YBN UNIVERSITY

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As per Section 2(f) of UGC Act.1956

NEP-2020

ZOOLOGY COURSE/STRUCTURE

For

FOUR YEAR UNDERGRADUATE PROGRAMMES

(FYUGP)

UNDER YBNU RANCHI JHARKHAND

Implemented in the Department of Zoology (School of Science)

Semester-I, II, III & IV

From

Academic Session-2023

RAJAULATU, NAMKUM, RANCHI, JHARKHAND-834010

COURSE OF STUDY OF FOUR YEAR UNDERGRADUATE PROGRAMME FOR (2) YEAR-2023 onwards

COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME

Table l: Course structure for Undergraduate Certificate Programme [May Exit after Sem.-II]

Semester	Common Course		Introductory Course	Major		Total credits	
Sem-I	LCS (MIL/TRL)	Understanding India	Health & Wellness, Yoga Education, Sports & Fitness	IRC-1	IVS-1A	MJ-1	
	(6Credits)	(2Credits)	(2Credits)	(3Credits)	(3Credits)	(6Credits)	(22)
Sem-II	LCS (Hindi)	Global Citizenship	Mathematical & Computational	IRC-2	IVS-1B	MJ-2	
	(6Credits)	Education (2Credits)	Thinking (2Credits)	(3Credits)	(3Credits)	(6Credits)	(22)

Total = 44 Credits

(LCS: Language and Communication Skills; MIL: Modern Indian Languages; TRL: Tribal Regional Languages; IRC: Introductory Regular Courses; IVS; Introductory Vocational Studies, MJ: Major)

Table 2: Course structure for Undergraduate Diploma Programme [May Exit after Sem.-IV]

Semester	Common Course			Introductory Course	Major	Minor	Internship/ Project	Vocational	Total credits
Sem-III	Environmental Studies	Community Engagement/ NCC/NSS	Digital Education	IRC-3	MJ-3		Internship/ Project		
	(3Credits)	(3Credits)	(3Credits)	(3Credits)	(6Credits)		(4Credits)		**(22)**
Sem-IV					MJ-4, MJ-5	MN-1		VS-1	
					(6+6=12 Credits)	(6Credits)		(3Credits)	**(22)**

Total=88Credits

(MN: Minor; VS: Vocational Studies)

Table 3: Course structure for Bachelor's Degree Programme [May Exit after Sem-VI]

Semester	Major Course	Minor Course	Vocational	Total Credits
Sem-V	MJ-6, MJ-7	MN-2	VS-2	
	(6+6=12Credits)	(6Credits)	(4Credits)	(22)
Sem-VI	MJ-8, MJ-9	MN-3	VS-3	
	(6+6=12Credits)	(6Credits)	(4Credits)	(22)

Total=132Credits

Table 4: Course Structure for Bachelor's Degree with Hons. /Research Programme

Semester	Advance course	Research Course		Vocational	Total Credits
Sem-VII	AMJ-1, AMJ-2	Research Methodology			
		(6+6=12Credits)		(4Credits)	(22)
Sem-VIII	AMJ-3, AMJ-4	Research Int./Field Work	Research Report	VSR	
	(6+6=12Credits)	(4Credits)		(2Credits)	(22)

Total=176 Credits

(AMJ: Advance Major: VSR: Vocational Studies associated with Research)

SEMESTER WISE COURSE OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME 2023 ONWORDS

ZOOLOGY

Table 5: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course			Examination Structure			
	Code	Paper	Credits	Theory	Internal Assessment	Practical	Total
I	1Y4CC-1	Language and Communication Skills (Modern Indian Language including TRL)	6	75	25	---	100
	1Y4CC-2	Understanding India	2	75	25	---	100
	1Y4CC-3	Health & Wellness, Yoga Education, Sports & Fitness	2	50	25	50	100
	1Y4ZOOIRC-1	Introductory Regular Course-1 **Introductory Zoology**	3	50	25	25	100
	1Y4IVS-1A	Introductory Vocational Studies-I **ORGANIC FARMING**	3	50	25	25	100
	1Y4ZOOMJ-1	Major paper-1 (Disciplinary/Interdisciplinary Major) **Non –Chordates and Chordates**	6	50	25	25	100
II	2Y4CC-4	Language and Communication Skills (Hindi)	6	75	25	---	100
	2Y4CC-5	Mathematical and Computational Thinking Analysis	2	50	25	25	100
	2Y4CC-6	Global Citizenship Education & Education for Sustainable Development	2	50	25	25	100
	2Y4ZOOIRC-2	Introductory Regular Course-2 **Introductory Zoology**	3	50	25	25	100
	2Y4IVS-2B	Introductory Vocational Studies-2 **ORGANIC FARMING**	3	50	25	25	100
	2Y4ZOOMJ-2	Major paper-2 (Disciplinary/Interdisciplinary Major) **Ecology and Biochemistry**	6	50	25	25	100
	2Y4EVSCC-7	Environmental Studies/EVS	3	50	25	25	100

III	2Y4CC-8	Digital Education (Elementary Computer Applications)	3	50	25	25	100
	2Y4CC-9	Community Engagement & Service (NSS/NCC/Adult education)	3	50	25	25	100
	3Y4ZOOIRC-3	Introductory Regular Course-3 **Introductory Zoology**	3	50	25	25	100
	3Y4ZOOIAP	Internship/Apprenticeship/Project	4	50	25	25	100
	3Y4ZOOMJ-3	Major paper-3 (Disciplinary/Interdisciplinary Major) **Cell Biology and Biostatistics**	6	50	25	25	100
IV	4Y4ZOOMJ-4	Major paper-4 (Disciplinary/Interdisciplinary Major) **Animal Physiology**	6	50	25	25	100
	4Y4ZOOMJ-5	Major paper-5 (Disciplinary/Interdisciplinary Major) **Comparative Anatomy**	6	50	25	25	100
	4Y4ZOOMN-1	Minor paper-1 (Disciplinary/Interdisciplinary Minor) **Animal Diversity**	6	50	25	25	100
	4Y4VS-1	Vocational Studies-1 (Minor) **Introduction to Stock Market**	4	50	25	25	100
V	5Y4ZOOMJ-6	Major paper-6 (Disciplinary/Interdisciplinary Major) **Molecular Biology**	6	50	25	25	100
	5Y4ZOOMJ-7	Major paper-7 (Disciplinary/Interdisciplinary Major) **Genetics & Ehtology**	6	50	25	25	100
	5Y4ZOOMN-2	Minor paper-2 (Disciplinary/Interdisciplinary Minor) **Food Nutrition and Health**	6	50	25	25	100
	5Y4VS-2	Vocational Studies-2 (Minor)	4	50	25	25	100
VI	6Y4ZOOMJ-8	Major paper-8 (Disciplinary/Interdisciplinary Major) **Developmental Biology**	6	50	25	25	100
	6Y4ZOOMJ-9	Major paper-9 (Disciplinary/Interdisciplinary Major) **Evolution**	6	50	25	25	100
	6Y4ZOOMN-3	Minor paper-3 (Disciplinary/Interdisciplinary Minor) **Environment & Public Health**	6	50	25	25	100
	6Y4VS-3	Vocational Studies-3 (Minor)	4	50	25	25	100
VII	7Y4ZOOAMJ-1	Advance Major paper-1 (Disciplinary/Interdisciplinary Major) **A. Endocrinology B. Wildlife Conservation and Management**	6	50	25	25	100
	7Y4ZOOAMJ-2	Advance Major paper-2 (Disciplinary/Interdisciplinary Major)	6	50		25	

		A. Immunology B. Mammalian Physiology			25		100
	7Y4RC-1	Research Methodology	6	50	25	25	100
	7Y4RC-2	Research Proposal	4	50	25	25	100
VIII	8Y4ZOOAMJ-3	Advance Major paper-3 (Disciplinary/Interdisciplinary Major) **Insecta**	6	50	25	25	100
	8Y4ZOOAMJ-4	Advance Major paper-4 (Disciplinary/Interdisciplinary Major) **Fish & Fisheries**	6	50	25	25	100
	8Y4ZOORC-3	Research Internship/Field Work	4	---	---	---	100
	8Y4ZOORC-4	Research Report	4	---	---	---	100
	8Y4VSR	Vocational Studies (Associated with Research)	2	50	25	25	100
		Total Credits	**176**				

Abbreviations:

CC Common Course
IRC Introductory Regular Courses
IVS Introductory Vocational Courses
IAP Internship/Apprenticeship/Project
VS Vocational Studies
MJ Major Disciplinary/Interdisciplinary Courses
MN Minor Disciplinary/ Interdisciplinary Courses
AMJ Advance Major Disciplinary/ Interdisciplinary Courses
RC Research Courses
VSR Vocational Studies associated with Research

Table 6: Semester Wise Course Code and Credits Points:

