ST. MARY'S COLLEGE (AUTONOMOUS)

Re-accredited with A+ Grade by NAAC

Thoothukudi – 628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

Syllabus

B.Sc. Zoology

School of Biological Sciences

Outcome Based Curriculum

(w.e.f. 2021)

Preamble

Zoology is a vital stream of science, it gives an insight into the essence of life. It helps for the betterment of human race through various fields. It unravels the magic of co-existence and ecological balance by creating awareness of conservation of biodiversity. After completing the graduate degree the candidates have tremendous opportunities for higher studies and lots of job opportunities both in public and private sectors.

Vision: To prepare young women face the challenges of life through education, an ideal weapon for empowerment.

Mission: To impart knowledge and skills in Zoology through specialization in recently emerging technologies and thereby to produce quality graduates capable of contributing to the development of knowledge based society.

Programme Outcome:

PO.No.	Upon completion of B.Sc. Degree programme, the graduates will be able to
PO-1	apply the acquired knowledge of fundamental concepts in the field of Science and to find solutions to various problems.
PO-2	inculcate innovative skills and team – work among students to meet societal expectations.
PO-3	perform analysis to assess, interpret, and create innovative ideas through practical experiments.
PO-4	facilitate to enter multidisciplinary path to solve day-to-day scientific problems.
PO-5	carry out fieldworks and projects, both independently and in collaboration with others, and to report in a constructive way.
PO-6	improve communication ability and knowledge transfer through ICT aided learning integrated with library resources.
PO-7	transfer the knowledge to the other stakeholders through extensive community development programme.
PO-8	attain competency in job market / entrepreneurship
PO – 9	focus on developing domain specific language skills and knowledge of the students.

Programme Specific Outcome

PSO No.	Upon completion of B.Sc. Zoology Degree programme, the graduates will be able to	PO Mapped
PSO-1	acquire the knowledge about the characteristics common to all animals and understand their unique features, significances and systematic positions and interpret it in simple language	PO – 1,3
PSO-2	understand the basic concepts of Biology, compare and contrast various developmental, physiological processes in organisms and able to write about the processes using the illustrations	PO – 1,3
PSO-3	explore fundamental ecological principles from populations to communities through ecosystems; interactions between biotic and abiotic factors; employ technical and analytical skills to quantify the environmental toxicants as well as listen and understand the lectures related to the ecological issues	PO – 4,2
PSO-4	institute a thorough understanding of the function of biological molecules through the study of their structure; determine and connect the role of DNA in regulating cell activity to its importance as the basis of inheritance, evolution and biotechnology and read about recent advances in biological sciences	PO – 8,6
PSO-5	demonstrate updated knowledge of Sericulture, Aquarium Management, Animal care, Aquaculture, Apiculture, Vermitechnology, Economic Zoology, Value added fishery products for rural development and self-employment and communicate their skills in a effective manner	PO – 2,7,8
PSO-6	demonstrate the proficiency in basic methods of instrumentation and quantitative analytical skills used to conduct biological research including fundamental methods of microscopy, cell and molecular biology and read or listen to instructions and follow them.	PO – 5,2
PSO-7	identify the structure, function, and characteristics of immune system, find suitable vaccines for infections / immunological problems. Assess the modes of transmission and the mechanisms of microbial pathogenesis, treatment, control measures to microbial infection and able to present the data skilfully	PO – 1,5
PSO-8	evolve critical thinking skills/lab techniques/ virtual laboratory so as to be capable of designing, carrying out and interpreting scientific experiments and write the results without grammatical or spelling errors	PO – 3.6

Department of Zoology
Course Structure (w.e.f. 2021)
Semester –I

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	21ULTA11	nghJj;jko jhs - 1 ,f;fhy ,yf;fpak (nra;As ,yf;fzk ,yf;fpatuyhW>ciuei L>rpWfij)	6	3	40	60	100
	French	21ULFA11	Introductory French Course					
II	General English	21UGEN11	Poetry, Prose, Extensive Reading and Communicative English-I	6	3	40	60	100
III	Core I	21UZOC11	Invertebrata	6	6	40	60	100
	Core Practical I	21UZOCR1	Invertebrata	2	1	40	60	100
	Allied I	21UCHA11	Allied Chemistry - I	4	3	40	60	100
	Allied Practical I	21UCHAR1	Allied Chemistry – I Practical	2				
IV	Skill Enhancement Course - I	21UZOPE1	Professional English for Zoology - I	2	2	20	30	50
	Ability Enhancement Course – I	21UAVE11	Value Education	2	2	20	30	50
Total				**30**	**20**			

Semester II

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	21ULTA21	nghJj;jkpo jhs 2 rka ,yf;fpaq;fSk epj; ,yf;fpaq;fSk (nra;As; ,yf;fzk> ,yf;fpatuyhW> ciuei L> tho;f;iftuyhW)	6	3	40	60	100
	French	21ULFA21	Intermediate French Course					
II	General English	21UGEN21	Poetry, Prose, Extensive Reading and Communicative English-II	6	3	40	60	100
III	Core II	21UZOC21	Chordata	6	6	40	60	100
	Core Practical II	21UZOCR2	Chordata	2	1	40	60	100
	Allied II	21UCHA21	Allied Chemistry – II	4	3	40	60	100
	Allied Practical I	21UCHAR1	Allied Chemistry – II Practical	2	2	40	60	100
IV	Skill Enhancement Course - II	21UZOPE2	Professional English for Zoology - II	2	2	20	30	50
	Ability Enhancement Course – II	21UAEV21	Environmental Studies	2	2	20	30	50
Total				**30**	**22**			

Semester III

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil /	21ULTA31	nghJj;jkpo jhs 3 :fhg;gpaq;fSk rpw;wpyf;fpaq;fSk (nra;As) ,yf;fzk) ,yf;fpatuyhW>ciuei L) Gjpdk;)	6	4	40	60	100
	French	21ULFA31	Advanced French Language					
II	General English	21UGEN31	Poetry, Prose, Extensive Reading and Communicative English-III	6	4	40	60	100
III	Core III	21UZOC31	Developmental Zoology	4	4	40	60	100
	Core Practical III	21UZOCR3	Developmental Zoology	2	2	40	60	100
	Allied III	21UBOA31	Plant Diversity	4	3	40	60	100
	Allied Practical II	21UBOAR1	Plant Diversity – Practical	2				
	Skill Based Elective	21UZOS31/ 21UZOS32	A. Fishery Products B. Aquarium Management	2	2	20	30	50
	NME I	21UZON31	Basic Biotechnology	2	2	20	30	50
IV	Ability Enhancement Course - III	21UAWS31	Women's Synergy	2	2	20	30	50
	Self Study/ MOOC / Internship (Compulsory)	21UZOSS1	Wildlife Conservation		2		50	50
Total				**30**	**25**			

Semester IV

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil / French	21ULTA41 21ULFA41	nghJj;jkpo jhs 4; rq;f ,yf;fpak; (nra;As) ,yf;fzk;>,yf;fpatuyh W>ciueilLehLfk) French Course and Literature	6	4	40	60	100
II	General English	21UGEN41	Poetry, Prose, Extensive Reading and Communicative English-IV	6	4	40	60	100
III	Core IV	21UZOC41	Biochemistry and Bioinstrumentation	4	4	40	60	100
	Core Practical IV	21UZOCR4	Biochemistry and Bioinstrumentation	2	2	40	60	100
	Allied IV	21UBOA41	Angiosperm Taxonomy and Plant Physiology	4	3	40	60	100
	Allied Practical II	21UBOAR1	Angiosperm Taxonomy and Plant Physiology – Practical	2	2	40	60	100
	Skill Based Elective	21UZOS41/ 21UZOS42	A. Clinical Laboratory Technology B. Nutrition and Health	2	2	20	30	50
	NME II	21UZON41	Applied Biotechnology	2	2	20	30	50
IV	Ability Enhancement Course - IV	21UAYM41	Yoga & Meditation	2	2	20	30	50
	Self Study / Online course / Internship (Optional)	21UZOSS2	Animal Care and Services		+2		50	50
V	NCC, NSS & Sports Extension Activities / CDP				1 +1			
Total				**30**	**26+3**			

Semester V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
	Core V (Common Core)	21UBCC51	Biotechnology	4	3	40	60	100
III	Core VI	21UZOC51	Animal Physiology	4	4	40	60	100
	Core VII	21UZOC52	Cell Biology and Genetics	4	4	40	60	100
	Core VIII	21UZOC53	Ecology	4	4	40	60	100
	Core Practical V	21UZOCR5	Animal Physiology, Cell Biology and Genetics & Ecology	6	3	40	60	100
	Common Core Practical VI	21UBCCR1	Biotechnology	2	1	40	60	100
	Core Elective	21UZOE51 21UZOE52	A. Introduction to Research B. Evolutionary Biology	4	3	40	60	100
IV	Common Skill Based Course	21UCSB51	Computer for Digital Era and Soft Skills	2	2	20	30	50
	Self Study/ Online course / Internship (Optional)	21UZOSS3	Animal Behaviour	--	+2		50	50
Total				**30**	**24+2**			

Semester VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
III	Core IX	21UZOC61	Immunology and Microbiology	4	4	40	60	100
	Core X	21UZOC62	Biostatistics and Bioinformatics	4	4	40	60	100
	Core XI	21UZOC63	Marine Biology	4	4	40	60	100
	Core XII	21UZOC64	Economic Zoology	4	4	40	60	100
	Core Practical VII	21UZOCR6	Immunology and Microbiology & Biostatistics and Bioinformatics	4	2	40	60	100
	Core Practical VIII	21UZOCR7	Marine Biology & Economic Zoology	4	2	40	60	100
IV	Project	21UZOP61		6	3	40	60	100
Total				**30**	**23**			
Total				**180**	**140+5**			

Semester	Hours	Credits	Extra Credits
I	30	20	---
II	30	22	---
III	30	25	--
IV	30	26	3
V	30	24	2
VI	30	23	--
Total	**180**	**140**	**5**

Courses	Number of Courses	Hours / week	Credits	Extra Credits
Tamil	4	24	14	--
English	4	24	14	--
Core	12T+8P	52T+24P	50T+14P	--
Skill Based Elective	2	4	4	--
Core Elective	1	4	4	--
Group Project	1	6	3	--
Allied	4T+2P	16T+8P	12T+4P	--
NME	2	4	4	--
Skill Enhancement Course	2	4	4	--
Ability Enhancement Course	4	8	8	--
Common Skill Based Course	1	2	2	--
NCC, NSS & Sports		--	1	
Extension Activities		--		1
Self Study Papers (Optional)	2	--		4
Self Study Papers (Compulsory)	1	--	2	--
Total		**180**	**140**	**5**

SEMESTER - 1			
Part – 1 nghJj;jkpo jhs; - 1 ,f;fhy ,yf;fpak; (nra;As;> ,yf;fzk> ,yf;fpa tuyhW> ciueil> rpWfij)			
Course Code: 21ULTA11	**Hrs/Week:6**	**Hrs/Semester: 90**	**Credits: 3**

Objectives:

- khztpaUf;F ey;y kjpg;gPLfisf fw;gpj;J tho;tpy; mtw;iwg gpd;gw;w toptFj;jy;.
- ,yf;fpa khe;jhpd tho;f;if mDgtq;fs; %yk tho;tpy; gpur;ridfis vjph;nfhs;Sk jpwk> jd;dk;gpf;if> MSikj;jpwk> nkhopmwpT ,tw;iw cUthf;Fjy;.

Course Outcome:

CO.NO	**,g;ghLj;jpLLk khztpaUf;F**	**mwpTrhh; kjpg;gPL**
CO-1	ngz rhh;e;j tpLjiy czh;it tsh;f;fpwJ.	tsh;r;rp
CO-2	nghJikr; rpe;jidia tsh;f;fpwJ	tsh;r;rp
CO-3	,dk rhjp Fwpj;j ghFghLbypUe;J tpLjiy ngWk toptiffisf fw;Wf;nfhLf;fpwJ.	eilKiwg;gLj;Jjy
CO-4	,aw;ifiag NgZjw;Fk tho;tpd tsh;r;rp epiyia Nkk;gLj;jpf; nfhs;Sjw;Fk cjTfpwJ.	eilKiwg;gLj;Jjy
CO-5	rka ey;ypzf;fk> xw;Wik czh;T> ,iw ek;gpf;if ,tw;iw cUthf;FfpwJ.	cUthf;fk;
CO-6	nkhopiag gpioapd;wp NgrTk vOjTk cjTfpwJ.	Ghpjy; jpwd Nkk;ghL
CO-7	vjhh;j;j tho;it Nkw;nfhs;s cjTfpwJ.	Ghpjy; jpwd Nkk;ghL
CO-8	jdpkdpj tho;f;ifr; rpf;fy;fis vjph;nfhs;Sk epiyia cUthf;FfpwJ.	eilKiwg;gLj;Jjy
CO-9	rKjhag; gpur;ridfis vjph;nfhs;Sk jpwk fpiLf;fpwJ.	eilKiwg;gLj;Jjy
CO-10	NghLbj; Njh;TfSf;Fg; gad;gLk tifapy; giLg;ghf;fj; jpwid tsh;f;f cjTfpwJ.	giLg;ghw;wy jpwd Nkk;ghL

SEMESTER - 1			
Part – 1 nghJj;jkpo jhs; - 1 ,f;fhy ,yf;fpak; (nra;As>; ,yf;fzk> ,yf;fpa tuyhW> ciueiL> rpWfij)			
Course Code: 21ULTA11	Hrs/Week:6	Hrs/Semester: 90	Credits: 3

myF – 1 nra;As; - 2 kzp

1. jkpo;nkho> tho;j;J – ghujpahh
2. GJikg; ngz - ghujpahh
3. Gjpa cyF nra;Nthk - ghujpjhrd
4. cyif khw;WNthk - ftpauR Kbaurd
5. fz;zPhpd ,ufrpak; - mg;Jy; uFkhd
6. kuq;fs; - K.Nkj;jh
7. fhy tpj;jpahrk; - ituKj;J
8. itaj;ij ntw;wp nfhs;s - rp.rptukz>
9. ftpijg; G+q;fhL – gh.tp[a;
10. ngz ,dNk – ikj;Nuap
11. i`f;$ ftpijfs
12. ehLLhh; ghLy;fs;
    m. jhyhL;Lg; ghLy;
    M. kPdth ghLy;

myF - 2 ,yf;fzk - 1 kzp

vOjJ

1. vOj;J - tpsf;fk;>
2. KjnyOj;Jfs> rhh;ngOj;Jfs
3. RL;nLOj;Jfs> tpdh vOj;Jfs
4. nkho> Kjy vOj;Jfs;> nkho> ,Wj> vOj;Jfs
5. ty;ypdk kpFk ,Lq;fs;> ty;ypdk kpfh ,Lq;fs;
6. nkhog;gapw;rp : GJf;ftpij> rpWfij>
   gj;jphpiff;Fr; nra;jp mDg;Gjy;

myF - 3 ,yf;fpa tuyhW - 1 kzp

1. GJf;ftpij Njhw;wKk tsh;r;rpAk
2. rpWfij Njhw;wKk tsh;r;rpAk
3. ciueiL Njhw;wKk tsh;r;rpAk
4. ehL;Lg;Gw ,ay; mwpKfk

myF - 4ciueiL - 1 kzp

ePNa nty;tha; - f.g.mwthzd;

myF – 5 rpWfij - 1 kzp

1. Nfjhhpapd jhahh; - fy;fp
2. tpbAkh? - F.g.uh[Nfhghyd
3. fhyDk; fpotpAk - GJikg;gpj;jd;
4. fUg;gz;zrhk> Nahrpf;fpwhh - mwpQh mz;zh
5. ehw;fhyp - fp.uh[ehuhazd
6. uh[h te;jpUf;fpwhh - mofph> rhkp
7. N[hbg; nghUj;jk - n[auj> mf];b

I B.A., / B.Sc Part I FRENCH

SEMESTER – I			
Course Title : PART – I French Paper – I Introductory French Course			
Course Code :21ULFA11	**Hrs/week : 6**	**Hrs/ Sem : 90**	**Credits : 3**

Objectives

To initiate a beginner to the francophonic world and to train them to make their maiden efforts in spoken and written French.

To create a number of real-life situations to make the learner express herself in the target language through experiential teaching method.

Course Outcomes

CO	At the end of this course, the students will be able to	CL
1.	greet and introduce oneself and others	Kn, Ap
2.	fill an identity form	Ap, Cr
3.	ask, give and understand directions	Kn, Ap
4.	frame a questionnaire	Cr
5.	place order in a restaurant	Ap, Cr
6.	tell and understand opening and closing time	Kn
7.	express likes and dislikes	Ap
8.	describe an object and to say what it serves for	Kn, Un
9.	ask and say a price of a product	Ap
10.	understand the French and francophonic lifestyle	Kn

Unit 1 – Bienvenue !

1.1- Une introductionà la langue française
1.2 – Les Salutations
1.3 – Les pronoms
1.4 – Les couleurs
1.5 – Dans la classe

Unit 2 – Et vous ?

2.1 – Se présenter, demander de se présenter
2.2 – Donner des informations personnelles
2.3 – Demander et donner des coordonnes
2.4 –Artistes francophone
2.5 – Réaliser une fiche d'identité

Unit 3 – On va où ?

3.1 – Demander / Indiquer un chemin
3.2 – Comprendre un itinéraire
3.3 – Se déplacer en métro ou en bus
3.4 – Paris / Montréal : deux villes à découvrir
3.5 – Réaliser un questionnaire sur la vie dans un quartier

Unit 4 – Qu'est-ce qu'on mange ?

4.1 – Comprendre / Donner des horaires
4.2 – Faire des courses / Commander au restaurant
4.3 – Exprimer ses gouts
4.4 – Québec / France : qu'est-ce que vous mangez ?
4.5 – Créer la carte d'un bar a jus

Unit 5 – Les soldes, c'est parti !

5.1 – Situer un moment dans une année
5.2 – Parler du métro
5.3 – Demander / dire la taille et la pointure
5.4 – Décrire un objet, dire à quoi ça sert
5.5 – Demander / Dire un prix

Prescribed Textbook :

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz.*Edito A1Méthode de français*. Paris : Didier, 2016.

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz. *Edito A1 Cahier d'exercises*. Paris : Didier, 2016.

Books, Journals and Learning Resources

- J.Girardet&J.Pécheur avec la collaboration de C.Gibble.*Echo A1*. Paris : CLE International, 2012.
- Carlo Catherine, Causa Mariella.*Civilisation Progressive du Français – I*. Paris : CLEInternational, 2003.
- Cocton Marie-Noëlle.*Génération 1 Niveau A1, Méthode de français et cahier d'exercices*.Paris : Didier, 2016.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, DupleixDorothée, Cocton Marie-Noëlle.*Saison 1 Niveau 1, Méthode de français et cahierd'exercices*. Paris : Didier, 2015
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com

SEMESTER-I			
Part II General English	**Poetry, Prose, Extensive Reading and Communicative English-I**		
Course Code 21UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Objectives:

- To provide adequate exposure and opportunities for students to imbibe, develop, practise and use LSRW skills
- To help students read and comprehend contents in English

Course Outcome:

CO. No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO- 1	improve their listening and writing skills.	Un
CO- 2	apply and incorporate basic grammar and mechanics in writing.	Ap
CO- 3	paraphrase main ideas through reading passages.	Ap
CO- 4	communicate in English with confidence.	Ap
CO- 5	appreciate literary pieces.	Ap
CO- 6	label and paraphrase main ideas through reading passages.	Ap
CO- 7	imbibe ethical and moral values through the study of the literary pieces.	Ev
CO- 8	construct simple sentences and short paragraphs in response to reading and writing.	Cr

SEMESTER-I			
Part II General English	**Poetry, Prose, Extensive Reading and Communicative English –I**		
Course Code 21UGEN11	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Unit I –Poetry

Rabindranath Tagore – Leave This Chanting

W.W. Gibson – The Stone

Ted Hughes – Hawk Roosting

Unit II – Prose

Stephen Leacock – My Lost Dollar

J.B. Priestley – On Doing Nothing

Robin Sharma – Your Commitment to Self- Mastery: Kaizen

Unit III – Short Story

Oscar Wilde – The Model Millionaire

Leo Tolstoy – Three Questions

K.A. Abbas – The Refugee

Unit IV – Grammar

Parts of Speech – Noun, Pronoun, Article, Adjective, Verb - Modals and Auxiliaries – Types of Sentences - Subject -Verb Agreement

Unit V- Communication Skills

Vocabulary, Listening Comprehension – Speaking – Reading, Filling Forms (TANSCHE – Module I

Text Books:

Units I-III – To be compiled by the Research Department of English

Unit IV- Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006. Print.

