

**Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBAJINAGAR.**



CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technolgy, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajanagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBAJINAGAR- 431004 (M. S.), INDIA**



FACULTY OF SCIENCE AND TECHNOLOGY

B. Sc. Degree Programme

[3 Years/4 Years (Honors)/4 Years (Honors with Research)]

As Per

National Education Policy-2020

Revised

Course Structure and Curriculum

(As per NEP-2020)

Subject (Major): Zoology

For

**B. Sc. First Year
(Semester-I and II)**

Effective from Academic Year- 2024-25

Handwritten signature and date: 31/1/2024

PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.


INTRODUCTION TO UNDERGRADUATE DEGREE COURSE IN ZOOLOGY

As per the recommendations of the NEP-2020, the undergraduate degree course in Zoology is a six/ eight semester course spread over three/ four academic years. The teaching – Learning process is student-centric, and it involves both theory and practical components. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. Besides the Discipline Specific Core (DSC) courses, a student can opt courses from the syllabus comprising of Discipline Specific Electives (DSEs), Generic Electives (GEs), Skill Enhancement Courses (SECs), Ability Enhancement courses (AECs) and Value Addition Courses (VACs). Thereby, bringing out the multidisciplinary approach and adherence to innovative ways within the curriculum framework. Moreover, it allows a student maximum flexibility in pursuing his/her studies at the undergraduate level to the extent of having the liberty to eventually design the degree with multiple exit options depending upon the needs and aspirations of the student in terms of his/her goals of life, without compromising on the teaching learning, both in qualitative and quantitative terms. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Courses of Study:

Courses of the study indicate pursuance of study in a particular discipline. Every discipline shall offer four categories of courses of study, viz. Discipline Specific Core (DSC) courses, Discipline Specific Electives (DSEs), Skill Enhancement Courses (SECs) and Generic Electives (GEs). Besides these four courses, a student will select Ability Enhancement Courses (AECs) and Value-Added Courses (VACs) from the respective pool of courses offered by the University.

- a) **Discipline Specific Core (DSC):** Discipline Specific Core is a course of study, which should be pursued by a student as a mandatory requirement of his/ her programme of study. In Bachelor of Science (Hons.) Zoology programme, DSCs are the core credit courses of Zoology which will be appropriately graded and arranged across the semesters of study, being undertaken by the student, with multiple exit options as per NEP 2020.


31/12/24

- b) **Discipline Specific Elective (DSE):** The Discipline Specific Electives (DSEs) are a pool of credit courses of Zoology from which a student will choose to study based on his/ her interest.
- c) **Generic Elective (GE):** Generic Electives is a pool of courses offered by various disciplines of study (excluding the GEs offered by the parent discipline) which is meant to provide multidisciplinary or interdisciplinary education to students. In case a student opts for DSEs beyond his/ her discipline specific course(s) of study, such DSEs shall be treated as GEs for that student.
- d) **Ability Enhancement course (AEC), Skill Enhancement Course (SEC) and Value Addition Course (VAC):** These three courses are a pool of courses offered by all the Departments in groups of odd and even semesters from which a student can choose.
- i) **AEC:** AEC courses are the courses based upon the content that leads to knowledge enhancement through various areas of study. They are based on Language and Literature, and Environmental Science which are mandatory for all disciplines.
 - ii) **SEC:** SECs are skill-based courses in all disciplines and are aimed at providing hands-on training, competencies, proficiency and skills to students. SEC courses may be chosen from a pool of courses designed to provide skill-based instruction.
 - iii) **VAC:** VACs are common pool of courses offered by different disciplines and aimed towards personality building, embedding ethical, cultural and constitutional values; promote critical thinking, Indian knowledge systems, scientific temperament, communication skills, creative writing, presentation skills, sports and physical education and teamwork which will help in all round development of students.