Sem.	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				
	Code	Papers	Credits	Theory	Internal Assessment	Practical	Total
I	1Y4ZOO MJ-1	**Non –Chordates and Chordates**	6	50	25	25	100
II	1Y4ZOO MJ-2	**Ecology and Biochemistry**	6	50	25	25	100
III	1Y4ZOO MJ-3	**Cell Biology and Biostatistics**	6	50	25	25	100
IV	1Y4ZOO MJ-4	**Animal Physiology**	6	50	25	25	100
	1Y4ZOO MJ-5	**Comparative Anatomy**	6	50	25	25	100
V	1Y4ZOO MJ-6	**Molecular Biology**	6	50	25	25	100
	1Y4ZOO MJ-7	**Genetics & Ethology**	6	50	25	25	100
VI	1Y4ZOO MJ-8	**Developmental Biology**	6	50	25	25	100
	1Y4ZOO MJ-9	**Evolution**	6	50	25	25	100
VII	1Y4ZOO AMJ-1	**A. Endocrinology B. Wildlife Conservation and Management**	6	50	25	25	100
	1Y4ZOO AMJ-2	**A. Immunology B. Mammalian Physiology**	6	50	25	25	100
	1Y4ZOO RC-1 R	**Research Methodology**	6	50	25	25	100
	1Y4ZOO RC-2	**Research Proposal**	4	50	25	25	100
VIII	1Y4ZOO AMJ-3	**Insecta**	6	50	25	25	100
	1Y4ZOO AMJ-4	**Fish & Fisheries**	6	50	25	25	100
	1Y4 RC-3	**Research Internship/Field Work**	4	---	---	---	100
	1Y4 RC-4	**Research Report**	4	---	---	---	100
	1Y4 VSR	**Vocational Studies (Associated with Research)**	2	50	25	25	100
		Total Credit	**98**				

Table 7: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment	Practical	Total
I/ II/ III	IRC	Introductory Zoology	3	50	25	25	100
IV	MN-1	Animal Diversity	6	50	25	25	100
V	MN-2	Food Nutrition and Health	6	50	25	25	100
VI	MN-3	Environment & Public Health	6	50	25	25	100

Table 8: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses						
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment	Practical	Total
I	1Y4IVSOF-1A	ORGANIC FARMING – IRC-1	2	50	25	25	100
	1Y4IVSDM-1A	DIGITAL MARKETING – IRC-2	2	50	25	25	100
	1Y4IVSCM-1A	COMPUTER BASICS AND MULTIMEDIA – IRC-3	2	50	25	25	100
	1Y4IVSEWS-1A	ENGINEERING WORKSHOP-IRC-4	2	50	25	25	100
	1Y4IVSED-1A	ENGINEERING GRAPHICS-IRC-5	2	50	25	25	100
	1Y4IVSEMC-1A	ENTREPRENEURSHIP AND MANAGEMENT CONCEPTS-IRC-6	2	50	25	25	100
	1Y4IVSOB-1A	ORGANIZATION BEHAVIOUR-IRC-7	2	50	25	25	100
II	2Y4IVSOF-2B	ORGANIC FARMING – IRC-1	2	50	25	25	100
	2Y4IVSDM-1B	DIGITAL MARKETING – IRC-2	2	50	25	25	100
	2Y4IVSCM-1B	COMPUTER BASICS AND MULTIMEDIA– IRC-3	2	50	25	25	100
	2Y4IVSEWS-1B	ENGINEERING WORKSHOP-IRC-4	2	50	25	25	100

	2Y4IVSED-1B	ENGINEERING GRAPHICS-IRC-5	2	50	25	25	100
	2Y4IVSEMC-1B	ENTREPRENEURSHIP AND MANAGEMENT CONCEPTS-IRC-6	2	50	25	25	100
	2Y4IVOB-1B	ORGANIZATION BEHAVIOUR-IRC-7	2	50	25	25	100

The aim of bachelor's degree programme in Zoology are as follows:

Zoology is the study of all animal life; from primitive microscopic malaria-causing protozoa to large advanced mammals, across all environmental spheres from red deer in mountain forests to dolphins in deep oceans, and from underground burrowing voles to golden eagles in the skies. Some of these animals are useful to us and we nurture them as pets or livestock; some are serious pests or disease-causing; and some are simply splendid and awe-inspiring. No matter what our relation with the animals is, we need to understand their behaviour, population dynamics, physiology and the way they interact with other species and their environments. It provides students with the knowledge and skill base that would enable them to undertake further studies in Zoology and related areas or in multidisciplinary areas that involve advanced or modern biology and help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship

The modern era requires a classical zoologist with a modern approach to master many subjects of Zoology. There is a need for the students to compete with the globe, therefore, the main focus of this curriculum is to enable the student to be professionally competent and successful in a career. Having Zoology as backbone of the curriculum, this course, with the department centric electives will enhance the skills required to perform research in laboratory and experimental research. The students can choose to focus on a “whole animal” or a “bits of animals” approach. The “whole animal” pathway makes the students proficient in the identification and study of animals while the latter approach provides the skills required to pursue laboratory and experimental work such as disease research, DNA technologies, wildlife forensics etc. The curriculum can be modified to such extent that a student at B.Sc. level can be a specialist in immunology, ornithology, animal behaviour or entomology. For such specializations, the curriculum needs to focus on special skills to maximize the students’ employment probability; for example, few skills needed by industry may include the species-specific monitoring for key species, handling of dangerous/ poisonous/ wild animals and the use of Geographic Information Systems (GIS) for data collection.

The programme learning outcomes relating to Honours/Research Degree in Zoology:

Knowledge and Understanding

Demonstrate:

I. in-depth knowledge and understanding about the fundamental concepts, principles and processes underlying the academic field of Zoology and its different subfields (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal biotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases, apiculture, aquarium fish keeping, medical diagnostics, and sericulture)

II. Procedural knowledge that creates different types of professionals in the field of Zoology and related fields such as, apiculture, aquarium fish keeping, medical diagnostics, and sericulture, etc.

III. Skills related to specialization areas within Zoology as well as within subfields of Zoology, including broader interdisciplinary subfields (Chemistry, Physics and Mathematics).

- Over the years, Zoologists were able to find many differences within the same breed of an animal species. As a Zoology professional one can study extinct animals by specializing in Paleozoology, on the different types of birds in Ornithology opt for studying Herpetology and Arachnology, the branches dealing with the study of snakes and spiders, respectively or
- Appreciate the complexity of life processes, their molecular, cellular and physiological processes, their genetics, evolution and behaviour and their interrelationships with the environment.
- Study concepts, principles and theories related with animal behaviour and welfare.
- Understand and interpret data to reach a conclusion Design and conduct experiments to test a hypothesis.
- Understand scientific principles underlying animal health, management and welfare.
- Accept the legal restrictions & ethical considerations placed for animal welfare.
- Understand fundamental aspects of animal science relating to management of animals.

The core courses would fortify the students with in-depth subject knowledge concurrently; the discipline specific electives will add additional knowledge about applied aspects of the program as well as its applicability in both academia and industry. Generic electives will introduce integration among various interdisciplinary courses. The skill enhancement courses would further add additional skills related to the subject as well as other than subject. In brief, the students graduated with this type of curriculum would be able to disseminate subject knowledge along with necessary skills to suffice their capabilities for academia, entrepreneurship and Industry. For each syllabus, the course content has been divided into four units with a breakup of the topics to be covered to provide the students better understanding of the main theme represented in the title of each unit. Such type of design is to indicate the breadth of content to be taught thus ensuring more or less uniform coverage of

information on a certain theme. The teacher has to take up the contents in such a manner by asking questions and answering them that the whole process appears to be an interesting narrative with topics falling in line rather than appearing as unrelated complex terms. Learning will be more enjoyable and imbibing if appropriate examples are cited from our daily lives.

SEMESTER-I

Semester	Course Structure For Semester-I Common, Introductory, Major, Minor, Vocational & Internship Course						
	Code	**Paper**	**Credits**	**Theory**	**Internal Assessment**	**Practical**	**Total**
I	1Y4CC-1	Language and Communication Skills (Modern Indian Language including TRL)	6	75	25	---	100
	1Y4CC-2	Understanding India	2	75	25	---	100
	1Y4CC-3	Health & Wellness, Yoga Education, Sports & Fitness	2	50	25	50	100
	1Y4ZOOIRC-1	Introductory Regular Course-1 **Introductory Zoology**	3	50	25	25	100
	1Y4IVS-1A	Introductory Vocational Studies-I **ORGANIC FARMING**	3	50	25	25	100
	1Y4ZOOMJ-1	Major paper-1 (Disciplinary/Interdisciplinary Major) **Non –Chordates and Chordates**	6	50	25	25	100

SEMESTER I

COMMON COURSE –CC 1: **(Credits: 6) Total Marks: 100**

Language and Communication Skills (Modern Indian Language including TRL)

ENGLISH LANGUAGE &, COMMUNICATION SKILLS (1Y4CC-1)

OBJECTIVE: - To equip students effectively to acquire skills in reading, writing, comprehension and communication for English language &; Communication.

COURSE OUTCOMES:

- Students will improve their speaking ability in English both in terms of fluency and comprehensibility
- Students will give oral presentations and receive feedback on their performance
- Students will increase their reading speed and comprehension of academic articles
- Students will strengthen their ability to write academic papers, essays and summaries using the process approach.
- Students will enlarge their vocabulary. They will also heighten their awareness of correct usage of English grammar in writing and speaking

Unit I: Communication – Meaning, Types, Channels, Barriers. Skills of Language learning: Listening, Speaking, Reading & Writing.

Unit II: English as a Global Language Growth & Status of English language in India

Unit III: Class-presentation – Introduction, Conversation, Greetings, Likes and Dislikes, Opinion, Agreeing, Disagreeing, Complaint, Apology

Unit IV: Writing skills notice writing, précis writing, essay writing, letter writing resume writing.

