x4) course OR choose one GE (1x4) course	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
tudents shall he		VII DSC A/B/C (4)	VIII DSC A/B/C (4)	itudents shall be L

Name & Signature of Members of Board of Studies

C		
Chair person/HOD: Dr. Usha Sahu	<b>Departmental Members</b>	
Subject Expert	1. Dr. Divya K. Minj	the simp
Subject Expert R. P-1 L	2. Dr. Neeru Agrawal	NAT I
VC Nominee	3. Ms. Mausumi Dey	Im it
Member of other Department	4. Dr. Sanju Sinha	Siller ,
Industrial Representative	5. Dr. Alka Mishra	
Student Nominee Dollyfeury	6. Mr. Sudesh Sahu	They t
>	7. Mr. Anurag Mishra	Many mile

- 1. In 1st semester Hindi Language, 2nd semester English Language and Environmental studies in 3rd and 4th Semester will be offered as AEC.
  - Students are required to take Generic Specific courses (courses from other than A/B/C Disciplines) 3
- 3. DSC-1 to DSC-7 shall be core courses of either Discipline A or B or C.
- 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. 4.
- 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. 5.
- 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.



### Name & Signature of Members of Board of Studies

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

Pa	rt A: Introduction			2 8
S	rogram: Bachelor in cience (Bio Group) rtificate/diploma/deg ree/honors	Class: B. Sc.	Semester - V	Session: 2024-2025
1	Course Code		BZO501	
2	Course Title		Biochemistry and Hist	ology
3	Course Type		Discipline Specific Course	e (DSC05)
4	Course Learning Outcome (CLO)	<ul> <li>Know a</li> <li>Gain ki</li> <li>Carboh</li> <li>Underst</li> <li>Compre regulation</li> </ul>	e will enable the students to: bout the importance and scope of nowledge about the structure any ydrate, Protein and Lipids. and the histological structure and hend the concept of enzyme, i on.	nd biological significance of function of different tissues. its mechanism of action and
5	Credit Value	3C	1 credit =15 Hours –	Learning and Observation
6	Total Marks	Maximum Ma	rks :100	Minimum Passing Marks:40

	Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)	
Unit	Topics (COURSE CONTENTS)	No. of Periods
Ι	<b>Biochemistry of Carbohydrates:</b> Introduction, scope and importance of Biochemistry. <b>Carbohydrate:</b> 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
П	<ul> <li>Biochemistry of Lipids: Lipid structure and Biological significance.</li> <li>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.</li> </ul>	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	<b>Histology:</b> Introduction to tissues. <b>Epithelial tissue:</b> types, structure and characteristics. <b>Connective tissue:</b> Structure and function of loose, dense and adipose tissue. Structure and function of Blood plasma, blood cells, lymph and Stem cell. <b>Cartilage and bone:</b> classification, and fine structure.	12
V	<b>Muscular tissue:</b> Ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. <b>Nerve Tissue:</b> 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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### 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 R-P. Nau	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 Dollyfally	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra

### Part C - Learning Resource

Text Books, Reference Books, Other Resources

1

### **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.
- 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

Part D: Assessment and Evaluation					
Suggested Cont	inuous Evaluation Methods:				
Maximum Marks: 75 Marks					
Continuous Cor	nprehensive Evaluation (CCE):	15 Marks			
Semester End E		60 Marks			
Internal       Internal Test - One of 15 Marks +         Assignment/Seminar- One of 15 Marks         Continuous         Comprehensive         Evaluation(CCE)		57	Best of test and Assignment shall be considered against 15 marks		
		02 x 5unit = 10 Marks 03 x 5 unit = 15 Marks			
	Section-D: Long answer type ques	tion	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 Rip-D-V-	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
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Student Nominee DollyPall	6. Mr. Sudesh Sahu
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### Lab Course: BZOL501 (DSC-05) Biochemistry and Histology

	Part A: Introduction				
S	cience ( rtificate	Bachelor in Bio Group) /diploma/deg nonors	oup)		Session:2024-2025
1	Cours	e Code		BZOL501	
2	Cours	e Title	Biochemistry and Histology		ology
3	Cours	е Туре		Discipline Specific Lab.	Course
4		e Learning me (CLO)	<ul> <li>This Course will enable the students to:</li> <li>Know about the importance and scope of biochemistry.</li> <li>Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids.</li> <li>Understand the histological structure and function of different tissues.</li> <li>Comprehend the concept of enzyme, its mechanism of action and regulation.</li> <li>Learn the preparation of models of biomolecules.</li> </ul>		
5	Credi	t Value	1C	1 credit =15 Hours –	Learning and Observation
6	Total	Marks	Maximum Marks :25 Minimum Passing Marks:10		Minimum Passing Marks:10
<b>S.</b> ]	<b>No.</b> 1.	List of Experiments           Study of permanent slides of different tissues.			
	2.	Biochemical detection of Carbohydrate, Protein and Lipid.			
	3.	Determinatio	on of acid value	of oil.	
	4.	Blood group	Blood group detection (A, B, AB, O)		
	5.	R. B. C. and W.B.C count			

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

### Name & Signature of Members of Board of Studies

<u> </u>	
Chair person/HOD: Dr. Usha Sahu	Departmental Members
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Subject Expert R. P. T.	2. Dr. Neeru Agrawal NApul
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee D.O.UySally	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	W. P

### 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.
- 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-3rdedition?sku_id=50937951&gad_source=1&gclid=Cj0KCQjwai0BhDPARIsAB6hmP4gpkRECVQOelavluya7prcQcetWqfJBNZvcMJhqylCK8K3dOHCw 2UaAgEJEALw_wcB

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 RPD-112	2. Dr. Neeru Agrawal HAnt
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Scinha,
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollyball	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	V

