KURUKSHETRA UNIVERSITY KURUKSHETRA

Scheme of Examination and Syllabus for Under-Graduate Programme (Subject: Zoology)

Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020 w.e.f. 2023-24 (in phased manner)

Subject: Zoology

			SEM	ESTER-1					
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-1 MCC-1	B23-ZOO-101	Animal Diversity of Non-Chordates	3	3	20	50	70	3 hrs.
Aac	4 credit		Practical	1	2	10	20	30	4 hrs.
Scheme C only	MCC-2 4 credit	B23-ZOO-102	Type study of Non-chordates	3	3	20	50	70	3 hrs.
C only			Practical	1	2	10	20	30	4 hrs.
Scheme	CC-M1 2 gradit	B23-ZOO-103	Introduction of Non-Chordates	1	1	10	20	30	3 hrs.
RemarksCo TScheme A & CC MC 4 cScheme C onlyMC 4 cScheme A & CCC 4 cScheme A & CMI 3 cRemarksCo TScheme A & CMI 4 cScheme A & CMI 4 cScheme A & CCo 4 cScheme A & CCo 4 cScheme A & CDS 4 cScheme A onlyCC 2 cScheme A onlyMI	2 crean		Practical	1	2	5	15	20	4 hrs.
Scheme	MDC-1	D22 700 104	Basics of Zoology-I	2	2	15	35	50	3 hrs.
A & C	3 credit	B23-Z00-104	Practical	1	2	5	20	25	4 hrs.
			SEM	ESTER-2					
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-2 MCC-3	B23-ZOO-201	Animal Diversity of Chordates	3	3	20	50	70	3 hrs.
Adt	4 credit		Practical	1	2	10	20	30	4 hrs.
Scheme	DSEC-1	B23-ZOO-202	Applied Zoology	3	3	20	50	70	3 hrs.
Scheme C only4 of C onlyScheme AC onlyScheme A & CMA & C3 of O onlyScheme A & CMScheme C onlyMScheme A onlyC onlyScheme A onlyC only	4 credit	B23-ZOO-202	D 1	1		10	20	20	1 hrs
			Practical	1	2	10	20	30	4 111 8.
Scheme	CC-M2	B23-ZOO-203	Practical Introduction of Chordates	1	2	10	20	30	4 ms. 3 hrs.
Scheme A only	CC-M2 2 credit	B23-ZOO-203	Practical Introduction of Chordates Practical	1 1 1	2 1 2	10 10 5	20 20 15	30 30 20	4 hrs. 3 hrs. 4 hrs.
Scheme A only Scheme	CC-M2 2 credit MDC-2 3 credit	B23-ZOO-203 B23-ZOO-204	Practical Introduction of Chordates Practical Basics of Zoology-II	1 1 1 2	2 1 2 2	10 10 5 15	20 20 15 35	30 30 20 50	4 hrs. 3 hrs. 4 hrs. 3 hrs.

Subject: Zoology

			SEMES	TER-3							
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
Scheme A. B & C	CC-3 MCC-4	B23-ZOO-301	Cell Biology and Animal Genetics	3	3	20	50	70	3 hrs.		
, 2 4 0	4 credit		Practical	1	2	10	20	30	4 hrs.		
Scheme	MCC-5 4 credit	B23-ZOO-302	Type study of Chordates	3	3	20	50	70	3 hrs.		
вас			Practical	1	2	10	20	30	4 hrs.		
Scheme	MDC-3	B23-ZOO-303	Basics of Zoology-III	2	2	15	35	50	3 hrs.		
A, B & C	3 credit	<u>D25 200 505</u>	Practical	1	2	5	20	25	4 hrs.		
SEMESTER-4											
Remarks	Course	Course	Name of the	Credit	Contact Hours/	Internal Assessment	End Term	Max.	Exam		
	Туре	Code	Course		Week	marks	Marks	Marks	Duration		
Scheme	CC-4 MCC-6	Code B23-ZOO-401	Course Biomolecules and Mammalian Physiology	3	Week 3	marks 20	Marks 50	Marks 70	3 hrs.		
Scheme A, B & C	CC-4 MCC-6 4 credit	Code B23-ZOO-401	Course Biomolecules and Mammalian Physiology Practical	3	Week 3 2 2	marks 20 10	Marks 50 20	Marks 70 30	3 hrs. 4 hrs.		
Scheme A, B & C Scheme	CC-4 MCC-6 4 credit MCC-7	Code B23-ZOO-401 B23-ZOO-402	Course Biomolecules and Mammalian Physiology Practical Aquaculture	3 1 3	Week 3 2 3 3 3	marks 20 10 20	Marks 50 20 50	Marks 70 30 70	Juration3 hrs.4 hrs.3 hrs.		
Scheme A, B & C Scheme B & C	TypeCC-4MCC-64 creditMCC-74 credit	Code B23-ZOO-401 B23-ZOO-402	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical	3 1 3 1	Week 3 2 3 2 3 2 2	marks 20 10 20 10 20	Marks 50 20 50 20 50	Marks 70 30 70 30	Duration3 hrs.4 hrs.3 hrs.4 hrs.		
Scheme A, B & C Scheme B & C Scheme	TypeCC-4MCC-64 creditMCC-74 creditMCC-8	Code B23-ZOO-401 B23-ZOO-402 B23-ZOO-403	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical Pest Management	3 1 3 1 3	Week 3 2 3 2 3 3 2 3 2	marks 20 10 20 10 20 10 20	Marks 50 20 50 20 50 20 50	Marks 70 30 70 30 70	Duration 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs.		
Scheme A, B & C Scheme B & C Scheme B & C	TypeCC-4MCC-64 creditMCC-74 creditMCC-84 credit	Code B23-ZOO-401 B23-ZOO-402 B23-ZOO-403	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical Pest Management Practical	3 1 3 1 3 1	Week 3 2 3 2 3 2 3 2 3 2 3	marks 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10	Marks 50 20 50 20 50 20 20 20 20 20 20 20 20 20	Marks 70 30 70 30 70 30 70 30 70 30 70 30 70	Duration 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs.		
Scheme A, B & C Scheme B & C Scheme B & C	Type CC-4 MCC-6 4 credit MCC-7 4 credit MCC-8 4 credit DSE-1	Code B23-ZOO-401 B23-ZOO-402 B23-ZOO-403 B23-ZOO-404	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical Pest Management Practical Biodiversity and Wildlife Management	3 1 3 1 3 1 3	Week 3 2 3 2 3 2 3 2 3 3 2 3 3	marks 20 10 20 10 20 10 20 10 20 20 20 20 20 20 20 20 20 20 20	Marks 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50	Marks 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70	Duration 3 hrs. 4 hrs. 3 hrs.		
Scheme A, B & C Scheme B & C Scheme B & C	TypeCC-4MCC-64 creditMCC-74 creditMCC-84 creditDSE-14 credit	Code B23-ZOO-401 B23-ZOO-402 B23-ZOO-403 B23-ZOO-404	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical Pest Management Practical Biodiversity and Wildlife Management Practical	3 1 3 1 3 1 3 1 3 1	Week 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3	marks 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10	Marks 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50 20	Marks 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30	Duration 3 hrs. 4 hrs.		
Scheme A, B & C Scheme B & C Scheme B & C Scheme B & C	Type CC-4 MCC-6 4 credit MCC-7 4 credit MCC-8 4 credit DSE-1 4 credit Select one option	Code B23-ZOO-401 B23-ZOO-402 B23-ZOO-403 B23-ZOO-404 B23-ZOO-405	Course Biomolecules and Mammalian Physiology Practical Aquaculture Practical Pest Management Practical Biodiversity and Wildlife Management Practical Cytogenetics	3 1 3 1 3 1 3 1 3	Week 3 2 3 2 3 2 3 2 3 2 3 3 2 3 3 2 3 3 3	marks 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20 10 20	Marks 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50 20 50	Marks 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70 30 70	Duration 3 hrs. 4 hrs. 3 hrs. 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs. 4 hrs. 3 hrs.		

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			SEMES	IEK-5					
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-5 MCC-9	B23-ZOO-501	Ecology and Environment	3	3	20	50	70	3 hrs.
А, В & С	4 credit		Practical	1	2	10	20	30	4 hrs.
Scheme	MCC-10	B23-ZOO-502	Animal Taxonomy	3	3	20	50	70	3 hrs.
B & C	4 credit	B23 200 302	Practical	1	2	10	20	30	4 hrs.
	DSE-2	B23-ZOO-503	Animal Behaviour and Chronobiology	3	3	20	50	70	3 hrs.
Scheme	4 credit		Practical	1	2	10	20	30	4 hrs.
B & C	one	B23-ZOO-504	Comparative Anatomy of Vertebrates	3	3	20	50	70	3 hrs.
В & C Scheme В & C	Option		Practical	1	2	10	20	30	4 hrs.
	DSE-3	D22 700 505	Biology of Insects	3	3	20	50	70	3 hrs.
Scheme	4 credit	B23-200-303	Practical	1	2	10	20	30	4 hrs.
B & C	Select	B23-700-506	Parasitology	3	3	20	50	70	3 hrs.
	Option	B23-200-300	Practical	1	2	10	20	30	4 hrs.
			SEMES	TER-6					
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-6 MCC-11	B23-ZOO-601	Developmental Biology & Evolution	3	3	20	50	70	3 hrs.
A, D & C	4 credit		Practical	1	2	10	20	30	4 hrs.
Scheme	MCC-12 4 credit	B23-ZOO-602	Basics of Endocrinology and Immunology	3	3	20	50	70	3 hrs.
вас			Practical	1	2	10	20	30	4 hrs.
	DSE-4	P22 700 602	Reproductive Physiology	3	3	20	50	70	3 hrs.
Scheme	4 credit	B23-200-003	Practical	1	2	10	20	30	4 hrs.
B & C	Select one	P22 700 604	Neurophysiology	3	3	20	50	70	3 hrs.
	Option	B23-200-004	Practical	1	2	10	20	30	4 hrs.
	DSE-5	P22 700 605	Molecular Biology	3	3	20	50	70	3 hrs.
Scheme	4 credit	B23-200-003	Practical	1	2	10	20	30	4 hrs.
B & C	Select		Forensic Biology	3	3	20	50	70	3 hrs.
	Option	B23-ZOO-606	Practical	1	2	10	20	30	4 hrs.