Unit V: Vocabulary building: One word substitution, synonyms and antonyms, idioms and phrases, Common Errors, Prefix, Suffix, Homophones, Confusing words

Suggested Reading:

1. Technical Communication, M.H. Rizvi, Tata McGrawhill
2. Everyday Smart English, Dr. Arti Gupta, I.D. Publishers
3. Effective Business Communication, Asha Kaul
4. Developing Communication Skills, Krishnamohan
5. Functional Grammar and Spoken and Written Communication in English, Bikram K. Das, Orient Blackswan
6. Precis, Paraphrase and Summary,P.N. Gopalkrishnan, Authors Press
7. Communication Skills, Sanjay Kumar and Pushplata, Oxford Publication

SEMESTER I

COMMON COURSE –CC 2:

Understanding India (1Y4CC-2)

(Credits: 2) **Total Marks: 100**

Unit I: Background of India's culture: Harappan civilisation and Vedic age Buddhism, Jainism, Sanatan (Hinduism) and Islam

Unit II: Growth and development of Indian Education and literature: Bharat's Natyashastra, Kalidas, Panini, Patanjali Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS

Unit III: Leaders of India's freedom struggle: Mahatma Gandhi, Jawaharlal Nehru, Subhash Chandra Bose, Freedom fighters of Jharkhand (Tilka Manjhi, Sidho-Kanho, Birsa Munda & Jatra Bhagat)

Unit IV: Geographical features of India

1. India on the map of world and its neighboring Countries.
2. Physical features of India including mountain, plateau, plain, coast, island, vegetation, rivers, soils, and climate

Unit V: The People of India: Racial diversities, Population, its growth, distribution, Migration**.**

Unit VI: Indian Constitution

1. Preamble
2. Salient features
3. Fundamental rights
4. Fundamental duties

Unit VII: Political ideas: Non-violence, Satyagraha and Social Justice

Unit VIII: The Indian Economy: The Indian Economy through the Ages (Agriculture, Industry and Trade-Transport)

Suggested Readings:-

1. L. Basham, A Cultural History of India, Oxford University Press, 1997
2. A. L. Basham, A Wonder that was India, Rupa, New Delhi, 1994
3. N. R. Ray, An Approach to Indian Art, Publication Bureau, Chandigarh, 1974
4. A. L. Basham, A Cultural History of India, Oxford University Press, 199

5. NayanjotLahiri, Marshaling the Past: Ancient India and its Modern Histories, Permanent Black, 2012
6. R.C. Majumdar (ed.), History and Culture of Indian People (Relevant Volumes and Chapters), Bhartiya Vidya Bhawan, Bombay.
7. S. C. Ghosh, History of Education in Modern India, 1758-1986, Orient Longman, Hyderabad, 1995
8. Tirthankar Ray, The Economic History of India 1857-1947, OUP, 2006
9. Vijay Joshi and I.M.D. Little, India's Economic Reforms, 1991-2001, OUP, 1999

SEMESTER I

COMMON COURSE –CC 3:

Health & Wellness, Yoga Education, Sports & Fitness (1Y4CC-3)

(Credits: 2) **Total Marks: 100**

OBJECTIVE:

- To raise awareness towards fitness among the students.
- To develop the individual as a fit citizen in the society.
- To acquire knowledge about yoga and health & wellness.

COURSE OUTCOMES:

- Students will understand and learn different dimension of active lifestyle
- Student will learn to apply knowledge and lead better quality life
- The students will be able to continue professional courses and research in health &; wellness &; yoga

HEALTH AND WELLNESS

Unit1:-Introduction

1. Meaning, Definition and Dimensions of Health and Wellness.
2. Factors affecting Fitness and Wellness.
3. Role of Fitness in maintaining Health and Wellness.
4. Importance of Health Education and Wellness.

Unit2:-Methods to Maintain Health and Wellness

1. Role of Physical Activities and Recreational Games for Health and Wellness
2. Role of Yoga asanas and Meditation in maintaining Health and Wellness
3. Nutrition for Health & Wellness

Unit3:-Anxiety, Stress and Aging

1. Meaning of Anxiety, Stress and Aging
2. Types and Causes of Stress
3. Stress relief through Exercise and Yoga

Suggested Readings:

1. Reklau Marc (2019), “30 Days: Change your habits, Change your life”, Rupa Publications, India

2. Russell, R.P.(1994).Health and Fitness Through Physical Education. USA Human Kinetics.
3. Scates Samantha (2019) " Healthy Habits for a Healthy Life" Samantha, Ireland
4. D.M Jyoti, Yogaand Physical Activities (2015) lulu.com3101, Hillsborough, NC2 7609, United States.

YOGA EDUCATION

Unit -1: Theory

Introduction to Health and Wellness

1. Meaning, definition and importance of Yoga
2. Types of Yoga, Introduction of Sat karma, definition of asana and Pranayama, it's physical and mental benefits
3. Stretching exercises
4. Warming up and limbering down
    a) General warm up exercises
    b) Specific warm up exercises

UNIT II Practical

A. Sukshma Vyayama
B. Suryanamaskara

(12 Poses are Compulsory 1. Ardhachakrasana 2.Padhastasana 3. Ashwasanchalasana 4.Dhandasana. 5 Shasangasana 6.Astangasana 7.Bhujangasana 8.Parvathasana 9. Shashangasana 10. Ashwasanchalasanal 11. Padhastasana 12.Ardhachakrasana)

C. Basic Set of Yoga Asanas -Sitting Poses
Padmasana, Sukhasana, Vajrasana, Gomukhasana,

Prone Position	Supine Position	Invert Position
Noka asang Bhujangasang Salabhasana Marjariasana makarasana	Ustrasana Setu Bandhasana chakrasana	Sarvangasana halasana Salambha Sarvangasana Sirsasana

Relaxing Pose → Shavasana

D. Basic Set of Pranayama, Meditation & Mudra

Pranayama- Anulom-Vilom Pranayama, Bhramari Pranayama, Ujjai Pranayama, Bhastrika Pranayama, Sitali Pranayama

Meditation- Omkar meditation

Mudra – Pranav mudra, Gyan mudra, Hridaya mudra

Suggested Readings:

1. Nagendra, H.R. &; Nagarathna, R. (2002).Samagra Yoga Chikitse. Bengaluru: Swami Vivekananda Yoga Prakasana.
2. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana
3. Shanti KY(1987)& The Science of Yogic Breathier & (Pranayama) DB Bombay
4. Iyengar B.K.S.(2006) " Light on Yoga" Thorsons (Publ.) India

SEMESTER I

INTRODUCTORY REGULAR COURSE (IRC)

INTRODUCTORY ZOOLOGY(1Y4ZOOIRC-1)

(Credits: Theory-02, Practicals-01) **Total Marks: 100**

Course Outcomes:

1. A general concept of the animal world
2. Awareness of students regarding biological mechanism of various processes, functions as well evolutionary significance could be learnt
3. Students will acquire knowledge about the cell in detail along with the different organelles
4. Will understand their own body processes
5. Will get an idea about origin of life and evolution.

UNIT I: General Introduction to Animal World, Need of Classification, General idea of Classification and Taxonomy, Cell theory.

UNIT II: Cell- Structure, Cell theory. Difference between Prokaryotic and Eukaryotic cells an overview of various cell organelles, including detailed structure of Mitochondria, Golgi body, Endoplasmic Reticulum, Nucleus, Ribosome, and their significant feature. (Any three)

UNIT III: A general introduction to human physiology.

UNIT IV: Basic structure of DNA and RNA,

UNIT V: Mendel's law of Inheritance and variation.

UNIT VI: Evolution: Lamarck's Inheritance theory, Darwin's natural selection theory mutation theory.

UNIT VII: General concept of Ecology, Ecosystem and its various components.

ZOOLOGY PRACTICAL- IRC LAB:

PRACTICALS:

1. Study of Permanent slides.
2. Amoeba, Paramecium, Sycon, Ascaris, Starfish, wall lizard, frog, Columba Bat, Kidney (T.S Mammal) liver, Pancreas, Ovary, Testis.
3. Homologous and Analogous organs.
4. Project on Food chain

Suggested Books

1. Animal Diversity (Biology of Invertebrates) -Pechnik
2. Cell Biology: De Robersies
3. Cell Biology: Ambrose
4. Cell Biology: C.B. Powar
5. Physiology: Gyton
6. Evolution: V.B. Rastogi
7. Ecology: M.C. Dash, P.D. Sharma

SEMESTER – I

ORGANIC FARMING

Course Code: 1Y4IVSOF-1A

(Credits: Theory-01+ Practical 02) **Total Marks: 100**

Course Content:

UNIT- I Agronomy

1. Organic farming- concept, characteristics, significance, organic ecosystem, scope of organic farming in India
2. Principles and types of organic farming

UNIT- II Soil Science

1. Organic farming for sustainable agriculture; Manures- compost, methods of composting
2. Green manuring, vermicompost and bio fertilizer

UNIT- III Fundamental of organic farm management

1. Land management in organic farming
2. Water management in organic farming

UNIT- IV Post harvest management

1. Processing, labeling of organic produce
2. Storage and transport of organic produce

ORGANIC FARMING PRACTICAL

Course Code: 1Y4IVSOF-1A-LAB

PRACTICALS: 60 Lectures

1. Field visit of organic farming
2. Seed and seed treatment
3. Preparation of Farm Yard Manure (FYM) & compost
4. Water management in organic agricultural

SEMESTER I

MAJOR COURSE –MJ 1:

NON –CHORDATES AND CHORDATES

(Credits: Theory-04, Practicals-02) **Theory: 60 Lectures**

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop understanding on the diversity of life with regard to protists, non-chordates and chordates.
2. Group animals on the basis of their morphological characteristics/ structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
5. Understand how morphological change due to change in environment helps drive evolution over a long period of time.
6. The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills.