### Course Code: BZO502 (DSE03) Applied Zoology

Par	rt A: Inti	roduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	Session:2024-2025		
1	Course	Code		BZO502		
2	Course	Title		Applied Zoology	1	
3	Course	Туре		Discipline Specific El	ective	
4		Learning ne (CLO)	<ul> <li>This Course will enable the students to:</li> <li>Understand the basic information about fishery, culture and harvestimethods of fishes, prawn and pearls</li> <li>Learn about beekeeping and managing beehives for honey production and pollination.</li> <li>Understand the biology and varieties of silkworms and the bast techniques of harvesting of cocoons and silk production.</li> <li>Gain knowledge of poultry rearing and vermicompost technology and applications.</li> <li>Comprehend the economic perspectives of applied zoology.</li> </ul>		production the basic	
5	Credit Value		3C	1 credit =15 Hours -	- Learning and Obser	vation
6	Total	Marks	Maximum Ma	rks :100	Minimum Passing N	1arks:40
Pa	rt B: Co	ntent of the	Course			
		Total r	o. of Teaching/	Learning Periods = 60 Period	ls (60 Hours)	
Un	it		<b>Topics (COURSE CONTENTS)</b>		No. of Periods	
	]	prawn; cultur of prawn. E	Ire: General Introduction. Prawn culture: Culture of fresh water14re of marine prawn; preparation of farm. preservation and processing14Export of prawn. Pearl Culture. Fish Culture: Breeding Pond,14ish Seed, Harvesting, preservation of fish. Composite fish farming.14			14

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

### Name & Signature of Members of Board of Studies

1. Dr. Divya K. Minj 2. Dr. Neeru Agrawal
Dr. Neery Agrawal MA
2. DI. Neeru Agrawai
3. Ms. Mausumi Dey
4. Dr. Sanju Sinha Sinha ,
5. Dr. Alka Mishra
6. Mr. Sudesh Sahu
7. Mr. Anurag Mishra

### 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
- <u>https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericulture%20lac%20culture%20and%20%20sericulture%20upload.</u> pdf.

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Part D: Assessment and Evaluation				
Suggested Conti	nuous Evaluation Me	thods:		
Maximum Marks: 75 Marks				
Continuous Comprehensive Evaluation (CCE): 15 Marks				
Semester End E	xam (SEE):	60 Marks		
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	A strange the strange of 15 Montre		Assignment shall be considered against 15	
Semester End Exam (SEE)	Exam (SEE)Each section will consist of questions from all 5 Units, Section C and internal choices.Section-A & B: Very short answer type question- 01x02 = 02 x 5 unit		- 01x02 = 02 x 5unit = 10 Marks 03 x 5 unit = 15 Marks	
	Section-D: Long ans	wer type question	$07 \times 5 \text{ unit} = 35 \text{ Marks}$ $Total = 60 \text{ Marks}$	

### Name & Signature of Members of Board of Studies

0	1
Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R-P-7-2-11	2. Dr. Neeru Agrawal HApl
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySally	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

### Course Code: BZOL502 (DSE03) Applied Zoology

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

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6.	Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized 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 R-P. TINDC	2. Dr. Neeru Agrawal NAM
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha '.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysel	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	V

### 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
- <u>https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20</u> <u>Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20</u> %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 EndLaboratory performance: As per Dept. (LOCF)Exam (SEE)

### 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 R-P-V	2. Dr. Neeru Agrawal HAT
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySalu	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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### Course Code: BZO503 (DSE04) Animal Behaviour

Part A: Introduction						
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	Session:2024-202	5	
1	Course	Code	BZO503			
2	Course	Title	Animal Behaviour			
3	Course Type		Discipline Specific elective			
4	Course Learning Outcome (CLO)		<ul> <li>This Course will enable the students to:</li> <li>Learn the concept and principles of biological evolution.</li> <li>Understand types of animal behaviour and their importance to the organisms.</li> <li>Enhance their observation, analysis, interpretation and documentation skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodiversity, Evolutionary biology, Ecology, Conservation biology and Genetic basis of the behaviour.</li> </ul>			
6	Credit Value Total Marks		3C Maximum Mar	1 credit =15 Hours -	Minimum Passing N	
				K9.100		/1a1K5.4U
rar	IB: Con	Total n		Learning Periods $= 60$ Period	s (60 Hours)	
			, or reaching/	Learning rerious = ou reriou		No. of
Unit			<b>Topics (COURSE CONTENTS)</b>		Periods	
branches. Stir of behaviuor		nulus: Definitio Foreging, agg	nimal behaviour study. Etholo n, Types of stimuli (internal and ressive, territorial, stereotype ( Neural and hormonal control of l	external). Pattern taxis, kinesis and	12	

II	Innate or instinctive behaviour: Definition and characteristics, innate releasing	10
	mechanism and action specific energy. Biological clocks:Advantages of	
	biological rhythms.Bird migration, navigation and orientation.	
III	Learning Behaviour: Classical conditioning (Pavlov experiment). Types of	14
	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.	
IV	Social behaviour: Social organi9sation in honey bee and primates. Elements of	12
	socio-biology: Eusociolity, Selfishness, co-operation, Altruism and kingship,	
	Communication: Chemical, visual, light, tactile and audio.	
V	Evolutionary aspects of behaviour: Feeding straitagies, mimicry and coloration,	12
	evolution of reproductive behaviour. Theory of sexual selection, Mate selection	
	and courtship behaviour Secondary sex characteritics, parental care in fish and	
	amphibia.	