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	SEMESTER-7 (FOR HONOURS/HONOURS WITH RESEARCH IN ZOOLOGY)										
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
	CC-H1 4 credit	B23-ZOO-701	Advances of Cell Biology	4	4	30	70	100	3 hrs.		
For Honours	CC-H2 4 credit	B23-ZOO-702	Biochemistry and Bio- techniques	4	4	30	70	100	3 hrs.		
in Zoology/ Honours	CC-H3 4 credit	B23-ZOO-703	Structure and Function of Invertebrates	4	4	30	70	100	3 hrs.		
with Research	DSE-H1 4 credit Select one	B23-ZOO-704	Biosystematics and Biostatistics	4	4	30	70	100	3 hrs.		
III Zoology	Option	B23-ZOO-705	Computational Biology	4	4	30	70	100	3 hrs.		
	PC-H1 4 credit	B23-ZOO-706	Practical Based on B23-ZOO-701 TO 704/705	4	8	30	70	100	6 hrs.		
SEMESTER-8 (FOR HONOURS IN ZOOLOGY)											
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
	CC-H4 4 credit	B23-ZOO-801	Structure and Function of Vertebrates	4	4	30	70	100	3 hrs.		
	CC-H5 4 credit	B23-ZOO-802	Comparative Physiology	4	4	30	70	100	3 hrs.		
Honours	CC-H6 4 credit	B23-ZOO-803	Population Genetics & Evolution	4	4	30	70	100	3 hrs.		
in Zoology	DSE-H2 4 credit	B23-ZOO-804	Population and Community Ecology	4	4	30	70	100	3 hrs.		
	Select one option	B23-ZOO-805	Environment and Public Health	4	4	30	70	100	3 hrs.		
	PC-H2 4 credit	B23-ZOO-806	Practical Based on B23-ZOO-801 TO 804/805	4	8	30	70	100	6 hrs.		
		OR SEMES	STER-8 (FOR HONOURS	WITH RES	EARCH IN	ZOOLOGY)					
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
Honoung	CC-H4 4 credit	B23-ZOO-801	Structure and Function of Vertebrates	4	4	30	70	100	3 hrs.		
with Research	CC-H5 4 credit	B23-ZOO-802	Comparative Physiology	4	4	30	70	100	3 hrs.		
in Zoology	Project/ Dissertation 12 credit	B23-ZOO-807	Project/Dissertation	8+4	-	-	-	-	-		

ZOOLOGY: SEMESTER-I									
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-1 MCC-1	B23-ZOO-101	Animal Diversity of Non-Chordates	3	3	20	50	70	3 hrs.
A & C	4 credit	B25-200-101	Practical	1	2	10	20	30	4 hrs.
Level of the	course: 100-1	199							
Pre-requisite	e for the co	urse (if any): Biolog	gy as a Subject at 4.0 Level	(Class XII)					
1. Student v	will be able to	describe unique cha	racters and recognize life for	rms of phyli	ım Protozoa an	d Porifera			
2. Student v	vill be able to	describe unique char	racters and recognize life for	rms of phylu	um Coelenterat	a and Helminthes			
3. Student v	vill be able to	describe unique char	racters and recognize life for	rms of phyli	um Annelida ar	d Arthropoda	IIamiaha	rdatas	
5. Students	will be capabl	le of identifying the	characters and classification	of Non-Ch	ordates			luales	
Instruction	s for Paper-S	etter							
1. Nine que	stions will be	set in all. All question	ons will carry equal marks.		1		1	.11.1	
2. Question selecting	No. 1, which	will be short answer from each Unit I to	IV The candidate will be re	labus, will to at	tempt question	No 1 and four m	ght questio	ons will be s	et unit wise
question	from each uni	t.		equired to a	tempt question	110. 1 und four in	lore questre	ins selecting	5 0110
UNIT	TOPICS							CONTAC	CT HOURS
	Phylum Pro	otozoa:							
	General cha	aracters and classific	ation up to class level						
I	Phylum Por	rifera:							12
	General cha	aracters and classific	ation up to class level,						
	Type study	of Sycon							
	General cha	aracters and classific	ation up to class level						
п	Type Study	of Obelia							11
ш	Phylum – P	latyhelminthes and A	Aschelminthes:						11
	General cha	aracters and classific $of I$ iver Fluke Fas	ation up to class level,						
	Phylum – A	Annelida:							
	General cha	aracters and classific	ation up to class level,						
	Type study	of Earthworm, <i>Pher</i>	etima posthuma (Habitat, ha	abits, metam	erism, digestiv	e System, circula	tory		
III	Phylum – A	Arthropoda:	uetive system)						11
	General cha	aracters and classific	ation up to class level,						
	Type study	of Cockroach, Perip	planeta americana (Habitat,	habits, exte	rnal morpholog	y, digestive syste	m,		
	Phylum - N	system, excretory sy Iollusca:	stem, reproductive system)						
	General cha	aracters and classific	ation up to class level,						
	Type study	of <i>Pila</i>							
IV	General cha	connodermata: aracters and classific	ation up to class level.						11
	Type study	of Asterias (Sea Star	r)						
	(Habitat, ha	bits, external morph	ology, water vascular syster	n, Circulato	ry System)				
	Classificati	michordata: General	characters of Hemichordate	es with exan	ples	ving animals.			
	1. Protozo	a: Lamination of cult	tures of Amoeba, Euglena a	nd Paramec	<i>ium;</i> permaner	it prepared slides:	Amoeba,		
	Euglena, T	rypanosoma, Noctilı	ıca, Eimeria, Paramecium (binary fissi	on and conjuga	ation), Opalina, V	'orticella,		
	Balantidium	n, Nyctotherus, radio (Porifera): Sycon	larian and formaniferan ooz	e. Spora	illa Eusponaia				
	3. Coelent	erata: <i>Porpita</i> , <i>Valei</i>	lla, Physalia, Aurelia, Rhize	ostoma, Me	tridium, Millip	ora, Alcyonium, 1	Tubipora,		
v	Zoanthus, N	Madrepora, Favia, F	<i>Sungia</i> , and Astrea. Permane	ent prepared	l slides: Hydra	(W.M.), Hydra v	vith buds,		
Practical	Obelia (col	ony and medusa), Se	ertularia, Plumularia, Tubul	aria, Bouga	unvillea, Aurel	<i>ia</i> (sense organs a	ind stages		30
	4. Playheli	ninthes: <i>Dugesia</i> , Fa	usciola, Taenia, Echinocoecu	us. Permane	nt prepared slid	es: Miracidium, S	porocyst,		
	Redia, Cerc	caria, Scolex and Pro	oglotttids of Taenia (mature	and gravid)			,		
	5. Aschelm	ninthes: Ascaris (ma	le and female), <i>Trichinella</i> ,	Ancylostom	a, Meloidogyne	Tubifar and David	obdolla		
	7. Arthron	a. Enereuma, Hetero oda: Perinatus Pal	aemon (Prawn). Lobster (Cancer (cra	b). Sacculina	Eupagurus (herr	nit crab)		
	Lepas, Bala	anus, Cyclops, Daph	nia, Lepisma, Periplaneta (cockroach),	Schistocerca	(locust), Poeciloc	erus (ak-		

 hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honey bee), Bombyx (silk moth), Cimex (beg bug), Pediculus (body louse), Millipede, Scolopendra (centipede), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab) 8. Mollusca: Mytilus, Ostrea, Cardium, Pholas, Solen (razor/Fish), Pecten, Holiotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium 9. Echinodermata: Asterias, Echinus, Cucumaia, Ophiothrix, Antedon and Asterophyton 10. Hemichordata: Balanoglossus 11. Study of slides of Non-Chordates phyla; Staining of Obelia and Sertularia 								
	Suggested Evaluation Methods							
Inter	nal Assessment:	End Term Examination:						
> • • • •	Internal Assessment: End Term Examination: > Theory • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 > Practicum • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10							
	Learning Resources							
1. Jord 2. Ayy Madras 3. Kotp 4. Nair 5. Rast	an, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi. ar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswana s. pal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut. c, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invert togi V.B. 2021. Invertebrate Zoology. Kedar Nath Ram Nath, Meerut	athan Printers and Publishers Pvt. Ltd. tebrates. Saras Publication, Nagercoil.						

	ZOOLOGY: SEMESTER-I									
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration	
Scheme	MCC-2	B23-ZOO-102	Type study of Non-chordates	3	3	20	50	70	3 hrs.	
C only	4 credit		Practical	1	2	10	20	30	4 hrs.	
Level of the	course: 100-1	.99		~						
Pre-requisite	e for the con	urse (if any): Biology	as a Subject at 4.0 Level (Class XII)						
1. Student v	vill be able to	describe about Type st	udy of <i>Paramecium</i>							
2. Student v	vill be able to	describe Type study of	Ascaris							
3. Student v	vill be able to	describe about Annelic	ls and Arthropods							
4. Student v	vill be able to	describe Type study of	Balanoglossus	-f.N Chand	- 4					
5. Students	s for Paper-S	etter	aracters and classification	of Non-Chord	ates					
1. Nine que	stions will be	set in all. All questions	s will carry equal marks.							
2. Question	No. 1, which	will be short answer ty	pe covering the entire syll	abus, will be c	compulsory. T	The remaining ei	ght question	ns will be se	t unit wise	
selecting	two questions	from each Unit I to IV	7. The candidate will be re-	quired to atten	npt question I	No. 1 and four m	ore questio	ns selecting	one question	
from each	n unit.							CONTAC		
UNIT	TOPICS							CONTAC	THOURS	
	Biodiversi	rotozoa: ty and economic impo	rtance of Protozoans:							
-	Type study	y of Amoeba, Paramec	ium						10	
1	Phylum P	orifera:							12	
	Biodiversi	ty and economic impor	rtance of poriferans,							
	Canal syst	em in sponges, Spicule	es in sponges							
	Biodiversi	- Coelentrata:	tance of cnidarians							
	Corals and	Corals and coral reefs								
п	Polymorph	Polymorphism in Siphonophores								
п	Phylum –	Platyhelminthes and	Aschelminthes:					11		
	Biodiversi	ty and economic import	rtance of flat worms,							
	Common i	y of <i>Ascarts tumbricold</i> roundworms and their e	economic importance							
	Phylum –	Annelida:								
	Biodiversi	ty and economic impor	rtance of annelids							
	Metameris	sm in Annelida								
ш	Larval for	Arthropoda:							11	
	Biodiversi	ty and economic import	rtance of insects (insect ve	ctors, lac inse	cts, honey bee	e, insect pest) &				
	crustacean	IS	`	,	, ,					
	Type study	y of Grasshopper								
	Evolutiona Dhylum	ary significance of Peri	patus							
	Biodiversi	ty and economic impor	rtance of Molluscs							
	Torsion ar	d detorsion in gastropo	oda							
	Phylum –	Echinodermata:								
IV	Biodiversi	ty and economic impor	rtance of echinoderms						11	
	Larval for	ms of Echinoderm	Functions							
	Phylum –	Hemichordata:	l'unctions							
	Type Stud	y of Balanoglossus								
	Study of t	he following permane	ent stained preparations:							
	1. L.S. an	d T.S. Sycon; gemmule	es, spicules and spongin files	bres of Sycon,	canal system	of sponges				
	2. 1.5. Hy 3. T.S. Fa	<i>usciola</i> (different region	15)							
•	4. T.S. As	caris (male and female	e)							
v Practical	5. T.S. Ph	neretima (pharyngeal ar	nd typhlosolar regions), Se	etae, septal nep	phridia and sp	ermathecae of <i>P</i>	Pheretima.		30	
acticul	6. Trache	a and mouthparts of co	ckroach.							
	7. Statocy 8. Glochi	ist of <i>Falaemon</i> . dium larva of <i>Anodonte</i>	r. radula and osphradium	of Pila						
	9. T.S. St	ar fish (arm).	., radulu ulla ospilludiulli (
	10. T.S. B	alanoglossus (through	various regions).							