**Structure of B. Sc. (Three/Four Years Honours/Honours with Research Degree)
Programme with Multiple Entry and Exit Options**

B. Sc. First Year: 1st Semester

Subject (Major): Zoology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory: Zoology	DSC-1	Animal Diversity I (Non Chordates)	2	---	2	---	2+2=4
	DSC-2	Practicals Based on DSC-1	---	4	---	2	
Major (Core) M2 Mandatory:	DSC-1	----	2	---	2	---	2+2=4
	DSC-2	Practicals Based on DSC-1	---	4	---	2	
Major (Core) M3 Mandatory:	DSC-1	----	2	---	2	---	2+2=4
	DSC-2	Practicals Based on DSC-1	---	4	---	2	
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen from the faculty other than that of Major	GE/OE - 1	To be chosen from other faculty	2	---	2	---	2
SEC (Skill Enhancement Course) (Choose any one from SEC- 1 and accordingly Choose relevant practical paper from SEC - 2)	SEC-1	1) Bee keeping 2) Animal Microtechnique	1	---	1	---	2
	SEC-2	1) Practical Based on SEC – 1 (Bee keeping) 2) Practical Based on SEC – 1 (Animal Microtechnique)	---	2	---	1	
AEC, VEC, IKS	AEC-1	English (Common for all faculty)	2	---	2	---	2+2=4
	IKS-1	Choose any one from pool of Courses	2	---	2	---	
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness (Common for all faculty)	---	4	---	2	2
			13	18	13	09	22

GE/OE-1: Vector disease and Management (This course will be available for the students from other faculty)

**Structure of B. Sc. (Three/Four Years Honours/Honours with Research Degree)
Programme with Multiple Entry and Exit Options**

B. Sc. First Year: 2nd Semester

Subject (Major): Zoology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory: Zoology	DSC- 3	Animal Diversity-II (Chordata)	2	---	2	---	2+2=4
	DSC- 4	Practicals Based on DSC-3	---	4	---	2	
Major (Core) M2 Mandatory:	DSC- 3	---	2	---	2	---	2+2=4
	DSC- 4	Practicals Based on DSC-3	---	4	---	2	
Major (Core) M3 Mandatory:	DSC- 3	---	2	---	2	---	2+2=4
	DSC- 4	Practicals Based on DSC-3	---	4	---	2	
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen from the faculty other than that of Major	GE/OE - 2	To be Chosen from other faculty	2	---	2	---	2
VSC (Vocational Skill Courses) (Choose any one from VSC - 1 and accordingly choose relevant practical paper from VSC - 2)	VSC- 1	1) Poultry Farming 2) Aquarium Fish Keeping	1	---	1	---	2
	VSC- 2	1) Practical Based on VSC – 1 (Poultry Farming) 2) Practical Based on VSC – 1 (Aquarium Fish Keeping)	---	2	---	1	
AEC, VEC, IKS	AEC- 2	English (Common for all faculty)	2	---	2	---	2+2=4
	VEC- 1	Constitution of India (Common for all the faculty)	2	---	2	---	
OJT/ FP/CEP/CC/RP	CC- 2	Yoga Education / Sports and Fitness (Common for all the faculty)	---	4	---	2	2
			13	18	13	09	22
Exit Option: Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course/ Internship OR continue with Major and Minor							

GE/OE-2: Dairy Production Technology (This course will be available for the students from other faculty)

Students will have to choose any three subjects as **Major 1, Major 2, Major 3**, from Basket 1 under the **Faculty of Science and Technology**.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of one subject as a **major subject** in the beginning of second year **out of three major options M1, M2 and M3 (which were opted in the first year)**.

Detailed Illustration of Courses included in 1st and 2nd semester:

- 1) **Major (Core)** subject are mandatory.

DSC-1: This is a 2 credit theory course corresponding to Major (core) subject

DSC-2: This is a 2 credit practical course based on DSC-1

DSC-3: This is a 2 credit theory course corresponding to Major (core) subject

DSC-4: This is a 2 credit practical course based on DSC-3

- 2) **Generic / Open Elective (GE/OE):** (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

GE/OE -1: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

GE/OE -2: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

- 3) **SEC (Skill Enhancement Courses):** Choose any one from pool of courses. These courses need to be designed to enhance the technical skills of the students in specific area.