### Name & Signature of Members of Board of Studies

Departmental Members
1. Dr. Divya K. Minj
2. Dr. Neeru Agrawal NAM
3. Ms. Mausumi Dey
4. Dr. Sanju Sinha
5. Dr. Alka Mishra
6. Mr. Sudesh Sahu
7. Mr. Anurag Mishra

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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-theenvironment/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, internal choices.		ction C and D will have	
	Section-A & B: Very short answer type question- $01x02 = 02x$ 5unit = 2		
	Section-C: Short answer type question	$03 \ge 5$ unit = 15 Marks	
	Section-D: Long answer type question	$07 \ge 5$ unit = 35 Marks	
		Total = 60 Marks	

### Name & Signature of Members of Board of Studies

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Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert P-P-T-X	2. Dr. Neeru Agrawal NAy
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySalu	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	V
# Course Code: BZOL503 (DSE04) Animal Behaviour

<ul> <li>organisms.</li> <li>Enhance their observation, analysis, interpretation and document skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodive Evolutionary biology, Ecology, Conservation biology and Genetic of the behaviour.</li> <li>Credit Value 1C 1 credit =15 Hours – Learning and Observation</li> </ul>	Pa	rt A: Introduction			
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: <ul> <li>Learn the concept and principles of biological evolution.</li> <li>Understand types of animal behaviour and their importance to organisms.</li> <li>Enhance their observation, analysis, interpretation and document skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodive Evolutionary biology, Ecology, Conservation biology and Genetic of the behaviour.</li> </ul> 5     Credit Value     1C     1 credit =15 Hours - Learning and Observation           6         Total Marks         Maximum Marks :25         Minimum Passing Marks:           2.         To study geotaxis behaviour in earthworm.         3.           3.         To study the phototaxis behaviour in insect larvae/earth worm.           4.         Study of conditioning behaviour in fishes.	Science (Bio Group) Certificate/diploma/deg		Class: B. Sc.	Semester - V	Session:2024-2025
3       Course Type       Discipline Specific Elective Lab. Course (DSE08)         4       Course Learning Outcome (CLO)       This Course will enable the students to: <ul> <li>Learn the concept and principles of biological evolution.</li> <li>Understand types of animal behaviour and their importance to organisms.</li> <li>Enhance their observation, analysis, interpretation and document skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodive Evolutionary biology, Ecology, Conservation biology and Genetic of the behaviour.</li> </ul> <li>5</li> <li>Credit Value</li> <li>1C</li> <li>1 credit =15 Hours - Learning and Observation</li> <li>Maximum Marks :25</li> <li>Minimum Passing Marks:</li> <li>To study geotaxis behaviour in earthworm.</li> <li>To study the phototaxis behaviour in fishes.</li> <li>Study of conditioning behaviour in fishes.</li> <li>Study of habituation in milliped.</li>	1	Course Code		DSE04	
4       Course Learning Outcome (CLO)       This Course will enable the students to: <ul> <li>Learn the concept and principles of biological evolution.</li> <li>Understand types of animal behaviour and their importance to organisms.</li> <li>Enhance their observation, analysis, interpretation and document skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodive Evolutionary biology, Ecology, Conservation biology and Genetic of the behaviour.</li> </ul> <li>5</li> <li>Credit Value</li> <li>1C</li> <li>1 credit =15 Hours - Learning and Observatio</li> <li>Minimum Passing Marks:</li> <li>S.No.</li> <li>List of Experiments</li> <li>Nests and nesting habits of the birds and social insects</li> <li>2. To study geotaxis behaviour in earthworm.</li> <li>3. To study the phototaxis behaviour in fishes.</li> <li>5. Study of conditioning behaviour in fishes.</li>	2	Course Title		Animal Behaviou	ır
Outcome (CLO)       • Learn the concept and principles of biological evolution.         • Learn the concept and principles of biological evolution.       • Understand types of animal behaviour and their importance to organisms.         • Enhance their observation, analysis, interpretation and document skills by taking short projects pertaining to Animal behaviour.       • Relate animal behaviour with other subjects such as Animal biodive Evolutionary biology, Ecology, Conservation biology and Genetic of the behaviour.         5       Credit Value       1C       1 credit =15 Hours - Learning and Observatio         6       Total Marks       Maximum Marks :25       Minimum Passing Marks:         5.       Study of conditioning behaviour in earthworm.       3.         7.       To study the phototaxis behaviour in insect larvae/earth worm.         4.       Study of habituation in milliped.	3	Course Type	l	Discipline Specific Elective Lab.	Course (DSE08)
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.	5	Outcome (CLO) Credit Value	<ul> <li>Learn the concept and principles of biological evolution.</li> <li>Understand types of animal behaviour and their importance to to organisms.</li> <li>Enhance their observation, analysis, interpretation and documentatis skills by taking short projects pertaining to Animal behaviour.</li> <li>Relate animal behaviour with other subjects such as Animal biodiversi Evolutionary biology, Ecology, Conservation biology and Genetic bas of the behaviour.</li> </ul>		and their importance to the rpretation and documentation Animal behaviour. is such as Animal biodiversity, ion biology and Genetic basis
1.Nests and nesting habits of the birds and social insects2.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.	S.M	No.		List of Experiments	
4.     Study of conditioning behaviour in fishes.       5.     Study of habituation in milliped.	м	1. Nests a	and nesting habits of the birds and social insects		
5. Study of habituation in milliped.	3. To study		y the phototaxis behaviour in insect larvae/earth worm.		
	4. Study of		f conditioning behaviour in fishes.		
6. Study of circadian functions in humans (daily eating, sleep and temperature patter		5. Study o	f habituation in	milliped.	
	6. Study of		f circadian func	tions in humans (daily eating, sle	ep and temperature patterns).

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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

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R. P-L-11	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Souha '.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dellysour	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	V P

# Part C - Learning Resource

7.

## 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

Part D: Assessment and Evaluation

**Suggested Continuous Evaluation Methods:** 

Maximum Marks:

5

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50

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25 Marks

(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)

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

 Exam (SEE)
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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 R-P-D-,	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 DollySalu	6. Mr. Sudesh Sahu
U	7. Mr. Anurag Mishra
	Q.