	Preparation of the following slides:						
	1. Temporary preparation of Volvo, Paramecium, Gemmules and spicules of Sycon; mouth par	rts and trachea of					
	Periplaneta (cockroach).						
	2. Preparation of permanent stained whole mounts of <i>Hydra</i> , <i>Obelia</i> , <i>Sertularia</i> , <i>Plumularia</i> an	d <i>Bougainvillea</i> .					
	3. Preparation of mouth parts of Mosquito, House fly and cockroach.						
	Study of Internal Anatomy						
	1. Computer, simulated study/ model of:						
	(i) <i>Earthworm</i> : Digestive, reproductive and nervous systems						
	(ii) <i>Pila</i> : Pallial complex, digestive and nervous system						
	2. Demonstration of internal anatomy of cockroach: Digestive, reproductive and nervous system	ns					
	Suggested Evaluation Methods						
Inter	rnal Assessment:	End Term Exa	nination:				
≫	Theory	> Theor	У				
•	Class Participation: 5	Writte	en Examination: 50				
•	Seminar/presentation/assignment/quiz/class test etc.: 5	≻	Practicum				
•	Mid-Term Exam: 10	Practical	Examination: 20				
≫	Practicum						
•	Class Participation: NA						
•	Seminar/Demonstration/Viva-voce/Lab records etc.: 10						
•	Mid-Term Exam: NA						
	Learning Resources						
1. Jord	lan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.						
2. Ayy	ar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanath	nan Printers and Pu	ıblishers Pvt. Ltd.				
Madra	IS.						
3. Kot	pal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.						
4. Nai	r, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertel	brates. Saras Publi	cation, Nagercoil.				
5. Ras	5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut						
6. Lal	S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut						
7 And	Jarson D.T. (1000) Invertebrate Zoology, Oxford University Press						

Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
 Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology ; Saunders College Pub.

ZOOLOGY: SEMESTER-I									
Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-M1	B23-ZOO-103	Introduction of Non-Chordates	1	1	10	20	30	3 hrs.
A	2 credit		Practical	1	2	5	15	20	4 hrs.
Level of the	course: 100-1	99							
Course Lea	rning Outcor	nes (CLO)							
 Student v Student v Student v Student v Student v 	will be able to will be able to will be able to will be able to will be capabl	understand about ph understand about ph understand about ph understand about ph e of identifying the c	ylum Protozoa and Porifer, ylum Coelenterata and Hel ylum Annelida and Arthrop ylum Mollusca, Echinoder ylum delassificatio	a minthes poda mata and Hen n of Non-Cho	nichordates				
Instruction	s for Paper-Se	etter			rates				
 Nine que Question selecting question 	 Nine questions will be set in all. All questions will carry equal marks. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit. 								
UNIT	TOPICS							CONTAC	T HOURS
Ι	Phylum Proto Phylum Porif	ozoa: General charac era: General charact	eters and classification of Paters and classification of Paters	rotozoa with th orifera with th	heir ecologica eir ecologica	al and economic i l and economic ir	mportance nportance		4
п	Phylum – Co importance Phylum – Pl ecological an	atyhelminthes and a deconomic importa	characters and classification Aschelminthes: General classes nce	on of Coelenti haracters and	rata with the	ir ecological and n of Helminthes	economic with their		4
III Phylum – Annelida: General characters and classification of Annelida with their ecological and economic importance Phylum – Arthropoda: General characters and classification of Arthropods with their ecological and economic importance									4
IV	Phylum - Mc importance Phylum – En economic im Phylum Hem	llusca: General char chinodermata: Gene portance ichordata: General (acters and classification of ral characters and classific Tharacters of Hemichordate	Mollusca wit ation of Echin es with examp	h their ecolog oderms with oles	gical and econom their ecological a	ic Ind		3
V Practical	V V Practical Sclassification up to orders with ecological note and economic importance of the following animals: Protozoa: Permanent slides: Amoeba, Euglena, Trypanosoma, Noctiluca, Eimeria, Paramecium (binary fission and conjugation), Opalina, Vorticella, Balantidium, Nyctotherus, radiolarian and formaniferan ooze. Porifera: Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia Coelenterata: Porpita, Valella, Physalia, Aurelia, Rhizostoma, Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia, and Astrea. Permanent slides of Hydra (W.M.), Hydra with buds, Obelia (colony and medusa), Sertularia, Plumularia, Tubularia, Bougainvillea, Aurelia. Playhelminthes: Dugesia, Fasciola, Taenia, Echinocoeccus. Permanent prepared slides: Miracidium, Sporocyst, Redia, Cercaria, Scolex and Proglotttids of Taenia (mature and gravid). Aschelminthes: Ascaris (male and female), Trichinella, Ancylostoma, Meloidogyne S. Annelida: Pheretima, Heteronereis, Polynoe, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella Arthropoda: Peripatus, Palaemon (Prawn), Lobster, Cancer (Crab), Sacculina, Eupagurus (Hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (Locust), Poecilocerus (ak-hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (Honey bee), Bombyx (Silk moth), Cimex (Bed bug), Pediculus (Head louse), Millipede, Scolopendra (centipede), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab) Mollusca: Mytilus, Ostrea, Cardium, Pholas, Solen (razor / Fish), Pecten, Holiotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium Steipod								30
			Suggested	l Evaluation I	Methods				
Internal A	ssessment:					End T	erm Exam	ination:	
> T	heory	4				≫	Theory	F	20
	ass Participati	on: 4 ation/assignment/gu	iz/class test etc ∙ N∆			•	Written	Examination	n: 20
• M	lid-Term Exan	1: 6	12, 01055 1051 010 IVA				 Practics 	rracticum Examination	1 on: 15
» P	racticum						i ideilet		

- Class Participation: NA
 Seminar/Demonstration/Viva-voce/Lab records etc.: 5
 Mid-Term Exam: NA
 Learning Resources
 - 1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.

2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.

3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.

4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.

5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut

6. Lal S.S. 2019. Practical Zoology Invertebrates. Rastogi Publications, Meerut

7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press

8. Edward E. Ruppert, Robert D. Barnes (1994). Invertebrate Zoology ; Saunders College Pub.

Remarks	Course	Course	Name of the	Credit	Contact Hours/	Internal Assessment	End Term	Max. Morka	Exam
	туре	Coue	Course		Week	marks	Marks	IVIALKS	Duration
Scheme	MDC-1	B23-ZOO-104	Basics of Zoology-I	2	2	15	35	50	3 hrs.
A & C	3 credit	100	Practical	1	2	5	20	25	4 hrs.
Pro requisit	for the c	-199 ourse (if any): NA							
Course Log	rning Oute	ourse (II ally). NA							
1 Student v	vill be able t	o learn about Kingdo	m Animalia						
2. Student v	vill be able t	o learn about Chords	ntes						
3. Student v	vill be able t	o describe unique ch	aracters and recognize life fu	nctions of phy	lum Annelid	a and Arthropoda			
4. Student v	vill be able t	to describe unique ch	aracters and recognize life fu	nctions of phy	lum Mollusc	a, Echinodermata	and Hemic	hordates	
5. Students	will be capa	ble understand the ro	ble of non chordates in their su	urroundings		,			
Instruction	Instructions for Paper-Setter								
1.Nine ques	1. Nine questions will be set in all. All questions will carry equal marks.								
2. Question	No. 1, whic	h will be short answe	er type covering the entire syl	labus, will be	compulsory.	The remaining ei	ght question	ns will be set	unit wise
selecting	two questio	ns from each Unit I t	o IV. The candidate will be re	equired to atte	mpt question	No. 1 and four m	ore questio	ns selecting	one
question	from each u	nit.							
UNIT	TOPICS							CONTAC	T HOURS
	Zoology:	Definition and scope	, introduction to Animal King	dom, animal	characters				
Ι	Non-Chor	dates and invertebrat	es with examples, invertebrate	e Phyla, Introd	fuction to bas	ic characters of an	imal with	:	8
	Special rel	Study of Amooba and	lordates; Biodiversity: Introdu	iction and Sc	ope; General	characters of Pro	tozoa and		
	General d	baracters of Coelentr	ata and Appelida: Ecological	importance c	f corals: Mo	mbology of earth	worm and		
II	II denotation contractions of Coefficient and Annenda, Ecological Importance of Corais, Morphology of earthworth and 8								
	General cl	haracters of Arthrono	and Mollusca: Study of ba	sic characters	s of insects ar	d snails. Insects a	is nest.		
III	Grasshop	per, Economic impo	rtance of Honey Bee; Snails a	s pest in Padd	ly fields	, 115 00 50	is pesti	,	7
IV	General cl	haracters of Echinod	ermata; Study of basic charact	ters of Star fis	sh with refere	nce to its role in		,	7
11	ecosystem	i; Economic importa	nce of Star Fish						/
	1. To stud	y the non chordates t	from pond water						
	2. To stud	y the different parts	of Insects by examining Hous	efly, butterfly	, beetles				
	3. To stud	y the characters of b	urrowing non chordates e.g. E	arthworm				3	0
Practical	4. To stud	y the life cycle of Bu	itterfly/Mosquito						
	5. To stud	y various minor phyl	datas spacimons of various ph	via					
	0. Identifi	cations of Non-Chor	Suggested	Evoluction N	lothod a				
T			Suggesteu	Evaluation N	lethous	F -1 T		• •	
Internal A	ssessment:					Ena 1	erm Exam	ination:	
> TI	heory					≥	Theory		
• Cl	lass Participa	ation: 4				•	Written	Examination	n: 35
• Se	eminar/prese	entation/assignment/c	uiz/class test etc.: 4				≻	Practicum	1
• M	id-Term Exa	am: 7					Practical E	Examination:	20
> Pı	racticum								
• Cl	lass Participa	ation: NA							
• Se	eminar/Dem	onstration/Viva-voce	/Lab records etc.: 5						
• M	id-Term Exa	am: NA							
			Lear	ning Resourc	es				
1. Jordan, E	.L and P.S.	Verma. 2009. Inverte	brate Zoology, S.Chand and	Co. Ltd. New	Delhi.				
2. Ayyar, E.	K and T. Ar	nanthakrishnan. 1992	. Manual of Zoology Vol.1 In	vertebrates P	art I and II, S	.Viswanathan Prin	nters and Pu	ublishers Pvt	. Ltd.
Madras.									
3. Kotpal, R	.L. 2021. Zo	bology Invertebrates.	Rastogi Publications, Meerut	Ioomit					
H. J. Kasiog	т у. 2021 2019) Practi	al Zoology Invertel	sy. Keuai main Kani Main Main , M Mates Rastogi Publications N	/Jeerut					
J. La D.D. (2017/11acti	ica zoology mvenet	rates. Rastogr 1 ubileations, N	iiu					