Unit – V – CLIL (Content & Language Integrated Learning) – Module I by TANSCHE (Tamil Nadu State Council for Higher Edu

SEMESTER - I			
Ability Enhancement Course -Value Education			
Code : 21UAVE11	**Hrs/Week : 2**	**Hrs / Semester: 30**	**Credits : 2**

Unit I: Introduction to Value Education

Concept of Values -Types of Values- Approaches to values - Benefits of Value Education-Characteristics of Values

Unit II: Human Values

Human Values -Sources of Human Values - Love -Compassion - Gratitude - Courage - Optimism - Forgiveness- the need and urgency to reinforce Human Values

Unit III: Social Values

Role of family and society in teaching values - Role of educational institutions in inculcating values-Three general functions of education for society-Self-Reflection- Our society's needs - Social Responsibilities of a student

Unit IV: Spiritual Values

Spiritual Values - Spiritual Development -Moral Development - Importance of Spiritual Values - Cultivation of Spiritual Values -Five most common spiritual values -Spiritual Resources

Unit V: Values for Life Enrichment

Goal Setting - Building relationship - Friendship - Love relationship - Family relationship - Professional relationship Interpersonal Relationship -Essential Life Skills that Help in Students Future Development-Life Enrichment Skills Domain

Books for Reference:

1. Sneha M. & K. Pushpanadham Joshi. *Value Based Leadership in Education Perspective and Approaches*, Anmol Publications Pvt. Limited, 2002.
2. Venkataiah.N. *Value Education*, APH Publishing, 1998
3. Pramod KumarM.*A Handbook on Value Education*, Ramakrishna Mission Institute of Culture (RMIC) 2007
4. Jagdosh Chand.*Value Education*. Shipra Publication 2007
5. Indrani Majhi (Shit)Ganesh Das, *Value Education*, Laxmi Publication Pvt. Ltd., 2017
6. Arumugam, N. S. Mohana, Lr.Palkani, *Value Based Education*, Saras Publication 2014

SEMESTER I			
Core I	**Invertebrata**		
Course Code: 21UZOC11	**Hrs/Week : 6**	**Hrs/Sem : 90**	**Credits : 6**

Objectives:

- To impart knowledge on invertebrate animals.
- To elaborate the organization, functional morphology, anatomy and taxonomic position of representative invertebrates.

Course Outcomes:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO- 1	know the distinctive features of taxonomic classes within the phyla covered	1	Kn
CO -2	recognize the common members of each phylum and of selected classes	1	Kn
CO – 3	analyze the important concepts in invertebrate body structure and organization, including body symmetry, body cavity, gut formation, segmentation	2	An
CO – 4	examine the important biological processes in invertebrates, including locomotion, body support, reproduction, development, feeding, digestion, excretion, osmoregulation etc.	2	An
CO – 5	impart information on the ecological and economic importance of invertebrates.	2	Un
CO – 6	aware of the importance and diversity of invertebrates	2	Un
CO – 7	develop basic laboratory skills including microscopy, dissection and careful observation.	8	Cr
CO – 8	use knowledge in invertebrates as basic course for further subjects on higher level study.	8	Ap

Unit I Protozoa and Porifera

Salient features of invertebrates.
Protozoa- General characters and outline classification up to classes with Indian or local examples.
Type study: *Paramecium caudatum*: Morphology, nutrition, osmoregulation, excretion. Reproduction (Binary fission and conjugation).
General topic: Life cycle, pathogenicity and control measures of *Entamoeba histolytica.*
Porifera - General characters and outline classification up to classes with Indian or local examples.
Type study: *Leucosolenia*- External morphology – body wall – Reproduction.
General topics – Canal system in sponges

Unit II Coelenterata and Platyhelminthes

Coelenterata - General characters and outline classification up to classes with Indian or local examples.
Type study: *Obelia* – External characters and reproduction
General topic: Polymorphism in coelenterates.
Platyhelminthes - General characters and outline classification up to classes with Indian or local examples.
Type study: *Taenia solium*- Morphology and reproduction
General topic: Parasitic adaptations in Platyhelminthes

Unit III Aschelminthes and Annelida

Aschelminthes - General characters and classification up to classes with Indian or local examples.
Type study: *Ascaris* – External morphology and life cycle
General topic: Nematode parasites – *Wuchereria bancrofti*, *Ancylostoma duodinale*
Annelida- General characters and classification up to classes with Indian or local examples.
Type study: Earthworm – Morphology and reproduction
General topic: Biological significance of earthworm

Unit IV Arthropoda

General characters and classification up to classes with Indian or local examples.
Type of study: *Penaeus* – external morphology – reproduction and life history.
General topic: Beneficial insects (Honey bee).

Unit V Mollusca and Echinodermata

Mollusca -General characters and classification up to classes with Indian or local examples.

Type of study: *Pila globosa*– morphology, reproduction and nervous system

General topic: Pearl formation in bivalves

Echinodermata - General characters and classification up to classes with Indian or local examples.

Type study: *Asterias* – External morphology – water vascular system

General topic: Larval forms of echinoderms and their phylogenetic significance.

Text Books:

1. Kotpal R.L. *Modern Text Book of Zoology: Invertebrates.* Meerut: Rastogi Publications 2009.
2. EkambaranathaIyer M. and T.N. Ananthakrishnan. *A Manual of Zoology*. Vol. 1. India: S. Viswanathan Pvt Ltd 1977.

Books for Reference

1. Nair N.C. Leelavathi. S and N.A. Soundara Pandian. *Text book of Invertebrates*. Nagercoil: Saras Publication 2006.
2. Murugan. T and N. Arumugam. *Invertebrates*. Nagercoil: Saras Publication, 2006.
3. Jordan. E.L and P.S. Verma. *Invertebrate Zoology*. New Delhi: S. Chand and Company Ltd, 2007.
2. Mary. S. Gardiner. *The Biologyof Invertebrates*. New York : Mc Graw-Hill Book Company 1972.
5. Robert. D Barnes. *Invertebrate Zoology*. Japan Holt Saunders, International Editions 1982.

Websites for Reference

http://www.enchantedlearning.com/subjects/invertebrates/index.shtml

http://animalkingdom.net/category/invertebrates/

http://animaldiversity.org/

PRACTICALS

Course Code: 21UZOCR1

Hrs / Week – 2 **Credit: 1**

I. Dissections

Cockroach: Digestive system and Nervous system

II. Mountings

Cockroach: Mouthparts

Earthworm: Body setae and pineal setae

Prawn: Appendages

III. Spotters

Studies of the animals with classification upto order with ecological importance of the following animals :

Paramecium, Entamoeba histolytica, Leucosolenia, Sycon, Obelia colony, *Physalia, Taenia solium, Fasciola, Ascaris lumbricoides,* (male & female), *Wuchereria bancrofti, Anchylostoma*, Earthworm, Nereis, *Penaeus*, *Oryctus rhinoceros*, *Pila*, Sepia, *Asterias*, Sea cucumber.

Observation of the following permanent slides

Taenia solium- scolex, larval forms of *Fasciola hepatica* (Redia, cercaria), larval forms of *Penaeus* (nauplius, zoea, protozoea, mysis), larval forms of Echinoderms (bipinnaria, auricularia).

IV. Collection and submission of any five invertebrate specimens

Books for Reference

1. Nair N.C. Arumugam N. Leelavathi. S. Soundara Pandian N. and T. Murugan. *Practical Zoology Invertebrata Vol. 1*. Nagercoil: Saras Publication 2013.
2. Richard A. Boolootain and Donald Heyneman. *An Illustrated Laboratory Text in Zoology*. U.S.A: Holt, Rinehart and Winston 1977.

SEMESTER I			
PROFESSIONAL ENGLISH FOR ZOOLOGY – I			
Course Code:21UZOPE1	**Hrs/ Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To develop language and communication skills of the students by offering adequate practice in professional contexts.
- To enhance competence in reading, writing, listening and speaking.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	recognize their own ability to improve their own competence in using the language	1,5	Un, Ap
CO-2	use language for speaking with confidence in an intelligible and acceptable manner	5	Ap
CO-3	understand the importance of reading for life	4,6	Un
CO-4	read independently unfamiliar texts with comprehension	4,6	Un
CO-5	understand the importance of writing and apply in academic life	2, 8	Un, Ap
CO-6	write simple sentences without committing error of spelling or grammar	8	An, Ap
CO-7	listen to lectures and interpret critically	3,8	Un, Ap
CO- 8	become proficient in communication and become confident to present themselves.	5,7	Un, Ap

UNIT 1: COMMUNICATION

Listening: Listening to instructions and following– Instructions to use microscope.

Speaking: Pair walk- dialogue between a patient and nutritionist (formal conversation)

Reading: Comprehension passage - Professor Har Gobind Khorana.

Writing: Developing stories from pictures - Life Cycle / Metamorphosis of a Butterfly

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 2: DESCRIPTION

Listening: Listening to descriptive video clip and gist writing - How to grow Hibiscus cutting in water.

Speaking: Role play - Conversation between a Zoology teacher and a student

Reading: Skimming/Scanning - Ultra sound scanning machine

Writing: Compare and contrast expressions – plant and animal cell

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 3: NEGOTIATION STRATEGIES

Listening: Listening to interviews of specialist - Mario Molina (Ozone scientist) - https://www.youtube.com/watch?v=iGf4TGHO_Jc

Speaking: Brain storming - Mind Mapping**(**Microorganisms)

Reading: Passage reading - The basic macronutrients and micronutrients

Writing: Essay Writing - Essay on Conservation of Nature

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 4: PRESENTATION SKILLS

Listening: Listening to lecture and syllabification - Iron deficiency (https://www.youtube.com/watch?v=Q3b-Vsh5NEo)

Speaking: Preparation for a short speech - Chocolate is a psycho addictive food

Reading: Reading comprehension passage - Louis Pasteur-Synonyms

Writing: Recommendations (Using laptop or PC)

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 5: CRITICAL THINKING SKILLS

Listening: Listening and comprehending – Introduction to enzymes

Speaking: Making a power point presentation - Do's and Dont's.

Reading : Note making - Water cycle

Writing: Problem and Solution essay - Non-biodegradable waste

Vocabulary: Unit specific - Incorporated into the LSRW tasks

Books for Reference

English for Life Sciences, Tamil Nadu State Council for Higher Education (TANSCHE)

SEMESTER I			
Allied I	**Invertebrate & Chordate Zoology**		
Course Code: 21UZOA11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives:

- To enlighten the students about the diverse forms of invertebrates and vertebrates
- To develop broad foundational knowledge of the extreme diversity in animal form, function, adaptation and natural history.

Course outcome:

Co. No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	acquire basic knowledge of invertebrates and chordate animal	1	Un
CO-2	compare common and distinctive features of invertebrate phyla	1	Un
CO-3	understand the parasitic adaptation through their mode of life	1	Un
CO-4	develop the ability to control the parasites	1	Ap
CO-5	characterize the major classes of sub phylum vertebrata of the phylum Chordata	1	Kn
CO-6	assess the interaction of organisms with environment and their adaptive mechanism	1,3	Ev
CO-7	distinguish the unique features and evolutionary relationship between each chordate group	1	An
CO-8	apply the knowledge of biological diversity to our daily life and conservation of bioresources	1,3	Ap

UNIT I

General characters of invertebrates

Protozoa: General characters–*Paramecium caudatum*–external morphology – reproduction – binary fission and conjugation

Porifera: General characters

Leucosolenia - external morphology

Coelenterata: General characters

Obelia - structure

General Topics: Protozoan parasites – *Entamoeba histolytica*

UNIT II

Platyhelminthes: General characters - *Fasciola hepatica* - external morphology and life cycle Annelida: General characters – *Hirudinaria* (Leech) – external morphology

General Topic: Human Helminth parasites – *Ascaris lumbricoides* – life cycle, pathogenecity and control measures

UNIT III

Arthropoda: General characters – *Periplaneta americana* - external morphology and digestive system – mouth parts of honey bee.

Mollusca: General characters

Lamellidens marginalis - external characters

Echinodermata: General characters

Asterias rubens – external characters

UNITIV

General characters and outline classification of Chordata upto classes Pisces: General characters – *Scoliodon* – external characters

Amphibia: General characters – *Rana hexadactyla* - external characters and respiratory system. Reptilia: General characters

Calotes versicolor – external characters.

General topic: Identification of poisonous and non poisonous snakes

UNIT V

Aves: General characters - *Columba livia* – external characters

Mammalia: General characters – *Oryctolagus cuniculus*–external characters and urinogenital system.

General topic: Adaptations of aquatic mammals.

Text Books

1. Nair, N.C, Leelavathi, S and Soundara Pandian, N.A. *Text book of Invertebrates*. Nagercoil: Saras Publication, 2006.
2. Thangamani. A, Prasanna Kumar. S. Narayanan. L.M, and Arumugam, N. *Chordata*. Nagercoil: Saras Publication, 2006.

Books forReference

1. Ekambaranatha Ayyer M.A and Viswanathan S. *Manual of Zoology*. Vol I Chennai : Viswanathan Printers and Publishers, 1993.
2. Ekambaranatha Ayyer M.A and Viswanathan S. *Manual of Zoology*. Vol II Chennai : Viswanathan Printers and Publishers, 1993.
3. Arumugam N. *Text Book of Chordates*. Revised edition. Nagercoil: Saras Publication, 2010.
4. Jordon E.C and Verma P.S. Invertebrate Zoology. Revised edition. New Delhi : S. Chand and Company Ltd., 2009.
5. Shukla G.S. and Upadhyay V.B. Economic Zoology. First edition. Meerut : Rastogi Publication,1985.

PRACTICALS

Course Code : 21UZOAR1

Hrs/Week–2 **Credit–1**

Cockroach : Digestive system
Mounting**:**
Honey bee – Mouth parts
Earth worm – Body setae
Shark – Placoid scale
Virtual dissection
Frog (Respiratory System)

Slides/ Models/ Charts:
Invertebrata: *Paramecium caudatum*, *Leucosolenia*, *Obelia*, *Entamoeba histolytica*, *Fasciola hepatica, Ascaris lumbricoides* (male and female), sea anemone, hermit crab, *Asterias*, redia and cercaria

Chordata: *Amphioxus*, *Scoliodon*, *Naja naja*, *Rana hexadactyla*, *Columba livia*, aquatic mammals - *Orcinus* (killer whale) and *Delphinus* (dolphin)

Books forReference

1. Leelavathy S., Soundara Pandian N. and Murugan T. *Practical Zoology* Vol. I *Invertebrata.* Nagercoil : Saras Publication, 2013.
2. Verma P.S. *A manual of Practical Zoology, Chordates*. Ramnagar, Delhi: S. Chand and Company Ltd, 2008.

SEMESTER - I			
Ability Enhancement Course -Value Education			
Code : 21UAVE11	**Hrs/Week : 2**	**Hrs / Semester: 30**	**Credits : 2**

Unit I: Introduction to Value Education

Concept of Values -Types of Values- Approaches to values - Benefits of Value Education-Characteristics of Values

Unit II: Human Values

Human Values -Sources of Human Values - Love -Compassion - Gratitude - Courage - Optimism - Forgiveness- the need and urgency to reinforce Human Values

Unit III: Social Values

Role of family and society in teaching values - Role of educational institutions in inculcating values-Three general functions of education for society-Self-Reflection- Our society's needs - Social Responsibilities of a student

Unit IV: Spiritual Values

Spiritual Values - Spiritual Development -Moral Development - Importance of Spiritual Values - Cultivation of Spiritual Values -Five most common spiritual values -Spiritual Resources

Unit V: Values for Life Enrichment

Goal Setting - Building relationship - Friendship - Love relationship - Family relationship - Professional relationship Interpersonal Relationship -Essential Life Skills that Help in Students Future Development-Life Enrichment Skills Domain

Books for Reference:

1. Sneha M. & K. Pushpanadham Joshi. *Value Based Leadership in Education Perspective and Approaches*, Anmol Publications Pvt. Limited, 2002.
4. Venkataiah.N. *Value Education*, APH Publishing, 1998
5. Pramod KumarM.*A Handbook on Value Education*, Ramakrishna Mission Institute of Culture (RMIC) 2007
4. Jagdosh Chand.*Value Education*. Shipra Publication 2007
7. Indrani Majhi (Shit)Ganesh Das, *Value Education*, Laxmi Publication Pvt. Ltd., 2017
8. Arumugam, N. S. Mohana, Lr.Palkani, *Value Based Education*, Saras Publication 2014

SEMESTER - II			
Part -1 nghJj;jkpo - jhs; 2 rka ,yf;fpaq;fSk; ePjp ,yf;fpaq;fSk; (nra;As;> ,yf;fzk; ,yf;fpa tuyhW>ciueilL tho;f;if tuyhW)			
Course Code: 21ULTA21	**Hrs/Week:6**	**Hrs/ Semester : 90**	**Credits :3**

Objectives:

- tho;tpay ed;ndwpfshd kdpjNeak; rkj;Jtk Nghd;wtw;iw tsh;j;Jf; nfhs;sf; fw;Wf nfhLj;jy
- mwnewpiaf; filg;gpbg;gNj epiyahdJk ePbj;jJkhd ed;ikiaj jUtJ vd;gijr; rhd;Nwhhpd tho;f;if newpfs; %yk czur;nra;jy>; nkho; mwpT> ,yf;fpa mwpT ,tw;iw tsh;j;Jf; nfhs;sf; fw;Wf nfhLj;jy

Course Outcome

Co.No.	,g;ghLj;jpLLk khztpaUf;F	mwpTrh; kjpg;gPL
CO-1	,iw Mw;wiy czh;e;Jnfhs;s cjTfpwJ	kjpg;gPL
CO-2	ey;y ez;gh;fisAk ey;y kdpjh;fisak ,dk fz;Lnfhs;s top tFf;fpwJ.	eilKiwg;gLj;Jjy
CO-3	md;G> ,uf;fk;> ew;nrhy;> ew;nray; Nghd;w ew;gz;GfNshL tho to; tFf;fpwJ.	kjpg;gPL
CO-4	kdpj Nea gz;GfNshL tho;e;j rhd;Nwhhpd mDgtq;fisg; ngw;Wf;nfhs;s cjTfpwJ	eilKiwg;gLj;Jjy
CO-5	nkhopiag gpioapd;wp NgrTk vOjTk gad;gLfpwJ	Ghpjy;> jpwd Nkk;ghL
CO-6	jdpkdpj tho;f;ifr; rpf;fy;fisAk gpur;ridfisAk vjph;nfhs;Sk Mw;wiy cUthf;FfpwJ.	eilKiwg;gLj;Jjy;>jpwd Nkk;ghL
CO-7	,iwtd Kd midtUk rkk vd;w rpe;jidia cUthf;FfpwJ.	kjpg;gPL
CO-8	NghLbj;Njh;TfSf;Fg; gad;gLk tifapy giLg;ghf;fj; jpwid tsh;f;f cjTfpwJ.	giLg;ghw;wy

SEMESTER - II			
Part -1 nghJj;jkpo - jhs; 2 rka ,yf;fpaq;fSk; ePjp ,yf;fpaq;fSk (nra;As;> ,yf;fzk› ,yf;fpa tuyhW› ciueil› tho;f;if tuyhW)			
Course Code: 21ULTA21	**Hrs/Week:6**	**Hrs/ Semester : 90**	**Credits :3**

myF - 1 nraAs; - 2 kzp
rka ,yf;fpaq;fs;
,iwtzf;fk - jpUehTf;furh;
irtk 1. Njthuk; - jpUQhd rk;ge;jh;> jpUehTf;furh› Re;juu;
2. jpUthrfk - khzpf;fthrfh;
3. jpUke;jpuk; - jpU%yh
4. jpUgGfo - mUzfphp ehjh;
itztk: 1. jpUg;ghit - MzLhs;
2. jpUtha;nkho›- ek;kho;thh
ngsj;jk: kzpNkfiy - rPj;jiyr rhj;jdhh;
fpwpj;jtk;: 1. Njk;ghtzp - tPukhKdpth
2.,NaR fhtpak - ftpQh; fz;zjhrd
,Ryhkpak: NgL;iL Mk;Gh; mg;Jy; fhjph; rhfpG ghLy; - rf;fwhj;J ehkh
ePjp ,yf;fpaq;fs;
1. jpUf;Fws; - Cf;fKiLik
2. ehybahh - 1. ed;dpiyf; fz;
2. cwq;Fk JizaJ
3. gonkho› ehD}W- 1. nghy;yhj nrhy;yp
3. tUtha; rpwpnjdpDk**myF - 2 ,yf;fzk - 1 kzp**
1. nrhy;ypd nghJ ,yf;fzk
2. XnuOj;J xUnkho› nrhy;ypd tiffs;
3. ngah;r;nrhy; - mWtifg ngah;fs;
4. tpidr;nrhy; - tiffs;- Kw;W› vr;rk;> Vty;> tpaq;Nfhs› nra;tpid› nrag;ghL;Ltpid› jd;tpid› gpwtpid
5. ,iLr;nrhy; - Vfhu› Xfhu› ck;ik ,iLr;nrhw;fs;
6. chpr;nrhy - ,yf;fzk› tiffs
nkhopg;gapw;r›–xyp NtWghL mwpjy
myF - 3 ,yf;fpa tuyhW – 1 kzp
1. irt ,yf;fpaq;fs;
2. itzt ,yf;fpaq;fs;
3. fpwpj;jtk; jkpOf;Fr; nra;j njhz;L
4. ,Ryhkpak jkpOf;Fr; nra;j njhz;L
5. gjpndz fPo;f;fzf;F E}y;fspy; 11 mwE}y;fs;

myF - 4 ciueiL - 1 kzp
epiwthd tho;f;iff;F Neuk; xJf;Fq;fs; - N[.nksu];
(10 Kjy 19 tiu cs;s fL;Liufs;)
myF – 5 tho;f;if tuyhW - 1 kzp
kdpjNk Gdpjk - RLh;e;njO - Kidth mUL;rNfhjh› M.kh

SEMESTER – II			
Course Title : PART – I French Paper – II Intermediate French Course			
Course Code :21ULFA21	**Hrs/week : 6**	**Hrs/ Sem : 90**	**Credits : 3**

Objectives

To develop and improve upon the acquisition of four competencies of language learning.