SEC-1: This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SEC-2: This is a 1 credit practical course based on SEC-1.

- 4) **VSC (Vocational Skill Courses) :** Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

VSC-1: This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

VSC-2: This is a 1 credit practical course based on VSC-1.

- 5) **AEC (Ability Enhancement courses):** The focus of these courses should be based on linguistic and communication skills. In first semester it will be English and will be common for all the faculty.

AEC-1: English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2: English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

- 6) **IKS (Indian Knowledge System):** The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.

IKS-1: To be chosen from the pool of courses designed by the University

This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty.

- 7) **VEC (Value Education Courses):** The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1: Constitution of India

This is a 2 credit theory course based on value education. It will be common for all the faculty.

- 8) **CC (Curricular Courses):** The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Performing Arts.

CC-1: Health and Wellness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty.

CC-2: Yoga education / Sports and Fitness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty.

General Guidelines for Course Selection

- 1) The Major subject is the discipline or course of main focus, bachelor's degree shall be awarded in that discipline / subject.
- 2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from **Basket 1** under the Faculty of Science and Technology.
- 3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
- 4) In the beginning of second year, students will have to select / declare choice of **one major subject and one minor subject** from three major options **M1, M2 and M3 (which were opted in the first year)**.
- 5) Once the students finalize their **Major Subject and Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
- 6) Students are required to select **Minor subject from other discipline of the same faculty**.
- 7) Students are required to select **Generic /Open Elective** (vertical 3 in the credit framework) **compulsorily from the faculty different than that of their Major / Minor subjects**.
- 8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject.
- 9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

Programme Educational Objectives (PEOs):

Programme Educational Objectives (PEOs) for the Bachelor of Science Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge:** Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.
2. **Interdisciplinary Proficiency:** Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.
3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.
4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.
5. **Global Citizenship and Cultural Sensitivity:** Graduates will possess a global perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1. The citizenship and society:** Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.
- **PO2. Environment and sustainability:** Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.
- **PO3. Ethics:** Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.
- **PO4. Individual and teamwork:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.
- **PO5. Communication:** Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO6. Project management and finance:** Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.
- **PO7. Life-long learning:** Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

On completion of the 03/ 04 years Degree in **B.Sc. (Zoology)** students will be able to:

PSO1: Domain knowledge: This programme will demonstrate and apply the deep knowledge of fundamental and advanced areas of subject zoology that will provide both classical and modern concepts of zoology in higher education.

PSO2: Problem Analysis: Identify the problems related to subject at varied complexity and develop strong, critical thinking and abilities for substantiated solution and conclusion effectively.

PSO3: Design Development of solutions: Graduates will possess the capability to create and execute research ideas. They will have both fundamental and scientific approach towards Zoology.

PSO4: Conduct Investigation of complex problems: Graduates will be established knowledge and methods to design experiments, analyze resulting data and interpret the same to provide valid conclusions. Importance is given to practical learning and presentation skill of students. The lab courses and skill provide students to their employability.

PSO5: Modern Tools and techniques: Graduate will create appropriate techniques and cultivate skills in life science for agricultural, animal husbandry and relevant to human studies more emphasis is given to branches like biochemistry, economic zoology, behavioral biology, evolutionary biology, molecular biology, genetic engineering, bioinformatics etc.

PSO6: Communication Skills: Graduates will effectively communicate scientific ideas, methodologies, and results through written reports, oral presentations, and scientific publications, facilitating collaboration and dissemination of knowledge within the scientific community.

PSO6: Research related skill: Ability to pursue advanced studies and research in zoology and provide opportunity for the mobility of the student both within and across the world.

SEMESTER – I

DSC-1: Animal Diversity-I (Non-Chordata)

Total Contact Hours: 30

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To understand the basic concepts in zoology.
- ii To learn the general characters and classification of non chordates.
- iii To understand the diversity and complexity of life from Protista to Echinodermata.