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	CC-2 MCC-3	B23-ZOO-201	Animal Diversity of Chordates	3	3	20	50	70	3 hrs.
A & C	4 credit	220 200 201	Practical	1	2	10	20	30	4 hrs.
Level of the	course: 100-1	99		~					
Pre-requisite	e for the cou	arse (if any): Biolo	gy as a Subject at 4.0 Level (Class XII)					
1. Student v 2. Student v 3. Student v 4. Student v	vill be able to o vill be able to o vill be able to o vill be able to o will be capable	describe unique cha describe unique cha describe unique cha describe unique cha describe unique cha	racters and recognize life fun- racters and recognize life fun- racters and recognize life fun- racters and recognize life fun- characters and classification of	ctions of Uroc ctions of Pisco ctions of Amp ctions of Bird	chordates es bhibians & Re s & Mammal	eptiles s			
Instruction	s for Paper-S	etter	enaracters and classification (51 Chordates					
 Nine que Question selecting from each 	stions will be No. 1, which two questions n unit.	set in all. All questi- will be short answer from each Unit I to	ons will carry equal marks. type covering the entire sylla IV. The candidate will be red	abus, will be c quired to atten	compulsory. 7 npt question 1	The remaining eig No. 1 and four mo	ht questions ore question	s will be set t s selecting o	unit wise ne question
UNIT TOPICS								CONTAC	T HOURS
I	I Chordates: Protochordates: Urochordata: Systematic position, distribution, ecology, morphology and affinities Userbardete: Urochordate: Systematic position, distribution, ecology, morphology and affinities							1	2
п	Pisces: Ger Fins, Type study	neral characters and	classification up to classes w	ith examples	emphasizing	their biodiversity,	, Scales &	1	1
ш	Amphibia Type study <u>Reptilia:</u> (: General characters of frog, Parental Caracters and General characters and	and Classification upto class are and Neoteny in Amphibia nd Classification upto classes	level;				1	.1
IV	Aves: Gen Flight/Aeri <u>Mammals</u> Type study	eral characters and (al adaptation in bird General characters of Rat	Classifications upto classes. ls, <i>Archaeopteryx</i> as missing and classification up to class	link ses;				1	1
Type study of Rat 1. Classification upto orders, habit, habitats, external characters and economic importance (if any): • Protochordata: Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura, and Amphioxus. • Cyclostomata: Myxine, Petromyzon and Ammocoetus larva. • Chondrichthyes: Zygaena, Pristis, Narcine (electric ray), Trygon, Rhinobatus, Raja and Chimaera. • Osteichthyes: Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea and Polypterus. Any of the Lung Fishes. • Amphibia: Necturus, Proteus, Amphiuma, Salamandra, Ambystoma, Axolotl larva, Alytes, Bufo, Rana. • Reptilia: Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone (Turtle) and Testudo (Tortoise). • Aves: Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon • Mammalia: Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus. 2. Study of the skeleton of Scoliodon, Labeo, Rana (Frog), Varanus, Pigeon or Gallus and Orcyctolagus/rat. 3. Study of the following permanent slides: Tornaria larva, T.S. Amphioxus (through different regions). Oikopleura, Histology of rat (compound tissues), different types of scales. 4. Make permanent stained preparations of the following: Salpa, Spicules, and Pharynx of Herdmania, Amphioxus, Cycloid scales 5. Eidd Visit to Protected areas (National Bark (Wildlifa Sancturary or							3	60	
T ()))			Suggested 1	Evaluation M	lethods			•	
Internal A	ssessment:					End T	erm Exam	ination:	
$ \begin{array}{c} > & \Pi \\ \bullet & CI \\ \bullet & Se \\ \bullet & M \\ > & Pr \end{array} $	ass Participati minar/present id-Term Exan cacticum	on: 5 ation/assignment/qu 1: 10	iiz/class test etc.: 5			•	Written ≫ Practical E	Examination Practicun Examination:	n: 50 1 20
Cl Se M	ass Participati minar/Demon <u>id-Term</u> Exan	on: NA stration/Viva-voce/ n: NA	Lab records etc.: 10						
	Learning Resources								

- R.L.Kotpal. Modern Textbook of Zoology 1.
- 2.
- E.L. Jordan and Verma. Chordate Zoology. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York. 3.
- 4.
- 5. Kent, C.G. Comparative anatomy of vertebrates.
- 6. S.S. Lal. Practical Zoology Vertebrate

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
Scheme	DSEC-1		Applied Zoology	3	3	20	50	70	3 hrs.
C only	4 credit	B23-ZOO-202	Practical	1	2	10	20	30	4 hrs.
Level of the	course: 100-	199	<u> </u>	a					
Pre-requisite	for the co	ourse (if any): Biology	as a Subject at 4.0 Level (Class XII)					
1. Students v	vill be able to	b identify different spec	ties and casts of honeybees	and species o	f silkworm.				
2. Students v	vill be able to	o use the tools and tech	niques used in apiculture, s	ericulture, aqu	uaculture, pig	gery poultry and	leather Indu	stry and cap	abilities to
initiate st	artups will de	evelop valain the basic concent	of Poultry and Discioultur	0					
4. Students v	ill understand	d the basic concepts of	industry based applied met	hods.					
5. Students v	vill develop s	skills in basic laboratory	y techniques and understan	d the principle	es in biology.				
Instructions	for Paper-S	Setter	111						
2. Question selecting from each	 Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit. 								
UNIT	TOPICS							CONTAC	Γ HOURS
	Apiculture	e: History and introduct	tion; Honey bee and kinds;	; Social organ	ization and c	olony nests; Lifec	ycle; Bee		
	keeping, s	election, methods, prod	lucts; Honey composition,	quality and in	nportance				
I	Sericultur	e: Silkworm moth spec	ies and their life cycle; Re	aring of silkw	orm, silk ree	ling, twisting and	weaving;	1	2
	Silk comp	osition, kind and uses;	Diseases and pests of silkw	vorm					
	Prawn Cu	lture: Introduction to P	rawns, species: Prawn farm	ning methods.	processing a	nd preservation of	prawns.		
п	Pearl Cult	ure: Historical backgro	und species: Pearl formati	on compositi	on quality an	d commercial val	116	1	1
ш	Artificial	aulturing synthetic page	rl types and their manufact	uring method	la of hornosti		ue,	1	.1
		euturing, synthètic pea	in types and then manufact	uing, memor		ng. Eish fannsina tasl			
	Piscicultu	re: Economically impo	ortant fresh water and ma	rine fisnes; F	isn culture,	Fish farming tech	nnologies,		
	Problems	of seed collection from	n natural resources, Induce	ed breeding n	nethods, Proc	lucts and by prod	ucts from		
III	piscicultur	re						1	.1
	Poultry: N	Iomenclature and breed	s of poultry birds; Egg stru	cture and qua	lity, nutritive	values, factors af	fecting		
	size and e	gg processing, Poultry	products and by products						
	Fur and le	eather industry: Fur pro	oducing animals; Fur farm	ing, dressing,	processing a	and dyeing, Fur in	ndustry in		
TT 7	India; Ani	mals of leather industry	y, processing of skin, flayir	ng, curing salt	ing and tanni	ng.			-
IV	Piggery and	nd other utilities of ani	mals: Characteristics of sv	vine and impo	ortant breeds,	Products and by	products;	I	.1
	Pharmace	uticals from animals; U	ses of animals in vaccine p	production					
	1. Life cy	cle of Chicken, Poultry	/ farming						
	2. Life hi	story of honeybee.							
	3. Morph	ology of Carp, Cat fish	and Perch.						
\mathbf{V}	4. Fishing	g Crafts and Gears						3	0
Practical	5. Prepara	ation of permanent slid	es of phytoplankton and z	ooplanktons v	which constitu	ute the food of co	mmercial	·	0
	fishes.	their identification and	study of important charact	ers.					
	6. Field v	visit to aviary/fish pond	and fish market/sericulture	e unit/Prawn fa	arm and prepa	aration of field re	port.		
			Suggested	Evaluation N	lethods				
Internal A	ssessment:		Buggesteu		i centous	End T	erm Exam	ination:	
> Tł	leory					≫	Theory		
• Cl	ass Participat	tion: 5	· • · · · -			•	Written	Examination	1: 50
• Se	minar/presen	itation/assignment/quiz/ m: 10	class test etc.: 5				> Des -t: 1 ⊑	Practicum	20
> Pr	acticum						Fractical E	xammation:	20
• Cl	ass Participat	tion: NA							
• Se	Seminar/Demonstration/Viva-voce/Lab records etc.: 10								

- Mid-Term Exam: NA ٠ Learning Resources Concepts of Insect Control by Ghosh M. R. Wiley Eastern Ltd. New Delhi. Economic Zoology. Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998. 1.
- 2.
- Insect Pest Management by Dent, D. 3.
- Agricultural Entomology by Hill, D.S., Timber Press. 4.
- General and Applied Entomology by Nayar K. K. and T. N. Ananthkrishnan and B. V. Davis, Tata McGrew Hill Publications. New Delhi. Agricultural Pests: Biology and Control Measures by B. M. Deoray and T. B. Nikam, Nirali Publication, Pune. 5.
- 7.