To motivate the learner through role plays as to create real life situations. To prepare her for the real communication challenges.

Course Outcomes

CO	At the end of this course, the students will be able to	CL
1.	talk about her activities, hobbies	Kn, Ap
2.	ask and say time	Ap, Cr
3.	fix, accept or refuse a meeting	Kn, Ap, Cr
4.	talk about her family and describe a character	Kn, Un
5.	describe and give information about a lodging	Ap
6.	express her preferences	Ap, Un
7.	write a formal mail and a postcard	Cr, Ap
8.	express emotions and surprise	Ap
9.	get a gist of the French literature	Kn, Un

Unit 1 – C'est quoi le programme ?

1.1 –Parler de ses activités quotidiennes
1.2 – Demander/ Dire l'heure
1.3 – Proposer/ fixer / accepter ou refuser un rendez-vous.
1.4 – Réserver par téléphone
1.5 – Créer un mini-article sur un loisir

Unit 2 – Félicitations !

2.1 – Comprendre un arbre généalogique
2.2 – Présenter sa famille
2.3 – Féliciter / adresser un souhait
2.4 – Décrire le physique et le caractère d'une personne
2.5 – Créer les personnages d'une famille pour un film

Unit 3 – Chez moi

3.1 – Comprendre un état des lieux simple
3.2 – Se renseigner sur un logement
3.3 – Comprendre un règlementintérieur d'immeuble
3.4 – Exprimer des règles de vie commune
3.5 – S'excuser dans un message

Unit 4 – Bonnes vacances

4.1 – Comprendre un site de réservation en ligne
4.2 – Exprimer la préférence / Hésiter
4.3 – Ecrire un mail formel / une carte postale
4.4 – Exprimer des sensations, une émotion positive, la surprise
4.5 – Ecrire une liste de voyage

Unit 5 – Le texte littéraire

5.1. Le Petit Prince (Chapitre 1) - Antoine de Saint Exupéry
5.2. La colombe poignardée et le jet d'eau – Calligramme - Guillaume Apollinaire

PrescribedTextbook :

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz. *Edito A1Méthode de français*. Paris : Didier, 2016.

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz. *Edito A1 Cahier d'exercises*. Paris : Didier, 2016.

Books, Journals and Learning Resources

- J.Girardet&J.Pécheur avec la collaboration de C.Gibble.*Echo A1*. Paris : CLE International, 2012.
- Carlo Catherine, Causa Mariella.*Civilisation Progressive du Français – I*. Paris : CLEInternational, 2003.
- Cocton Marie-Noëlle.*Génération 1 Niveau A1, Méthode de français et cahier d'exercices*.Paris : Didier, 2016.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, DupleixDorothée, Cocton Marie-Noëlle.*Saison 1 Niveau 1, Méthode de français et cahier d'exercices*. Paris : Didier, 2015
- Apollinaire Guillaume, *Calligrammes :Poèmes de la paix et de la guerre 1913-1916*.Paris: Gallimard, 1966.
- Antoine de Saint-Exupéry.*Le Petit Prince*. Paris : Gallimard, 2007.
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com

SEMESTER-II			
Part II General English	**Poetry, Prose, Extensive Reading and Communicative English –II**		
Course Code 21UGEN21	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Objectives

- To help students realise how life, literature and language are closely connected
- To expose students to language skills through the core subjects

Course Outcome:

CO.No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO-1	comprehend passages.	Un
CO- 2	build effective communication skills.	Un
CO- 3	demonstrate improved oral fluency.	Un
CO- 4	use vocabulary through the study of word parts.	Ap
CO- 5	construct paragraphs and essays through prose writings.	An
CO- 6	develop the skills of interpretation, critical thinking, and clear writing.	An
CO- 7	make use of context clues and analyse poetic content and correlate to experiences.	An
CO- 8	support future academic study by developing a high social, aesthetic and cultural literacy.	Cr

SEMESTER-II			
Part II General English	**Poetry, Prose, Extensive Reading and Communicative English–II**		
Course Code: 21UGEN21	**Hrs/Week: 6**	**Hrs/Semester:90**	**Credits:3**

Unit I –Poetry

William Wordsworth – Resolution and Independence

Henry W. Longfellow – Psalm of Life

Toru Dutt – The Lotus

Unit II – Prose

A.G. Gardiner – On Courage

Desmond Morris – A Little Bit of What You Fancy

Kalpana Chawla – The Sky is the Limit

Unit III – Short Story

Saki – Mrs. Packletide's Tiger

Liam O'Flaherty – The Sniper

Langston Hughes – Thank You Ma'am

Unit IV – Grammar

Tenses: Present, Past and Future

Unit V- Communication Skills

Listening, Reading, Pronunciation, Key Functions, Speaking (TANSCHE - Module - II)

Text Books:

Units I-III – To be compiled by the Research Department of English

Unit – IV - Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Unit - V – CLIL (Content & Language Integrated Learning) – Module II by TANSCHE (Tamil Nadu State Council for Higher Education)

SEMESTER II			
Core II	**Chordata**		
Course Code: 21UZOC21	**Hrs/ Week : 6**	**Hrs/ Sem : 90**	**Credits : 6**

Objective:

- To impart information on the morphology and comparative anatomy of chordates.
- To provide knowledge on the organization and diversity of chordates.

Course Outcomes:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	explain the fundamental organization of chordates.	1	Un
CO-2	classify the phylum Chordata	1	Un
CO-3	appreciate the basic concepts of chordate diversity	1	Un
CO-4	analyse the characters of different classes of the chordates	2	An
CO-5	identify the major groups within the phylum Chordata	1	Un
CO-6	reason out the inclusion of different representative animals in particular class	8	An
CO-7	recognize the different structural organizations from evolutionary point of view	8	Ev
CO-8	compare the anatomy of different functional systems in chordates.	2	Ev

Unit I Chordata- Prochordata

Chordata introduction - General characters of chordates and classification up to classes with examples. General characters of prochordates, Type study: *Amphioxus*- external morphology - digestive and excretory system. External morphology and biological significance of the following – *Ascidian, Balanoglossus*. General characters of vertebrates, Agnatha - General characters - Type study: Petromyzon - External morphology, breeding and migration.

Unit II Pisces and Amphibia

Pisces: General characters and classification up to sub-classes with examples. Type study: *Scoliodon sorrakowah* - Fins and scales, digestive system, respiratory system, circulatory system, sense organs, reproductive system - General topic: Migration of fishes

Amphibia: General characteristics and classification up to orders with examples. Type study: *Rana hexadactyla* – External morphology, skin, digestive, respiratory, circulatory and nervous system, reproductive system, General topic: Parental care in Amphibia

Unit III Reptilia and Aves

Reptilia: General characters and classification up to order. Type study: *Calotes* - External morphology, digestive system and circulatory system only. General Topic: Identification of poisonous and non poisonous snakes.

Aves: General characteristics and classification up to subclasses. Type study: *Columba livia* - external morphology, flight muscle, digestive system, respiratory system, urinogenital system. General topic: Migration in birds and flight adaptations of birds.

Unit IV Mammalia

Mammalia: General characteristics and classification up to subclasses with examples. Type study: *Oryctolagus cuniculus* – dentition, digestive system, respiratory system,

circulatory system, urinogenital system. General topics: Egg laying mammals and adaptations of aquatic mammals.

Unit V Comparative Anatomy

Comparative anatomy: Respiratory system- skin, gills, lungs, air sacs, air bladder and accessory respiratory organs in fishes. Circulatory system – Evolution of heart and aortic arches, venous system and lymphatic system.

Text Books

1. Kotpal R.L. *Modern Text Book of Zoology - Vertebrates.* Meerut: Rastogi Publications. 2019.
2. Jordan E.L and Verma P.S. *Chordate Zoology.* New Delhi: S. Chand & Co Ltd. 2006.
3. Thangamani. A, Prasanna Kumar. S. Narayanan. L.M, N. Arumugam. *Chordata.* Nagercoil: Saras Publication. 2006.

Books for Reference

1. Ekambaranatha Iyer M., Anantha Krishnan T.N. *Manual of Zoology Vol II* Chennai: S. Viswanathan Pvt Ltd. 1995.
2. Jordan E.L and Verma P.S. *Chordate Zoology.* New Delhi: S. Chand & Co. Ltd. 2006.
3. Newman. H.H. *The Phylum Chordata.* Motikala: Satish Book Enterprise.1987.
4. Prasad S.N. *Vertebrate Zoology.* Allahabad: Kitab Mahal Private Ltd. 2005.

Practicals

Course Code: 21UZOCR2

Hrs / Week – 2 **Credit-1**

1. Dissections and mountings:

Fish - Digestive system

Frog - Arterial system (virtual dissection)

Frog - Venous system (virtual dissection)

Scoliodon - Placoid scales

Teleost fish - Ctenoid and cycloid scales

Frog - Brain (virtual dissection)

Feathers - Observation of barbs and barbules

2. **Museum specimens: slides/ models/ charts.**

Prochordata - *Amphioxus, Balanoglossus,* Ascidian

Agnatha - *Petromyzon*

Pisces - *Scoliodon,* Eel, *Narcine, Hippocampus,*

Amphibia - *Rhacophorus,* Salamander, *Ichthyophis*

Reptilia - Draco, Typhlops, *Naja naja,* Krait, Dryophis, Chameleon

Aves –*Columba livia*, Quill feather, Kingfisher, *Archaeopteryx*

Mammalia - Bat, *Oryctolagus cuniculus,* Platypus

3. Collection of any five locally available fishes.

Books for Reference

1. Verma, P.S. *A Manual of Practical Zoology – Chordates.* New Delhi: S. Chand & Company Ltd. 2008.
2. Jeyasurya, L.M. Narayanan, Thangamani and Prasanna Kumar. *Practical Zoology - Vol-2 Chordata.* Nagercoil: Saras Publication. 2013.
3. Richard A. Boolootian/ Donald Heyneman. *An illustrated laboratory text in Zoology.* U.S.A: Holt, Rinehart and Winston. 1997.

SEMESTER II			
PROFESSIONAL ENGLISH FOR ZOOLOGY – II			
Course Code: 21UZOPE2	**Hrs/ Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To prepare the students of life sciences for exuberant science communication.
- To develop language and communication skills of the students by offering adequate practice in professional contexts.

Course Outcomes:

CO. No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	recognise their own ability to improve their own competence in using the language	1,5	Un, Ap
CO-2	use language for speaking with confidence in an intelligible and acceptable manner	5	Ap
CO-3	understand the importance of reading for life	4,6	Un
CO-4	read independently unfamiliar texts with comprehension	4,6	Un
CO-5	understand the importance of writing and apply in academic life	2, 8	Un, Ap
CO-6	write simple sentences without committing error of spelling or grammar	8	An, Ap
CO-7	listen to lectures and interpret critically	3,8	Un, Ap
CO-8	become proficient in communication and become confident to present themselves.	5,7	Un, Ap

UNIT 1: COMMUNICATION

Listening: Listening to an audio text - Importance of water for the lives on earth.

Speaking: Group conversations - Informal discussion in a small group making plans for a get-together.

Reading: Passage reading - Vertebrates and invertebrates

Writing: Narration of story from pictures – Story of an elephant

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 2: DESCRIPTION

Listening: Illustration of a descriptive process - Induced fertilization in fish

Speaking: Role play - Interview with a famous scientist

Reading: Descriptive reading - What Happened to the Reptiles? (Zai Whitaker)

Writing : Single sentence and extended definitions

Vocabulary: Unit specific - Incorporated into the LSRW tasks

UNIT 3: NEGOTIATION STRATEGIES

Listening : Listening to a passage - The Crescograph ("J.C.Bose" by Aldous Huxley)

Speaking: Small group discussion - Genetically modified crops.

Reading: Passage reading- Fashion Trends.

Writing: Developing essay from the passage -Healthy diet.

Vocabulary: Unit specific-Incorporated into the LSRW tasks.

UNIT 4: PRESENTATION SKILLS

Listening : Listening to lectures and notes taking-
(https://www.youtube.com/watch?v=Dh9ptiJj7TE)

Speaking: Organized speech – Frustrations of colour-blind people. (informative)

Reading: Comprehensive passage - Digestive System and answering questions.

Writing: Descriptive writing – Interpretation - Animals for ever (Gerald Durrell's)

Vocabulary: Unit specific - Incorporated into the LSRW tasks.

UNIT 5: CRITICAL THINKING SKILLS

Listening: Listening for information - Introduction to enzymes

Speaking: Preparation of Power Point presentation – Small group discussion on errors in power point presentation (History of Zoology)

Reading : Note making – Professional Competence and Professional Ethics

Writing: Summary writing - Human immune system.

Vocabulary: Unit specific-Incorporated into the LSRW tasks.

Books for Reference:

English for Life Sciences, Tamil Nadu State Council for Higher Education (TANSCHE)

SEMESTER II			
Allied II	**Genetics, Physiology and Developmental Zoology**		
Course Code: 21UZOA21	**Hrs/ Week:4**	**Hrs/ Sem:60**	**Credits:3**

Objectives:

- To highlight the importance of genetics, physiology and developmental zoology to the students
- To learn the developmental stages, structure and functions of various organ systems of human.

Course outcomes

CO. No	**Upon completion of this course, students will be able to**	**PSO Addressed**	**CL**
CO-1	compare and contrast the Mendelian inheritance and its modifications	4	An
CO-2	explain the importance of genetics and welfare of human society	4	Ev
CO-3	characterize the types of food and the process of digestion, absorption and assimilation	2	Cr
CO-4	attain knowledge of respiration, excretion and understand the mechanism of transport of gases and urine formation	4	Ap
CO-5	comprehend the structure and functions of human reproductive system	2	Un
CO-6	list the various stages in human developmental biology	2	An
CO-7	Understand the menstrual cycle and the role of contraceptive in population control	2	Un, An
CO-8	explain the different aspects of infertility and its treatment	2	Ev

Unit I Genetics

Simple Mendelian traits in man – multiple alleles – ABO blood group – Rh factor in man – erythroblastosis foetalis – sex determination in man- sex linked inheritance in man – haemophilia and colour blindness – nondisjunction - Down's and Klinefelter's syndrome.

Unit II Physiology - Digestion

Nutrition: Food constituents – carbohydrates, proteins and fats. Digestion: Role of enzymes in the digestion of carbohydrates, proteins and fats. Absorption: Absorption of digested food.

Unit III Respiration and Nervous Co-ordination

Respiration : Haemoglobin – transport and exchange of oxygen and carbon dioxide. Nervous co–ordination: Structure and types of neurons – conduction of nerve impulse through neuron and synapse.

Unit IV Excretion and Reproduction

Excretion: Structure of kidney and nephron - urine formation. Reproduction: Structure of human testis and ovary, Graafian follicle, menstrual cycle and its hormonal control, menopause.

Unit V Developmental Zoology

Man - structure of sperm and ovum – fertilization – cleavage, gastrulation – fate map. Placenta in mammals – types (diffuse, cotyledonary and discoidal) and functions – Birth control measures – contraceptive devices, infertility - ART, IVF, IUI, Twins.

Text Books:

1. Verma P.S., Tyagi B.S.& Agarwal V.K. *Animal Physiology.* 6thEdition. New Delhi: S. Chand & Company Ltd. 2000.
2. Verma P.S. and Agarwal V.K. *Chordate Embryology*. 10th Edition. New Delhi:

S. Chand & Company Ltd. 2010.

3. Meyyan R.P. *Genetics.* Nagercoil: Saras Publication. 2007.

Books forReference:

1. Verma P.S. and V.K. Agarwal. *Cell Biology*, Genetics, Molecular Biology, Evolution &

Ecology. New Delhi: S. Chand & Company Ltd. 2013.

2. Arumugam N. *Developmental Zoology*. Nagercoil: Saras Publication. 2009.

3. Meyyan R. P. *Genetics.* Nagercoil: Saras Publication. 2007.

4. Verma P.S. Tyagi B.S. & Agarwal V.K. *Animal Physiology*, 6th Edition. New Delhi:

S. Chand & Company Ltd. 2000.

PRACTICALS

Course Code : 21UZOAR1 **Hrs/ Week : 2**
Credit: 1

1. Simple Mendelian traits in man
2. ABO blood grouping
3. Qualitative tests for glucose, protein and lipid
4. Examination of excretory products (ammonia, urea and uric acid crystals)
5. Museum specimens: Slides/ Charts/ Models

Sex linked inheritance of colour blindness, haemophilia, Down syndrome. Frog - sperm and egg, diffuse placenta (pig), cotyledonary placenta (sheep). Villus, nephron, neuron, human sperm and human egg

Book for Reference:

1. Jeyasurya, Dulsy Fatima, Kumaresan and Selvaraj. *Practical Zoology* Volume -3.Nagercoil: Saras Publication. 2013.

Semester – II			
Environmental Studies			
Course Code : 21UAEV21	**Hrs/ Week : 2**	**Hrs/Sem:30**	**Credits : 2**

Course Outcomes:

Upon completion of this course, the students will be able to

1 Recognize the biotic and abiotic components of ecosystem and how they function.
2 Use natural resources more efficiently and know more sustainable ways of living.
3. Acquire an attitude of concern for the environment.
4. Participate in improvement and protection of environment.
5. Manage unpredictable disasters.
6 Create awareness about environmental issues to the public.