#### COURSE CODE: GEC05 Biochemistry and Histology

Par	t A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	Session: 2024-2025
1	Course Code		GEC05	
2	Course Title		Biochemistry and Hist	cology
3	Course Type	General Elective Course		
4	Course Learning Outcome (CLO)	<ul> <li>Know al</li> <li>Gain kn Carbohy</li> <li>Understation</li> <li>Compression</li> <li>Learn th</li> </ul>	e preparation of models of biom	and biological significance of I function of different tissues. its mechanism of action and olecules.
5	Credit Value	3C		- Learning and Observation
6	Total Marks	Maximum Ma	rks :100	Minimum Passing Marks:40

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	Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)	
Unit	Topics (COURSE CONTENTS)	No. of Periods
Ι	<ul> <li>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.</li> </ul>	12
II	<ul> <li>Biochemistry of Lipids: Lipid structure and Biological significance.</li> <li>Fatty acids: Types and Classification- Triglycerides, Phospholipids,</li> <li>Sphingolipids, Cholesterol, β- oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms. Ketogenesis.</li> </ul>	12
III	<ul> <li>Biochemistry of proteins: Structure and biological significance of proteins.</li> <li>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</li> </ul>	12
IV	<b>Histology:</b> Introduction to tissues. <b>Epithelial tissue:</b> types, structure and characteristics. <b>Connective tissue:</b> Structure and function of loose, dense and adipose tissue. Structure and function of Blood plasma, blood cells, lymph and Stem cell. <b>Cartilage and bone:</b> classification, and fine structure.	12
V	<b>Muscular tissue:</b> Ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. <b>Nerve Tissue:</b> 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

#### 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 R-p. T.	9. Dr. Neeru Agrawal NAm
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Seinha".
Industrial Representative	12. Dr. Alka Mishra
Student Nominee Dollysalu	13. Mr. Sudesh Sahu
V	14. Mr. Anurag Mishra

#### Part C - Learning Resource

Text Books, Reference Books, Other Resources

1

### **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.
- 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

Part D: Assessment and Evaluation					
Suggested Cont	inuous Evaluation Me	thods:			
Maximum Mar	ks:	75 Marks			
Continuous Cor	nprehensive Evaluation	on (CCE): 15 Marks			
Semester End E	Exam (SEE):	60 Marks			
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One o Assignment/Seminar-		Best of test and Assignment shall be considered against 15 marks		
Semester End Exam (SEE)	internal choices.	sist of questions from all 5 U short answer type question- ver type question	Units, Section C and D will have $01x02 = 02 \times 5$ unit = 10 Marks $03 \times 5$ unit = 15 Marks $07 \times 5$ unit = 35 Marks		
			Total = 60 Marks		

# Name & Signature of Members of Board of Studies

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

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# Lab Course: GECL05 Biochemistry and Histology

				Part A: Introduction		
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	Session:2024-2025		
1	Course	Code	GECL05			
2	Course	Title		Biochemistry and Hist	ology	
3	Course	Туре		General elective Lab. C	Course	
4	4 Course Learning Outcome (CLO)		<ul> <li>This Course will enable the students to:</li> <li>Know about the importance and scope of biochemistry.</li> <li>Gain knowledge about the structure and biological significance of Carbohydrate, Protein and Lipids.</li> <li>Understand the histological structure and function of different tissues.</li> <li>Comprehend the concept of enzyme, its mechanism of action and regulation.</li> <li>Learn the preparation of models of biomolecules.</li> </ul>			
5		t Value	1C		Learning and Observation	
6		Marks	Maximum Ma	rks :25	Minimum Passing Marks:10	
S. No.		List of Experiments				
1. Study of per		manent slides o	of different tissues.			
2. Biocher		Biochemica	ical detection of Carbohydrate, Protein and Lipid.			
3. Determi		Determination	nation of acid value of oil.			
	4. Blood group		detection (A, E	3, AB, O)		
	5. R. B. C. and		W.B.C count			

O

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
Subject Expert	8. Dr. Divya K. Minj
Subject Expert P-P-	9. Dr. Neeru Agrawal HAy
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Sanha :
Industrial Representative	12. Dr. Alka Mishra
Student Nominee DollySally	13. Mr. Sudesh Sahu
0	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-3rdedition?sku_id=50937951&gad_source=1&gclid=Cj0KCQjwai0BhDPARIsAB6hmP4gpkRECVQOelavluya7prcQcetWqfJBNZvcMJhqylCK8K3dOHCw 2UaAgEJEALw_wcB

Part D: Assessment and Evaluation				
Suggested Cont	inuous Evaluation Methods:			
Maximum Mar	ks: 25 Marks			
(Will include Ir	iternal assessment, Lab records and End Semester Viva/Voce and performance)			
Semester End	Laboratory performance: As per Dept. (LOCF)			
Exam (SEE)				

## Name & Signature of Members of Board of Studies

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Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj Print
Subject Expert R.P.D.	9. Dr. Neeru Agrawal NAV
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Seinha.
Industrial Representative	12. Dr. Alka Mishra
Student Nominee Dolly8alu	13. Mr. Sudesh Sahu
0	14. Mr. Anurag Mishra
	v. T

# Course Code: GEC06 Evolution

Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	Session:2024-2025
1	Course Code		GEC06	
2	Course Title		Evolution	
3	Course Type		General Elective Co	burse
4 Course Learning Outcome (CLO)		<ul> <li>Acquire an animalworf</li> <li>Develop a animals.</li> <li>Enable the</li> <li>Understance</li> <li>Develop an animals</li> </ul>	will enable the students to: in in-depth knowledge on the d ld. holistic appreciation on the p students to understand the evolu ling on the process and theories in interest in the debates and discu- nary biology.	hylogeny and adaptations in ution of universe and life. in evolutionary biology.
5	Credit Value	3C		- Learning and Observation
6	Total Marks	Maximum Ma	1 100	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
Ι	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
П	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

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

#### Part C - Learning Resource

Text Books, Reference Books, Other Resources

#### **TEXT BOOKS Recommended :**

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

#### **Reference Books :**

- 1. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates.
- 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/

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)	<ul> <li>Pattern -FOUR Section A, B, C, D</li> <li>Each section will consist of questions from all 5 Units, Section-a choices.</li> <li>Section-A &amp; B: Very short answer type question- 01x02 = Section-C: Short answer type question</li> <li>Section-D: Long answer type question</li> </ul>	