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration	
Scheme	CC-M2 2 gradit	B23-ZOO-203	Introduction of Chordates	1	1	10	20	30	3 hrs.	
A only		_	Practical	1	2	5	15	20	4 hrs.	
Level of the	course: 100-19	99								
Course Lea	rning Outcon	nes (CLO)								
1. Student w 2. Student w 3. Student w 4. Student w	vill be able to d vill be able to d vill be able to d vill be able to d	escribe unique chara escribe unique chara escribe unique chara escribe unique chara	cters of Protochordates icters of Pisces icters of Amphibians & Re icters of Birds & Mammals	ptiles						
5. Students	will be capable	of identifying the cl	naracters and classification	of Chordates						
Instruction	s for Paper-Se	etter								
 Nine question Question selecting question 	tions will be se No. 1, which w two questions from each unit	et in all. All question will be short answer from each Unit I to I	s will carry equal marks. type covering the entire syl V. The candidate will be re	llabus, will be equired to atte	compulsory. empt question	The remaining ein No. 1 and four n	ight question nore questio	ns will be set ns selecting	t unit wise one	
UNIT TOPICS CONTACT HOURS										
Ι	I Chordates: Salient features of chordates; Principles of classification; Origin and evolutionary tree of chordates Urochordates: 4 Urochordate & Cephalochordates: Systematic position, distribution, ecology, morphology and affinities									
п	Cyclostomata: General characters and classification up to classe with examples emphasizing their biodiversity, Scales & 4 Fins.									
ш	Amphibia: General Characters and Classification upto class level; Parental Care and Neoteny in Amphibia Reptilia: General Characters and Classification upto classes. Extinct reptiles: Poisonous apparatus in snakes									
IV	IV Reptilia: General Characters and Classification upto classes, Extinct reptiles; Poisonous apparatus in snakes IV Aves: General Characters and classifications upto class level. Flight/Aerial adaptation in birds, Archaeopteryx as missing link Mammals: General Characters and classification up to class; Adaptive radiations of mammals.								3	
V Practical	 I. Classification upto orders, habit, habitats, external characters and economic importance (if any): Protochordata: Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura, and Amphioxus. Cyclostomata: Myxine, Petromyzon and Ammocoetus larva. Chondrichthyes: Zygaena, Pristis, Narcine (electric ray), Trygon, Rhinobatus, Raja and Chimaera. Osteichthyes: Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea and Polypterus. Any of the Lung Fishes. Amphibia: Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotl larva, Alytes, Bufo, Rana. Reptilia: Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone (Turtle) and Testudo (Tortoise). Aves: Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon Mammalia: Ornithorhynchus, Echidan, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus. Study of the skeleton of Scoliodon, Labeo, Rana (Frog), Varanus, Pigeon or Gallus and Orcyctolagus/rat, Palates of birds, skulls of dog & rabbit. Study of the following prepared slides: Tornaria larva, T.S. Amphioxus (through different regions). Oikopleura, Histology of rat (compound tissues), different types of scales. Make permanent stained preparations of the following: Salpa, Spicules, and Pharynx of Herdmania, Amphioxus, Cycloid scales Field Visit to National Park or Zoo. 									
			Suggested	Evaluation N	Aethods					
Internal A	ssessment:					End T	erm Exam	ination:		
> T	heory					≫	Theory	.	20	
• Cl • Se • M	ass Participation 2015 2017 and 201	on: 4 ation/assignment/qui	z/class test etc.: NA			•	Written	Examination Practicum	n: 20 1 15	
> Pi	ass Participation	on: NA					Fractical E	zammation:	13	
• Se • M	Class Participation: NA Seminar/Demonstration/Viva-voce/Lab records etc.: 5 Mid-Term Exam: NA									

- 1. R.L.Kotpal. Modern Textbook of Zoology
- K.E.Kolpal. Modeln Textbook of Zoology
 E.L. Jordan and Verma. Chordate Zoology.
 Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
 Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
- 5. Kent, C.G. Comparative anatomy of vertebrates.
- 6. S.S. Lal. Practical Zoology Vertebrate

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/	Internal Assessment	End Term	Max. Marks	Exam Duration	
G 1			Desta (7. des II	2	Week	marks	Marks	50	2 1	
Scheme	MDC-2	B23-ZOO-204	Basics of Zoology-II	2	2	15	35	<u> </u>	3 nrs.	
Level of the c	$\frac{5 \text{ crean}}{100-10}$	Q	Flactical	1	2	5	20	43	4 111 5.	
Pre-requisite	for the cou	rse (if any): NA								
Course Lear	ning Outcom	es (CLO)								
1 Student wi	ill learn the ro	le of different grou	ps of chordates in mantling a	n equilibrium	in our ecosys	stem				
2 Students w	ill be able to	identify local fishe	s species and their role in the	ecosystem	in our ceosys	, centr				
3. Course wi	ll help to unde	erstand how the nat	ural systems on which we der	pend function						
4. Course wi	ll give the ide	a about how birds a	are economically important.	joind function	•					
5. Student wi	ill learn about	identification of ch	nordates							
Instructions for Paper-Setter										
1. Nine questions will be set in all. All questions will carry equal marks.										
2. Question N	Jo. 1. which w	vill be short answer	type covering the entire sylla	abus, will be c	compulsory, T	he remaining eig	ht questions	s will be set i	init wise	
selecting ty	wo questions	from each Unit I to	IV. The candidate will be rec	uired to atten	npt question I	No. 1 and four mo	re question	s selecting of	ne question	
from each	unit.			1	1 1		1	U	1	
UNIT	TOPICS							CONTAC	Γ HOURS	
т	Basics of C	hordates: Define a	and Salient features of chorda	tes, Differenc	e between no	on chordates and o	chordates.		8	
-	Characters of	of protochordates							0	
	Pisces (Fisl	sces (Fishes): Characteristic features of freshwater and marine fishes, Edible fishes of India, Composite fish								
п	culture.	culture.								
п	Class Amphibia: Features of amphibians, Parental care in amphibians, Role of amphibians in ecosystem,									
	Identification of turtles and tortoise, Frog and Toad.									
ш	Class Repti	lia: Features of Re	ptiles, Common reptiles of In	dia, Identifica	tion of Poiso	nous and non pois	sonous		7	
	snakes, Diff	erence between cro	codile and Gharial						,	
	Class Aves	Characteristic feat	tures of birds, Common birds	of India, Flig	ht adaptation	s in birds, Comme	ercial			
IV	uses of bird	s, Role of birds in a	igriculture.						7	
	Class Mam	mals: Characters a	nd economic importance of n	nammals						
	1. Identify	ing feature of diffe	erent class of chordates							
V	2. Study o	of connecting links	in chordates							
Practical	3. Study o	of different types of	feathers.					3	50	
	4. Study o	of different local sp	ecies of fishes							
	5. Study of	of nesting pattern of	some local birds, mammals							
			Suggested	Evaluation N	fethods					
Internal As	sessment:					End T	erm Exam	ination:		
> The	eory					≻	Theory			
• Cla	ss Participatio	on: 4				•	Written	Examination	: 35	
• Sen	ninar/presenta	tion/assignment/qu	iz/class test etc.: 4				≫	Practicum		
• Mic	I-Term Exam	:7					Practical F	xamination.	20	
> Dro	otioum						I fuetieur L		20	
	Class Destination: NA									
• Cia	Seminar/Demonstration/Viva_voca/I ab records etc.: 5									
• Sen	Intal/Demons	NIA	Lab records etc 5							
• MIC		INA	T	• D						
			Learr	mg kesourc	5					
1. K.L.Kotj	bai. Modern I	extbook of Zoolog	У							
2. E.L. Jord	an and verm	a. Unordate Zoolog	y.			-1-				
5. Barringto	on, E.J.W. Th	e Biology of Hemi	chordata and Protochordata. (Juver and Bo	ya, Eainbourg	gn.				
4. Walters,	п.е. and Say	ies, L.D. Biology 0	n vertebrates. MacMillan & C	o., new York	ζ.					
\mathcal{L}	5. Kent, C.O. Comparative anatomy of venebrates.									
0. S.S. Lal.	rfactical Zoo	nogy vertebrate								

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
Scheme	CC-3 MCC-4	B23-ZOO-301	Cell Biology and Animal Genetics	3	3	20	50	70	3 hrs.		
А, В & С	4 credit		Practical	1	2	10	20	30	4 hrs.		
Level of the c	course: 200-	299		(Class VII)							
Course Lear	for the co	(\mathbf{CLO})	bgy as a Subject at 4.0 Level	(Class XII)							
1. Students w 2. Students w 3. Students w	vill understa vill be able t vill have acq	nd the nature and ba to apply the knowled quaintance with the b	sic concept of cell biology a lge of internal structure of co basic causes associated with	and genetics. ell and their ro inborn errors	ole in many m and other gen	netabolic functior netic disorder and	of organisr will be able	n e to give cou	nseling to		
general 4. Students w	people vill be able t	o explain the concer	ot of gene interactions, Sex 1	inked inherita	nce and their	role in medical s	ciences.	C	0		
5. Students w	vill be able t	o conduct the morph	nomatric analysis of chromo	somes and de	monstrate cel	l division					
Instructions 1. Nine quess 2. Question N selecting tr question fr	for Paper-S tions will be No. 1, which wo question rom each un	Setter e set in all. All quest n will be short answe is from each Unit I t it.	ions will carry equal marks. er type covering the entire sy o IV. The candidate will be r	llabus, will be required to att	e compulsory empt questio	The remaining n No. 1 and four	eight questio	ons will be se ons selecting	et unit wise one		
UNIT	UNIT TOPICS CONTACT HOURS										
I	General structure of animal cell. Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis. Endoplasmic reticulum (ER): types and functions. Golgi complex: Structure, associated enzymes and role of golgi-complex in animal cell.										
Ш	Bibosomes: Types, biogenesis and role in protein synthesis. Lysosomes: Structure, enzymes and their role; polymorphism Mitochondria: Structure, Mitochondria as semiautonomous body, biogenesis, functions of mitochondria. Cilia and Flagella: Structure and Functions Ultrastructure and functions of Nucleus: Nuclear membrane, nuclear lamina, nucleolus, fine structure of										
ш	Introduction and Mendel's Laws of Inheritance, Linkage and recombination: Cell Cycle, crossing-over and chiasma formation; gene mapping. Sex determination and its mechanism: male and female heterozygous systems, genetic balance system; role of Y-chromosome, male haploidy, cytoplasmic and environmental factors, role of hormones in sex determination. Sex linked inheritance: Haemophilia and colour blindness in man, eye colour in Drosophila, Non-disjunction of sex-chromosome in Drosophila, Sex-linked and sex-influenced inheritance Extra chromocomal and cytoplasmic inheritance: Kappa particles in Paramecium. Shell coiling in snails. Milk							1			
IV	Multiple a Human ge monozygo Inborn err Applied ge	ullelism: Eye colour enetics: Human kary otic and dizygotic two ors of metabolism (<i>i</i> enetics: Genetic cou	in Drosophila; A, B, O blood otype, Chromosomal abnor ins. Alcaptonuria, Phenylketonur nseling, pre-natal diagnosis,	d group in ma malities invo ria, Albinism, DNA-finger	n. lving autosoi sickle-cell ar printing, tran	nes and sex chro naemia). sgenic animals.	omosomes,	1	1		
V Practical	V 1. Cell division: Prepared slides of stages of mitosis and meiosis. 2. Salivary gland and polytene chromosomes of Drosophila/ Chironomus. 3. Temporary squash preparations of onion root tip/grasshopper testis for the study of mitosis 4. Blood antigens and antibodies: Blood group testing 5. Preparation of Human Karyotype and Idiogram 6. Barr Body and Drum stick slide Broparations							3	0		
			Suggested	Evaluation N	Methods						
Internal As	sessment:					End 7	Ferm Exam	ination:			
> The	eory					≫	Theory				
• Cla	ss Participa	tion: 5				•	Written	Examination	n: 50		
• Sen	ninar/presen	itation/assignment/q	uiz/class test etc.: 5				> Dreati1⊺	Practicun	20		
	- i crini Exal						Practical E	examination:	20		
• Cla	ss Participat	tion: NA									
• Sen	ninar/Demo	nstration/Viva-voce	/Lab records etc.: 10								
• Mic	d-Term Exa	m: NA									
			Lear	ning Resourc	ces						
1. Molecul	1. Molecular Cell, Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.										