Unit I Environment and Ecosystem

Aim and need for Environmental Awareness - Components of Environment Ecosystem - Components of Ecosystem: Abiotic and biotic factors (Producer, Consumer and Decomposer) – Food Chain, Tropic Levels - Food Web, Energy flow and Ecological pyramids

Unit II Natural Resources:

Renewable and non-renewable resources – Water Resources: Uses and Conservation of Water – Rain Water Harvesting – Forest Resources: Importance of Forests - Major and Minor forest produces - Conservation of Forest Energy Resources: Solar Fossil Fuel – Wind – Role of individuals in the conservation of natural resources

Unit III Environmental Pollution

Pollutants – Types of pollution: Air, Water, Noise and Plastic Pollution – Causes, effects and Control measures – Global warming and Climate Change

Unit IV **Human Population and Environment**

Effect of human population on environment – Population Explosion problems related to population explosion – Involvement of population in conservation of environment – Measures adopted by the Government to control population growth – Environment and human health

Unit V **Disaster Management**

Floods–Drought–Earthquakes– Cyclones – Landslide–Tsunami–Control measures

Semester – II			
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Course Code : 21UAEV21	**Hrs/ Week : 2**	**Hrs/Sem:30**	**Credits : 2**

Course Outcomes:

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SEMESTER – III			
Part-I nghJj;jkpo - jhs; 3fhg;gpa ,yf;fpaq;fSk rpw;wpyf;fpaq;fSk; (nra;As;> ,yf;fzk;>,yf;fpa tuyhW>ciueiL› Gjpdk;›)			
Course Code: 21ULTA31	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

Objectives:

- khztpah ,iw ek;gpf;ifapYk› ew;gz;GfspYk tsh;e;J> ,yf;fpa mwptpYk nkhopj;jpwdpYk rpwe;J tpsq;f topfhLLy;.
- fhg;gpa khe;jhpd tho;f;ifapd %ykhf fLTs; ek;gpf;if> ey;y cwTfs;> ,aw;ifia Nerpj;jy› nkhopmwpT Nghd;wtw;iw tsur; nra;jy›.

Course Outcome:

CO.No.	,g;ghLj;jpLLk khztpaUf;F	mwpTrhh; kjpg;gPL
CO-1	ngz;fspd rLLq;fs; chpikfs;> Ntiytha;g;G gw;wpa tpguq;fis mw;e;J nfhs;s cjTfpwJ.	eiLKiwg;gLj;jy
CO-2	murpay; #o;r;rp› ,dk› rhj› Fwpj;j ghFghL ,tw;wpypUe;J tpLjiy ngWk toptiffisf; fw;Wf;nfhLf;fpwJ.	eiLKiwg;gLj;jy
CO-3	,yf;fpa mwptpid tsh;f;f> fhg;gpar; Rit czh;e;J Ritf;f tha;g;gspf;fpwJ.	eiLKiwg;gLj;jy
CO-4	rkaey;ypzf;fk› ,iwek;gpf;if ,tw;iw cUthf;FfpwJ.	cUthf;fk;
CO-5	nkhopiag gpioapd;wpg; NgrTk vOjTk cjTfpd;wJ. giLg;ghw;wy jpwid tsh;f;f cjTfpwJ.	Ghpe;Jnfhs;Sjy;>jpwd Nkk;ghL
CO-6	jdpkdpj tho;f;ifr; rpf;fy;fis vjpHnfhs;Sk; epiyia cUthf;FfpwJ	eiLKiwg;gLj;jy
CO-7	,g;gFjpapy; thOk mbj;jL;L kf;fspd tho;T epiyia mwpe;J nfhs;s cjTfpwJ. ngz;fs; ePjpf;Fg; NghuhLk czHit tsh;f;fpwJ.	eiLKiwg;gLj;jy;>jpwd Nkk;ghL
CO-8	NghLbj; Njhtfsf;Fg; gad;gLk tifapy; giLg;ghf;fj; jpwid tsHf;f cjTfpwJ.	giLg;ghw;wy;>jpwd Nkk;ghL

SEMESTER – III			
Part-I nghJj;jkpo - jhs; 3fhg;gpa ,yf;fpaq;fSk; rpw;wpyf;fpaq;fSk **(nra;As;> ,yf;fzk;>,yf;fpa tuyhW› ciueiL› Gjpdk;)**			
Course Code: 21ULTA31	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

myF - 1 nra;As; - 2 kzp
fhg;gpaqfs

1. rpyg;gjpfhuk; - miLf;fyf; **fhij** : 11 – 94 ghLybfs;
2. kzpNk**fiy** – MGj;jpud **j**pwd mwptpj;j **fhij** : 1 **Kjy** 56 ghLybfs;
3. nghpaGuh**zk** - **fz**;zg;g ehadhh Guhzk; (ghLy;fs;: 757 - 762› 67› 74› 81› 84›85› 804› 05› 06› 12› 14› 18› 19› 825 – 832› 834.
4. **fk**;guh**khazk** - eL;Gf;NfhL gLyk;
5. rPwhg;Guh**zk** - **fs;ti**u ejp kwpj;j gLyk;
6. N**jk**;ghtzp - **tsd rd**pj;j gLyk;- 9 **Kjy** 31 ghLy;fs;.

rpw;wpyf;fpak;

1. **j**pUf;Fwwhyf; FwtQ;r;. IV FwtQ;r; ehL**fk**; 8. vq;fs; k**i**yNa.

myF -2 ,yf;fzk - 1 kzp
nghUs; ,yf;fzk

1. mfg;nghUs; : vOjpi**z** tpsf;fk; - **Kjy**› fU› ch**p**g;nghUs;
2. Gwg;nghUs; : **ntL**;r**p**j;jpi**z Kjy** ghLh**z;jpiz tiu** tpsf;fk kL;Lk

ahg;G ,yf;fzk

1. ahg;G cWg;Gfs;. (v**Oj**;J> m**i**r> rPh;› **ji**s> mb> **njhi**L)

myF - 3 ,yf;fpa tuyhW - 1 kzp

1. **I**k;ngUq;fhg;gpq;fs;
2. **I**Q;rpWfhg;gpaq;fs;
3. rpw;wpyf;fpaj;jpd N**j**hw;wKk tsh;r;rpAk› gps;**isj**;jkpo› **fy**k;gfk› FwtQ;r;r› guzp.
4. G**j**pdk N**j**hw;wKk tsh;r;rpAk;.

myF - 4 ciueiL - 1kzp
,g;nghOJ **,t**s; - g. **j**pUk**i**y.

myF - 5 Gjpdk - 1 kzp
N**j**hpahazk (r%f ehty;) - **fz**;zFkhu tp];t&gd;

SEMESTER – III			
Course Title : PART – I French Paper – IIIAdvanced French Language			
Course Code : 21ULFA31	**Hrs/week : 6**	**Hrs/ Sem : 90**	**Credits : 4**

Objectives

To enhance the acquisition of all the four competencies of language learning.

To create the independent capability of the learner to respond and tackle the various situations of communication when the learner is in the native country of the target language

Course Outcomes

CO	At the end of this course, the students will be able to	CL
1.	give an explanation	Ap
2.	ask and say height and weight	Ap
3.	understand student exchange programme and professional world	Kn, Un, Ap
4.	express a goal and a skill	Ap
5.	understand a comic	Un
6.	describe a lifestyle	Kn, Ap
7.	talk about plans and difficulties	Ap
8.	enjoy, appreciate and understand the lyrics of the French songs	An
9.	write a CV	Cr
10.	comprehend French literature	Kn

Unit 1 – Pas de chance !

1.1 –Se plaindre / plaindre quelqu'un
1.2 – Donner une explication
1.3 – Exprimer une émotion négative
1.4 – Demander et dire le poids et la taille
1.5 – Chance et malchance

Unit 2 – Beau travail ?

2.1 – Comprendre un programme d'échange universitaire
2.2 – Exprimer le but, le souhait et un projet professionnel
2.3 – Exprimer une capacite, une compétence
2.4 – Comprendre des taches professionnelles
2.5 – Universités 2.0

Unit 3 – Au grand air

3.1 – Comprendre une BD sur un changement de vie
3.2 – Exprimer son insatisfaction
3.3 – Exprimer un choix de vie
3.4 – Décrire son mode de vie
3.5 – Je cultive mon jardin

Unit 4 – C'était bien ?

4.1 – Parler de ses difficultés
4.2 – Encourager, rassurer
4.3 – Parler d'un projet
4.4 – Exprimer son accord, son désaccord et intérêt
4.5 – Les Français en chanson

Unit 5 – Le texte littéraire

5.1 – Demain dès l'aube - Victor Hugo
5.2 – La Laitière Et Le Pot Au Lait - Jean De La Fontaine

PrescribedTextbook :

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz. *Edito A1Méthode de français*. Paris : Didier, 2016.

Céline Braud, Aurélien Calvez, Guillaume Cornuau, Anne Jacob,Sandrine Vidal, Cécile Pinson, Marion Alcaraz. *Edito A1 Cahier d'exercises*. Paris : Didier, 2016.

Books, Journals and Learning Resources

- J.Girardet&J.Pécheur avec la collaboration de C.Gibble.*Echo A1*. Paris : CLE International, 2012.
- Carlo Catherine, Causa Mariella.*Civilisation Progressive du Français – I*. Paris : CLEInternational, 2003.
- Cocton Marie-Noëlle.*Génération 1 Niveau A1, Méthode de français et cahier d'exercices*.Paris : Didier, 2016.
- Dintilhac Anneline, De Oliveira Anouchka, Ripaud Delphine, DupleixDorothée, Cocton Marie-Noëlle.*Saison 1 Niveau 1, Méthode de français et cahier d'exercices*. Paris : Didier, 2015
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.frenchtoday.com/french-poetry-reading/

SEMESTER – III			
Part II English Poetry, Prose, Extensive Reading and Communicative English - III			
Course Code: 21UGEN31	**Hrs/ Week: 6**	**Hrs/ Semester: 90**	**Credits: 4**

Objectives:

- To acquaint students with literary art and writings of universal appeal.
- To strengthen the proficiency of communicative English through literary based study.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	understand the language and literary components of texts	2,8	Un
CO-2	gain insight into literary experience and expressions of writers	8	Un, Ev
CO-3	comprehend aspects of grammar and its application	4	Un
CO-4	enrich vocabulary and its regular usage	9	Un, Ap
CO-5	analyse functional English in literary texts	1,8	An
CO-6	evaluate perspectives and human values for life	2,10	Ev
CO-7	adopt appropriate technique to enhance communication and writing	1,7	Ap, Cr
CO-8	develop skills of formal writing and speech	4,7	Cr

SEMESTER – III			
Part II English Poetry, Prose, Extensive Reading and Communicative English - III			
Course Code: 21UGEN31	**Hrs/ Week: 6**	**Hrs/ Semester: 90**	**Credits: 4**

Unit I –Poetry

William Shakespeare – All the World's a Stage

Dylan Thomas – Do not go gentle into that good night

Sri Aurobindo Ghosh – The Divine Worker

Unit II – Prose

Bertrand Russell – How to Avoid Foolish Opinions

Virginia Woolf – Men and Women

M.K. Gandhi – At School

Unit III – Fiction

Charlotte Bronte -*Jane Eyre* (Abridged Version)

Unit IV – Grammar

Active and Passive Voice, Direct and Indirect Speech

Unit V –Communication Skills

Listening Comprehension, Close Reading, Conversational English, Formal Writing

Text Books:

Units I – III – Compiled by the Research Department of English.

Units IV – Joseph, K.V. *A Textbook of English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Unit V – CLIL (Content & Language Integrated Learning) – Module IV by TANSCHE.

SEMESTER III			
Core III	**Developmental Zoology**		
Course Code: 21UZOC31	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objective:

- To acquire a greater appreciation of life and its development.
- To understand the complexity of developmental processes and the underlying mechanism.
- To attain knowledge on reproductive technology and stem cells.

Course Outcome

CO. No.	**Upon completion of this course, students will be able to**	**PSO Addressed**	**CL**
CO-1	understand the concepts and process in developmental biology	1	Un
CO-2	illustrate the events occur during fertilization	1,2	K
CO-3	acquire knowledge about the developmental process and embryogenesis	1	Un
CO-4	explain the sequential changes from cellular grade of organization to organ grade of organization	3	Un, K
CO-5	compare the types of extra embryonic membrane and the nature and physiology of placenta	1,4	An
CO-6	beaware of the new technologies in embryology to utilize its advantages.	1,4	Ap
CO-7	know about the advanced reproductive technologies to utilize for the welfare of man	1,7	K, Ap
CO-8	analyse the causes of infertility in human and can take preventive measures**.**	3,5	An

Unit I G**ametogenesis**

Basic concepts of developmental biology - gametogenesis – spermatogenesis, oogenesis - sperm and egg of chick and human.

Unit II Development of Chick

Fertilization : Pre and post fertilization events - cleavage, blastulation, gastrulation and fate map of Chick.

Unit III Development of Human

Cleavage – fate map of human – gastrulation in human – organogenesis - development of heart and brain in mammal.

Unit IV Organizer & Foetal membrane

Organizer - primary and secondary organizers, morphogenetic fields and gradient hypothesis, embryonic stem cells - culture & applications, placenta in mammals – types and physiology.

Unit V Assisted Reproductive Technology

Manipulation of reproduction in human - Infertility (Male & Female) - Poly Cystic Ovarian Disease (PCOD) - artificial insemination, IVF - test tube babies - amniocentesis - Birth control - contraceptive devices – surgical, hormonal methods, physical barriers – IUCD, termination of gestation.

Text Books

1. Berril. M.J. *Developmental Biology*. New Delhi: Tata Mc Graw- Hill Publishing Company Ltd. 1982

Books for Reference

1. Arumugam. N. 2006 *Developmental Zoology*, Nagercoil: Saras Publication. 2006.
2. Verma. P.S. and U.K. Agarwal. *Chordate Embryology.* New Delhi: S. Chand & Company Ltd, 10th Edition 2014.
3. Balinsky, B. I. and Bc. Fabian. *An Introduction to Embryology*. India: Cengage Learning 5th Edition 2012.

PRACTICALS

Course Code: 21UZOCR3

Hrs / Week – 2 **Credits: 2**

1. Types of eggs (alecithal, telolecithal and centrolecithal)
2. Temporary mounting of chick embryo
3. Chick – Blastula, Gastrula and Fate map
4. Observation of permanent slides of chick embryo 24, 48 ,72, and 96 hours.
5. Pregnancy test kit
6. Mounting of egg of fish
7. Museum specimens/ slides/ models and charts:
   a. Sperm and egg of mammal
   b. Contraceptive devices – condom, copper T, pills (Mala D).
   c. Placenta in mammals – diffuse, discoidal, zonary and cotyledenary placenta.

Books for Reference

1. Verma P. S, *A Manual of Practical Zoology Chordates.* New Delhi: S. Chand and Company Ltd.1992.
2. Balinsky B. *An Introduction to Embryology*. U.S.A and Japan:, B.W. Saunders Company Ltd. Fourth edition.1976.
3. Jeyasuriya, Arumugam , N , Dulcy Fatima , Narayanan. Nagercoil: *L.M. Practical Zoology* Saras Publications, Vol. 3. 2013.

SEMESTER III			
Skill Based Elective	**A. Fishery Products**		
Course Code: 21UZOS31	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credits: 2**

Objectives:

- To obtain knowledge on products of fisheries industry, their processing and preservation process.
- To encourage the students to follow hygiene in fish processing
- To develop entrepreneurial skills in the preparation of sea-food based convenience products in ready-to-eat or ready-to-cook forms

Course Outcome

CO. No.	Upon completion of this course, the graduates will be able to	PSO addressed	CL
CO-1	acquire knowledge on products and by-products of fisheries.	5	Un
CO-2	demonstrate various processing and preservation methods of fishery products	5	Un
CO–3	apply information on processing for the usage of fish by-products for industrial and domestic purposes.	7	Ap
CO–4	carry out study on sea weeds and analyse their usage as food for human consumption	2	An
CO–5	practice the preparation of value added fishery products.	8	Cr
CO–6	implement and discuss sanitation and quality control techniques.	7	Cr
CO–7	update the knowledge of preservation and processing techniques and recommend their use in day to day life.	7	Ev
CO-8	develop advanced techniques on fishery products.	8	Un, Cr

Unit I **Value Added Fishery Products**

Fish pickles, fish sauce, fish cutlets, fish balls, fish soup powder and fish sausage. Battered and braided products-fish finger, fish wafer.

Unit II **Fishery By Products**

Fishery by products - fish oil – isinglass – chitosan – pearl essence – shark fins

Unit III **Seaweed Products**

Uses of agar, algin and carrageenan. Use of sea weeds as food for human consumption.

Unit IV **Techniques of Preservation and Processing**

Freezing - quick, slow freezing; freezer - horizontal plate freezer, tunnel air blast freezer - cryogenic freezing; canning; smoking - hot, cold, electrostatic smoking; pickling; drying – natural, artificial; salting - dry, wet and mixed salting.

Unit V **Quality Control and Sanitation**

Sanitation in processing – environmental hygiene and personal hygiene in processing. Fishery guidelines for HACCP and FSSAI on fish and fish products.

Text Book

1. Dr. Surekha Gupta. *Textbook of Fishery*. New Delhi: Ane Books Pvt. Ltd. 2010

Books for Reference

1. Gopakumar, K. *A Textbook of Fish Processing Technology*. New Delhi: ICAR. 2002.
2. Gupta, S.K. and P.C Gupta. *General and Applied Ichthyology* [*Fish and fisheries*]. Ramnagar New Delhi: Chand and Company Ltd. 2006
3. K.R. Ravindranathan. *A Text book of Economic Zoology*. New Delhi*:* Wisdom Press. 2013.
4. Ayyapar, S. *Handbook of Fisheries and Aquaculture*. New Delhi: 2010
5. Srivastava, C.B.L. *A Text book of Fishery Science – Indian Fisheries.* New Delhi: Kitab Mahal. 2006.

SEMESTER III			
Skill Based Elective	**B. Aquarium Management**		
Course Code: 21UZOS32	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credits: 2**

Objectives

- To provide information on setting up and maintenance of an aquarium.
- To promote the self-employment opportunities.
- To foster the importance of peaceful, educational and stress-free hobby.

Course Outcome

CO. No	Upon completion of this course, the students will be able to	PSO addressed	CL
CO-1	acquire knowledge about home aquarium	1	Un
CO-2	identify common aquarium fishes	1, 2	K
CO-3	explain the different kinds of equipment and accessories used in setting up an aquarium	6	K, Un
CO-4	critically analyze the different kinds of fish feed and aquarium plants	5	An
CO-5	examine the common diseases, symptoms and management of aquarium fishes	7	Ap
CO-6	demonstrate skills in maintenance of water quality parameters	3,5	An, Ap
CO-7	develop the hobby of having an aquarium at home	8	Cr
CO-8	promote self-employment opportunities	8	Ap

Unit I **Construction of Home Aquarium**

Construction of home aquarium - materials needed - wooden and metal frames - frameless tanks, sealants and gums

Unit II **Setting up of an Aquarium**

Setting up aquarium – gravel/ pebbles – plants – ornamental objects and fishes – popular ornamental fishes – gold fish, molly, angel fish, zebra fish, cichlids - aquarium accessories – aerators, filters

Unit III **Maintenance of Aquarium**

Maintenance of aquarium - water quality management – pH, temperature, lighting, hardness, salinity, oxygen, carbon dioxide – optimum conditions for the growth of aquarium plants

Unit IV **Feed Formulation**

Nutritional requirements of aquarium fishes - Different kinds of feed - live feed – artemia and chironomous larva – feeding formula, feeding methods and devices.

Unit V **Fish Diseases and Management**

Symptoms - treatment, prevention and control of common diseases of aquarium fishes - tail rot, fin rot, white spot, velvet disease – scoliosis.

Text Book:

1. Jameson J.D. and Santhanam R. *Manual of Ornamental Fishes and Farming Technologies.* Tuticorin: Fisheries College and Research Institute, Tamil Nadu Veterinary and Animal Science University, 1996.