## 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 R-P-D	2. Dr. Neeru Agrawal NAV
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha ,
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysoli	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra
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## Lab Course: GECL06 Evolution

Part	A: Intro	duction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degre e/honors		Class: B. Sc.	Semester - V	Session:2024-2025	
1	Course	e Code		GECL06	J.,
2	Course	e Title		Evolution	
3	Course	туре	*	General Elective Lab.	Course
4 Course Learning Outcome (CLO)		<ul> <li>This Course will enable the students to:</li> <li>Acquire an in-depth knowledge on the diversity and relationships in animalworld.</li> <li>Develop a holistic appreciation on the phylogeny and adaptations in animals.</li> <li>Enable the students to understand the evolution of universe and life.</li> <li>Understanding on the process and theories in evolutionary biology.</li> <li>Develop an interest in the debates and discussion taking place in the field ofevolutionary biology.</li> </ul>			
5	Credi	t Value	1C	1 credit =15 Hours -	- Learning and Observation
6	Total	Marks	Maximum Marks :25 Minimum F		Minimum Passing Marks:10
S.No. List of Experiments					
	1. Study of for		ssils from models/ pictures.		
2. Study of evolution from models/pictures.					
	3.	Study of ho	mology and anal	ogy from suitable specimens/pi	cture/models.
4. Study and verification of Hardy-Weinberg Law by chi square analysis.		re analysis.			

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#### 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 R-P	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Scuba )
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysalu	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/

## 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 EndLaboratory performance: As per Dept. (LOCF)Exam (SEE)

#### 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 R.P S.M	2. Dr. Neeru Agrawal NAy
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha ',
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Solly Salur	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

#### Course Code: BZO601 (DSC06) Reproductive and Developmental Biology

Par	t A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - VI	Session:2024-2025	
1	Course Code		BZO601		
2	Course Title		Reproductive and Developme	ental Biology	
3	Course Type		Discipline Specific Cours	se (DSC)	
4	Course Learning Outcome (CLO)	<ul> <li>This Course will enable the students to:</li> <li>Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology.</li> <li>Describe the gonadal hormones and the mechanism of hormones action in reproduction.</li> <li>Explain the development of multicellular organisms from a single cell zygote.</li> <li>Describe the history and different stages of embryonic development and its implications.</li> <li>Identify the various developmental stages and the possible defects in growth.</li> </ul>			
5	Credit Value	3C	1 credit =15 Hours –	Learning and Observation	
6 Pa	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)				
Ur			cs (COURSE CONTENTS)	No. of Periods	
I	Structure and function of Male reproductive system       12         Structure and function of Female reproductive system       12				

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

## 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 R.P. V.	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysah	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra

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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.
- 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 :**

- 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.

## 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

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)	<ul> <li>Pattern -FOUR Section A, B, C, D</li> <li>Each section will consist of questions from all 5 Units, S internal choices.</li> <li>Section-A &amp; B: Very short answer type question- 01x02</li> <li>Section-C: Short answer type question</li> <li>Section-D: Long answer type question</li> </ul>	

# 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 R-CV	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 Allyscul	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
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# Lab Course: BZOL601 (DSC) Reproductive and Developmental Biology

Par	Part A: Introduction				
Internal Assessment: Continuous Comprehensive Evaluation(CCE)			One of 15 Marks + eminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks	
1	Course	Code		BZOL601	
2	Course	Title		Reproductive and Developr	nental Biology
3	Course	туре		Discipline Specific La	b. Course
4	<ul> <li>Course Learning Outcome (CLO)</li> <li>This Course will enable the students to:         <ul> <li>Understand the functional anatomy of male and female reprodu and write the process of fertilization in reproductive biology.</li> <li>Describe the gonadal hormones and the mechanism of hormones a in reproduction.</li> <li>Explain the development of multicellular organisms from a single zygote.</li> <li>Describe the history and different stages of embryonic development its implications.</li> <li>Identify the various developmental stages and the possible defe growth.</li> </ul> </li> </ul>		reproductive biology. e mechanism of hormones action alar organisms from a single cell es of embryonic development and ages and the possible defects in		
5	Credi	t Value	1C	1 credit =15 Hours	s – Learning and Observation
6	Total	Marks	Maximum Marks :25 Minimum Passing Marks:10		Minimum Passing Marks:10
<b>S.</b> 1	No.		List of Experiments		
	1.	Identification of stages of oogenesis & spermatogenesis.			
	2.	Histological study of gonads through permanent slides in vertebrates.			n vertebrates.
	3.	Study of	Study of extra-embryonic membrane in chick.		
	4.	Study of embryological slides of Amphioxus/frog/chick.			

#### 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 R. P. V.	2. Dr. Neeru Agrawal NAM
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha '.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysou	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	V F

### 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.
- 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

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 R-P-V-	2. Dr. Neeru Agrawal NApl
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sevla_'.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySaly	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra
	V. F

# Course Code: BZO602 (DSE05) Ecology

Par	rt A: Introduction		
Program: Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc. Semester - VI Session:2024-202	25
1	Course Code	BZO602	
2	Course Title	Ecology	
3	Course Type	Discipline Specific Elective (DSE	
4	Course Learning Outcome (CLO)		
5	Credit Value	3C 1 credit =15 Hours – Learning and Obser	
6 Par	6     Total Marks     Maximum Marks :100     Minimum Passing N       Part B: Content of the Course     Image: Course of the Course     Image: Course of the		
	Total n	o. of Teaching/ Learning Periods = 60 Periods (60 Hours)	
Uni		Topics (COURSE CONTENTS)	No. of Periods
I	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.		