GROUP A

UNIT I: Kingdom Protista (04 Lecture)

1. General introduction and classification upto class
2. Locomotion in Protista
3. Reproduction and Nutrition in Protista

UNIT II: Phylum Porifera, Cnidaria, Ctenophora. (04 Lecture)

1. General characters and classification upto class
2. Canal system in Porifera
3. Coral and coral Reef formation.
4. Alteration of Generation in cnidarian.
5. Evolutionary significance of ctenophore

UNIT III: Helminthes (04 Lecture)

1. General characters and classification of Platyhelminthes, Nemathelminthes and Aschelminthes. upto class
2. Life cycle of Fasciola hepatica

UNIT IV: Annelida (04 Lecture)

1. Segmentation in Annelids
2. Origin of coelom

UNIT V: Arthropoda (04 Lecture)

1. General characters, Classification upto class
2. vision in Arthropods, Appendages in Arthropods

UNIT VI: Mollusca (05 Lecture)

1. General characteristic of Mollusca. Classification upto class
2. Torsion and Detorsion in Mollusca

UNIT VII: Echinodermata (05 Lecture)

1. General characters, classification upto class
2. Water vascular system in Echinodermata

GROUP B

Chordates (Pisces to Mammals)

UNIT I: Chordata (04 Lecture)

Introduction to chordates and its origin general characters and outline classification

UNIT II: Protochordates (04 Lecture)

1. General characters of Hemichordates Urochordates and Cephalochordates.

UNIT III: Agnatha (03 Lecture)

General characters and classification of cyclostomes.

UNIT IV: Pisces (03 Lecture)

1. General classification of chondricthyes and Osteicthyes
2. Parental care in fishes

UNIT V: Amphibia (04 Lecture)

1. General Classes and classification of Amphibia
2. Parental care in Amphibians.

UNIT VI: Reptilia (04 Lecture)

Poison apparatus and Biting mechanism in snakes.

UNIT VII: Aves (04 Lecture)

1. General characters of Aves
2. Flight adaptations in birds
3. Flightless Birds, a brief idea.

UNIT VIII: Mammalia (04 Lecture)

General characters and classification up to classes, Dentition in mammals.

Reference Books:

1. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Singh, S. Keshari S. and Abhishek, K.S. (2016). Medical Zoology and Parasitology, Jharkhand Jharokha, Classical Publishing Company.
6. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
7. Pough H. Vertebrate life, VIII Edition, Pearson International.
8. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
9. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

ZOOLOGY PRACTICAL- MJ 1 LAB

NON –CHORDATES AND CHORDATES

PRACTICALS: **60 Lectures**

GROUP A

1. Study of whole mount of Euglena, Amoeba and Paramecium; Binary fission and Conjugation in Paramecium. Sycon (including T.S. and L.S.), Obelia, Physalia Aurelia, Gorgonia, Metridium, Pennatula, Aphrodite, Nereis, Heteronereis, Pheretima, Hirudinaria, Sacculina, Cancer, Pila,Unio, Asterias, Antedon
2. Study of adult Fasciola hepatica, Taeniasolium and their life cycles (Slides/microphotographs)
3. Study of adult Ascari slumbricoides and their life stages (Slides/micro-photographs)
4. Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta.

GROUP B

1. Study of Museum specimen: Petromyzon, Myxine, Scoliodon, Heteropneustes, Labeo, Exocoetus, Hippocampus, Tetrodon, Bufo, Hyla, Alytes, Salamandra, Uromastix, Draco, Vipera, Naja, Hydrophis, Columba, Bat
2. Types of beaks and claws

SEMESTER II

Semester	Course Structure For Semester-II Common, Introductory, Major, Minor, Vocational & Internship Course						
	Code	**Paper**	**Credits**	**Theory**	**Internal Assessment**	**Practical**	**Total**
II	2Y4CC-4	Language and Communication Skills (Hindi)	6	75	25	---	100
	2Y4CC-5	Mathematical and Computational Thinking Analysis	2	50	25	25	100
	2Y4CC-6	Global Citizenship Education & Education for Sustainable Development	2	50	25	25	100
	2Y4ZOOIRC-2	Introductory Regular Course-2 **Introductory Zoology**	3	50	25	25	100
	2Y4IVS-2B	Introductory Vocational Studies-2 **ORGANIC FARMING**	3	50	25	25	100
	2Y4ZOOMJ-2	Major paper-2 (Disciplinary/Interdisciplinary Major) **Ecology and Biochemistry**	6	50	25	25	100

SEMESTER II

Language and Communication Skills (Hindi) 2Y4CC-4

I. COMMON COURSE –CC 4: **(Credits: 6)** **अंक: 100**

हिंदी भाषा

इकाई-1 हिन्दीव्याकरण और रचना, संज्ञा, सर्वनाम, विशष्ठाण, क्रिया, अव्यय, कारक, वचन, सठिय, उपसर्ग, प्रत्ययासमास, लिगनिर्णय शब्द लोग शब्द, अनेक शब्दों के लिए एक शब्द, शब्द-शुद्धि, वाक्य शुद्धि, मुहावरे ओर लोकोकिया, पल्लवन एवं संक्ष पण।

इकाई-2 निबंध, कला तथा समसामयिक एवं राष्ट्रीय विषय पर लेखन

इकाई-3 संप्रेषण (संचार)- संप्रेषण की अवधारण और महत्व, संप्रष्ठाण के लिए आवश्यक शर्त संप्रेषण के प्रकार, संप्रेषण की तकनीक, वाचनकला, समाचारवाचन, साक्षात्कारकला, रचनात्मक लेखनका लक्ष्य, रचनात्मक लघु का आधार, भारत की भाव औंर विचारो की प्रस्तुति, वाक कला की उपयोहगता।

अनुशंसितपुस्तकें:-

- र्ृहतव्याकरणभास्कर डा॰ 0 र्चनद र्कुमार
- र्ह तहनबधं॰् भास्कर डा॰0 र्चनदर् कु मार
- आधुहनकहहन्दीव्याकरणऔररचना डा॰ 0 र्ासुद र्नन्दनप्रसाद
- रचनामानस प्रो0 राम श्वरनाथहतर्ारी
- व्यर्हाररकहहन्दी डा॰ 0 जंग बहादुरपाण्ड य
- रचनात्मक खन डा॰ 0 रमश्े गौतम
- राजहंसहहन्दीहनबंध प्रो0 आर0 एन0 गौड़
- सफ हहन्दीहनबंध रत्न श्वर
- हनबंध सहचर डा॰ 0 क्ष्मणप्रसाद
- उपकारमहु र्र और क हियाा॰ँ पार् 0 राज श्वरप्रसादचतर्वु दी
- कहाहनयोंकहार्ा॰ की प्रतापअनम
- सम्प्र षणपरकहहन्दीभाषाहशक्षण डा॰ 0 र्ै श्नारंग
- शै हर्ज्ञान डा॰ 0 सुर शकुमार
- शै हर्ज्ञानप्रहतमानऔरहर्श्ल षण डा॰0 पाडं य शहशभष्े ण „शीताशें्‟
- शै हर्ज्ञानकाइहतहास डा॰0 पाडं य शहशभष्े ण „शीताशं॰्‟

SEMESTER II

Mathematical and computational Thinking and Analysis (1Y4CC-6)

COMMON COURSE –CC 5: **(**Credits: 2) Total Marks: 100

Course Learning Outcomes: This course will enable the students to:

a) Understand the notions of logic and Mathematical Induction.
b) Basic concepts of sets.
c) Analytic approach toward the solution of algebraic equations.
d) Connections of roots and coefficients.
e) Understand basic concept of Probability and statistics
f) Understand and analyze the coordinate systems.

UNIT-1: Logic: statement, truth table, quantifiers, connectives and tautology, Mathematical induction.

UNIT-2: Sets and Number System: operations on sets, Elementary Properties, Decimal system, binary decimal, octal system, hexadecimal system, arithmetic, conversion from binary to decimal and decimal to binary.

UNIT-3: Theory of Equation: Relation between roots and coefficients, Transformation of equation, Symmetric functions of roots, Solutions of cubic and biquadratic equations.

UNIT-4: Statistics and Probability: Data collection and presentation using bar chart, column chart, line chart, pie chart, scatter chart, surface chart. Calculation of frequency. Measure of central tendency, Mean, Median and Mode, Definition of Probability, Elementary properties, addition theorem, multiplication theorem, independent events.

UNIT-5: Geometry: Cartesian, spherical polar and Spherical cylindrical coordinate systems; their interrelationship.