Books for Reference

1. Yadav B.N. *Fish and Fisheries*. New Delhi: Daya Publishing House, 2002.
2. Thara Devi C.S and Jeyashree K.V. *Home Aquarium*, Nagercoil: Saras Publications, 2009.
3. Gupta S.K. and Gupta P.C. *General and Applied Ichthyology* (Fish and Fisheries). New Delhi: S. Chand and Company Ltd., 2006.
4. Sebastian J. *The aquarium Handbook*. Cochin, Kerala: Amity Aquatech Pvt. Ltd., 2002.
5. Amita Saxena. *Aquarium Management.* Delhi: Daya Publishing House, 200

SEMESTER III			
NME I	**Basic Biotechnology**		
Course Code: 21UZON31	**Hrs/ Week : 2**	**Hrs/ Sem: 30**	**Credit: 2**

Objectives

- To impart basic knowledge on biotechnology
- To develop skills in biology using various biotechniques
- To motivate the students to take up career in biotechnology related fields in their future

Course Outcome

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	understand the basic principles of Biotechnology	1	Un
CO-2	distinguish between prokaryotic and eukaryotic cells from their structural studies	2	An
CO-3	understand the restriction enzymes and cloning vectors and assess their use in genetic engineering.	4	Un, Ev
CO-4	analyse the structure of DNA, and use various techniques to visualize, manipulate and separate the DNA molecules	4, 5	Un, An
CO-5	apply the various gene manipulation techniques to generate genetically modified organisms	6	An
CO-6	evaluate techniques of gene delivery and cloning to adapt in manipulation of genes	5	Ev
CO-7	discuss the preparation and characterization of appropriate nano materials in the field of nanotechnology	7	Cr
CO-8	to perform biotechnology experiments to isolate separate and amplify DNA molecules	8	Cr

Unit I **Introduction to Basic Biotechnology**

Definition, history of Biotechnology - scope of Biotechnology; structure of cell - eukaryotic and prokaryotic cells.

Unit II **Basics of Gene Manipulation**

Structure of DNA - gene concept - central dogma of life - concept of genetic engineering - Type II Restriction enzymes and DNA ligases in genetic engineering - cloning vectors – definition - general characters - plasmid cloning vector – pBR322 - construction of recombinant DNA - basic steps in cloning.

Unit III **Techniques in Biotechnology**

Agarose gel electrophoresis, SDS PAGE, PCR - Gene delivery methods – transformation, transfection, methods, biolistic method (gene gun).

Unit IV **Genetic Modification of Organisms**

Transgenic animals and plants - methods of production of transgenic organisms - outline of microinjection mediated gene transfer to animals - outline of Agrobacterium mediated gene transfer to plants – GMOs – Super mouse, Gold fish, Golden rice, Bt Cotton.

Unit V **Demonstrations/ Model/ Chart**

DNA isolation, restriction digestion, agarose gel electrophoresis, SDS PAGE, PCR, Structure - DNA, tRNA (Model/ Chart).

Text Book:

Kumaresan, V. *Biotechnology*. Nagercoil: Saras Publication, 6th edition, 2012.

Books for Reference:

1. Dubey, R.C. *A Textbook of Biotechnology*. New Delhi: S. Chand and Company Ltd., 2009.
2. Rastogi, S.C. *Biotechnology Principles and Applications*. Chennai: Reprint, Narosa. Publishing House, 2020.
3. Singh, B.D. *Biotechnology*. New Delhi: Kalyani Publishers. 2015.
4. Sathyanarayana, V. *Biotechnology*. Kolkatta:. Books and Allied (P) Ltd. 15th Edition. 2020.
5. Harisha S. *Biotechnology Procedures and Experiments Hand Book*. New Delhi: Lakshmi Publications. First Edition. 2008.
6. Asish Verma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. New Delhi: S. Chand and Company, Ltd., 2008.

Semester – III			
Women's Synergy			
Code : 21UAWS31	**Hrs/ Week : 2**	**Hrs/Sem:30**	**Credits : 2**

Unit I - Physical Health

Woman's Structural Organisation – Levels of organisation – Body image - Reproductive health – Hormonal Cycle and its Psycho-somatic implications – Child birth – lactation – Nutritional status of women.

Unit II – Psychological Health

Examining factors determining psychological conditions of women – Depression, anxiety, stress, hysteria – Socio – cultural and familial conditioning of women's minds – Self Image, Discrimination against women.

Unit III – Women and Legal Awareness

Women specific – centered legislations – legal issues – laws to prevent gender based violence National / State Pro-women schemes – educational and Employment schemes. Laws for protection of Women – Women's rights to property – Women's Rights in the Indian Constitution – Maternity benefit act.

Unit IV – Women and Finance

Manager of domestic finance – Budgeting basics – Create a family budget - Set financial goals – Plan for financial emergencies – Budget for travel – Saving strategies – Investment options

Unit V – Women's Empowerment in Various Domain

Introduction - Women created history in sports and music – P. T. Usha, M. S. Subbulakshmi - Women who crossed hurdles in Social Service – Mother Theresa, Muthulakshmi Reddy, Medha Patkar - Role of Women in Indian independence movement and Politics – Indira Gandhi, Aruna Asaf Ali.

SEMESTER III	
Self Study (Compulsory) **Wildlife Conservation**	
Course Code : 21UZOSS1	**Credits: 2**

Objectives:

- To recognize the importance of wildlife conservation.
- To study the techniques of wildlife census.
- To learn the role of Sanctuaries and National Parks in wildlife conservation.

Course outcome

CO. No	**upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	acquire knowledge on the need for conservation of wildlife	1	Un
CO-2	explain about the status and conservation of endangered species.	1	Un
CO-3	be aware of wildlife wealth of India and the threatened species	1	Un
CO-4	apply principles of wildlife management in protecting the threatened species	3	Ap
CO-5	analyse the values, benefits of wildlife and cause for wildlife depletion	3	An
CO-6	understand the Wildlife Conservation Policies and to improve the conservation strategies.	8	Un, Cr
CO-7	assess wildlife population by learning the various census techniques	6	Ev
CO-8	discuss the role of Wildlife Sanctuaries and National Parks in wildlife conservation	3	Cr

Unit I **Wildlife Census Techniques**

Wildlife census techniques - direct method - line transect method – block count method- indirect method - pellet analysis method - pugmark techniques.

Unit II **Need for Conservation**

Wildlife values and benefits - causes of wildlife depletion – need for conservation - endangered species of reptiles, birds and mammals in India.

Unit III **Wildlife and their Management**

Principles of wildlife management - wildlife wealth of India - threatened wildlife, threats to survival and management of Red Panda, Musk deer, Great Indian Bustard, Olive Ridley turtle, Nilgiritahr, Nilgiri langur.

Unit IV **Sanctuaries and National Parks**

Definition – importance – Vedanthangal, Koonthankulam Bird Sanctuary – Mudumalai Sanctuary- Anamalai Sanctuary - National Parks - Guindy Deer Park – Gulf of Mannar Biosphere Reserve.

Unit V **Wildlife Conservation Policies**

The World Conservation Union (IUCN), Red Data Book.
World Wildlife Fund (WWF), Indian Board of Wildlife (IBWL) – National Board for Wildlife (NBWL), Man and Biosphere Programme (MAB), Project Tiger. Wildlife Protection Act 1972, Significance of NGO's in wildlife conservation.

Books for Reference

1. Anubha Kaushik and Kaushik C.P. *Environmental Science & Engineering*. New Delhi: New Age International (p) Publishers. 2020.

2.Hosetti B.B. *Concepts in Wildlife Management*. New Delhi: Daya Publishing house, A division of Astral International Pvt. Ltd. 2017.

3. Dr. Reena Mathur. *Wildlife Conservation and Management*. Meerut: Rastogi Publications; 1st Edition. 2018

4. Seshadri, B. *India's Wildlife Reserves*. New Delhi: Sterling Publishers 1990.

5. Saharia, V.B. *Wildlife in India*. Dehradun: Nataraj Publication.1998.

6. Verma, P.S. and Agarwal V.K. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. New Delhi: S. Chand & Company Pvt. Ltd, Ram Nagar. 2009.

7. Brain Groombridge. *Global Biodiversity*. London SE1 8 HN: Chapman & Hall, 2-6 Boundary Row. 1992.

SEMESTER – IV			
Part-1 nghJj;jkpo - jhs; 4rq;f ,yf;fpak **(nraAs;> ,yf;fzk;>,yf;fpa tuyhW› ciueil>ehLfk;)**			
Course Code: **21ULTA41**	**Hrs / Week:6**	**Hrs / Semester: 90**	**Credits: 4**

myF - 1 nra;As; - 2 kzp
vL;Lj;njhif

1. ew;wpiz - ghLy;fs; : 64› 318
2. FWe;njhif - ghLy;fs; : 3› 20› 75
3. Iq;FEW}W - nryT mOq;Ftpj;jg; gj;J - ghLy;fs; : 304› 307› 308› 309
4. gjpw;Wg;gj;J - ghLy; : 25
5. ghpghLy; - ghLy; 6 (1-10 mbfs;)
5. fypj;njhif - ghLy; : 51
6. mfehD}W - ghLy;fs; : 20› 194
7. GwehD}W - ghLy;fs; : 191› 204

gj;Jg;ghL;L
kJiuf;fhQ;rp- 63 thpfs;

myF -2 ,yf;fzk - 1 kzp
1. **ghtiffs** - ntz;gh>Mrphpag;gh nghJ **,yf;fzk**
2. **mzp ,yf;fzk -**
ctik>cUtfk;>Ntw;Wik>tQ;rg;Gfo;r;rp› rpNyiL>jw;Fwpg;Ngw;wk
3. thf;fpa **tiffs**

4. gpwnkhopr nrhw;fisePf;fpvOJjy

m. Mq;fpyr nrhw;fs;

M. tLnkhopr nrhw;fs;

,. njYq;Fr; nrhw;fs;

myF 3 ,yf;fpatuyhW - 1 kzp
1. vL;Lj;njhif E}y;fs;
2. gj;Jg;ghLL E}y;fs;
3. rq;f ,yf;fpaj;jpd jdpr;rpwg;Gfs;
4. ehLfk - Njhw;wKk tsh;r;rpAk

myF - 4 ciueiL - 1kzp
,yf;fpaj njd;wy - jkpo;j;Jiw - fL;Liuj njhFg;G›
J}a khpad;idfy;Y}hp (jd;dhL;rp)› J}j;Jf;Fb

myF -5 ehLfk - 1 kzp
Mapuk G+f;fs kyuLLk - fPo;f;Fsk tpy;ytd

SEMESTER – IV			
Course Title : PART – I French Paper – IVFrench Course and Literature			
Course Code : 21ULFA41	**Hrs/week : 6**	**Hrs/ Sem : 90**	**Credits : 4**

Objectives

To create and develop the taste for literary readings in the target language.

To motivate students to appreciate the French literature.

Course Outcomes

CO	At the end of this course, the students will be able to	CL
1.	comprehend the French literary background	Un, An
2.	imbibe the basic grammatical structures of the language	Un, An
3.	inculcate the values imparted through the literary texts	Un, An
4.	appreciate simple literary texts	An, Ap
5.	acquire literary knowledge and enhance aesthetic perception	An, Ap
6.	explore a literary text, with the perspective of analyzing the content and manner of writing	An, Ap
7.	reflect upon the author's ideas and transform her own personality	Ap, Cr
8.	discover, interrogate and reflect on the humanistic value	Cr
9.	understand the history of France	Un

Unit 1 – XVII^{e}siècle

1.1 – Le Corbeau et le Renard - Jean de la Fontaine
1.2 – Le Petit Chaperon Rouge - Charles Perrault
1.3 – Le Passe Composé

Unit 2 – XVIII^{e}siècle

2.1 – Zadig : La danse - Voltaire
2.2 – La Révolution française
2.3 – L'imparfait

Unit 3 – IX^{e}siècle

3.1 – Chansons d'automne - Paul Verlaine
3.2 – Le Père Goriot *(extrait)* - Honoré de Balzac
3.3 – Les Pronoms relatifs

Unit 4 – XX^{e}siècle

4.1 – Le Pont Mirabeau - Guillaume Apollinaire
4.2 – L'Etranger *(extrait)* - Albert Camus
4.3 – Les Indicateurs temporels

Unit 5 – La littérature francophone

5.1 – Le Grand Cahier *(extrait)* - Agota Kristof
5.2 – Le fils à la recherche de sa mère- Pape Faye
5.3 – Le Futur proche et le futur simple

Books, Journals and Learning Resources

- K. Madanagobalane, N.C.Mirakamal.*Le Francais par les Textes*. Chennai :Samhita Publications, 2019.
- Blondeau Nicole, Allouache Ferroud jà, Ne Marie-Françoise.*Littérature Progressive du Français*.Paris : CLE International,2004.
- Carlo Catherine, Causa Mariella.*Civilisation Progressive du Français – I*. Paris : CLE International, 2003.
- Akyuz Anne,Bazelle-Shahmaei Bernadette, Bonenfant Joelle, GliemannMarie-Francoise.*Les 500 exercices de grammaire*. Paris : Hachette livre,2005
- Grégoire Maria.*Grammaire Progressive du français*. Paris :CLE International,2002.
- Sirejols Evelyne, TempestaGiovanna,Grammaire. *Le Nouvel Entrainez-vous avec 450 Nouveaux Exercices.* Paris : CLE International, 2002
- www.francaisfacile.com/exercices/
- www.bonjourdefrance.com
- https://www.conte-moi.net/node/120

SEMESTER – IV			
Part II English Poetry, Prose, Extensive Reading and Communicative English - IV			
Course Code 21UGEN41	**Hrs/ Week: 6**	**Hrs/ Semester: 90**	**Credits: 4**

Objectives:

- To advance students' understanding of literary art and writings of universal appeal.
- To further the proficiency of communicative English through literary studies.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	understand better the language and literary components of texts	2,8	Un
CO-2	gain deeper insight into literary experience and expressions of writers	8	Un
CO-3	comprehend sentence types and its application	5	Un
CO-4	be competent in conversational and functional English	1	Ap
CO-5	rightly employ verbal and non-verbal communication skills	2,4,10	Ap
CO-6	adopt right perspectives of human values for life	10	Ap
CO-7	develop skills of creative/ formal writing and speech	3,7	Cr
CO-8	face interviews and competitive exams with confidence	6,10	Ap

SEMESTER - IV			
Part II English Poetry, Prose, Extensive Reading and Communicative English - IV			
Course Code :21UGEN41	**Hrs/ Week: 6**	**Hrs/ Semester: 90**	**Credits: 4**

Unit I –Poetry

John Keats – Bright star, would I were steadfast

E.E. Cummings – I carry your heart with me

Jayanta Mahapatra – Relationship

Unit II – Prose

Helen Keller – Three Days to See

Jerzy Kosinski – TV as a Baby Sitter

Bhabani Bhattacharya – Names are not Labels

Unit III – Fiction

Thomas Hardy – *Tess of the d' Urbervilles* (Abridged Version)

Unit IV – Grammar

Types of Sentences, Transformation of Sentences

Unit V – Communication Skills

Verbal and Non-Verbal Communication, Interview, CV- Resume, Presentation Skills

Text Books:

Units I – III – Compiled by the Research Department of English.

Units IV – Joseph, K.V. *A Textbookof English Grammar and Usage*. Chennai: Vijay Nicole Imprints Private Limited, 2006.

Unit V – CLIL (Content& Language Integrated Learning) – Module IV by TANSCHE

SEMESTER IV			
Core I	**Biochemistry and Bioinstrumentation**		
Course Code: 21UZOC41	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To gain in-depth knowledge of molecular processes in Biology from chemical approach to understand the complexity of life.
- To impart fundamental chemical and biological principles to advance their understanding of living world, nutrition, better medical care, biotechniques to enhance the quality of life.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the structure of biomolecules such as carbohydrate, protein and lipids	4	Un
CO-2	evaluate the significance of biomolecules in the processes that occur within living cells	4	Ev
CO-3	analyse enzymes as biological catalysts and the mechanism of their action and develop the ability to comprehend life processes	4	An
CO-4	discuss the beneficial effects of vitamins and foods that contain vitamins required for the healthy functioning of the body	2	Cr
CO-5	recall, relate and deploy knowledge in identifying deficiency diseases of vitamins from symptoms and find the remedy	6	Ap
CO-6	understand the principle, working mechanism and application of standard laboratory equipments and modern instruments	6	Un
CO-7	develop proficiency in basic laboratory techniques in biochemistry and maintain records of lab activities	7	Ap
CO-8	apply appropriate biochemical techniques to plan and carry out experiments, test hypotheses and draw conclusions to conduct project works in near future	8	Ap

Unit I **Carbohydrates**

Carbohydrates – outline classification, properties, and biological significance - monosaccharides (glucose and fructose), glycoside linkage, disaccharides (sucrose, lactose) and polysaccharides(cellulose and glycogen).

Unit II **Protein**

Classification of amino acids based on the structure of side chain;
Protein - classification based on shape and structure, primary, secondary, tertiary and quaternary structure, properties, biological significance.

Unit III **Lipids**

Fatty acids - t y p e s - saturated, unsaturated fatty acids, essential, non-essential fatty acids; Lipids - classification, simple lipids (triglycerides and waxes), compound lipids (phospholipids, cerebrosides), derived lipids (steroids), properties, biological significance.

Unit IV **Enzymes and Vitamins**

Enzymes - classification and nomenclature, properties, mechanism of enzyme action, factors affecting enzyme activity,
enzyme inhibition, co-enzymes – functions of coenzyme.
Vitamins: fat soluble and water soluble, properties, sources, dietary requirements and deficiency symptoms.

Unit V **Instrumentation**

Principle, technique and applications of pHmeter, colorimeter, spectrophotometer, centrifuge, agarose gel electrophorosis and chromatography (Paper, TLC).

Text Book

1. Dulsy Fatima, L., Narayanan, R.P., Meyyan Pillai, K., Nallasivam, S., Prasanna Kumar and A. Arumugam. *Biochemistry*. Nagercoil: Saras Publication. 2013.

Books for Reference

1. Satyanarayana,V. and U. Chakrapani. *Biochemistry* – Elsivier – Division of Reed Elsivier India PVT. Ltd. and Books and Allied Pvt.Ltd.2013.
2. Ambika Shanmugam. *Fundamentals of Biochemistry for Medical student.* Chennai: Navabharat Offset Works. 2000.
3. David L. Nelson and Michael M. Cox, *Lehninger Principles of Biochemistry* USA :W.H. Freeman & Co Ltd; 8th edition. 2021
4. Denise R. Ferrier. *Biochemistry*. Philadelphia – Baltimore – Newyork–London: Wolters Kluwer/ Lippincott Williams and Wilkins. 2011
5. Srivastava, H.S. *Elements of Biochemistry*. Meerut: Rastogi Publications. 2006.

PRACTICALS

Course Code: 21UZOCR4

Hrs/ Week: 2 **Credit: 2**

1. Qualitative test for carbohydrate.
2. Qualitative test for proteins.
3. Qualitative test for lipid.
4. Determination of iodine number of dietary fat
5. Determination of saponification number of dietary fat.
6. Determination of acid value of dietary fat.
7. Separation of amino acid by paper chromatography / Iodine method.
8. Measurement of pH in different water samples.
9. Model/ chart – Structure of amino acid, glucose, fructose, sucrose and cholesterol, colorimeter, pH meter, centrifuge, agarose gel electrophoresis

Books for Reference

1. David T. Plummer. *An Introduction to Practical Biochemistry*. New Delhi: Fifth Reprint. Tata Mc Graw – Hill Publishing Company Limited, Third Edition. 1992.
2. Jayaraman J. *Laboratory Manual in Biochemistry*. New Delhi: New Age International (P) Ltd. Publishers, 2000.

SEMESTER IV			
Skill Based Elective	**A. Clinical Laboratory Technology**		
Course Code: 21UZOS41	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credits: 2**

Objectives

- To become skilled persons for employment.
- To learn the utility and the applications of the instruments.
- To study the etiology of various diseases affecting human beings.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the laboratory practices and know how to maintain the laboratory instruments	1	Un
CO-2	analyze and distinguish various types of blood cells	2	An
CO-3	understand the pathological diseases and explain the test for hepatitis, AIDS and intestinal parasite	3	An
CO-4	evaluate critical thinking of biochemical test	5	Un
CO-5	demonstrate the proficiency in basic methods of instrumentation and quantitative analytical skills used to conduct biological research	6	Un
CO-6	develop skills in various lab techniques	7	Cr
CO-7	acquire knowledge to handle clinical equipments	4	Un
CO-8	design, carryout and interpret scientific experiments	8	Ap

Unit I **Best Laboratory Practices and Instrumentation**

Best laboratory practices - norms to be followed in a clinical lab - sterilization - dry heat (hot air oven), moist heat (autoclave) and UV radiation (laminar flow chamber) – X- Ray - CT scan and MRI scan.

Unit II **Haematology**

Collection and storage of blood, preparation and use of blood components - blood groupings (A,B,O & Rh factor). Estimation of haemoglobin.

Unit III **Clinical Pathology**

Dialysis - hepatitis test – hemolytic jaundice - analysis of sputum - AIDS (ELISA Western blot test) Diagnosis of dengue and COVID-19.