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
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R-P-D311VL	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysoch	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra
	V

## 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.

#### **Reference Books :**

- 1. Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole.
- 2. Ricklefs, R.E. (2000) Ecology (5th edition) Chiron Press.
- 3. Kendeigh, F C. (1984) Ecology with Special Reference to Animal and Man. PrenticeHall Inc.
- 4. Stiling, P. D. (2012) Ecology Companion Site: Global Insights and Investigations.McGraw Hill Education.

# 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

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)	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 N		
	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 R. P-D	2. Dr. Neeru Agrawal NA
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha '.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysalu	6. Mr. Sudesh Sahu
V	7. Mr. Anurag Mishra
	an d

# Lab Course: BZOL602 Ecology

Par	rt A: Int	roduction			
<b>Program:</b> Bachelor in Science (Bio Group) Certificate/diploma/deg ree/honors		Class: B. Sc.	Semester - V	/I Session:2024-2025	
1	Course	Code		BZOL602	
2	Course	Title		Ecology	
3	Course	туре		Discipline Specific Electi	ve Lab. Course
4	Course Learning Outcome (CLO)		<ul> <li>Know the e</li> <li>Understand and excitin</li> </ul>	g endeavor.	tudy of animal ecology a crucial
		<ul> <li>Engage in field-based research activities to understand well the theoretical aspectstaught besides learning techniques for gathering data in the field.</li> <li>Analyse a biological problem, derive testable hypotheses and then design experimentsand put the tests into practice.</li> <li>Solve the environmental problems involving interaction of humans and naturalsystems at local or global level.</li> </ul>			
5	Credi	t Value	1C	1 credit =15 Hours – Learning and Observation	
6	Total	Marks	Maximum Ma	rks :25	Minimum Passing Marks:10
S.N	1 10.			List of Experiments	
	1. Constructin		g a food web by observing and collecting organisms from a given area.		
	2. Estimation of		of Population Density, Frequency, and abundance in given habitat.		
	3. Studying an		imal diversity in a habitat.		
	4. Study of Ec		cosystem through models/ pictures/field visit.		
	5. Study of po		Ilution of different ecosystem through personal observation.		
	6.	Study of po	llution indicator	species in given samples.	

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#### 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 Dollysoul	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	VI

## 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.

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:

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 R-V-V-16	2. Dr. Neeru Agrawal NAy
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Subar,
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollyScili	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	A. F

#### Course Code: BZO603 (DSE06) Chronobiology

Program: Bachelor in Science (Bio Group) Certificate/diploma/degr ee/honors		io Group) ploma/degr	Class: B. Sc.	Semester - VI	Session:2024-2025	5
1	Course			BZO603		
2	Course	Title		Chronobiology		
3	Course	Туре		Discipline Specific Electiv	e (DSE06)	
4	Outcon	Learning ne (CLO)	<ul> <li>This Course will enable the students to:</li> <li>Learn about the Biological Clocks and its importance.</li> <li>Study how Biological Rhythm influence animal behaviour.</li> <li>Interpreting the cause and effect of lifestyle disorders.</li> <li>Understand Social and Sexual Behaviour of animals.</li> <li>Comprehend the Behaviour Patterns of human and animals.</li> </ul>		vation	
5	Credit	t Value	3C		- Learning and Obser	
6	Total	Marks	Maximum Marks :100 Minimum Passing M		1arks:40	
Pa	rt B: Coi	ntent of the				
		Total ı	no. of Teaching/ L	earning Periods = 60 Period	s (60 Hours)	
Ur	nit		Topics (	COURSE CONTENTS)		No. of Period
	1	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		
	1	rhythms; Cir	ical Rhythm, Characteristics of biological rhythms; Short-and Long-term 14 s; Circadian rhythms; Tidal rhythms and Lunar rhythms; Supra- atic 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 R.P	2. Dr. Neeru Agrawal NAy
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Seinha ,
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySalı	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra
	A. L

# 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

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.		
		02 x 5unit = 10 Marks 03 x 5 unit = 15 Marks 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 R-P-V-1	2. Dr. Neeru Agrawal NAgu
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollyfach.	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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## Lab Course: BZOL603 (DSE06)

<b>Program:</b> Bachelor in Science (Bio Group)		Class: B. Sc.	Semester - VI	Session:2024-2025	
Certificate/diploma/deg ree/honors					
1	Cours	e Code		BZOL602	1
2	Cours	e Title		Chronobiology	
3	Cours	е Туре		Discipline Specific Elective l	Lab. Course
4	4 Course Learning Outcome (CLO)		<ul> <li>Learn abo</li> <li>Study ho</li> <li>Interpreti</li> <li>Understand</li> </ul>	e will enable the students to: out the Biological Clocks and its w Biological Rhythm influence an ng the cause and effect of lifestyl nd Social and Sexual Behaviour of end the Behaviour Patterns of hur	nimal behaviour. e disorders. of animals.
5	Cred	it Value	1C	1 credit =15 Hours –	Learning and Observation
6		Marks	Maximum Ma	rks :25	Minimum Passing Marks:10
<b>S.</b> I	S.No.		List of Experiments		
	1. Circadian ch observation)		nanges in the volume of nuclei in onion peel (Allium cepa) cells (microscop		
	2. Observation of leaf movement of a plant on circadian and longitudinal time scales			ngitudinal time scales	
	3. Study of circ		adian functions	s in human (daily eating, sleep and	d temperature patterns).
### 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 NApl
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee Dollysour	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

#### Part C - Learning Resource

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Text Books, Reference Books, Other Resources

#### **TEXT BOOKS Recommended :**

- 1. Insect Photoperiodism: Stanley D. Beck, Academic Press, New York and London
- 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)