Suggested reading:

1. An introduction to the theory of Numbers, 4th Ed., G. H. HARDY AND E. M. WRIGHT, 1975, Oxford University Press.
2. An Introduction to The Modern Theory of Equations, Florian Cajori, The Macmillan Company & London: Macmhian & Co., Ltd., 1904.
3. N. K. Singh, A text book of Probability and Statistics, 1st Edition, Pragati Publication, Meerut.
4. Probability and Statistics (4th Edition) 4th Edition, Morris H. DeGroot (Author), Mark J. Schervish, Pearsion Education limited 2014.
5. N. K. Singh, Theory of Equations, 1st Edition, Pragati Publication, Meerut.
6. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
7. Discrete Mathematical Structure, 4th Ed., Kolman, Busby and Ross, Pearson Education Asia, 2002.

SEMESTER II

GLOBAL CITIZENSHIP EDUCATION (1Y4CC-6)

COMMON COURSE –CC 6: **(Credits: 2) Total Marks: 100**

OBJECTIVE:

- To understand the concept and structure of global governance
- To empower learners to become aware of and understand global and sustainable development issues
- To become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
- Enabling students to embrace and practice constitutional, humanistic, ethical, and moral values in conducting one life, including universal human values and citizenship values.
- To practice responsible global citizenship required for responding to contemporary global challenges

COURSE OUTCOMES:

- Enhance the capacity of the learners to acquire and demonstrate problem-solving skills involving the capacity to solve different kinds of problems in familiar and non familiar contexts and apply one's learning to real-life situations.
- Promote critical thinking involving capability to apply analytical thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well analyze and synthesize data related to global issues from a variety of sources and draw valid conclusions and support them with evidence and examples.
- Creativity characterized by the ability to create or think in different and diverse ways, deal with problems and situations that do not have simple solutions; view a problem or a situation from multiple perspectives; think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
- Communication Skills characterized by skills that enable a person to present complex information in a clear and concise manner to different groups/audiences; express thoughts and ideas effectively in writing and orally and communicate with 3 others using appropriate media, convey ideas, thoughts and arguments using language that is respectful and sensitive to gender and social groups.
- Coordinating/collaborating with others involving the ability to: work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group, act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

UNIT 1: Global Citizenship Education (GCE) and Education for Sustainable Development

1. Global Citizenship Education; its meaning, characteristics, scope and subject matter emergence and development.
2. Rights and responsibilities of Global citizenship
3. Benefits, Importance and theories of Global Citizenship
4. Global governance – concept and structure
5. Global Citizenship: (a) General idea, (b) Multi cultureless & diversity, (c) tolerance & (d) Acharya Vinoba's ideas of 'Jai Jagat.'

UNIT2: Global Poverty, Inequalities and social change

1. Concept of Global Poverty and its impact on World economy
2. Concept of social change, its types and theories.
3. Human Right Education: Special reference to Universal Declaration of Human Rights, 1943
4. Concept of Peace and Security: Special reference to United Nations Charter

UNIT 3: Sustainable Development – Global Issues and Sustainable Issues

1. Global environment Issue-Climate change mitigation and adaptation
2. Sustainable Development: Brief overview
3. Biodiversity loss, Global warming and carbon emission
4. Effect of Global Issue on Human Species
5. Environmental justice

UNIT 4: Citizenship Education & Culture, Globalization

1. Gender equality
2. Meaning of Globalization and its impact of world economy
3. Meaning of culture, crucial factors in the Globalization of culture

Suggested Readings:

1. Global Politics – Rupak Dattagupta
2. Understanding Global Politics – Chanchal Kumar
3. Global Citizenship Education for Young Children – Robin Elizabeth Hancock
4. A New-World Education: The Global Citizen – Roy Andersen
5. Global Citizenship Education, A Critical and International Perspectives Springer – Adeel Jalil, A.K. Kari, Kathrine Meleg
6. Citizenship in a Globalising World – Ashok Acharya
7. Redesign the World: A Global Call to Action – Sam Pitroda
8. Measuring the World – Daniel Kehlmann
9. Global Citizenship Education: Challenges and Successes – Eva Aboagye & S. Nomburo Dlamini
10. Global Citizenship Education - William Gaudelli

11. Multiculturalism: A very short Introduction – Ali Rattansi
12. Diversity and Inclusion Matters – Jason Thompson
13. Multiculturalism – C. W. Watson
14. Multiculturalism, Identity and Rights – Bruce Haddock and P

SEMESTER II

INTRODUCTORY REGULAR COURSE (IRC-2)

INTRODUCTORY ZOOLOGY(1Y4ZOOIRC-2)

(Credits: Theory-02, Practicals-01) **Total Marks: 100**

Course Outcomes:

1. A general concept of the animal world
2. Awareness of students regarding biological mechanism of various processes, functions as well evolutionary significance could be learnt
3. Students will acquire knowledge about the cell in detail along with the different organelles
4. Will understand their own body processes
5. Will get an idea about origin of life and evolution.

UNIT I: General Introduction to Animal World, Need of Classification, General idea of Classification and Taxonomy, Cell theory.

UNIT II: Cell- Structure, Cell theory. Difference between Prokaryotic and Eukaryotic cells an overview of various cell organelles, including detailed structure of Mitochondria, Golgi body, Endoplasmic Reticulum, Nucleus, Ribosome, and their significant feature. (Any three)

UNIT III: A general introduction to human physiology.

UNIT IV: Basic structure of DNA and RNA,

UNIT V: Mendel's law of Inheritance and variation.

UNIT VI: Evolution: Lamarck's Inheritance theory, Darwin's natural selection theory mutation theory.

UNIT VII: General concept of Ecology, Ecosystem and its various components.

ZOOLOGY PRACTICAL- IRC LAB:

PRACTICALS:

1. Study of Permanent slides.
2. Amoeba, Paramecium, Sycon, Ascaris, Starfish, wall lizard, frog, Columba Bat, Kidney (T.S Mammal) liver, Pancreas, Ovary, Testis.
3. Homologous and Analogous organs.
4. Project on Food chain

Suggested Books

1. Animal Diversity (Biology of Invertebrates) -Pechnik
2. Cell Biology: De Robersies
3. Cell Biology: Ambrose
4. Cell Biology: C.B. Powar
5. Physiology: Gyton
6. Evolution: V.B. Rastogi
7. Ecology: M.C. Dash, P.D. Sharma

SEMESTER - II

ORGANIC FARMING – IRC-1

Course Code: 2Y4IVSOF-2B

(Credits: Theory-01 + Practical 02) **Theory: 15 Lectures**

Total Marks: 100

Course Content:

UNIT- I Agronomy

1. Choice of crops & varieties in organic farming
2. Initiative by Govt/NGOs/Other organizations for promotion of organic farming

UNIT- II Soil Science

1. Harmful effect of non-judicious chemical fertilization
2. Organic farming practices for improving soil health

UNIT- III Fundamental of organic farm management

1. Organic insect disease management
2. Organic pest disease management

UNIT- IV Post harvest management

1. Organic Quality control standards
2. Certification- types, process & procedure and agencies

ORGANIC FARMING PRACTICAL

Course Code: 2Y4IVSOF-2B-LAB

PRACTICALS: 60 Lectures

1. Crop planning & management in organic agriculture
2. Identification of different fungal and bacterial bio control agents
3. Application of manures and composts
4. Preparation of plant protection inputs Periods
5. Application of plant protection inputs

SEMESTER II

MAJOR COURSE- MJ 2:

ECOLOGY AND BIOCHEMISTRY

(Credits: Theory-04, Practicals-02) **Theory: 60 Lectures**

Total Marks: 100

Learning outcomes

After successfully completing this course, the students will be able to:

1. Know the evolutionary and functional basis of animal ecology.
2. Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.
3. Solve the environmental problem involving interaction of humans and natural systems at local or global level.
4. Understand about the importance and scope of biochemistry.
5. Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
6. Understand the structure and function of immunoglobulins.
7. Understand the concept of enzyme, its mechanism of action and regulation.
8. Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
9. Learn measurement of enzyme activity and its kinetics.

GROUP A: Ecology

UNIT I: An Overview of Ecology (06 Lecture)

1. Structure and function of an ecosystem
2. Energy flow in an ecosystem: Lindeman"s trophic dynamic concept
3. Laws of limiting factor: Shelfords law of tolerance
4. Food chain and Food web
5. Productivity and its management
6. Biome: An introduction and its type.

UNIT II: Population Ecology: (06 Lecture)

1. Population its attributes, Survivorship curve.
2. Exponential and logistic growth. 3. Population Regulation –Density and density independent factors/

UNIT III: Community Ecology: (06 Lecture)

1. Community Characters, Analytical and synthetic characters
2. Community Diversity Indices
3. Community Interactions –positive and Negative interactions
4. Niche concept: Niche overlap. Gause's principle with laboratory and field examples.
5. Community Dynamics-Succession and climax concept

UNIT IV: Environment Management: (06 Lecture)

1. Natural resources-types
2. Biogeochemical cycles –Water, Carbon, Nitrogen
3. Biodiversity-Alpha, Beta, Gamma. Hotspots
4. Environmental Degradation causes and its management including air, Water, Soil. and Noise

UNIT V: Environmental movements: (06 Lecture)

1. Chipko movement
2. Silent valley
3. Sardar Sarovar Mega Dam project.
4. Role of Gender and cultures in environmental conservation

GROUP B

Biochemistry

UNIT I: Biomolecules: A brief account of Carbohydrates, protein and lipids. (06 Lecture)

UNIT II: Carbohydrates: (06 Lecture)

1. Structure and classification. Metabolism of carbohydrates. Glycohysis, Kreb's cycle, ETS and ATP synthesis.
2. Glycogenesis, Gluconeosis. Glycogenesis HMP shunt.