Unit IV **Clinical Biochemistry**

Estimation of cholesterol, urea, uric acid, creatinine of blood - assay of enzyme alkaline phosphatase.

Unit V **Demonstration/ Charts/ Models/ Hands-on Training/ Hospital Visit**

Stethoscope, sphygmomanometer, electrocardiogram, EEG and echo cardiogram - analysis of urine - routine physical examination.

Text Book:

1. Ramnik Sood. *Medical Laboratory Technology*, Methods and Interpretations New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.2005.
2. Jyoti Saxena, Mamta Banuthiyal and Indu Ravi Laboratory. *Manual of Microbiology, Biochemistry, and Molecular Biology*. New Delhi: Scientific Publishers (India). 2015.

Books for Reference:

1. Biswajit Mohanty and Sharbari Basu. *Fundamentals of Practical Clinical Biochemistry.* New Delhi: B.I Publications Pvt. Ltd. 2006.
2. Estridge, B.H., Reynolds, A.P. and N.J. Walters. *Basic Medical Laboratory Techniques.* Banglore: Thomson Delmar Learing Fastern press (Bangalore) Pvt. Ltd. 4th edition 2000.
3. Kannai, L. Mukherjee. *Medical Laboratory Technology*. Chennai: Tata Mc Graw Hill Publishing Company Limited, Vol-I, Vol-II and Vol-III. 1997.

SEMESTER IV			
Skill Based Elective	**B. Nutrition and Health**		
Course Code : 21UZOS42	**Hrs /Week : 2**	**Hrs /Sem : 30**	**Credits : 2**

Objectives

- To familiarize the students with fundamentals of food, nutrients and their relationship to health.
- To create an awareness on nutrition related disorders.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO- 1	understand basic concepts of nutrients and their functions	1,2	Un
CO -2	outline the sources of micro and macro nutrients	1,2	Un
CO – 3	relate the nutritional significance and health benefits of macronutrients	3	Un
CO – 4	plan nutritional requirements during different stages of life	1,2	Ap
CO – 5	explain the recommended dietary allowances of micro and macro nutrients	4	Ev
CO – 6	analyse the role of various minerals important in maintaining health	4	An
CO – 7	discuss the etiologic and clinical features of nutrition related disorders	7	Cr
CO – 8	adopt dietary management for nutrition related disorders	8	Cr

Unit I Introduction

Definition - food, nutrition and health. Role of nutrition. Energy requirement.

Nutritional guidelines for health and fitness.

Unit II Micronutrients

Definition - sources, functions and recommended dietary allowance.

Vitamins and minerals (calcium, phosphorus and magnesium).

Unit III Macronutrients

Definition- sources, functions and recommended dietary allowance.

protein – carbohydrate – lipid.

Unit IV Balanced diet

Nutritional requirements of different age groups – infants – children –

adolescents – pregnant and lactating women – calorific value of food.

Unit V Life style related diseases

Weight imbalances – overweight and obesity, underweight.

Eating disorders – anorexia nervosa and Bulimia.

Hypertension and coronary heart disease.

Food allergy – Etiology, clinical features and nutritional management.

Text Book

1. Sri Lakshmi B. *Dietetics*. New Delhi: 6th Edition New Age International Ltd. Publications 2011.

Books for Reference

1. Sherman. *Chemistry of Food and Nutrition*. Jodhpur: Agrobios Publications 2010.
2. Blank F.C. *A Text Book of Foods and Nutrition*. Jodhpur : Agrobios Publications 2013.

3. Sumathi R. Mudambi and M.V. Rajagopal. *Fundamentals of Nutrition and Diet Therapy*. New Delhi : 5th Edition. New Age International Ltd. Publ 2020.
4. Swaminathan M. *Principles of Nutrition and Dietetics.* Bangalore: Vol. II BAPPCO Ltd. Publ1988.
5. Lily Premila C., Chandral S. & Retna Latha Sinazer *Public Health and Hygiene.* Nagercoil: C.S.I. Diocessan Press 2009.
6. Mathur J.S. *Introduction to Social and Preventive Medicine*. Vol. I to V Oxford & I BH Publishing Co1971.
7. Dubey R.C. & Maheswari D.K. *A Text book of Microbiology*. New Delhi: S. Chand & Company Ltd 2010.
8. Vijaya Ramesh K. *Food Microbiology*. Chennai: MJP. Publishers2021.
9. Purohit S.S *Microbiology Fundamentals and Applications.* India: Fourth Revised & Enlarged Edition Agro Botonical Publisher 2006.
10. Subramanian V. *A Text Book in Environmental Science*. New Delhi: 1stEdn. Narosa Publishing House 2002.

SEMESTER IV			
NME II	**Applied Biotechnology**		
Course Coe: 21UZON41	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 2**

Objectives

- To impart comprehensive knowledge on various aspects of modern biotechnology.
- To understand the applications of biotechnological innovations for environmental protection and human welfare.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	understand the production of different bio-products	4	Un
CO-2	examine the nature and feature of SCP and aerobic and anaerobic digestion	4,5	An
CO-3	apply the techniques to clean up the environment through various treatment methods	3,7	Ap
CO-4	create awareness to cure cancer	4	Cr
CO-5	understand the importance of biosafety and IPR	8	Un
CO-6	evaluate the synthesis and applications of bio-products	7	Ev
CO-7	adopt appropriate tools and techniques in biotechnological manipulation	7	Cr
CO-8	apply the experimental procedures to the spectrum of fields making use of Biotechnology	8	Ap

Unit I **Food and Beverage Biotechnology**

Fermented food – yoghurt, bread – microbial biomass – nutritive value of Single Cell Protein and mushroom cultivation (White button mushroom) - wine and beer. (Demo – Mushroom cultivation & Microbial production of wine).

Unit II **Fuel Biotechnology**

Biogas – substrates- process of production – applications; biodiesel – manufacture - advantages.

Unit III **Environmental Biotechnology**

Sewage treatment – primary, secondary and tertiary treatments. Bioremediation – types, bio remediation of ground water - In-situ and Ex-situ bioremediation.

Unit IV **Health Care Biotechnology**

Gene therapy methods – germ line and somatic cell line – gene therapy for cancer.

Unit V **Regulations in Biotechnology**

Biosafety – guidelines, Intellectual Property Right – copy right and trade mark – patent.

Text Book

1. Kumaresan, V. *Biotechnology*. Kottar, Nagercoil: Saras Publication: - 6th edition. 2012.

Books for Reference

1. Dubey, R.C. *A textbook of Biotechnology*. New Delhi: S. Chand and Company Ltd. 2009
2. Rastogi, S.C. *Biotechnology, Principles and Applications*. Chennai: Narosa Publishing House. 2012.
3. Singh, B.D. *Biotechnology*. New Delhi: Revised edition. Kalyani Publishers. 2015
4. Sathyanarayana, V. *Biotechnology*. Kolkatta: Books and Allied(P) Ltd.15th edition 2020
5. Harisha S. *Biotechnology Procedures and Experiments Hand Book*. New Delhi, India: Infinity Science Press, LIC, Hinghum, Massachusett. 2007.
6. Asish Verma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. New Delhi: S. Chand and Company. 2008.

SEMESTER- IV			
Ability Enhancement Course: Yoga and Meditation			
Code: 21UAYM41	**Hrs/Week : 2**	**Hrs/Semester : 30**	**Credits: 2**

Course Outcome:

- To learn and practice various meditation, yoga methods to transform the ordinary life into a healthy, harmonious life leading to holistic wellbeing,
- To create an eco-friendly, loving and compassionate world.
- Acquire knowledge and skill in yoga for youth empowerment.
- Increase their power of concentration
- Learn the causes and ways to overcome fear and sadness.
- Create a ecofriendly, loving and compassionate world.

Unit I: Meditation (6 Hrs)

Meditation – Purposes of meditation– Major types of meditations: Zazen, Mindfulness, Vipasana, Yoga, Self-inquiry, Listening, Qi Gong, Taoist, Tantra– Health benefits of meditation: physical, psychological, spiritual– Meditation and Silence:Silence of the body, mind, heart,and beyond – General methodology of meditation – Tips for better meditation

Exercises: Practicing Zazen meditation – Self-enquiry meditation exercises

Unit II: Self-Awareness (6 Hrs)

Awareness – Self-awareness – Importance of self-awareness – Shades of self-awareness – Difference between Awareness and Concentration – Power of concentration – Levels of concentration – How to increase concentration? – Beauty of living here and now – Ways to develop your presence – Self-awareness and Ecology: interconnectedness

Exercises: Body Scan exercise – Self-Witnessing exercise – Eating Raisin with full awareness

Unit III: Yoga (6 Hrs)

Meaning and importance of yoga – Yoga and human physical system – Principles of Yoga – Different types of yoga – Yoga and balanced diet – Yoga and energy balance – Pranayama – Surya namaskaram– Basic asanas for healthy life – Therapeutic benefits of simple yogasanas – Naturopathy for common ailments.

Exercises:Practicing basic Asanas – Doing Sun Salutation

Unit IV: Mindfulness (6 Hrs)

Definition of mindfulness – Three components of mindfulness– Benefits of mindfulness – Mindfulness and Brainwave patterns – Myths about mindfulness – Scientific Facts about mindfulness – Formal method to practice mindfulness – Qualities of Mindfulness – Obstacles for mindfulness – informal ways of practicing mindfulness – Mindfulness to get rid of addictions

Exercises: Practice Mindful Walking –Practice Mindful Talking

Unit V: Heartfulness (6 Hrs)

Attitude to life – Power of positive attitude – Techniques to develop positive attitude – Positive vs negative people – Forms of negative attitude – Heartfulness – Managing fear: Basic 5 fears, Ways to overcome fear–Handling anger: Anger styles, Tips to tame anger – Coping with sadness: Causes and ways to overcome sadness, dealing with depression – Ultimacy of compassion: Compassion to oneself, towards others: Forgiveness, to nature: Seeing God in all

Exercises: Practice Loving-Kindness meditation– Doing compassionate actions

Text Book:

1) Thamburaj Francis. *Meditation and Yoga for Holistic Wellbeing.* Trichy:Grace Publication. 2019.

Books References:

1) Osho. *Meditation the Only Way.* New Delhi: Full Circle Publication, 2009.
2) Thamburaj Francis. *Journey from Excellence to Godliness: Zen Meditation for Transformation.* Grace Publication, Trichy, 2017.
3) Osho. *Awareness: The Key to Living in Balance.* New York: St.Martin's Griffin Publication, 2001.
4) Tolle Eckart.*The Power of Now: A Guide to Spiritual enlightenment.* New World Library, 2004.
5) Swami Gnaneswarananda. *Yoga for Beginners.* Calcutta: Sri Ramakrishna Math, 2010.
6) HanhThichNhat. *The Miracle of Mindfulness: An Introduction to the Practice of Meditation.* Beacon Press, 2016.
7) Kamlesh D. Patel and Joshua Pollock. *The Heartfulness Way: Heart-Based Meditations for Spiritual Transformation.* Westland Publications, 2018.

SEMESTER IV	
Self Study (Optional) **Animal Care and Services**	
Course Code: 21UZOSS2	**Credit: +2**

Objectives

- To acquire skills on domestic animal care
- To understand the physiology of domestic animals and their health care
- To gain knowledge on the legal rights that govern animal welfare in India.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	apply their skills to take care of common domestic animals	1,5	Un, Ap
CO-2	suggest common pet care solutions	5	Ap, An
CO-3	formulate healthy pet feeds and outline a dietary schedule for lactating and new born animals	5	Ap
CO-4	render prenatal, antenatal and postnatal care of pet animals	2,5	Un, Ap
CO-5	diagnose common diseases of pet animals and control spread of infectious diseases of pets	1,5	Ap
CO-6	maintain proper hygiene of pet animals	5	Ap
CO-7	gain knowledge on various legislatures that govern animal welfare in India	5	Un, Ap
CO-8	acquire a comprehensive knowledge on animal welfare organizations and their responsibilities	5	Un, Ap

Unit I **Basic Principles of Animal Care**

Care for common breeds of cattle - cow, goat; Pet animals - dogs, love birds; Laboratory animals - mice, rabbits.

Unit II **Nutrition**

Feeding schedule - feed additives – diet formulation for newborn, pregnant, lactating and sick animals (cattle) - silage making.

Unit III **Reproductive Care of Farm Animals**

Pregnancy diagnosis – gestation - functional infertility - repeat breeding in farm animals- care and management of new born.

Unit IV **Epidemiology and Health**

Common zoonoses and their management - disposal of cadaver and clinical waste - guidelines for control of contagious and infectious disease.

Unit V **Animals and Animal Welfare**

Salient features of the Prevention of Cruelty to Animals Act (India), 1960 - Animal Welfare Organizations in India - Statutory Bodies - Animal Welfare Board of India, Committee for the purpose of control and supervision of experiments on animals, Society for the Prevention of Cruelty to Animals (SPCA), National Institute of Animal Welfare - Non-Governmental Animal Welfare Organizations in India - Blue Cross of India, PETA.

Books for Reference :

1. Rajeshwari Y.B. *Handbook on Care and Management of Laboratory and Pet Animals*. New Delhi: New India Publishing Agency. 2009.
2. Karen L. Campbell John R. Campbell, M. Douglas Kenealy. *Animal Sciences: The Biology, Care and Production of Domestic Animals.* New Delhi: Medtech, Scientific International Pvt. Ltd. 2013.
3. Banerjee G.C. *A Textbook of Animal Husbandry* 8th Ed. Oxford University Press, Chennai. 2019.
4. Reddy D.V. *Principles of Animal Nutrition and Feed Technology.* New Delhi: Oxford & IBH Publishing. Third Edition. 2018.

SEMESTER V			
Core V	**Biotechnology (Common Core)**		
Course Code: 21UBCC51	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credit: 2**

Objectives:

- To provide broad scope of biotechnology in various fields including agriculture, medicine, environment and forensic studies through effective teaching modules.
- To attain competence in handling biotechnological experiments that enable them to carryout research projects and lifelong profession accomplishment.
- Create awareness in applying modern tools for biotechnological innovation and priorities the ethical implementation of potential biotechnology.

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	discuss different types of animal and plant cloning vectors	1,2	Kn, Un
CO-2	scan the role of restriction enzyme in genetic modification	4	Un
CO-3	clarify the human genome sequences and its application in human welfare	4,7	Un, An
CO-4	apply various gene transfer techniques to generate genetically modified organisms	2,7	Cr
CO-5	perform cell culture, organ culture and stem cell culture to realize the positive impact in health care	6	Un, Ap
CO-6	encapsulate the characteristic features of microbes and their role in production of industrial products and environmental reclamation	5,6	An
CO-7	relate biotechnological achievement and its benefits to mankind	6,7	Ap, Ev
CO-8	get hands on experience to conduct experiments, analyze and interpret data for investigating problems in biotechnology and allied fields	7,8	Ap

Unit I Cloning Vectors

Introduction – Scope and importance of biotechnology – Gene cloning techniques - cloning vehicles – bacterial plasmid vectors – pBR322 and Ti plasmid – bacteriophage vectors – lambda – M13 – Plant viral vector – CaMV- Gemini virus and tobamo virus – animal viral vector – SV40- Role of restriction and modification enzymes.

Unit II Gene Cloning and Screening

Gene cloning – methods of introduction of cloned genes into host cells – transformation – liposome mediated transfer – electroporation – particle bombardment gun – viral vector method – DNA library – PCR – hybridization technique – Southern, Northern and Western.

Unit III Animal Cell Culture and Genome Project

Culture media – cell culture techniques – monolayer culture and immobilized culture of cell lines – techniques and applications of human embryonic stem cell culture – tissue engineering of artificial skin and cartilage. Human Genome Project – types – DNA sequencing methods - Maxam and Gilbert method, Sanger method – potential benefits to mankind.

Unit IV Environmental and Bioprocess Technology

Biotechnological methods for sewage and waste water treatment – bioremediation – degradation of xenobiotic (hydrocarbons and pesticides) – role of genetically engineered microbes – biomining – bioleaching – industrial production of penicillin and ethanol – Biodiesel – Biofertilizer – mass cultivation and application of Azolla.

Unit V Plant Tissue Culture and Health Care Biotechnology

Plant tissue culture – media - callus culture – plant embryo culture- in vitro pollination – organ culture – suspension culture and anther culture. Edible vaccines- Bt cotton – Golden rice- DNA probes and diagnosis of genetic disorders – DNA fingerprinting technique – gene therapy and treatment of genetic diseases.

Text Books

1. Dubey R.C. S. *A text book of Biotechnology*. New Delhi, Chand and Comp. Ltd, 2004.
2. Kumaresan, V. *Biotechnology* Nagercoil, Saras Publication, 2010.

Books for Reference

1. Clark and J. Pazdernik. *Biotechnology*, California, USA. 2009.
2. Elsevier Academic Press, Dubey, R.C. *Text Book of Biotechnlogy*, New Delhi. 4th edition, S. Chand and Co Ltd, 2006.
3. Ramadass, P. *Animal Biotechnology – Recent Concepts and Development*. Chennai. MJP Publishers. 2009.

4. Rema, L.P. *Applied Biotechnology*, Chennai. MJP Publishers, 2009.
5. Shailendra Singh, *Applied Biotechnology*, 1st edition, New Delhi. Campus Books International, 2007.
6. Singh, B.D. *Biotechnology*, Chennai. *Revised edition*, Kalyani Publishers. 2005.

Practical

Course Code: 21UBCCR1 **Hours/ Week : 2**

1. Isolation of Blue Green Algae
2. Isolation of protoplast
3. Plant tissue culture – anther culture, embryo culture and nodal culture
4. Preparation of synthetic seed
5. Estimation of dissolved oxygen and BOD
6. Separation of protein by column chromatography
7. Isolation of Plasmid
8. DNA Estimation by UV-Visible Spectrophotometric method
9. Preparation of animal tissue culture media
10. Preparation of SDS – PAGE (Gel mould only)

Book for Reference:

1. Aneja, K.R., *Experiments in Microbiology, Plant Pathology and Tissue Culture*, New Delhi. Wishwa Prakashan, (A Division of Wiley Eastern Ltd).
2. Asish Verma, Surajit Das, Anchal Singh. Laboratory Manual for Biotechnology. New Delhi: S. Chand and Company Ltd., 2008.
3. Joseph Sam Brook and David S. Russel. Molecular Cloning – A Laboratory Manual, New York, Cold Spring Harbor: Cold Spring Harbor Laboratory Press. 2001.

SEMESTER V			
Core VI	**Animal Physiology**		
Course Code : 21UZOC51	**Hrs / Week : 4**	**Hrs /Sem : 60**	**Credits : 4**

Objectives

- To gain deep understanding of structure, functions and coordination of physiological systems and processes.
- To provide insights on connections between structure – function relationship

Course Outcome

CO. No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO– 1	compare the structure and functions and co-ordination of organs and organ systems	1	Un
CO -2	assess the causes, diagnosis, prevention and treatment of illnesses	2	Ev
CO – 3	develop healthy personal life style	6	Cr
CO – 4	perform, analyse and report on experiments and observations clearly and effectively	5	An
CO – 5	unravel complexities of life processes and behaviour	4	An
CO – 6	apply explanatory skills in physiological studies	6	Ap
CO – 7	evaluate physiological challenges and processes under fluctuating environmental conditions	7	Ev
CO – 8	identify and solve the physiological issues to promote health and welfare of society	8	Cr

Unit I **Digestion and Nutrition**

Intracellular and extracellular digestion – digestive system of man - role of enzymes in digestion of carbohydrates, proteins and lipids – absorption of digested food materials – malnutrition – marasmus - kwashiorkor.

Unit II **Respiration and Circulation**

Types of respiratory pigments – transport of respiratory gases – oxygen and carbon dioxide - Respiratory quotient.
Composition of blood – blood coagulation – structure of human heart – origin and conduction of heart beat – cardiac cycle.

Unit III **Excretion and Homeostasis**

Structure and function of nephron – mechanism of urine formation in man – nitrogenous waste products – ammonotelism, ureotelism, uricotelism – homeostasis: Osmoregulation in crustaceans and fishes – thermoregulation – mechanisms – ectotherms – endotherms – heterotherms.