- 2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P. S. Verma and V.K. Aggarwal
- 3. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. Garland Publishing Inc., New York.
- 4. Cell Biology and Genetics by P.K. Gupta
- 5. Cell Biology and Genetics by Veer Bala Rastogi.
- 6. Principles of Genetics by M. Gardner, J. Simmons, D. P. Snustad
- 7. Genetics by D. P. Snustad, J. Simmons

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Interna Assessme marks	al ent s	End Term Marks	Max. Marks	Exam Duration
Scheme B & C	MCC-5	B23-ZOO-302	Type study of Chordates	3	3	20		50	70	3 hrs.
Bac	4 creuit		Practical	1	2	10		20	30	4 hrs.
Level of the	course: 200-2	299 		(Class VII)						
Course Lea	rning Outco	$\frac{(11 \text{ ally})}{\text{mes}} (\mathbf{CLO})$	bgy as a Subject at 4.0 Level	(Class All)						
 Student v Student v Student v Student v Student v 	vill be able to vill be able to vill be able to vill be able to will be capab	describe about Uroc describe about Pisc describe about Amp describe about life le of identifying the	chordates es phibians & Reptiles functions of Birds & Mamm characters and classification	als	2					
Instruction	s for Paper-S	Setter	endracters and endstitleation	r or enordates	,					
 Nine que Question selecting question 	 Nine questions will be set in all. All questions will carry equal marks. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit. 									
UNIT	UNIT TOPICS CONTACT HOURS									
I	Chordates: Origin and Evolutionary tree of chordates. Protochordates: Cephalochordata: Systematic position, distribution, ecology, morphology and affinities, Cephalochordata: Type study of <i>Amphioxus</i>									
II	Agnatha: General characters Image: Cyclostomata: General characters and classification upto class level. Ecological significance of cyclostomes Image: Cyclostomes Petromyzon: Structural & functional morphology type study Image: Cyclostomes Image: Cyclostomes									
ш	Reptilia:Type study of Lizard (<i>Hemidactylus</i>): Structural & Functional morphology,Extinct reptiles; Poisonous apparatus in snakes									
IV	Aves: Type study of Pigeon (<i>Columba livia</i>); Structural & Functional morphology Mammals: Adaptive radiations of mammals, dentition in mammals								1	.1
 V V Practical V of chostneta: Multiplication of the following animals: (i) Computer simulated model/study of : (a) Herofuania: General anatomy; (b) Rat: Digestive, arterial, venous and urinogenital systems; (c) Hemidactylus: Digestive, arterial, venous and Urinogenital systems; (b) Gag & rabbit. 4. Study of the skeleton of Scoliodon, Labeo, Rana (Frog), Varanus, Pigeon or Gallus and Orcyctolagus/rat, Palates of birds, skulls of dog & rabbit. 4. Study of the following prepared slides: Tomaria larva, T.S. Amphioxus (through different regions). Oikopleura, Histology of rat (compound tissues), different types of scales. 5. Make permanent stained preparations									0	
			Suggested	Evaluation N	Aethods					
Internal A	ssessment:					E	End Te	erm Exami	ination:	
> TI	neory	· _				≥	>	Theory		50
• Cl • Se	Class Participation: 5• Written Examination: 50Seminar/presentation/assignment/quiz/class test etc.: 5> Practicum									

•	Mid-Term Exam: 10	Practical Examination: 20
⊳	Practicum	
•	Class Participation: NA	
•	Seminar/Demonstration/Viva-voce/Lab records etc.: 10	
٠	Mid-Term Exam: NA	
	Learning Resources	
1.	R.L.Kotpal. Modern Textbook of Zoology	
2.	E.L. Jordan and Verma. Chordate Zoology.	
3.	Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.	
4.	Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.	
5.	Kent, C.G. Comparative anatomy of vertebrates.	

Kent, C.G. Comparative anatomy of vert
 S.S. Lal. Practical Zoology Vertebrate

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/	Internal Assessment	End Term Morka	Max. Marks	Exam Duration	
Scheme	MDC-3		Basics of Zoology-III	2	2 vv eek	15		50	3 hrs	
A. B & C	3 credit	B23-ZOO-303	Practical	1	2	5	20	25	4 hrs.	
Level of the	course: 200	-299	Tuchcui	1	-	5	20	20	4 11 5.	
Pre-requisite	e for the c	ourse (if any): NA	A							
Course Lea	rning Outc	omes (CLO)								
1. To under	stand the ba	sic anatomical con	cepts of skeletal and bones.							
2. Course w	ill help to u	nderstand importan	ce of blood group system in hum	ans.						
3. The stude	ent will lear	n the physiology of	respiration in humans.							
4. The cour	4. The course will make students understand the aspect of cell structure and its function.									
5. Course will provide practical knowledge of osteology in humans.										
Instruction	Instructions for Paper-Setter									
1. Nine que	stions will t	be set in all. All que	stions will carry equal marks.		1 7				., .	
2. Question	No. 1, whic	the will be short answer from the short answer the short and the short a	wer type covering the entire syllat	bus, will be o	compulsory.	The remaining eig	ght question	s will be set	unit wise	
from and	two questio	ns from each Unit I	to Iv. The candidate will be requ	uired to atter	npt question	No. 1 and four me	ore question	is selecting o	ne question	
		1						CONTAC	THOUDS	
UNII	TOPICS				1			CONTAC	I HOUKS	
Ŧ	Humans	Skeleton and bone	s: Characteristics (axial and appo	endicular sk	teleton), Join	ts, cartilage and	igaments,		0	
1	A DO and	n between skeletal	muscles and nerves.		nd donaono of	blood transfusion			5	
	Ab0 and	all and abromosom	ans, methods of determination, m	inportance a	ional alamant	of human ahron	1.			
II	Sev Dete	8								
	Respirati	on in humans. Ana	tomy and physiology of respiration	n factors af	fecting chang	e of gases and di	ffusing			
Ш	capacity 7								7	
	Introduct	ion to Dental Form	ula, types and development of too	oth.					-	
	Darwinis	m, species and pop	ulation: Concept of evolution, the	eory of Darw	/inism, Neo-I	Darwinism, Genet	ic drift,			
IV	Hardy W	einberg Law						,	7	
	Human E	Evolution: Origin ar	d evolution, adaptive evolution.							
	1. To st	tudy different Hum	an bones: Skull, Vertebrae, Girdle	es and limb	bones.					
V	2. Prep	aration of mitotic c	hromosomes from onion root tips					3	0	
Practical	3. Stud	y of different slides	s of mitosis and meiosis.						-	
	4. Bloo	d grouping in Hum	an							
			Suggested E	valuation M	lethods					
Internal A	ssessment:					End T	'erm Exam	ination:		
> T	neory					≫	Theory			
• Cl	ass Participa	ation: 4				•	Written	Examination	n: 35	
• Se	minar/prese	ntation/assignment	/quiz/class test etc.: 4				≻	Practicum	1	
• M	id-Term Exa	am: 7					Practical E	xamination:	20	
> Pı	acticum									
• Cl	ass Participa	ation: NA								
• Se	Seminar/Demonstration/Viva-voce/Lab records etc.: 5									
• M	Mid-Term Exam: NA									
			Learni	ng Resourc	es					
1. Essenti	als of huma	n Osteology by A.F	K. Dutta							
2. Cell Bi	ology and G	enetics by P.K. Gu	pta.							
3. Evoluti	on by Strikh	berger M. W.	•							
4. Evoluti	onary Biolo	gy by Futuyama								
5 Compa	rative anato	my of Vertebrates 1	ov Kent C G							
6 Prostia	al Zoology V	Vertebrates by S S	I al							
0. Tractic	an Zoology	· cicoraics by 5.5.	Lui							

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration	
Scheme A. B & C	CC-4 MCC-6	B23-ZOO-401	Biomolecules and Mammalian Physiology	3	3	20	50	70	3 hrs.	
	4 credit	200	Practical	1	2	10	20	30	4 hrs.	
Level of the	course: 200	-299	leaves a Subject at 4.0 Level (C							
Course Lea	rning Outco	$(\mathbf{CI} \mathbf{O})$	biogy as a Subject at 4.0 Level (C.	lass AII)						
1. Students v 2. Students v 3. It will ma 4. Students v 5. Students v	will be able t vill be able t ke the studer vill be able t vill be able t	o understand and e o explain the intera nts understand the a o explain the mech o understand and p	explain the mechanism that works action and interdependence of phy appropriate functioning of each be anism of action of hormones and perform biological and analytical t	to keep the ysiological a ody system i related mole techniques ir	human body nd biochemic n animals and ecules involv n labs to expl	functioning. cal processes. d mechanism of w ed in various phys ain biological acti	vorking. siological pr	rocesses		
Instructions	Instructions for Paper-Setter									
 Nine que Question selecting from each 	 Nine questions will be set in all. All questions will carry equal marks. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit. 									
UNIT	TOPICS							CONTAC	T HOURS	
	Introduct	ion, classification,	structure, function and general pr	operties of p	oroteins, carbo	phydrates and lipi	ds.			
I	Nomenclature, classification and mechanisms of enzyme action; Enzyme Kinetics, factors affecting enzyme activity, inhibition of enzymes 12 Transport through biomembranes (Active and Passive), osmotic pressure, hydrogen ion concentration and buffers 12									
п	Nutrition: Nutritional components: Carbohydrates, fats, lipids, Vitamins and Minerals; Types of nutrition & feeding, Digestion of lipids, proteins, carbohydrates & nucleic acids; symbiotic digestion, lactose intolerance, Physico-chemical mechanism of Absorption of nutrients & assimilation; control of secretion of digestive juices. <u>Muscles:</u> Types of muscles, ultra-structure of skeletal muscle, neuromuscular junction. Bio-chemical and physical events during muscle contraction, single muscle twitch, tetanus, muscle fatigue, muscle tone, oxygen debt., Cori's cycle, single unit smooth muscles, their physical and functional properties.									
ш	Circulation: Origin, conduction and regulation of heart beat; cardiac cycle, electrocardiogram, cardiac output, fluid pressure and flow pressure in closed and open circulatory system; Composition and functions of blood & lymph; Mechanism of coagulation of blood, coagulation factors; anticoagulants, haemopoiesis. Respiration: Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of haemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), control / regulation of respiration (peripheral reflexes, chemical control and Higher centres), Myoglobin. Excretion: Patterns of excretory products viz. Amonotelic, ureotlic uricotelic, ornithine cycle (Kreb's – Henseleit cycle) for urea formation in liver; Urine formation, composition of Urine, counter-current mechanism of urine							1	11	
IV	Neural In fibre, con Chemical action; p disorders Reproduc oestrous-	tegration: Nature, c duction of nerve ir integration of End hysiology of hypo ction: Spermatogen anoestrous cycle, N	origin and propagation of nerve in npulse across synapse, synaptic d ocrinology: Structure, chemical n thalamus, pituitary, thyroid, par esis, Capacitation of spermatozoa Aenstrual cycle in human, fertiliza	npulse along elay and syn ature and me athyroid, ad a, oogenesis, ation, implar	with medulla haptic fatigue, echanism of p lrenal, pancro ovulation, fo ntation and ge	ted & non-medull Neurotransmitter peptide and steroid eas and gonads, ormation of corpus estation, parturitio	ated nerve r. 1 hormone Hormonal s luteum, m]	11	
V PRACTIC AL	1. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides. 2. Study of human salivary amylase activity: Effect of temperature, pH, Concentration. 3. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies). 4. Use of Kymograph unit & respirometer. Study of Human salivary amylase activity: Effect of temperature, pH, Concentration. 6. Estimation of Hb. 7. DLC of Man/RBC count/WBC count. 8. Study of permanent slides of endocrine glands 9. Blood antigens and antibodies: Blood group testing						3	30		
			Suggested Eva	luation Met	thods					
Internal A	ssessment:					End T	erm Exam	ination:		
 ➤ Th Cl Se M ➤ Pr Cl 	 Theory Class Participation: 5 Seminar/presentation/assignment/quiz/class test etc.: 5 Mid-Term Exam: 10 Practicum Class Participation: NA 								n: 50 1 20	