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

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

# Course Code: GEC07 Reproductive and Developmental Biology

Pa	rt A: Introduction			
S	rogram: Bachelor in cience (Bio Group) rtificate/diploma/deg ree/honors	Class: B. Sc.	Semester - VI	Session:2024-2025
1	Course Code		GEC07	
2	Course Title		Reproductive and Developme	ntal Biology
3	Course Type		General Elective Course	(GEC)
	Outcome (CLO)	<ul> <li>This Course will enable the students to:</li> <li>Understand the functional anatomy of male and female reproduction and write the process of fertilization in reproductive biology.</li> <li>Describe the gonadal hormones and the mechanism of hormones action in reproduction.</li> <li>Explain the development of multicellular organisms from a single cell zygote.</li> <li>Describe the history and different stages of embryonic development and its implications.</li> <li>Identify the various developmental stages and the possible defects in growth.</li> </ul>		
5	Credit Value	3C	1 credit =15 Hours – ]	Learning and Observation
6	Total Marks	Maximum Ma	rks :100	Minimum Passing Marks:40
Pa	rt B: Content of the	Course		
	Total n	o. of Teaching	<pre>/Learning Periods = 60 Periods</pre>	60 Hours)
Unit Topics (COURSE CONTENTS)		No. of Periods		
Ι		Structure and function of Male reproductive system       12         Structure and function of Female reproductive system       12		

	COURSE CORRICULUM 2024-25	
Π	<ul> <li>Oogenesis: Origin of germ primordial cell in mammal, yolk formation, physico-chemical nature of yolk, function of yolk, Types of eggs. Process of oogenesis</li> <li>Spermatogenesis: Origin of germ primordial cell in mammal, formation of spermatids, spermiogenesis.</li> <li>Fertilization: mechanism of fertilization, activation of ovum, amphimixis, post fertilization changes in egg, types and significance if fertilization.</li> </ul>	12
III	<ul> <li>Cleavage: types and patterns. Peculiarities of cell division involved in cleavage, significance of cleavage.</li> <li>Morulation and Blastulation: Blastulation in Amphioxus, Frog and Chick. Fate Map.</li> </ul>	12
IV	Gastrulation: Germ layer differentiation. Epiboly, emboly/ invagination, involution. Extraembryonic membrane in chick. Tubulation.	12
V	<ul> <li>Embryonic induction: Experimental evidences to induction, Characteristics of organizer, Types of organizers, Genic and Gradient theory of induction.</li> <li>Competence: Molecular biology of competence.</li> </ul>	12

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

#### 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.

#### **Reference Books :**

- 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:

Continuous Comprehensive Evaluation (CCE): 15 Marks

Semester End Exam (SEE):

60 Marks

75 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, Se internal choices. Section-A & B: Very short answer type question- 01x02 = Section-C: Short answer type question Section-D: Long answer type question	

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

# Lab Course: GECL07 Reproductive and Developmental Biology

Par	rt A: Inti	roduction			
Internal Assessment: Continuous Comprehensive Evaluation(CCE)			One of 15 Marks + eminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks	
1	Course	Code		GECL07	
2	Course	Title		Reproductive and Develop	mental Biology
3	Course	Туре		General Elective Lab	o. Course
<ul> <li>4 Course Learning Outcome (CLO)</li> <li>4 Understand the functional anatomy of male and female is and write the process of fertilization in reproductive biolog</li> <li>5 Describe the gonadal hormones and the mechanism of horm in reproduction.</li> <li>6 Explain the development of multicellular organisms from zygote.</li> <li>7 Describe the history and different stages of embryonic deve its implications.</li> <li>8 Identify the various developmental stages and the possible growth.</li> </ul>		a reproductive biology. e mechanism of hormones action alar organisms from a single cell es of embryonic development and ages and the possible defects in			
5	Credit	redit Value 1C 1 credit =15 Hours – Learning and Obs		s – Learning and Observation	
6	Total I	otal Marks Maximum Marks :25 Minimum Passing Ma		Minimum Passing Marks:10	
<b>S.</b> ]	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.			

#### 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 R. P. V	9. Dr. Neeru Agrawal NApl
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha Seula -
Industrial Representative	12. Dr. Alka Mishra
Student Nominee Dollyfor	13. Mr. Sudesh Sahu
×	14. Mr. Anurag Mishra
	Do /

#### 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.
- Sastry, K.V. and Shukla Vinita (2018) Developmental Biology (2nd Revised Edition) Rastogi Publication.
- 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

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)