UNIT III: Lipids (06 Lecture)

Structure and classification. Steroids ketogenesis and synthesis of Palmitic Acid.

UNIT IV: Proteins (06 Lecture)

1. Composition, structure and Biological significance.
2. Amino acids: structure and classification.
3. Catabolism of Amino acid: Transamination & Deamination.

UNIT V: Enzymes (06 Lecture)

1. Nomenclature and classification.
2. Enzyme kinetics. Regulation of Enzyme action Coenzymes and Isoenzymes.
3. Enzyme inhibition and Km equation Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Reference Books:

Group A

1. Raziuddin, M.., Mishra P.K. 2014, A Handbook of Environmental Studies, Akanaksha Publications, Ranchi.
2. Mukherjee, B. 2011: Fundamentals of Environmental Biology.Silverline Publications, Allahabad.
3. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
4. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
5. Gleeson, B. and Low, N. (eds.) 1999.Global Ethics and Environment, London, Routledge.

6. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
7. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
8. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36--37.
9. McCully, P. 1996. Rivers no more: the environmental effects of dams(pp. 29--64). Zed Books.
10. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
11. Odum, E.P., Odum, H.T. & Andrews, J. 1971.Fundamentals of Ecology. Philadelphia: Saunders.

Group B

1. Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009,). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.

ZOOLOGY PRACTICAL- MJ 2 LAB:

ECOLOGY AND BIOCHEMISTRY

PRACTICALS: **60 Lectures**

GROUP A

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided'
2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community.
3. Study of an aquatic ecosystem: phytoplankton and zooplankton; Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Biological Oxygen Demand, Chemical Oxygen Demand and free CO2.
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

GROUP B

1. Quantitative test of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

SEMESTER III

Semester	Course Structure For Semester-III Common, Introductory, Major, Minor, Vocational & Internship Course						
	Code	**Paper**	**Credits**	**Theory**	**Internal Assessment**	**Practical**	**Total**
III	2Y4EVSCC-7	Environmental Studies/EVS	3	50	25	25	100
	2Y4CC-8	Digital Education (Elementary Computer Applications)	3	50	25	25	100
	2Y4CC-9	Community Engagement & Service (NSS/NCC/Adult education)	3	50	25	25	100
	3Y4ZOOIRC-3	Introductory Regular Course-3 **Introductory Zoology**	3	50	25	25	100
	3Y4ZOOIAP	Internship/Apprenticeship/Project	4	50	25	25	100
	3Y4ZOOMJ-3	Major paper-3 (Disciplinary/Interdisciplinary Major) **Cell Biology and Biostatistics**	6	50	25	25	100

SEMESTER III

Environmental Studies (Course Code: 3Y4CC7)

(Credits: Theory-2 credit + Field Work-1 credit = 3credits)

Course Objectives:

The course will seek to achieve the following objectives:

1. Generating the awareness about environmental problems among people and society.
2. To clarify modern environmental concept like how to conserve biodiversity.
3. Inculcating basic knowledge about the environment and its allied problems.
4. Developing an attitude of concern for the environment.
5. Motivating public to participate in environment protection and environment improvement.
6. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
7. Striving to attain harmony with Nature.

Course Learning Outcomes:

At the end of the course students will be able to:

1. Know the more sustainable way of living.
2. Use natural resources more efficiently.
3. Know the behaviour of organism under natural conditions.
4. Know the interrelationship between organisms in populations and communities.
5. Aware and educate people regarding environmental issues and problems at local, national and international levels.

Unit 1: Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

(2 lectures)

Unit 2: Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **(8 lectures)**

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts conflicts over water (international & inter-state).
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

(10 lectures)

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

(10 lectures)

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

(9 lectures)

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

(10 lectures)

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.

- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi).

(6 lectures)

Environment Studies Field Work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, spring, etc.

(Equal to 10 lectures)

References:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California
3. Press.
4. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
5. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
6. Room, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology.
7. Sunderland: Sinauer Associates, 2006.
8. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-
9. 37.
10. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
11. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
12. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
13. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
14.]Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
15. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
16. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.
17. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.

18. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
19. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
20. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
21. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
22. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
23. World Commission on Environment and Development. 1987. Our Common Future. Oxford University

SEMESTER III

Digital Education (Elementary Computer Application)

Course code: 3Y4DECC8

Credits: 03

Course Objectives:

This course is specially designed for better understanding of digital education in India. The course has been designed to introduce key concepts in digital education to the students to sharpen their understanding of importance and significance of digital education in India. The students need to develop a critical thinking about the development of India in the background of expanding digital networks and our constant dependence on them in our day-to-day life.

Learning Outcome:

- Students will understand the meaning of digital education and its importance.
- They will be able to focus on different digital platform, its utility and its applications.
- The students will be exposed to different tools of digital education available in India.
- They will understand the importance of E-Learning in the changing context of Digital India.
- They will come to know about their responsibility as citizen in digital growth in India.

UNIT I: Introduction to Digital Education 5 Classes

Meaning & Evolution of Digital Systems. Role & Significance of Digital Technology, digital education vs traditional education, advantages and disadvantages of digital education.

UNIT II: Digital Education Tools (10 Classes+ 5 Hands on Sessions)

Information & Communication Technology & Tools Interactive tools- Microsoft Teams, Google Classroom, Linkedin Creative Tools - Google Slides, Google Spreadsheets, Google form, Youtube)

UNIT III: Digital Education in India (10 Classes + 5 Hands on Sessions)

Government initiatives for Digital education in India: SWAYAM, E-Pathshala, National digital library of India (NDL India), DigiLocker. Advantages & challenges in digital education in India.

UNIT IV: E- Governance 10 Classes)

Introduction of E-Governance in India, Types of E-Governance-G2C (Government to Citizen), G2E (Government to Employee), G2B (Government to Business), G2G (Government to Government), E – Governance in Jharkhand.

Suggested Readings:

1. E-Governance in India: Initiatives and issues by R.P.Sinha
2. Information & Communication Technology (ICT) in Education by Dr. Vanaja M,Dr. S Rajasekar, Dr. S. Arulsamy.
3. Digital India: Understanding Information, Communication and Social Change by Pradip N.

References:

1. www.slideshare.net
2. www.lisportal.com/en/lis-blog

SEMESTER III

COMMUNITY ENGAGEMENT NCC/NSS

Course code (1Y4CC6)

Total Marks: 100

Course Objectives

Understand the community in which they work and their relation, Identify the needs and problems of the community and involve them in problem-solving, develop capacity to meet emergencies and natural disasters, Practice national integration and social harmony and, Utilize their knowledge in finding practical solutions to individual and community problems.

Course Outcomes

- To impart hands-on skills in preparation, In the end of the paper, a student should be able to: - Understand the importance of having community problems and their solutions. It might help in job opportunities in some government approved NGOs, and ministry of youth affairs and sports. The students can carry out basic information about the community, which in turn will be of great help in disaster management fields. Students can also go for social community courses, opening opportunities in different social activity related departments.

Unit-I: NSS:

- Introduction, Origin and growth of NSS, Objectives, Motto, Symbol, NSS, Import National Days, NSS Song, Environmental Awareness : Natural Resources – Conservation and Management, Water conservation and Rain water harvesting, Solid waste management, Pollution control: Water, Air, Noise and Soil; Energy conservation- Wildlife Conservation, Global warming.

Unit-II: Special Programme:

- Legal Awareness – Health awareness –Blood Donation Camp, First –Aid –Career Guidance – Leadership. Training cum –Cultural Programme –Globalization ant its Economic Social and Cultural Impacts. Planning and Preparation of special Camping Programme. Planning at institutions level – Guidelines for the success of camp- Importance of successful camping programme – Guiding principles – organization of camp – Administration of camp.

Unit-III: Social Awareness:

- Basics and Social Service, Weaker Section of our society and their needs – NGOs : Role and Contribution –Civic responsibility – causes and Prevention; role of y uth – Drug Abuse and Trafficking –awareness of IV / AIDS.. National Integration : Impo tance and Necessity – Freedom Struggle and Nationalistic movement in India – National interests, Objectives, Threats and Opportunities – Unity in Diversity – Contribution of Youth in Nation Building.

Unit-IV: First Aid:

- Artificial Respiration – Control of Bleeding – Fractures – Burns – Shock – Wounds – Eye Injures – Heat Stroke – Snake Bite – Dog Bites – Poisoning., Disaster Management : Characteristics and types of Disasters (Geological and Mountain Area Disaster , Wind and Water Related natural Disaster, Man-made Disaster) , Causes and effects, Assistance during Natural / Other Calamities Flood / Cyclone / Earth Quake / Accident etc..

Unit-V: N.S.S. Regular Activities

- NSS Programme Officer – NSS Volunteer – Community – Aims of NSS Programme /Activities – Classification of NSS Programme – Adoption of Villages – Contacting Villages / Area Leaders – Survey of the Villages / Area Identification of Problem(s) Completion of Projects – Evaluation of Project – Adoption of Slums – Survey of the Slum – Services in Slums - Coordination with Voluntary – Organizations.