Course Outcomes (COs): After completion of the course, students will be able to -

- i Understand general organization of unicellular and multicellular animals.
- ii Recognize diversity and adaptation of invertebrate animals and significance.
- iii Acquire deep knowledge and importance of biodiversity conservation.
- iv Develop the capacity to investigate pathogenicity of micro and macro fauna.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Introduction to animal kingdom: Definition of Zoology, Outline classification, Protozoa, Parazoa, Metazoa and Major Phyla. Protozoa and Porifera: General characters and outline classification up to class with examples. Locomotion in Amoeba and Euglena, Reproduction in Paramecium. Canal system in Porifera	10 Hrs.
II	Coelenterata, Helminths & Annelida: General characters and outline classification up to classes with examples. Polymorphism in Coelenterates, Taenia solium, Fasciola and Ascaris: Morphology Earthworm: Nephridia: Structure and Function, Metamerism in Annelids	10 Hrs.
III	Arthropoda, Mollusca, Echinodermata and Hemichordata: General characters and outline classification up to classes with examples. Crustacean parasites, Mouth parts of insects. Torsion in gastropods, pearl formation Water vascular system in sea star, Larval forms in Echinodermata	10 Hrs.

Learning Resources:

- 1) Anderson, D.T.(Ed.) (2001). Invertebrate Zoology. 2nded. Oxford University
- 2) Ayur, E.K., And T.N. Ananthkrishnan, Manual of Zoology Vol. I, Invertebrate, Part I and II S.Viswanathan (Printers and Publishers) Pvt. Ltd. Madras.
- 3) Barrington, E. J. W. (1981). Invertebrate Structure and function. 2nd Ed. ELBS & Nelson.
Black welder, R.E., (1967). Taxonomy- A Text and reference book. John Wiley & Sons.
- 4) Brusca, R. C. & Brusca, G. J. (2002). Invertebrates. 4th Ed. Sinauer Associates...Dhami. S and J.K. Dhami – Invertebrate Zoology–S. Chand and Co.
- 5) Chaki, Kundu, Sarkar Introduction to General Zoology. Vol 1. New Central Book Agency (P) LTD.
- 6) E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.
- 7) Hickman, C.P.Jr, F.M. Hickuman and L. S. Roberts, 1984.Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065pp.Hyman, L. H. (1951). The Invertebrates (Vol-I). Mcgraw Hill Book Company.
- 8) Jordan, E.L. & Verma,P. S.(2006).Invertebrate Zoology. S. Chand & Company Ltd. New Delhi.
- 9) Kapoor,V.C.(2008).Theory and practice of animal taxonomy. 6th Ed. Oxford & IBH Pub
- 10) Kotpal, R.L., 1988 –1992. (All Series) Protozoa, Porifera, Coelentereta, Annelida, Arthropoda, Mollusca, Echinodermata, – Rastogi Publications, Meerut – 250002.
- 11) Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.
- 12) Mayr, E. & Ashlock, P.D. (1991). Principles of Systematic Zoology.2nd Ed., mcgraw-Hill. Meglitsch,P. A. & Schram, F.R. (1991). Invertebrate Zoology. Oxford University Press.
- 13) Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors. New Delhi.
- 14) Parker, T.J. & Haswell, W. (1972). Text Book of Zoology, Volume I. Macmillan Press, London.
- 15) Pechenik, J.A. (1998). Biology of the Invertebrates,4th Ed.mcgraw Hill. Rupperte.E., Fox, R. & Barnes R.D. (2003). Invertebrate Zoology: A Functional Evolutionary Approach. 7th Ed. Brooks Cole.
- 16) Press.Barnes, R.D. & Ruppert, E.E., (1994). Invertebrate Zoology.6th Ed.brookscole.
- 17) Sinha, K.S., Adhikari,S. & Ganguly, B.B. Biology of Animals. Vol. I. New Central Book Agency. Kolkata.