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

# Course Code: GEC08 Food Nutrition and Health

Program: Bachelor in		Class: B. Sc. Semester - VI	Session:2024-202	5
	cience (Bio Group)			
Certificate/diploma/deg				
ree/honors				
1     Course Code     GEC08				
2	Course Title	Food Nutrition and Health		
3	Course Type	General Elective Course (GEC)		
4	Course Learning	This Course will enable the students to:		
	Outcome (CLO)	• Understand the role of food and nutrients in	n health and disease	e.
		• Provide culturally competent nutrition serv	vices for diverse ind	ividuals.
		• Implement strategies for food access, pr	rocurement, prepar	ation, and
		safety that are relevant for the culture, as		
		economic status of clients and groups.		
		Perform food system management and lead	lership functions the	at conside
		sustainability in business, healthcare, co		
		sustainability in business, healthcare, co arenas.	ommunity, and in	istitutiona
		<ul><li>sustainability in business, healthcare, containability arenas.</li><li>Understand the principles and practices</li></ul>	ommunity, and in	istitutiona
		<ul> <li>sustainability in business, healthcare, coarenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> </ul>	ommunity, and in of food safety t	istitutiona to preven
5	Credit Value	<ul><li>sustainability in business, healthcare, containability arenas.</li><li>Understand the principles and practices</li></ul>	ommunity, and in of food safety t	istitutiona to preven
	Credit Value Total Marks	<ul> <li>sustainability in business, healthcare, coarenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> </ul>	ommunity, and in of food safety t	nstitutiona to preven trvation
5		<ul> <li>sustainability in business, healthcare, contained arenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> <li>3C 1 credit =15 Hours – 1 Maximum Marks :100</li> </ul>	ommunity, and in of food safety t Learning and Obser	nstitutiona to preven trvation
5	Total Marks	<ul> <li>sustainability in business, healthcare, contained arenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> <li>3C 1 credit =15 Hours – 1 Maximum Marks :100</li> </ul>	ommunity, and in of food safety t Learning and Obser Minimum Passing M	nstitutiona to preven trvation
5 Par	Total Marks t B: Content of the Total n	<ul> <li>sustainability in business, healthcare, contained arenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> <li>3C 1 credit =15 Hours - 1 Maximum Marks :100</li> <li>Course</li> <li>o. of Teaching/ Learning Periods = 60 Periods</li> </ul>	ommunity, and in of food safety t Learning and Obser Minimum Passing M	nstitutiona to preven trvation
Par	Total Marks t B: Content of the Total n	sustainability in business, healthcare, co arenas. • Understand the principles and practices foodborne illnesses. 3C 1 credit =15 Hours – 1 Maximum Marks :100 Course	ommunity, and in of food safety t Learning and Obser Minimum Passing M	nstitutiona to preven <b>tvation</b> 1arks:40
) Par	Total Marks Total Marks Total n	<ul> <li>sustainability in business, healthcare, contained arenas.</li> <li>Understand the principles and practices foodborne illnesses.</li> <li>3C 1 credit =15 Hours - 1 Maximum Marks :100</li> <li>Course</li> <li>o. of Teaching/ Learning Periods = 60 Periods</li> </ul>	ommunity, and in of food safety t Learning and Obser Minimum Passing M	nstitutiona to preven rvation farks:40 No. of
5 Par	Total Marks Total Marks Total n Total n I Basic conce	sustainability in business, healthcare, co arenas.  Understand the principles and practices foodborne illnesses.  3C 1 credit =15 Hours - 1 Maximum Marks :100 Course to. of Teaching/ Learning Periods = 60 Periods Topics (COURSE CONTENTS)	ommunity, and in of food safety t <b>Learning and Obser</b> Minimum Passing M <b>6 (60 Hours)</b> of balanced diet,	nstitutiona to preven rvation farks:40 No. of Periods
Uni	Total Marks Total Marks Total n	sustainability in business, healthcare, co arenas.  Understand the principles and practices foodborne illnesses.  3C 1 credit =15 Hours - 1 Maximum Marks :100 Course to. of Teaching/ Learning Periods = 60 Periods Topics (COURSE CONTENTS)	ommunity, and in of food safety t Learning and Obser Minimum Passing M	rvat Iark

п	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	<b>Definition and concept of health:</b> 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 domesticlevel. 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 theirtransmission, causative agent, sources of infection, symptoms and prevention.Causes of food spoilage and its prevention.	12

# Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj Aming
Subject Expert R-VP-David	2. Dr. Neeru Agrawal NAy
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha Sinha'.
Industrial Representative	5. Dr. Alka Mishra
Student Nominee 20 Mapor	6. Mr. Sudesh Sahu
0	7. Mr. Anurag Mishra
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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 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

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, Se internal choices.	ection C and D will have
	Section-A & B: Very short answer type question- 01x02 = Section-C: Short answer type question Section-D: Long answer type question	= 02 x 5unit = 10 Marks 03 x 5 unit = 15 Marks 07 x 5 unit = 35 Marks Total = 60 Marks

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert R P-P-11	2. Dr. Neeru Agrawal NAp
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee DollySalu	6. Mr. Sudesh Sahu
X	7. Mr. Anurag Mishra
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### Lab Course: GECL08 Food, Nutrition and Health

Program: Bachelor in			Class: B. Sc.	Semester - VI	Session:2024-2025
Science (Bio Group) Certificate/diploma/deg ree/honors		/diploma/deg			
1	1 Course Code		GECL08		
2	2 Course Title Food, Nutrition and Health		ealth		
3	Cours	е Туре	General elective Lab. Course (GECL)		se (GECL)
4	4 Course Learning Outcome (CLO)		<ul> <li>This Course will enable the students to:</li> <li>Understand the role of food and nutrients in health and disease.</li> <li>Provide culturally competent nutrition services for diverse individuals.</li> <li>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.</li> <li>Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas.</li> <li>Understand the principles and practices of food safety to prevent foodborne illnesses.</li> </ul>		
			• Unders	stand the principles and practic	es of food safety to prevent
5	Cred	it Value	• Unders	stand the principles and practic orne illnesses.	es of food safety to prevent Learning and Observation
5		it Value I Marks	• Unders foodbo	stand the principles and practic orne illnesses. 1 credit =15 Hours –	
5			Unders foodbo     1C	stand the principles and practic orne illnesses. 1 credit =15 Hours –	Learning and Observation
5	Tota	l Marks	Unders foodbo     1C     Maximum Ma	stand the principles and practic orne illnesses. <b>1 credit =15 Hours</b> – rks :25	Learning and Observation Minimum Passing Marks:10
5	Tota No.	l Marks Datecting ad	Unders foodbo     1C     Maximum Ma	stand the principles and practic orne illnesses. <b>1 credit =15 Hours –</b> rks :25 <b>List of Experiments</b> Ghee b) Sugars c) Tea leaves an	Learning and Observation Minimum Passing Marks:10
6	Tota <b>No.</b> 1.	l Marks Datecting ad Estimation of	Unders foodbo     1C     Maximum Ma dulteration in a) of Lactose in mi	stand the principles and practic orne illnesses. <b>1 credit =15 Hours –</b> rks :25 <b>List of Experiments</b> Ghee b) Sugars c) Tea leaves an	Learning and Observation Minimum Passing Marks:10

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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.

#### Name & Signature of Members of Board of Studies

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Subject Expert	2. Dr. Neeru Agrawal NAT
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Member of other Department	4. Dr. Sanju Sinha Sinha
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Student Nominee Delye un	6. Mr. Sudesh Sahu
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### Part C - Learning Resource

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Text Books, Reference Books, Other Resources

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- 3. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
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https://www.health.harvard.edu/topics/nutrition

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

#### Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
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Subject Expert R-V 15.13	2. Dr. Neeru Agrawal
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	7. Mr. Anurag Mishra
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