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Moyes C, Schulte P (2015). Principles of Animal Physiology, Pearson; 3rd edition
 Satyanarayana (2021). Biochemistry, Elsevier; 6th edition

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/	Internal Assessment	End Term	Max. Marks	Exam Duration	
Cabarra	-JP*		Aquaquitura	2	Week	marks	Marks	70	2 hrs	
Scheme B & C	MCC-/ 4 credit	B23-ZOO-402	Aquaculture	3	3	20	20	70	3 firs.	
Level of the	course: 200-2	299	Tacuca	1	4	10	20	50	4 11 5.	
Pre-requisit	e for the co	urse (if any): Biolog	gy as a Subject at 4.0 Level	l (Class XII)						
Course Lea	rning Outcon	nes (CLO)								
1. Students	will understan	d about fresh water f	ishes of India							
2. Students	will capable to	o undertake about fis	hing crafts and gears	ē						
4. Students	will be able to	explain the culture t	echnology in fishery	5						
5. Students	will be able to	identify fish specim	ens							
Instruction	s for Paper-S	etter								
1. Nine que	1. Nine questions will be set in all. All questions will carry equal marks.									
2. Question	No. 1, which	will be short answer	type covering the entire sy	llabus, will b	e compulsory	. The remaining e	eight questi	ons will be so	et unit wise	
question	from each uni	t from each Unit I to	IV. The candidate will be	required to au	tempt questio	n No. 1 and four	more questi	ons selecting	, one	
UNIT	TOPICS							CONTAC	T HOURS	
	Introduction	to world fisheries: P	roduction, utilization and d	emand. Maio	r species cult	ured				
-	Eroch Water	fishes of India, Diva	r sustam reservoir pond t	onk ficharias	contine and	ultura ficharias	old water			
I	Fresh water	listies of mula: Kive	r system, reservoir, pond, t	ank fisheries;	captive and	culture fisheries, o	cold water	1	2	
	fisheries.									
	Fishing crafts and gears.									
	Fin fishes, Crustaceans, Molluscs and their culture.									
II	Traits of imp	ortant cultivable fish	and shellfish and their cul	ture methods	_ Indian mai	or carns exotic ca	arns air	1	1	
					manan maj	or earps, exotic er	ups, au			
	breathing fish	hes, cold water fishes	s, freshwater prawns, muss	els						
тт	Seed product	ion: Natural seed res	ources – its assessment, co	ollection, Hate	chery product	ion		1	11	
111	Nutrition: So	urces of food (Natur	al, Artificial) and feed con	position (Cal	orie and Che	mical ingredients)).	11		
	Field Culture	: Culture, Culture in	Pond-running waters; recy	cled water cu	ilture, cage ci	ilture; poly cultur	e.			
IV	Culture techr	ology: Induced brea	ding in fishes, techniques a	and hormones	; Fish Biotec	hnology (Transge	nesis and	1	1	
	Cryopreserva	ation of gametes).								
	1. Identificat	ion of <i>Catla catla, L</i>	abeo rohita, L. calbasu, Ci	rrhinus, mrig	ala, Puntius s	arana, Channa p	unctatus,			
	C. maruli	us, C. stariatus, Tric	hogaster fasciata, Mystus s	seenghala, M.	cavasius, M.	tengra, Callichro	ous			
V Duc sties l	pabola, C	. bimaculatus, Walla	<i>go attu</i> , Prawns, Crabs, Lo	obsters, Clams	s, Mussels &	Oysters.		3	50	
Practical	2. A study o	f the different types	of nets e g cast net gill n	et drift net ar	nd drag net					
	4. A visit to	lake/reservoir/fish b	reeding centre.	et, unit net u	ia arag net.					
			Suggested E	valuation M	ethods					
Internal A	ssessment:					End T	'erm Exam	ination:		
> T	heory					>	Theory			
• C	lass Participat	ion: 5				•	Written	Examination	n: 50	
• Se	Seminar/presentation/assignment/quiz/class test etc.: 5								1	
• M	lid-Term Exan	n: 10					Practical E	Examination:	20	
> P	racticum									
	lass Participat	ion: NA	ab records etc. 10							
• M	id-Term Exan	n: NA	200 1000103 00010							
111		'* *	Lear	ning Resour	ces					
1. Arumu	gam N. (2014	4). Aquaculture and I	Fisheries, Saras Publication	1						
2. Bardac	h, JE, Ryther	& McLarney, Wo (1	972) Aquaculture, New Yo	ork: Wiley-Int	terscience. 89	брр.				
3. Lagler	3. Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.									
4. Khann	a S S, & Sing	п н к (2014). Textb	ook of Fish Biology and Fi	sneries 3rd ec	in. Narendra	Publishing House	•			

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration			
Scheme	MCC-8		Pest Management	3	3	20	50	70	3 hrs.			
B & C	4 credit	B23-ZOO-403	Practical	1	2	10	20	30	4 hrs.			
Level of the	course: 200-2	299		•				•				
Pre-requisite	Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)											
Course Lea	Lourse Learning Outcomes (CLO) 1. Students will able to understand ecologically important and harmful insects											
1. Studen	ts will able to	understand ecologic	ally important and narmful	insects.								
3. It will	make the stud	lents understand abo	out the vegetable pest									
4. Studen	ts will be able	to explain about var	rious pest control approache	S								
5. Studen	ts will be able	to identify various i	insect and pest species									
Instruction	Instructions for Paper-Setter											
1. Nine que	1. Nine questions will be set in all. All questions will carry equal marks.											
2. Question	two questions	from each Unit I to	IV The candidate will be r	equired to att	e compuisory.	No. 1 and four m	gnt questio	ns will be sel	one			
auestion	from each uni	t.	TV. The candidate will be for	equired to att	mpt question		iore questie	ins selecting	one			
UNIT	TOPICS							CONTAC	T HOURS			
	Study of im	portant insect pests of	of crops and vegetables:									
	Sugarcane:	(With their systema	atic position, habits and natu	re of damage	caused.							
	(a) Sugarcar	ne leaf-hopper (Pyrin	lla perpusilla)									
	(b) Sugarcan	ne Whitefly (Aleuro	lobus barodensis)									
	(c) Sugarcan	he top borer (<i>Scirope</i>	ophaga nivella)									
	(u) Sugarca	ur horer (<i>Rissetia sta</i>	eniellus)									
I	Life cycle a	nd control of <i>Pyrilla</i>	<i>perpusilla</i> only.					1	.2			
	Cotton: (W	ith their systematic	position, habits and nature o	f damage cau	sed.							
	(a) Pink bol	lworm (Pestinophor	a gossypfolla)									
	(b) Red cott	on bug (Dysdercus o	cingulatus)									
	(c) Cotton g	rey weevil (<i>Mylloce</i>	rus undecimpustulatus)									
	Life cycle a	nd control of <i>Pectin</i>	ophore gossypiella									
	Wheat: Wh	eat stem borer (Sesa	<i>unia inferens)</i> with its system	matics positio	on, habits, nat	ure of damage ca	used. Life					
	cycle and	d control methods.	•••••			C						
	Paddy: (Wi	th their systematic p	position, habits and nature of	f damage caus	sed)							
п	(a) Gundhi	bug (Leptocorisa ad	cuta)					1	.1			
	(c) Rice ster	n borer (<i>Scirpopha</i>	nus banian) 19 incertullus)									
	(d) Rice His	pa (Diceladispa arn	nigera)									
	Life cycle a	nd control of Loptoc	corisa acuta only									
	Vegetables	: (Their systematics	position, habits and nature of	of damage cau	ised.							
	(a) Aulacop	ohora faveicollis – T	he Red pumpkin beetle.									
	(b) Dacus d	<i>cucurbitas</i> – The pur	npkin fruit fly.									
	(d) Epilach	<i>na</i> – The Hadda bee	tle									
	Life cycle a	nd control of Aulaco	phora faveicollis									
ш	Stored grai	ns: (Their systemati	c position, habits and nature	e of damage c	aused.			1	1			
	(a) Pulse b	eetle (Callosobruchi	us maculatus)					-	.1			
	(b) Rice we	evil (Sitophilus ory:	zae)									
	(d) Rust Re	ed Flour beetles (Tri	bolium castaneum)									
	(e) Lesser	grain borer (<i>Rhizope</i>	ertha dominica)									
	(f) Grain &	Flour moth (Sitotro	oga cerealella)									
	Life cycle a	nd control of Trogod	derma granarium)									
	Important b	Piological -	of agriculture & their manage	gement.	utions and f	ability of biolo-	cal acorta					
	for contr	<u>н.</u> Бююдісаї с ol.	ondoi, its instory, requireme	ent and preca	utions and rea	sionity of biologi	cai agents					
IV	Chemical c	ontrol: History, Cat	egories of pesticides, impor	tant pesticide	s from each c	ategory to pests a	gainst	1	.1			
	which th	ey can be used, inse	ct repellants and attractants.				-					
	Integrate	d pest management										
T 7	1. External	morphology, identif	fication marks, nature of dan	nage and host	of the follow	ring pests:-						
V Practical	(1) <u>Sugarca</u>	<u>ne</u> : Sugarcane leaf	t-hopper, Sugarcance whit	etly, Sugarca	ance top bor	er, Sugarcane ro	oot borer,	3	60			
1 actical	(ii) Cotto	n : Red Cotton bug										