Classification to be followed from Barnes and Ruppert 1994, 6thEdition

**DSC-2: Practicals Based on DSC-1
Animal Diversity-I (Non-Chordata)**

Total Contact Hours: 60

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To familiarize students with identification and the study of museum specimens.
- ii To enable students to study mounting and anatomy of invertebrate species.
- iii To prepare students for taxonomical work and research in the areas of biodiversity.

Course Outcomes (COs): After completion of the course, students will be able to –

- i Understand systemic position, habit and habitat of invertebrate animals.
- ii Understand the pathogenicity and life cycle of parasite and vectors.
- iii Develop skills to recognize surrounding animals and their importance.

Expt. No.	Name of Experiments
01	Study of slides from Ciliates, Opalinates, and Flagellates. (Any Five)
02	Study of museum specimen and slides from Porifera to Hemichordata (Minimum two from each phyla)
03	Study of the following specimens to bring out and their adaptations to their respective modes of life. (Any five) Entamoeba, Trypanosoma, Leishmania, Sycon, Taenia solium, Ancylostoma duodenale, Enterobius Vermicularis, Ascaris, Wuchereria bancrofti, chaetopterus, Leech, Limulus, Any two Crustacean Larvae, Starfish, Balanoglossus.
04	Study of the following specimens to bring out their biological significance: (Any five) Obelia, Corals, physalia, porpita, vellela, Trochophore Larva, Peripatus, Sacculina On Crab, Sea Anemone on Hermit Crab, Pearl Oyster, Bipinnaria Larva,
05	Mounting of any five of the following. Sponge spicules, Gemmule, Obelia colony, Jaws of Leech. Spermatoca, testes nerve ring of Earthworm, Parapodia of Nereis. Prawn appendages, Mouthparts of insects (Cockroach, Mosquito, House fly, Bed bug and Honeybee). Redula of Pila, Pedicellaria of Star fish.
06	Dissections: (Experimental or Demonstration) E/D Earthworm - Digestive, Reproductive and Nervous System. Prawn - Nervous system Cockroach – Digestive, Reproductive and Nervous Systems
07	Arrange field visit to study the animal biodiversity and complete study report.

Learning Resources:

1. E.L. JORDEN & P.S. VERMA, Invertebrate Zoology, S. Chand & Co. Ltd. New Delhi.
2. Kotpal, R.L. Modern Text Book of Zoology Invertebrates, Rastogi Publication, Meerut.
3. Parker, T.J. & Haswell, W. (1972). Text Book of Zoology, Volume I. Macmillan Press, London.
4. S. S. Lal: Invertebrate Practical book.

SEC-1: Bee Keeping

Total Contact Hours: 15

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i To inculcate importance of Bee keeping and honey processes in relation with entrepreneurship development.
- ii To give students knowledge about various techniques of Bee keeping and honey processing and its marketing to make them self-sustainable after graduation.
- iii To teach techniques of construction of Bee Hives and its maintenance.
- iv To teach students about Honey production and health related problems with Honey bees. Importance of honey
- v Students will learn important steps in bee keeping and bee hive handling without fear.
- vi Students will learn the use of different equipments in bee keeping.

Course Outcomes (COs): After completion of the course, students will be able to -

- i The learner will able to differentiate in different types of honey bee castes.
- ii Learner will be able to use the artificial hive for beekeeping
- iii Learner will be able to use the technique of honey purification and processing.
- iv Learner will be able to construct the artificial honey hive and maintain it.
- v Learner if is not employed can find own employment by doing Bee keeping
- vi Lerner can start own beekeeping equipment agency for farmers or beekeepers.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Scope and history of Apiculture - systematic position of honeybee, Species of Honey bees, Biology and life history of Honey bee.	05 Hrs
II	Bee colony – social organization, bee communication, swarming, pheromone. Bee hive – structure and types of bee hives, Newtons beehives. Instruments used in Apiary. Site selection of apiculture, flora of apiculture – nectar, non nectar and pollen plants, modern method of apiculture, Care and management of apiary.	05 Hrs
III	Nector - honey composition and its formation. Medicinal and commercial values of honey. Bee wax and its uses, Diseases of honey bees and their control measures. Enemies of honey bee. Economic Importance of Apiary products, Bee Keeping Industry status in India, Recent Efforts, Apiculture as self – employment venture.	05 Hrs