Unit IV **Muscular and Nervous System**

Structure of skeletal muscle and myofibril – mechanism and chemistry of muscle contraction. Structure of neuron – generation and conduction of nerve impulse - synaptic transmission – neuromuscular junction. Receptors – structure of eye and photochemistry of vision.

Unit V **Reproduction and Endocrinology**

Anatomy of reproductive organs in human – ovary – testis – hormonal control of menstrual cycle, pregnancy, parturition and lactation. Endocrine glands: structure and functions of pituitary, thyroid, adrenal and pancreas.

Text Book

1. Verma P, Tyagi S. and Agarwal V.K. *Animal Physiology*. New Delhi: S. Chand& Company Ltd, 2002.

Books for Reference

1. Goyal and Sastry. *Animal Physiology*. Meerut: Rastogi Publications, 7th Edition 2017.

2.Rastogi S.C. *Essentials of Animal Physiology*. Chennai: New Age International Private Limited 4th Edition 2019.

2. Sembulingam K. and Prema Sembulingam. *Essentials of Medical Physiology*. New Delhi:8 th Edition Jaypee Brothers Medical Publishers. 2019.

4. Maria Kuttikan A and Arumugam N. *Animal Physiology*. Nagercoil Kottar: Saras Publication 2014.

5. Nagabhushanam R. Kodarkar M.S. and Sarojini R. *Text Book of Animal Physiology.* New Delhi: Second Edition, Oxford and IBH Publishing Co, Pvt. Ltd. 2002.

PRACTICALS

Course Code: 21UZOCR5

Hrs/ Week: 2 **Credit -1**

1. Human salivary amylase activity in relation to temperature.
2. Effect of temperature on the opercular movement in fish and calculation of Q10.
3. Examination of excretory products (ammonia, urea and uric acid crystals)
4. Rate of oxygen consumption in fish
5. Study of osmosis in red blood cells
6. Haemocytometer – Demonstration of RBC and WBC counting
7. Kymograph / simple muscle twitch – model
8. Human blood smear (Preparation and observation of different blood cells)
9. Hormonal control of menstrual cycle (chart)
10. Slides – sections of skeletal, cardiac, smooth muscle and endocrine glands (pituitary, thyroid, adrenal and pancreas).

Books for Reference

1. Nigam S .C. and Omkar. 2006. *Experimental Animal Physiology and Biochemistry*. New Age International (P) Limited New Delhi.

SEMESTER V			
Core VII	**Cell Biology and Genetics**		
Course Code: 21UZOC52	**Hrs/week : 4**	**Hrs/sem: 60**	**Credit: 4**

Objectives

- To give an insight on basic organization and functions of the cellular components and the principles of inheritance at the cellular level in organisms.
- To impart and explore the intricate relationship between cells and genes.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the organization of the cell and to differentiate between prokaryotic and eukaryotic cell.	2	Un
CO-2	describe the structure and functioning of cell organelles as a system to carry out cellular processes	2	Un
CO-3	analyse the complexity and harmony of the cell from the acquired knowledge	2	An
CO-4	interpret the structure and types of chromosome and composition, structure, and replication of DNA	4	Ev
CO-5	demonstrate the genetic basis of Mendelian and non-Mendelian inheritance	5	Ap
CO-6	develop the ability to think critically, analyze and use the information gained to solve problems related to genetics	6	Cr
CO-7	evaluate hereditary patterns for genetic disorders and solutions for health and related issues.	6	Ev
CO-8	apply the practical and conceptual knowledge of Cell Biology and Genetics to understand other fields of biology	8	Ap

Unit I **Cell and Plasma membrane**

Protoplasm theory - Cell theory. Prokaryotic and Eukaryotic cells. Plasma membrane – Structure- Membrane models - Fluid mosaic model - bimolecular leaflet model, chemical composition, specialized structures and functions.

Unit II **Cell Organelles**

Ultrastructure and functions of mitochondria, Golgi apparatus, endoplasmic reticulum, lysosome, ribosome.

Unit III **Nucleus**

Ultrastructure and functions - nucleus, nuclear membrane, nucleolus. Chromosome – structure – types, giant chromosomes - polytene chromosome. DNA – chemistry-structure - Watson and Crick model. RNA- structure and types

Unit IV **Mendelian Genetics**

Mendelian laws – monohybrid and dihybrid cross – back cross – test cross – incomplete dominance – inheritance of combs in fowls – multiple alleles – ABO and Rh blood groups in man – multiple genes – skin colour in man.

Unit V **Sex linked Inheritance and Genetic Disorders**

Sex determination in man – sex linked inheritance in man – haemophilia – colour blindness. Inborn errors of metabolism – phenylketonuria, alkaptonuria, albinism. Mutant haemoglobins – sickle cell anaemia. Syndromes – autosomal – Down's syndrome – sex chromosomal – Turner's and Klinefelter's syndrome.

Text books

1. Verma P.S. and V.K Agarwal. *Cytology* . New Delhi: S. Chand and Co Ltd. 8th edition. 2008.
2. Meyyan, R.P. *Genetics*. Nagercoil: Saras Publications. 2007

Books for Reference

1. Powar, C.B. *Cell Biology.* Mumbai: Himalaya Publishing House. 8th Edition. 2015.
2. De Robertis, E.D.P. and De Robertis, E.M.F *Cell and Molecular Biology* Mumbai: K.M. Varghese Company, 8th Edition. 2017.
3. Gardner, Simmons and Snustad. *Principles of Genetics*. New York: John Wiley and Sons. Inc. 8th Edition.2011.
4. Arumugam, N. *Cell Biology*. Nagercoil: Saras Publications. 2017.
5. Rastogi V.B. *A Textbook of Cell Biology and Genetics*. Meerut: Kedarnath Ramnath. First Edition. 2020

PRACTICALS

Course Code: 21UZOCR5

Hrs / Week : 2 **Credit - 1**

1. Preparation of squamous epithelium.
2. Onion root tip squash: Observation of different stages of mitosis.
3. Chironomous larva: Mounting of polytene chromosomes.
4. Observation of cells through phase contrast microscope.
5. Micrometry and measurement of cell dimensions.
6. DNA – Watson & Crick model, Golgi complex, endoplasmic reticulum, mitochondria, ribosome (models/ charts)
7. Verification of Mendel's monohybrid cross using beads.
8. Verification of Mendel's dihybrid cross using beads.
9. Sex-linked inheritance of colour blindness and haemophilia (chart).
10. Genetic basis and clinical manifestations of Down's, Klinefelter's and Turner's syndrome (chart).

Books for Reference:

1. Verma P.S. *A Manual of Practical Zoology - Chordates*. New Delhi: S. Chand & Company Ltd. 2018.
2. Jayasurya, Dulsy Fatima, R.P. Meyyan N. Arumugam and V. Kumaresan. *Practical Zoology* (*Cell Biology – Embryolgy- Animal Physiology - Immunology- EcolGenetics - Evolution - Microbiology - Biochemistry - Biophysics*). Nagercoil: Saras Publication. 2013.
3. Emmanuel C., Rev. Fr. S. Ignacimuthu S.J. and S. Vincent. *Applied Genetics - Recent Trends and Techniques*. Chennai : MJP Publishers. 2006.

SEMESTER V			
Core VIII	**Ecology**		
Course Code: 21UZOC53	**Hrs / Week : 4**	**Hrs / Sem: 60**	**Credits:4**

Objectives

- To study the interaction and interdependence among environmental factors and living organisms
- To develop knowledge and critical understanding of ecology
- To create an awareness and concern towards environment and its conservation.

Course Outcomes:

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO- 1	understand the modern scope of scientific inquiry in the field of ecology	1,2	Un
CO -2	recall variety of ways that organisms interact with both physical and the biological environment	3	Un
CO – 3	relate population and community ecology	3	Un
CO – 4	explain the structure and impact of biogeochemical cycles	3	Un
CO – 5	identify major habitats found on land and water	3	Ap
CO – 6	evaluate the global scale of environmental issues	3	Ev
CO – 7	explain government policies and green economy for sustainable development	3	Ev
CO – 8	design field and laboratory experiments in a systematic way	8	Cr

Unit I **Introduction**

Scope and importance of ecology. Biotic (producers, consumers and decomposers)and abiotic factors (light and temperature) – food chain, food web, energy flow. Intra and interspecific relationship – mutualism, commensalism and parasitism.

Unit II **Population & Community Ecology**

Population: Definition – density and estimation, natality – mortality – age distribution – age pyramids – population growth patterns – population fluctuations - population equilibrium — biotic potential – regulation of population density – dispersal – dispersion – population interaction

Community: concepts and characteristics – diversity – structure – community dominance – community stratification – periodicity – community interdependence – Ecotone – Edge effect – ecological niche – ecological succession

Unit III **Biogeochemical cycles**

Definition - types – gaseous cycle (oxygen, carbon, nitrogen) - sedimentary cycle (phosphorous and sulphur).

Unit IV **Habitat Ecology**

Lentic habitat – pond – characteristic fauna and adaptation

Lotic habitat – river – characteristic fauna and adaptation

Deep sea characteristic fauna and adaptation

Terrestrial habitat – desert characteristics, fauna and adaptations.

Unit V **Global Environmental Issues and Policies**

Deforestation - urbanization – climate change and global warming – ozone layer depletion and acid rain. Introduction of government policies and green economy: Swatch Bharat Abhiyan – Initiatives, responsibilities and future aspects.

Text Books

1. Saha, T.K. *Ecology and Environmental Biology*. Kolkata: Books and Allied (P) Ltd 2013.

Books for Reference

1. Kumaraswamy. K. Alagappa Moses A. and Vasanthy M. *Environmental Studies.*

Publication Division 2018.

2. Santra S.C. *Fundamentals of Ecology and Environmental Biology*. Kolkata: New Central Book Agency (p) Ltd 2015.

3. Prabhakar, V.K. *Environmental Education*. New Delhi: Anmol publications (P) Ltd 2004.

4. Agarwal, K.C. *Environmental Biology*. Agro Botanica1999.

5. Verma, P.S. and Agarwal V.K. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.* New Delhi: S. Chand& Company 2013.

6. Arumugam, N and KumaresanV. *Environmental Studies*. Nagercoil: Saras Publication 2014.

7. Verma and Agarwal. *Principles of Ecology*. New Delhi: S. Chand& Company Ltd 2000.

8. Krisnamoorthy, K.V. *An Advanced Text Book of Biodiversity*. New Delhi: Oxford and IBH 2004.

9. Arumugam, N. *Concepts of Ecology*. Nagercoil: Saras Publication Kottar 2010.

PRACTICALS

Course Code: 21UZOCR5

Hrs/ Week – 2 **Credit - 1**

1. Estimation of dissolved O_2 in water sample (pond and sea water)
2. Determination of dissolved CO_2 in water sample (pond and sea water)
3. Estimation of alkalinity in water sample (pond and sea water)
4. Detection of transparency of water by Secchi disc
5. Analysis of plankton – fresh water / marine
6. Analysis of food chain and food web (Pond or Grass land)

7. Mutualism (Hermit crab & Sea anemone), Commensalism (Echeneis & Shark), Parasitism (Sacculina on crab)
8. Field visit to understand basic ecological concepts (Report on one day trip to sea shore or any place of ecological interest). Coastal/ Estuary/ Bird Sanctuary/ Wildlife Sanctuary.

Books for Reference

1. Jeyasuriya, Arumugam N. and Dulcy Fatima. *Practical Zoology.* Nagercoil: Vol.3 Saras Publications, Kottar2013.
2. Krisnamoorthy K.V. *An Advanced Text Book of Biodiversity*, New Delhi: Oxford and IBH 2004.

SEMESTER V			
Core Elective	**A. Introduction to Research**		
Course Code: 21UZOE51	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 4**

Objectives:

- To inculcate research aptitude in students.
- To prepare the students to use the scientific writing in their research work.
- To strengthen research by assisting students using scientific techniques in the most optimal way.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	demonstrate critical thinking and scientific approach in the essentials of research	8	Un
CO-2	examine and evaluate the scientific ideas and research methods	6	Ev
CO-3	acquire basic skills to design tools and techniques	8	Ap
CO-4	analyze and update information regarding literature collection and citing the references	4	An
CO-5	write a research report and thesis and appreciate the components of scholarly writing and evaluate its quality	8	Ev
CO-6	identify appropriate research topics and parameters	6	Un
CO-7	develop new scientific tools, concepts and theories to understand and solve scientific problems	2	Cr
CO-8	organize and conduct research in a more appropriate manner	8	An

Unit I **Essentials of Research**

Research – Definition – Objectives – Types of Research – Qualitative and Quantitative Research – Descriptive and Analytical Research – Basic and Applied Research – Importance of Research - Qualifications of a Researcher.

Unit II **Designing of Research**

Categories of Research Design – Designing of Experiments – Bias – Randomization – Blinding – Replication – Sample Selection – Sample Size –Minimization – Observational Studies – Data Collection – Techniques and Tools.

Unit III **Methods of Research**

Research Methods in Biological Sciences – Types of Data – Data Collection - Survey – Types of Surveys – Survey Methodology and Design – Sampling – Types of Sampling – Random and Non-Random Sampling – Case Study – Questionnaire Design.

Unit IV **Scientific Writing**

Introduction – Selection of Title – Literature Collection – Source of Literature – Journals, Encyclopaedia, Year Book, Periodicals, Computer Aided Searches – Search Engines – Reference Styles – Citing the References – Different Systems of Citing References.

Unit V **Research Report**

Introduction – Components of a Report –Title – Authors and Addresses – Abstract – Keywords – Introduction – Materials and Methods – Results – Discussion – Summary – Conclusion – Bibliography - Acknowledgement – Conflict of Interest – Authors Contribution – Plagiarism.

Text Book

1. Ramadoss. P and A. Wilson Aruni. *Research and Writing: Across the Disciplines.* Chennai: MJP Publishers, Triplicane.2009.

Books for Reference

1. Palanichamy S. and M. Shanmugavelu. *Research Methods in Biological Sciences*. Palani: Paramount Publication.1997.
2. Arumugam.N. *Research Methodology for Life Sciences*. Nagercoil: Saras Publication, Kottar Post. 2015.
3. Gurumani. *Research Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.
4. Debbie Holmes Peter Moody and Diana Dine. *Research Methods for the Biosciences*. United Kingdom : OUP Oxford Publisher. 2006.
5. C.R. Kothari and Gaurav Garg. *Research Methodology: Methods and Techniques*. India: New Age International Publishers, Fourth edition. 2019.
6. Bipin Asthana, Vijaya Srivastava, Nidhi Asthana. K. *Research Methodology*. India: Rastogi Publications, Shivaji Road Meerut - 250002. 2019.
7. Kulkarni. A.P. *Basics of Research Methodology*. Karnataka: Paras Medical Books Pvt. Ltd. 2015.
8. Elizabeth De Poy, Laura Gitlin. United States of America*: Introduction to Research: Understanding and Applying Multiple Strategies*. Elsevier. 2019.

SEMESTER V			
Core Elective	**B. Evolutionary Biology**		
Course Code: 21UZOE52	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To comprehend the scientific concepts of animal evolution through the process and theories in evolutionary biology.
- To provide a deeper knowledge related to human evolution.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	provide a detailed explanations of the theories and processes of evolution	4	Un
CO-2	examine the evidences for evolution	3	An
CO-3	explain the processes driving variation, natural selection and speciation	4	Un
CO-4	acquire knowledge about the evolutionary significance of mimicry and protective colouration	1	Ev
CO-5	Outline the processes of social and cultural change of modern humans through time	2	Un
CO-6	analyse the major ecological processes underlying evolution and selection	3	An
CO-7	evaluate the various processes concerned with the evolution of man	2	Ev
CO-8	compare and contrast the biological and cultural evolution of man	2	An

Unit I **Theories of Evolution**

Origin of life – chemical origin of life – experimental evidences – concept of Urey and Miller - theories of evolution and their modern concepts – Lamark, Darwin, De Veries and modern synthetic theory.

Unit II **Evidences of Evolution**

Evidences in favour of evolution –homologous and analogous organs – morphological, embryological, biochemical and paleontological evidences – fossils and fossilization – geological time scale - chart.

Unit III **Forces of Evolution**

Variation – sources of variation - natural selection – types, mechanism and evolutionary significance.

Speciation - allopatric, sympatric and parapatric.

Isolating mechanisms – prezygotic and postzygotic.

Unit IV **Mimicry and Colouration**

Mimicry – Batesian and Mullerian mimicry, Camoflauge – evolutionary significance.

Colouration – protective, aggressive and warning colouration and evolutionary significance.

Unit V **Evolution of Man: Biological and cultural**

Evolution of man – ancestry of man – salient features of old age and new age man – trends in human evolution.

Causes for human evolution – evolution of man as seen in the fossil record.

Milestones in cultural evolution of man.

Text Book

1. Mohan P. Arora. *Organic Evolution*. Karnataka: Himalaya Publishing House. 1991.

Books for Reference

1. Arumugam, N. *Evolution*. Nagercoil: Saras Publication, Kottar. 2001.

2. William D. Stansfield. *The Science of Evolution*. New York: MacMillan Publishing Co. 1977.

3. Ledyard Stebbins. *Processes of Organic Evolution*. Delhi: Prentice Hall of India. 1970.

4. Ernst Mayr. *Populations, Species and Evolution. An Abridgment of Animal Species and Evolution.* USA: The Belknap Press of Harvard University. 1970.

5. Dobzshansky, Francis J. Ayala, G. Ledyard Stebbins James W. Valentine. *Evolution*. Delhi: Surjeet Publications. 1973.

6. Jay M Savage. *Evolution*. New Delhi: Amerind Publishing House Co. 1998.

7. Paul Amos Moody. *An Introduction to Evolution*. Ludhiyana: Kalyani Publishers. 1997.

Semester – II			
Environmental Studies			
Course Code : 21UAEV21	**Hrs/ Week : 2**	**Hrs/Sem:30**	**Credits : 2**

Course Outcome

- Identify different types of computer systems.
- Classify various types of software being used.
- Compare various digital payments and use them in day to day life.
- Recognise the innovative technologies IoT and integrate it in various fields.
- Analyze various social networking platforms and use them efficiently.
- Distinguish various cyber attacks and apply preventive measures.
- Understand the various soft skills needed to become successful.
- Analyze self and adapt oneself to work in a team.

Unit I: Fundamentals of Computers:

Introduction to computers- Components of computers-Working principle-Types of computers-Tablet-Notebook-Smart phone-PDA-Impact of computers on society-Types of software.

Unit II: Recent Trends in Computer Science and e-Governance:

IoT - applications- Mobile applications - E-Learning- E-Commerce - digital payments

Unit III: Social Media:

Face book-Twitter-Linked In-Instagram-Advantages of Social Networking-Issues/Risks of Social Networking-Protecting ourselves from social Networking problems-Cybercrimes-Hacking-Phishing-Cyber Security

Unit IV: Introduction to Soft Skills:

Learning objectives – What are soft skills?-Categories of Soft Skills-Integral Parts of Soft Skills.

Unit V: Understanding Self and Team Building:

Transactional Analysis (TA) - Structural analysis of Ego states- The functional model of Ego states - Egogram-Storkes - Life Position - Egogram and Life Positions Questionnaire-Team and Team Building- Features of effective creative teams

Books for Reference:

1. Peter Norton, Introduction to Computers 6th Edition
2. Charles P Pfleeger, Shari Lawrence Pfleeger, Security in Computing,I Edition, Pearson Education, 2003.
3. E.Balagurusamy, Fundamentals of Computers, McGraw Hill
4. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang , E-Commerce fundamentals and applications, Wiley Student edition
5. Benita Bhatia Dua, DeepaJeyaraman, Profit with Social Media, CNBC
6. Dr.K.Alex, Soft Skills, S.Chand & Co
7. http://www.digitalindia.gov.in/content/social-media-analytics
8. https://www.researchgate.net/publication/307878962_Introduction_to_E-Governance
9. http://www.ijqr.net/journal/v10
10. https://www.researchgate.net/publication/258339295_FUNDAMENTALS_OF_ COMPUTER _ STUDIES

SEMESTER V	
Self Study (Optional) **Animal Behavior**	
Course Code: 21UZOSS3	**Credit: +2**

Objectives

- To acquire comprehensive knowledge on the fundamental concepts of animal behavior.
- To understand the biological rhythms that control animal behavior.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	gain a comprehensive understanding of the behavior of animals.	1,2	Un, Ap
CO-2	correlate the role of animal's environment in the development of behavior.	1,2,3	Ap, An
CO-3	summarize the types of social behavior of animals	1, 3	Un
CO-4	classify the types of animal behavior	1	Un, Ap
CO-5	relate the role of hormones on the sexual behaviour	1,4	Ap, Ev
CO-6	explain the modes of communication in animals	2,4	Ap
CO-7	understand the various type of biological rhythms	2	Un
CO-8	explain the role of circadian rhythm on human behavior	2,3	Un, Ap

Unit I Introduction to Animal Behavior

Behavior: Definition - origin and history of ethology - classification of behavior - innate behaviour, learning, reasoning, motivation - migration and homing with special reference to birds.