REFERENCES:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009.
3. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
4. Rashtriya Seva YojanaSankalpana- Prof. Dr. SankayChakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
6. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
7. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
8. Case material as a Training Aid for Field Workers, Gurmeet Hans.
9. Social service opportunities in hospita's, Kapil K. Krishnan, TISS
10. New Trends in NSS, Research papers published by University of Pune.
11. ANOOGUNJ Research Journal, published by NSS Unit C. K. Thakur college
12. Training Manual for Field Work published by RGNIYD, Shreeperumbudur
13. Prof. Ghatole R.N. Rural Social Science and Community Development.
14. PurushottamSheth, Dr. Shailaja Mane, National Service Scheme

Related Online Contents:

1. https://en.wikipedia.org/w/index.php?search=National-service-scheme &title=Special%3ASearch&fulltext=1&ns0=1
2. https://nss.gov.in
3. https://twitter.com/nssybnuranchi1
4. https://twitter.com/nssybnuranchi2
5. https://www.facebook.com/profile.php?id=100083943787477

SEMESTER III

INTRODUCTORY REGULAR COURSE (IRC)

INTRODUCTORY ZOOLOGY(1Y4ZOOIRC-3)

(Credits: Theory-02, Practicals-01) **Total Marks: 100**

Course Outcomes:

6. A general concept of the animal world
7. Awareness of students regarding biological mechanism of various processes, functions as well evolutionary significance could be learnt
8. Students will acquire knowledge about the cell in detail along with the different organelles
9. Will understand their own body processes
10. Will get an idea about origin of life and evolution.

UNIT I: General Introduction to Animal World, Need of Classification, General idea of Classification and Taxonomy, Cell theory.

UNIT II: Cell- Structure, Cell theory. Difference between Prokaryotic and Eukaryotic cells an overview of various cell organelles, including detailed structure of Mitochondria, Golgi body, Endoplasmic Reticulum, Nucleus, Ribosome, and their significant feature. (Any three)

UNIT III: A general introduction to human physiology.

UNIT IV: Basic structure of DNA and RNA,

UNIT V: Mendel's law of Inheritance and variation.

UNIT VI: Evolution: Lamarck's Inheritance theory, Darwin's natural selection theory mutation theory.

UNIT VII: General concept of Ecology, Ecosystem and its various components.

ZOOLOGY PRACTICAL- IRC LAB:

PRACTICALS:

5. Study of Permanent slides.
6. Amoeba, Paramecium, Sycon, Ascaris, Starfish, wall lizard, frog, Columba Bat, Kidney (T.S Mammal) liver, Pancreas, Ovary, Testis.
7. Homologous and Analogous organs.
8. Project on Food chain

Suggested Books

8. Animal Diversity (Biology of Invertebrates) -Pechnik
9. Cell Biology: De Robersies
10. Cell Biology: Ambrose
11. Cell Biology: C.B. Powar
12. Physiology: Gyton
13. Evolution: V.B. Rastogi
14. Ecology: M.C. Dash, P.D. Sharma

SEMESTER III

MAJOR COURSE CELL BIOLOGY AND BIOSTATISTICS

COURSE CODE: (3Y4ZOOMJ3)

(Credits: Theory-04, Practicals-02)

Learning outcomes

After successfully completing this course, the students will be able to

1. Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
2. Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
3. Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.
4. Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.
5. Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor.
6. Know basic concepts of probability and statistics
7. Understand data mining tool and its practical application in a case study 8. Apply the knowledge in future course of their career development in higher education and research

GROUP A

UNIT I: A general concept of prokaryotic and eukaryotic cells

Cell theory, General structure of different cell organelles including Mitochondria, Golgi complex,

(03 Lecture)

UNIT II: Endoplasmic reticulum, Nucleus. Ribosome, Lysosome **(05 Lecture)**

UNIT III: Cytoskeleton-Composition and function. Microtubules and microfilaments GERL system

(03 Lecture)

UNIT IV: Cell membrane structure: Chemical composition of Plasma membrane of Erythrocyte, Active and Passive transport, (Diffusion and osmosis) ATPase Pump and Exchange. **(10 Lecture)**

UNIT V: Cell Adhesion molecules and ECM **(05 Lecture)**

UNIT VI: Cell cycle, cell signaling, and cell culture: **(15 Lecture)**

1. A brief introduction to cell cycle, its various phases
2. Mitosis and Meiosis, Cell division, Check points and its regulation.
3. Apoptosis and Cancer
4. Cell signaling, Regulation of signaling pathways. (GPCR and RTR)
5. Cell communication

UNIT VII: Types of culture media: Sterilization methods

Somatic cell hybridization. **(08 Lecture)**

GROUP B:

Biostatistics **(10 Lecture)**

1. Types of data: Primary and secondary data
2. Mean, Median, Mode, Standard Deviation, Standard error, Chi square test, t-test, f-test, ANOVA, Correlation, Regression Analysis.
3. Basics of statistics software – SPSS and R

Reference Books:

GROUP-A

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition.
2. John Wiley and Sons. Inc.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition.
5. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
6. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the
7. Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
8. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London

GROUP B

1. W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley.
2. Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and Health
3. Sciences (2nd edition) McGraw Hill. 4. Zar, J.H. (2013) Biostatistical Analysis (5th edition) Pearson.

ZOOLOGY PRACTICAL- MJ 3 LAB:

PRACTICALS:

GROUP A

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. Study various stages of meiosis from permanent slides.
3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
    a) DNA by Feulgen reaction
    b) DNA and RNA by MGP
    c) Mucopolysaccharides by PAS reaction
    d) Proteins by Mercurobromophenol blue/Fast Green.

GROUP B

1. Calculation of mean, standard deviation and standard error.
2. Calculation of correlation coefficient values and finding out the probability
3. Student's t – test dependent and independent, hand calculation and calculation using MS-Excel.
4. ANOVA - hand calculation and calculation using MS-Excel. 5. Suggested Readings:

SEMESTER IV

Semester	Course Structure For Semester-IV Common, Introductory, Major, Minor, Vocational & Internship Course						
	Code	**Paper**	**Credits**	**Theory**	**Internal Assessment**	**Practical**	**Total**
IV	4Y4ZOOMJ-4	Major paper-4 (Disciplinary/Interdisciplinary Major) **Animal Physiology**	6	50	25	25	100
	4Y4ZOOMJ-5	Major paper-5 (Disciplinary/Interdisciplinary Major) **Comparative Anatomy**	6	50	25	25	100
	4Y4ZOOMN-1	Minor paper-1 (Disciplinary/Interdisciplinary Minor) **Animal Diversity**	6	50	25	25	100
	4Y4VS-1	Vocational Studies-1 (Minor) **Introduction to Stock Market**	4	50	25	25	100

SEMESTER IV

MAJOR COURSE- MJ 4: ANIMAL PHYSIOLOGY

COURSE CODE: (4Y4ZOOMJ4)

(Credits: Theory-04, Practicals-02)

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of the evolution of various organ systems which work in coordination.
2. Have a detailed discussion of major organ systems.
3. Understand how cells, tissues, and organs function at different levels.
4. Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc.
5. Get a flavor of research besides improving their writing skills and making them well versed with the current trends.
6. Undertake research in any aspect of animal physiology in future.

UNIT I: Tissue **(06 Lecture)**

Structure and classification, Bone and Cartilage

UNIT II: Digestive System **(06 Lecture)**

Gastrointestinal tract and its associated glands, Mechanical and Chemical digestion of food, Absorption of Carbohydrate, Protein and Lipid

UNIT III: Respiratory System **(06 Lecture)**

Histology of trachea and Lungs, Respiratory volumes, Respiratory Pigments, Diffusion of respiratory gases and Transport of O2 and CO2

UNIT IV: Circulatory System **(06 Lecture)**

Structure and Working of Mammalian Heart Blood groups, Rh factor Blood and its components, Blood clotting Mechanism Cardiac cycle

UNIT V: Skeletal system **(06 Lecture)**

Ultra-structure of Skeletal Muscle, chemical basis of muscle contraction.

UNIT VI: Excretory System **(06 Lecture)**

Kidney: structure and function, Mechanism of urine formation, Counter- Current theory, Ornithine-Arginine cycle

UNIT VII: Reproductive System **(08 Lecture)**

Histology of male and female reproductive organs, physiology of reproduction in male and female, Accessory Reproductive organs, Methods of Contraception, Reproductive Hormone.

UNIT VIII: Endocrine system: **(08 Lecture)**

Basics of Endocrine glands (Pituitary, Pineal, Thyroid, Pancreas Adrenal, Thymus, and Gonads). Classification of hormone Mode of hormone action. (TSH/Adrenaline)

UNIT IX: Nervous System **(08 Lecture)**

Ultrastructure of Neuron, Physiology of nerve conduction, Reflex Action,

Reference Books:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons.
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.
5. DeFiore Atlas of Human histology. Physiology Vandor

ZOOLOGY PRACTICAL- MJ 4 LAB:

PRACTICALS:

1. Recording of simple muscle twitch with electrical stimulation (or virtual).
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells.
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.
5. Microtome: Preparation of permanent slide of mammalian tissues.