	 (iii) <u>Wheat</u>: Wheat stem borer (iv) <u>Paddy</u>: Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one). (v) <u>Vegetables</u>: Aulocophora faveicollis, Dacus cucurbitas, Tetranychus tecarious, Epilachna (vi) <u>Pests of stored grains</u>: Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour borer (any three). 2. Stages of life history of silk moth and honey bee 	a (any t beetle, i	hree). lesser grain		
	3. Preparation of permanent/temporary slides for identification of mosquitoes				
	Suggested Evaluation Methods				
Int	ernal Assessment:	End	Term Exam	ination:	
> • •	Theory Class Participation: 5 Seminar/presentation/assignment/quiz/class test etc.: 5 Mid-Term Exam: 10	> •	Theory Written ≫ Practical F	Examination: 50 Practicum Examination: 20	
>> •	Practicum Class Participation: NA Seminar/Demonstration/Viva-voce/Lab records etc.: 10 Mid Tarm Exam: NA				
-	Learning Resources				
1. 2. 3. 4. 5.	 David Dent , Richard Binks (2020). Insect Pest Management CABI Publishing; 3rd edition Larry P Pedigo , Marlin E. Rice (2014) Entomology and Pest Management. Waveland Pr Inc; 6th edition John R. Ruberson (2019) Handbook of Pest Management, CRC Press; 1st edition Kalatia M.K. (2021) Introduction to principles of pest and disease management; Walnut Publication Smith K M (2013) A Textbook of Agricultural Entomology by Hill, Cambridge University Press 				

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration		
Scheme	DSE-1 4 credit	B22 700 404	Biodiversity and Wildlife Management	3	3	20	50	70	3 hrs.		
B & C	Select one option	B23-200-404	Practical	1	2	10	20	30	4 hrs.		
Level of the	course: 200-2	299		(0)							
Pre-requisite	e for the con	urse (if any): Biol	ogy as a Subject at 4.0 Level	(Class XII)							
1. Students	will be able to	understand about	wildlife zones of India								
2. Students	will be able to	explain the concep	ot of Protected area system								
3. It will ma	ke the student	s understand about	IUCN categories								
4. Students	will be able to	explain the mecha	nism of biodiversity threats	accomont mot	hoda						
J. Students	s for Paper-S	etter	understanding of whome mai	lagement met	nous						
1. Nine que	stions will be	set in all. All ques	tions will carry equal marks.								
2. Question	2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise										
selecting	selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit										
UNIT	question from each unit. UNIT TOPICS										
	Concept of 1		comac								
-	Dottorn and										
1	Techniques			.2							
	Conservatio	Conservation of biodiversity: <i>in-situ</i> and <i>ex-situ</i>									
п	Concept of Protected Area Systems 11										
	Important Protected Areas of India (Biosphere reserve, National Park & Wildlife sanctuaries)										
	Red Data Bo	ook and its uses									
III	IUCN Categ	gories of wildlife sp	pecies					11			
	Climate cha	nge and loss of bio	diversity								
	Threats to be	iodiversity: habitat	loss, poaching of wildlife, m	an-wildlife co	onflicts						
IV	Wildlife To	urism			a			1	.1		
	Biosphere R	leserves concept ar	id Indian Biosphere Reserves	; Location & S	Significance		1				
	1. Study of t	o find out their Zor	s various organisms (Listing C	n an the anni		and around your n	ouse and				
	2. Identifica	tion and photograp	by of various species.								
V	3. Visits to a	a local animal park	or zoo to identify and study t	he captive fau	ana and prepa	ration of report.		2	30		
Practical	4. Study of a	adaptive characteri	stics of various vertebrates in	different clin	nate.						
	5. Study of I	biodiversity in gras	sland and pond water by usin	ig Shannon -V	Veiner index.						
	6. Comparis	son of two species of	of birds belonging to same ge	nus (Interspec	cific different	ce).					
			Suggested E	valuation Me	ethods	[
Internal A	ssessment:					End T	erm Exam	ination:			
> T	heory	F				>	Theory	F iti	. 50		
	ass Participati	1011: J tation/assignment/c	miz/class test etc · 5			•	written	Examination	1: 50		
• M	id-Term Exan	n: 10					Practical F	rracticun xamination	1 20		
⇒ Pi	racticum								-		
• C	lass Participati	ion: NA									
• Se	eminar/Demon	stration/Viva-voce	e/Lab records etc.: 10								
• M	id-Term Exan	n: NA									
			Lear	ning Resourd	ces	•					

- 1. Trends in wildlife biodiversity conservation and management. B.B. Hosetti and M. Venkateshwarlu.
- 2. Wildlife conservation and management. Reena Mathur.
- 3. Concepts of Wildlife management. B.B.Hosetti.
- 4. Techniques for wildlife Census in India by W.A. Rogers (A field manual); Wildlife Institute of India, Dehradun.
- 5. Wildlife Wealth of India by T.C. Majupuria; Tecpress Services, L.P., 487/42-SOL-Wattenslip, Pratunam Bangkok, 10400, Thailand.
- 6. Ali, S. Ripley S.D. Handbook of Birds of India, Pakistan 10-Vols. Oxford University Press, Bombay.
- 7. The Book of Indian Animals by S.H. Prater, BNHS-Publication, Bombay.
- 8. Wildlife in India by V.B. Saharia Natraj Publishers, Dehradun.
- 9. E.P. Gee, The Wildlife of India.

Remarks	Course Type	Course Code	Name of the Course	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration	
Scheme B & C	DSE-1 4 credit	B23-ZOO-405	Cytogenetics	3	3	20	50	70	3 hrs.	
	Select one option		Practical	1	2	10	20	30	4 hrs.	
Level of the	course: 200-29	99								
Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)										
Course Learning Outcomes (CLO)										
1. Students will be able to understand about Biology of chromosomes 2. Students will be able to explain the concept of gene mutations and genetics of call cucle										
2. Students will be able to explain the concept of gene mutations and genetics of cell cycle 3. It will make the students understand about Human cytogenetics										
4. Students will be able to explain the mechanism molecular cytogenetics										
5. Students will be able to understand about practical exposure of cytogenetics										
Instructions for Paper-Setter										
1. Nine que	estions will be s	set in all. All questi	ons will carry equal marks.							
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one										
question	from each unit	•								
UNIT	TOPICS							CONTAC	T HOURS	
I	Biology of Chromosomes: Molecular anatomy of eukaryotic chromosomes. Heterochromatin and euchromatin.									
	Giant Chromosomes: Polytene and Lampbrush Chromosomes								12	
	Chromosome Banding Techniques: O-banding, C-banding, G-banding, R-banding, T-banding, High-Resolution									
	& Replication banding and Nuclease banding. Functional significance of chromosome bands.									
Ш	Genes in Pedigrees: Mendelian pedigree pattern. Heritable diseases in human. Inheritance of mitochondrial									
	diseases, Non-Mendelian traits.									
	Gene Mutations: Spontaneous mutations – Base pair substitution and frame shift mutations. Induced mutations –								1	
	Radiation, chemical and environmental. $in -vitro$ site specific mutagenesis. Detection of mutagens – The Ames test and sister chromatid exchanges								1	
	Genetics of Cell Cycle: Genetic regulation of cell division in yeast and eukaryotes. Molecular basis of cellular									
	check points. Molecular basis of neoplasia.									
	Human Cytogenetics: Human karyotype, Nomenclature for normal chromosomes (ISCN), Variable chromosome									
	features, Nomenclature for acquired chromosome aberrations									
ш	cry syndrome. Trisomy 13. Trisomy 18. Trisomy 21. Sex chromosomal syndromes – Turner syndrome Klinefelter								1	
	syndrome, XYY, True and Pseudo-hermaphroditism.								-	
	The mechanisms which contribute to cytogenetic alterations: Polyploidy, Aneuploidy, Duplications, deletions,									
	inversions, translocations.									
	Molecular Cytogenetic Techniques: FISH, Chromosome painting, automated karyotyping, Flow cytometery,									
	Microarrays									
IV	Genome Projects: Human genome project – history, organization, goals and value of the project. Genetic &							11		
	Physical mapping of the human genome, Human genome diversity project, Model organisms and other genome									
	projects. Life in the post genomic era.									
V Practical	 Identification of meiotic and mitotic stages from permanent slides. Study of chiasma frequency and terminalisation co-efficient. 									
	 Study of emasma frequency and terminalisation co-encient. Study of mitosis from hepatic ceacae/bone marrow of suitable animals (invertebrate/vertebrate) and preparation 									
	of karyotype and idiogram.									
	4. Making karyological preparations from testicular material of suitable animals (invertebrate/vertebrate) to study									
	the structure and behaviour of chromosomes duringmeiosis.									
	 Nuclear sexing from polymorphonuclear leucocytes. Proparation of human buccal smear to study on abromatin 									
	7. Micronucleus test for genetic damage.								30	
	8. Preparation of pedigrees and pedigree analysis.									
	9. Demonstration of banding techniques.									
	10. PCR: Introduction and demonstration.									
	11. Isolation of genomic DNA.									
	a) ABO and Rh blood groups									
	b) Some morphogenetic and behavioural traits.									
	c) Some bi	ochemical traits.								
Suggested Evaluation Methods										

Intern	al Assessment:	End Term Examination:					
≫	Theory	> Theory					
•	Class Participation: 5	• Written Examination: 50					
•	Seminar/presentation/assignment/quiz/class test etc.: 5	> Practicum					
•	Mid-Term Exam: 10	Practical Examination: 20					
≫	Practicum						
•	Class Participation: NA						
•	Seminar/Demonstration/Viva-voce/Lab records etc.: 10						
•	Mid-Term Exam: NA						
Learning Resources							
1. Atherly, A.C., J.R. Girton and J.F. McDonald. The Science of Genetics. Sauders CollegePublishing, Harcort Brace College Publishers, NY.							
2. Brooker, R.J. Genetics: Analysis and Principles. Benjamin/Cummings, Longman Inc.							

- 3. Fairbanks, D.J. and W.R. Anderson. Genetics The Continuity of Life. Brook/ColePublishing Company ITP, NY, Toronto.
- 4. Gardner, E.J., M.J. Simmons and D.P. Snustad. Principles of Genetics. John Wiley and Sons. Inc., NY.
- 5. Griffiths, A.J.F., J.H. Miller, D.T. Suzuki, R.C. Lewontin and W.M. Gelbart. An introduction to genetic analysis. W.H. Freeman and company, NY.
- 6. Lewin, B. Genes. VI. Oxford University Press, Oxford, New York, Tokyo.
- 7. Snustad, D.P. and M.J. Simmons. Principles of Genetics. John Wiley and Sons. Inc., NY.
- 8. Watson, J.D., N.H. Hopkins, J.W. Roberts, J.A. Steitz and A.M. Weiner. Molecular Biology of Genes. The Benjamin/Cummings Publishing Company Inc., Tokyo.

9. Tom Strachan & Read, A.P. Human Molecular Genetics 3rd edition, Garland Publishing2004, London