Unit II Ecological Aspects of Behavior

Habitat selection- food selection and optimal foraging theory - anti-predator defense mechanism - aggression, territoriality and dispersal.

Unit III Social Behavior

Schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism.

Unit IV Reproductive Behavior

Evolution of sex, reproductive strategies, mating systems, courtship, sperm competition, sexual selection and parental care.

Unit V Biological Rhythms

Circadian, circannual, tidal/ lunar, ultradian, infradian rhythms - synchronization of biological rhythms, phase shift - photoperiodism with reference to birds and mammals.

Books for Reference

1. Dustin R. Rubenstein, Johb Alcock. *Animal Behaviour*. New York: Oxford University Press. 2019.
2. Mandal Fatik Barar. *Textbook of Animal Behaviour*. India: PHI Learning Pvt Ltd; 3rd Edition. 2015.
3. Agarwal V.K. *Animal Behaviour* (*Ethology*). New Delhi: S Chand & Company, First Edition. 2010.
4. Shukla J.P. *Fundamentals of Animal Behaviour.* India: Atlantic, First Edition. 2021.
5. Reena Mathur. *Concepts of Animal Behaviour* (*Z-80*). India: Rastogi Publications; 1st Edition. 2018.

SEMESTER VI			
Core IX	**Immunology and Microbiology**		
Course Code: 21UZOC61	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To highlight the importance of immunity, immune system, and lymphoid organs
- To elucidate the nature of microorganisms and the culture techniques of bacteria
- To learn the role of microbes in agriculture, food and in medical field.

Course outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the importance of immunity and immune response	2	Un
CO-2	explain the structure and functions of different types of lymphoid organs	2	Ev
CO-3	demonstrate the types and basic structure of immunoglobulins	4	Un
CO-4	classify bacteria and outline the general structure of microbes	1	An
CO-5	analyse the causes and prevention of food poisoning, food spoilage and to discuss preservation methods	7	An, Cr
CO-6	explain the causative agents, symptoms of microbial diseases and to propose preventive measures	7	Un, Cr
CO-7	to perform experiments in Immunology and interpret the results	8	Ev
CO-8	to develop skills in fundamental techniques in microbiology including sterilization, isolation and culture of bacteria	6, 8	Cr

Unit I **Immunity Types and Lymphoid Organs**

Immunity – types – innate immunity – factors controlling innate immunity – acquired immunity –types – active and passive immunity, Lymphoid organs – thymus, bone marrow, spleen and lymph nodes.

Unit II **Immune Response**

Cells of the immune system – development and fate of stem cells - Lymphocytes, B Lymphocytes, T Lymphocytes - types of T cells and macrophages –Immune response – humoral - primary and secondary – B cell activation - cell mediated immune response – Tcell activation – biological functions of cell mediated immunity.

Unit III **Antigens and Antibodies**

Antigens – definition – epitopes – cross reactive antigen - heterophile antigen – Frossman antigen – haptens. Antibodies (Immunoglobulins) - definition – structure and functions of immunoglobulin – Ig classes - IgG, IgA, IgM, IgD and IgE.

Unit IV **Structure, Shape and Culture of Microbes**

Importance and scope of Microbiology – classification of bacteria - general structure of bacteria, fungus and virus. Culture media, continuous and batch culture techniques – bacterial growth curve.

Unit V **Food, Agricultural and Medical Microbiology**

Food Microbiology: Food poisoning - botulism, salmonellosis; food spoilage and preservation methods. Agricultural Microbiology: Rhizosphere - microorganisms - symbiotic and asymbiotic nitrogen fixation. Medical Microbiology: Causative agent, symptoms, prevention and control of tuberculosis, gonorrhea, candidiasis, dermatophytosis, dengue and COVID-19.

Textbook

1. Kannan, I. *Immunology*. Chennai: MJP Publishers 2007
2. Chakraborty, P.A. *Text Book of Microbiology*. Kolkata: New Central Book Agency (P) Limited. 1995.

Books for Reference

1. Arumugam, N., Mani, A., Narayanan, L.M., Dulsy Fatima and A.M.Selvaraj. *Immunology and Microbiology*. Nagercoil : Saras Publication. 2015.
2. Rao, C.V. *An Introduction to Immunology*. New Delhi: Narosa Publishing House. 2005.
3. Joshi K.R and Osamo N.O. *Immunology*. India: Agro Botanical Publishers, 4th Edition, 1994.
4. Surendra Naha. *Fundamentals of Immunology*. New Delhi: Dominant Publishers & Distributors Pvt. Ltd. 2012.
5. Pelczar, M.J, Chan, E.C.S. and N.R. Krieg. *Microbiology* New Delhi: Mc Graw– Hill Book Company. 1986.
6. Arti Kapil. *Text Book of Microbiology.* India: Universities Press (India) Pvt. Ltd. 9th Edition, 2013.

PRACTICALS

Course Code: 21UZOCR6

Hours/ Week: 2 **Credit: 1**

1. Lymphoid organs– chart/ slides of histology
2. Single Radial Immuno diffusion (Demonstration)
3. Double Immuno diffusion (Demonstration)
4. Microscopic observation of different types of lymphocytes
5. Sterilization techniques
6. Preparation of culture media
7. Serial dilution technique
8. Simple staining of bacteria

9. Gram staining of bacteria
10. Hanging drop technique.
11. Study of distribution of microorganisms in nature – soil, water and air.
12. Culture and counting of bacterial colonies using colony counter.
13. Spotters – autoclave, hot air oven, laminar flow hood, inoculation needle, agar plate.

Books for Reference

1. Jayasurya, Dulsy Fatima, Meyyan, R.P., Arumugam, N. and V. Kumaresan. *Practical Zoology*. (*Cell Biology- Embryology - Animal Physiology - Immunology- Ecology-Genetics-Evolution - Microbiology - Biochemistry - Biophysics*). Nagercoil: Saras Publication, Kottar P.O.2013.
2. James Cappuccino and Natalie Sherman. *Microbiology A Laboratory Manual*. Tokyo: Addison - Wesly- Hyman Inc.1990.

SEMESTER VI			
Core X	**Biostatistics and Bioinformatics**		
Course Code: 21UZOC62	**Hrs/ Week : 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To explore the integration and application of statistics and bioinformatics in biology
- To acquire the skills and perspectives on statistics and bioinformatic tools in analysis and interpretation of data

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	attain an insight on statistical methods for analysis of biological data	2	Un
CO-2	acquire knowledge on the bioinformatics concepts for analyzing molecul data	2	Un
CO-3	identify the problems in data analysis and match the appropriate statistical method and corresponding software	4	An
CO-4	analyse and use the bioinformatics tools for advanced sequence alignment, data base searches, genome analysis and protein structure studies	8	An
CO-5	undertake statistical operations in biological data analyse	7	Ap
CO-6	operate commonly used bioinformatic tools and statistical methods and understand their limitation	8	Ap
CO-7	apply bioinformatics in life science research	8	Ap
CO-8	critically evaluate the data analysis procedures in publications of molecular biology research	2,3	Ev

Unit I Biostatistics–Collection and Display of Data

Introduction–populations and samples–types of variables–classification of data – frequency distribution – presentation of data –tables - parts -types – diagrams – bar diagram – pie diagram – graphs –histogram – frequency polygon – frequency curve - ogives.

Unit II Measures of Location and Dispersion

Concept – computation for grouped and ungrouped data – relative merits and limitations of measures of central tendency mean, median and mode – emprical relationship between mean, median and mode – measures of dispersion – range, variance, standard deviation, standard error and coefficient of variation.

Unit III Statistical Inference and Correlation Analysis

Probability theory – terminology – types - theorems of probability - chi-square test and goodness of fit – correlation – definition – types – uses of correlation analysis - scatter diagram – Karl Pearson's correlation coefficient–calculation of r value and interpretation – testing the significance of relationship using student's t-test.

Unit IV Bioinformatics– An Overview

Definition – scope – applications of bioinformatics – properties of biological databases – hard link relationships between databases - databases retrieval tools – PubMed – Medline – Locuslink

Unit V Protein and Nucleotide Sequence Databases

Protein sequence databases – NCBI – SWISSPROT–PDB – nucleotide sequence databases – EMBL – GENBANK – homology search tools – BLAST – FASTA – applications of bioinformatics tools in research.

Text Books

1. Gurumani N. *An Introduction to Biostatistics.* 2nd edition, Chennai: MJP Publishers, 2005.
2. Prakash Lohar. *Bioinformatics*. 1st edition Chennai: MJP Publishers, 2019.

Books for Reference

1. Palanisamy S. and Manoharan M. *Statistical Methods for Biologists.* Palani: Palani Paramount Publications, 1990.

2. Arumugam N. *Biostatistics, Computer Applications, Bioinformatics and*

Instrumentation. Nagercoil: Saras Publication, 2010.

3. Agarwal S.K. *Biostatistics.*New Delhi: APH Publishing Corporation, 2008.

4. Arunima Mukherjee. *Bioinformatics.* Jaipur, India: Oxford Book Company, 2008.

5. Thiagarajan B. and Rajalakshmi Pa. *Computational Biology.* Chennai: MJP Publishers, 2009.

6. Claverie J M. and Notredame C. *Biinformatics for Dummies.* 2nd edition, Hoboken: Wiley Publishing Inc, NJ07030-5774, 2007.

PRACTICALS

Course Code: 21UZOCR6

Hours/ Week: 2 **Credit: 1**

1. Preparation of a questionnaire and collection of data by survey method.
2. Demonstration of simple random sampling by simulation using students (lottery and table of random number method)
3. Construction of continuous frequency table for the weight/height of students.
4. Diagrammatic presentation of data - simple bar diagram and pie diagram
5. Graphical presentation of data – histogram, frequency polygon, frequency curve and ogives
6. Calculation of mean, median, mode, variance, standard deviation, standard error and coefficient of variation using neem leaves
7. Study of probability and chi – square test with two coins tossing experiment
8. Calculation of correlation coefficient and testing its significance
9. FASTA format conversion and sequence alignment using BLAST
10. Retrieving data from EMBL database - Print out

Books for Reference

1. Rajadurai M. *Bioinformatics – A Practical Manual*. Chennai: PSB Book Enterprises, 2010.
2. Gurumani N. *An Introduction to Biostatistics.* 2nd edition. Chennai: MJP Publishers, 2005.

SEMESTER VI			
Core XI	**Marine Biology**		
Course Code : 21UZOC63	**Hrs / week : 4**	**Hrs / sem : 60**	**Credits : 4**

Objectives

- To provide quality education and training in the field of marine biology and marine environment.
- To raise awareness about marine environment for the welfare of the community and society.
- To develop necessary skills to manage and preserve the resources of sea.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO- 1	classify the different ecological zones of marine environment, diversity of marine organisms and their adaptations	1,3	Un
CO -2	explain the physical and chemical properties of seawater and their significance to marine life	3	Un
CO - 3	appraise the ocean production, characteristics and types of coral reefs, mangroves and estuaries	3	Ev
CO - 4	explain the formation, types and properties of the dynamics of ocean	3	Un
CO - 5	analyse various types of marine resources and assess the various environmental concerns related to the use and abuse of marine resources	3	An
CO - 6	develop specialized skills in a range of theoretical and practical applications	8	Cr
CO - 7	create awareness of scientific issues in marine biology within the larger social context	8	Cr
CO - 8	design and implement effective solutions to problems in marine environment	8	Cr

Unit I **Marine Habitat**

Classification of marine habitat. Characteristics of pelagic and benthic divisions – Intertidal rocky, sandy and muddy shores – the features of flora and fauna and their adaptations.

Unit II **Physical and Chemical Characteristics of Sea Water**

Physical parameters – light, temperature, density. Chemical parameters - Nutrients (major, minor and trace elements) dissolved gases and salinity.

Unit III **Biological Characteristics of the sea**

Plankton – classification, adaptations and methods of collection. Primary and secondary production. Coral reef, mangroves, estuaries - characteristics types and their adaptations.

Unit IV **Dynamics of Ocean**

Tides - generating forces, types, effects of tides in coastal areas; Waves - formation, properties, types – tsunami, currents – equatorial and western boundary currents.

Unit V **Resources of the Sea**

Chemical resources - manganese nodules, phospharite, petroleum.

Biological resources – natural products from sponges, mollusks, star fish and ascidians. Sargassum and calurpa.

Text Book

1. Nybakken J.W. *Marine Biology – An Ecological Approach*. California: Addison Weslay Longman, Inc. 1997.

Books for Reference

1. Gross G. *Oceanography: A view of the Earth.* New Jersey: Sixth edition. Prentice Hall Inc 2008.

2. Mc Cormick J.M. and Thiruvathaakal J.V. *Elements of Oceanography*. Philadelphia: W.B.

Saunders Company1981.

3. Olivia J. Fernando. *Sea water - Properties and dynamics*. Ponnagam, Thanjavur: Dhanesh Publications 1999.

4. Girish Chopra. *Coastal and Marine Geography*. Delhi: Common Wealth Publisher 2012.

5. Veena. *Understanding Marine Biology - Discovery*. New Delhi: Publishing House PVT. LTD 2012.

6. Russel. *Marine Ecology*. London: Academic Press.1970.

PRACTICALS

Course Code: 21UZOCR7

Hrs/ Week: 2 **Credits: 2**

1. Collection and identification of marine plankton (any two zooplankton)
2. Estimation of primary productivity
3. Determination of salinity in sea water
4. Estimation of chloride in sea water
5. Determination of acidity in sea water
6. Estimation of nitrite in sea water
7. Determination of phosphorus in sea water
8. Museum Specimen/ Charts

   Barnacles, Sea anemone, Uca, Cerithidea, Oyster, Ascidian, Rhizophora, Chiton, Arenicola, Nereis, sargassum and calurpa.
9. Visit to Rocky/ Sandy shore/ Mangroves/ Estuary.

Books for Reference

1. Michael P. *Ecological methods for field and laboratory investigations.* New Delhi: Second Reprint. Tata Mc Grew - Hill Publishing Company Limited 1990.

SEMESTER VI			
Core XII	**Economic Zoology**		
Course Code: 21UZOC64	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- To impart basic knowledge on solid waste management using vermicomposting technology.
- To provide information and technical skills in various aspects of sericulture, apiculture, aquaculture and dairy management to equip the students for self employment.
- To inculcate knowledge on profitable animals and encourage young learners to take up the small- scale livestock farming.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	compare the various species of earthworm and choose the suitable species for vermiculture	1	Un
CO-2	demonstrate vermicomposting technology and applications of vermiwash	3	Un, Ap
CO-3	develop skills on moriculture, silkworm rearing processes and harvesting of cocoons	2, 8	Cr
CO-4	select the suitable species for apiary and make use of bee keeping equipment	1	Ap
CO-5	describe cultivable organisms, nutritional requirements and formulate feed for aquaculture organisms and manage culture ponds	1, 8	Cr
CO-6	understand and analyse general management of dairy animals and the different kinds of feed for dairy animals.	2	An
CO-7	be aware of the importance and types of milk products and evaluate the nutritive value of milk.	7	Ev
CO-8	develop skills for self-employment and promote rural development	5	Cr

Unit I **Vermitechnology**

Need for vermi culture - selection of suitable species of earthworm, preparation and maintenance of vermicomposting bed, harvesting the worms; Vermicompost - Vermicomposting methods - Pit method - bin method - windrow method; vermiwash - preparation - applications.

Unit II **Sericulture**

Mulberry cultivation – common Indian varieties of mulberry - methods of propagation; Silk worm rearing – rearing house – rearing appliances – chawkirearing – application of sampoorna; Mountage - Chandrike - harvesting of cocoons.

Unit III **Apiculture**

Choice of species in apiculture- Indian bee, European bee. Bee keeping equipment - Langstroth hive and Newton's hive- Appliances used in apiaries. Swarming – prevention and control. Extraction and uses of honey- bee wax- bee venom.

UnitIV **Aquaculture**

Importance of aquaculture - Cultivable organisms and their qualities. Management of culture ponds - control of water quality parameters – fertilization. Fish feed – artificial feed - feed formulation and composition of formulated feed, live feed organisms.

Unit V **Dairy Management**

Calf raising, heifer management, management of pregnant, parturition and lactating cows. Balanced food ratio for dairy animals. Dairy products - milk, butter, cheese, ghee - nutritive value of milk - pasteurization of milk.

Text Books

1. Mary Violet Christy A. *Vermitechnology*. Chennai: MJP Publishers, First edition. 2020.
2. Ganga G. and J. *Sulochana Chetty*. New Delhi: An Introduction to Sericulture. Oxford & IBH Publishing Co Pvt. Ltd. 2019.
3. Johnson, J. and I. Jeya Chandra. *Apiculture*. Marthandam: Olympic offset Printers. 2005.

4. Santhana Kumar and Selvaraj, A.M *Concepts of Aquaculture*. Nagercoil: Mac ram Publications.2006.
5. Prasad Jayadish, *Principle and Practices of Dairy Farm*. NewDelhi: Kalyani Publisher. 2016.

Books for Reference

1. Prakash Malhotra, *Economic Zoology*. New Delhi: First edition. Adhyayan Publishers and Distributers. 2008.
2. Gupta P. K. *Vermicomposting for Sustainable Agriculture*. India: Agrobios, 2nd Revised Edition. 2012.
3. Talashilkar S. C. and Dosani *Earthworm in Agriculture*. Jodhpur: Agrobios Publications, First edition.2005.
4. Krishnaswami S. *New Technology of Silkworm Rearing*. Bangalore: Published by Central Silk Board.1990.
5.Kamal Jaiswal, Sunil P. Trivedi, B.V. Pandey and P.N. Pandey. *Indian Sericulture*. New Delhi: ALFA Publication.2009.
6. Mishra. R.C. *Perspectives in Indian Apiculture*. New Delhi: Agro Botanica, 1997.
7. Raja Justus. E. *Economics of Bee Keeping Industry.* Jaipur and. New Delhi: Rawat Publications. 2009.
8. Dinabandhu Sahoo, S.Z. Qasim. *Sustainable Aquaculture*. New Delhi: A.P.H Publishing Co. 2009
9. Sailendra Ghosh. *Fisheries and Aquaculture Management*. New Delhi: Adhyayan Publisher& Distributors.2009.
10. Banerjee, G.C. *Textbook of Animal Husbandry*.New Delhi: Oxford and IBH Publishing Co.Pvt.Ltd,Eighth edition. 2011.
11. Danjyaganj. *Handbook of Animal Husbandry*.New Delhi:Sangam Book Depot.ICAR edition. 2015.

PRACTICALS

Course Code : 21UZOCR7

Hrs/Week: 2 **Credit: 1**

1. Identification of earthworm species (*Lumbricus terrestris, Eisenia fetida, Lampito mauritii*)
2. Preparation and maintenance of vermicomposting bed
3. Common Indian varieties of Mulberry
4. Rearing appliances in Sericulture (chopping knives, chopping board, foam rubber stripes)
5. Identification of Indian bee, European bee
6. Mounting of mouth parts, legs, sting of bee
7. Bee keeping equipment (Newton Hive, smoker, extractor)
8. Cultivable organisms and their qualities – Indian major carps
9. Fish feed formulation and preparation
10. Balanced food ratio for dairy animals
11. Visit to sericulture unit / apiary/ dairy/ aquaculture farm.

Books for Reference

1. Alka Prakash. *Laboratory Manual of Entomology*. New Delhi: New Age International (P) Ltd. 2001.
2. Tammanna N. Son walker. *Hand Book of Silk Technology*. Chennai: Wiley Eastern Ltd. 1993.
3. Agarwal, S.C. *A Hand book of Fish Farming*. Delhi: Narendra Publishing House.1994.