SEMESTER IV

MAJOR COURSE- MJ 5: COMPARATIVE ANATOMY

COURSE CODE: (4Y4ZOOMJ5)

(Credits: Theory-04, Practicals-02)

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.
2. Have an overview of the evolutionary concepts including homology and homoplasy, and detailed discussions of major organ systems.
3. Understand how cells, tissues, and organisms function at different levels. The course content also provides the basis of understanding their abnormal function in animal and human diseases and new methods for treating those diseases.
4. Get a flavor of research besides improving their writing skills and making them well versed with the current trends. It will further enable the students to think and interpret individually due to different aspects chosen.

UNIT I: Integumentary System **(06 Lecture)**

Structure Function and Derivatives of integument

UNIT II: Skeletal System **(07 Lecture)**

An Overview of Axial and Appendicular Skeleton, Jaw suspensorium

UNIT III: Digestive System **(07 Lecture)**

Alimentary Canal and associated gland, Dentition

UNIT IV: Respiratory System **(08 Lecture)**

Skin, Gills, Lungs, Air Sacs and accessory respiratory organs

UNIT V: Circulatory System **(08 Lecture)**

Evolution of Heart and Aortic arches, General plan of Circulation

UNIT VI: Urinogenital System **(08 Lecture)**

Succession of Kidney, Evolution of Urinogenital duct

UNIT VII: Nervous system **(08 Lecture)**

Comparative account of brain, Autonomic Nervous System, Spinal Cord, Cranial Nerves in Mammals

UNIT VIII: Sense Organs **(08 Lecture)**

Brief account of Visual and Auditory receptors

Reference Books:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.

2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills
4. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
5. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

ZOOLOGY PRACTICAL- MJ 5 LAB:

PRACTICALS:

1. Study of placoid, cycloid and ctenoid scales through permanent slides/ photographs.
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit.
3. Carapace and plastron of turtle/ tortoise.
4. Mammalian skulls: One herbivorous and one carnivorous animal.
5. Dissection of rat to study arterial and urinogenital system (subject to permission digital mode)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video
7. Recording (may be included if dissection not permitted).
8. Project on skeletal modifications in vertebrates (may be included if dissection not permitted).

SEMESTER IV

MINOR ELECTIVE-1 ANIMAL DIVERSITY

COURSE CODE: 4Y4BOTMN1

(Credits: Theory-04, Practicals-02)

Course Learning Outcomes:

1. Develop understanding on the diversity of life with regard to protista, non-chordates and chordates
2. Grouping of animals on the basis of their morphological characters.
3. will be able to examine evolutionary history of a taxon

UNIT I: Kingdom Protista **(03 Lecture)**

General characters and classification up to classes; Locomotary Organelles and locomotion in Protozoa

UNIT II: Phylum Porifera **(03 Lecture)**

General characters and classification up to classes; Canal System in Sycon 3

UNIT III: Phylum Cnidaria **(03 Lecture)**

General characters and classification up to classes; Polymorphism in Hydrozoa

UNIT IV: Phylum Platyhelminthes **(03 Lecture)**

General characters and classification up to classes; Life history of Taeniasolium

UNIT V: Phylum Nemathelminthes **(03 Lecture)**

General characters and classification up to classes; Life history of Ascarislumbricoides and its parasitic adaptations

UNIT VI: Phylum Annelida **(03 Lecture)**

General characters and classification up to classes; Metamerism in Annelida

UNIT VII: Phylum Arthropoda **(03 Lecture)**

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

UNIT VIII: Phylum Mollusca **(02 Lecture)**

General characters and classification up to classes; Torsion in gastropods

UNIT IX: Phylum Echinodermata **(03 Lecture)**

General characters and classification up to classes; Water-vascular system in Asteroidea

UNIT X: Protochordates **(04 Lecture)**

General features and Phylogeny of Protochordata

UNIT XI: Agnatha **(04 Lecture)**

General features of Agnatha and classification of cyclostomes up to classes

UNIT XII: Pisces **(04 Lecture)**

General features and Classification up to orders; Osmoregulation in Fishes

UNIT XIII: Amphibia **(04 Lecture)**

General features and Classification up to orders; Parental care

UNIT XIV: Reptiles **(04 Lecture)**

General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

UNIT XV: Aves **(05 Lecture)**

General features and Classification up to orders; Flight adaptations in birds

UNIT XVI: Mammals **(05 Lecture)**

Classification up to orders; Origin of mammals

Reference Books:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The
2. Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
4. Pough H. Vertebrate life, VIII Edition, Pearson International.
5. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
6. Pechnek, J.A.2000. Biology of Invertebrates. Tata McGraw-Hill Publishing Company, New

ZOOLOGY PRACTICAL- MN 1 LAB:

PRACTICALS:

Study of the following specimens:

1. Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taeniasolium, Male and female Ascarislumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis.
2. Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

Study of the following permanent slides:

1. T.S. and L.S. of Sycon
2. Study of life history stages of Taenia
3. T.S. of Male and female Ascaris 4. Key for Identification of poisonous and non-poisonous snakes

SEMESTER IV

INTRODUCTION TO STOCK MARKET – VS-1

Subject Code: 4Y4VS-1

(Credits: Theory-01 + Practical 02)

Course Content:

Unit I: Financial System and Services:

Nature and role of financial structure - Financial system and financial markets - Financial system and economic development -Indian financial system: an overview; Investment alternatives and evaluation; Reforms in financial system, Investment banking; Credit Rating; factoring and Forfaiting; Housing Finance; Leasing and hire purchase; Financial inclusion and Microfinance

Unit II: Financial Markets:

Money market- meaning, constituents & function; Money market instruments – call money, treasury bills, and certificate of deposits, Commercial bills, and trade bills, Acceptance Houses, Discount Houses; Capital markets – primary and secondary market; Government securities markets; Role of SEBI - an overview and recent developments. Role of RBI, SEBI. DFHI, SHCI in Financial Markets.

Unit III: Financial Institutions:

Reserve bank of India – organization, management, and function; Commercial banks - meaning, functions and investment policies; Development banks – concept, objectives, and function; Insurance companies – objectives, role, and investment practices, -IRDS; Unit Trust of India – objective, function, and schemes; role and functions of nonbanking financial institutions; Merchant banking-functions and role.

Unit IV: Financial Instruments

Sources of finance – Financial Instruments – Types, Features and advantages – Equity and special types of equity, ADRs & GDRs; Preferred stock - Equity derivatives – Credit derivatives-Asset –backed securities - Convertibles and warrants - Types of Bonds and debentures- Non- Marketable Financial Assets - Options instruments – securitization.

Unit V: Mutual Funds:

Concept and performance of Mutual funds; Regulation of Mutual funds (with special reference to SEBI guidelines); Designing and marketing of mutual fund schemes; Latest mutual funds schemes in India – an overview; Mutual Fund Evaluation and Tax aspects of Mutual Fund Investments.

Unit VI: Capital Markets in India

An overview of Indian Securities Market, Meaning, Functions, Intermediaries, Role of Primary Market – Methods of floatation of capital – Problems of New Issues Market – IPO's- Investor protection in primary market – Recent trends in primary market – SEBI measures for primary market.

Unit VII: Stock exchanges and its Functions:
Meaning, Nature, Functions of Secondary Market – Organization and Regulatory framework for stock exchanges in India – SEBI: functions and measures for secondary market – Overview of major stock exchanges in India - Listing of Securities: Meaning – Merits and Demerits – Listing requirements, procedure, fee – Listing of rights issue, bonus issue, further issue – Listing conditions of BSE and NSE – Delisting

Unit VIII: Trading, settlement and Surveillance
System in Stock Exchanges: Different trading systems – BSE - BOLT System – Different types of settlements - Pay-in and Pay-out – Bad Delivery – Short delivery – Auction – NSE – NEAT system options – Market types, Order types and books – De-mat settlement – Physical settlement – Institutional segment – Funds settlement – Valuation debit – Valuation price – Bad and short delivery Risk management system in BSE & NSE – Margins – Exposure limits – Surveillance system in BSE & NSE – Circuit breakers

Unit IX: Stock Market Indices:
Meaning, Purpose, and Construction in developing index – Methods (Weighted Aggregate Value method, Weighted Average of Price Relatives method, Free-Float method) – Stock market indices in India – BSE Sensex - Scrip selection criteria – Other BSE indices (briefly) – NSE indices – S&P CNX Nifty – Scrip selection criteria – Construction – Stock market indices in foreign countries (Overview).

Unit X: Commodity and Currency Markets:
Commodity exchanges: evolution and history- role in globalizing economy – governing regulations – price –risk management – commodity exposure – hedge accounting – currency futures – managing exchange rate – carbon markets – weather derivatives – ETFs – Purpose, Importance, types, construction

PRACTICALS: 60 Lectures

1. Visit to a local market to study various marketing functions performed by different agencies (market functionaries).
2. Identification of marketing channels for selected mutual fund.
3. Identification of marketing channels for selected Equity.
4. Identification of marketing channels for selected commodity.
5. Computation of marketable and marketed surplus of important commodities.
6. Construction of index numbers.
7. Collection of data regarding marketing cost and marketing margins of different commodities and presentation of report in the class.
8. Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning.
9. Application of principles of comparative advantage of international trade
10. Plotting and study of demand and supply curves and calculation of elasticity's.
11. Study of relationship between market arrivals and prices of some selected commodities.
12. Study of price behaviour over time for some selected commodities.