Learning Resources:

1. Abrol,D.P.(1997) Bees and Beekeeping.Kalyani Publisher, New Delh.
2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4. Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Cherian R, & K.R. Ramanathan, 1992 – Bee keeping in India,
7. Mishra, R.C., 1985 – Honey bees and their Management in India, ICAR.
8. Singh, S.1982-Bee keeping – ICAR 4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Chandigarh
9. Rare, S. 1998-Introduction. to bee keeping, Vikas publishing house.

SEC-1: (Animal Microtechnique)

Total Contact Hours: 15

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i To prepare the slides as whole mounts of microscopic fauna.
- ii To adapt preservation of animal tissues for sectioning and histological study
- iii To learn hydration, dehydration and use of clearing agent for mount the slides.
- iv To develop skill of microtechnique in medical purpose.

Course Outcomes (COs): After completion of the course, students will be able to –

- i Understand the selection of nuclear and cytoplasmic stains.
- ii Understand the proper histological structure of animal tissue.
- iii Understand the different types of cell and learned physiological structure.
- iv The skill learner will get opportunities in the field of Health institutes, Hospitals and Pathological labs.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Introduction: Definition, Scope and Applications of Micro technique. Collection and selection of specimen or tissue of animal for whole mount, smearing or teasing.	05 Hrs
II	Fixation: Definition and Importance and examples of fixatives. Significance and the process of Washing, Dehydration, Clearing agents Merits and demerits of clearing agents- Xylene, Toluene Significance and use of Cold and hot infiltration	05 Hrs
III	Significance and procedure: Embedding: Embedding containers: a) Paper trays b) L o Embedding procedure Block making: Block making, labeling of block and storage of block. Trimming and Mounting of trimmed block on microtome peg.	05 Hrs

Learning Resources:

1. Weesner., F.M. (1968), General zoological microtechniques. Maryland, U.S.A.: The Williams & Wilkins Company
2. Mr. Jeremy Sanderson (1994) Biological Microtechnique by Garland Science publishers: First edition • Baker F.I and R.E Silvertan,
3. R.Marimuthu(2011) Microscopy and Microtechnique published by Mjp
4. Vonnie D.C.Sheild and Thomas Heinbokel Microtechnique.
5. Peter Gray(1952) Basic Microtechnique published by The blakiston company,toronto.
6. Dr.M.K.Prasad (2000) Outlines of Microtechnique published by Emkay.
7. Brian Bracegirdle(1978) A History of Mirotechnique published by Heinemann Educational books Ltd.
8. Richard W.Horobin(1982) Histochemistry published by Butterworth Educational books Ltd.

**SEC-2: Practicals Based on SEC-1
(Bee Keeping)**

Total Contact Hours: 30

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i To inculcate importance of Bee keeping and honey processes in relation with entrepreneurship development.
- ii To give students knowledge about various techniques of Bee keeping and honey processing and its marketing to make them self-sustainable after graduation.
- iii To teach techniques of construction of Bee Hives and its maintenance.
- iv To teach students about Honey production and health related problems with Honey bees. Importance of honey
- v Students will learn important steps in bee keeping and bee hive handling without fear.
- vi Students will learn the use of different equipments in bee keeping.

Course Outcomes (COs): After completion of the course,

- i The learner will be able to differentiate in different types of honey bee castes.
- ii Learner will be able to use the artificial hive for beekeeping
- iii Learner will be able to use the technique of honey purification and processing.
- iv Learner will be able to construct the artificial honey hive and maintain it.
- v Learner if is not employed can find own employment by doing Bee keeping
- vi Lerner can start own beekeeping equipment agency for farmers or beekeepers.

Expt. No.	Name of Experiments
01	To study the morphology of honey bees and its social casts.
02	Temporary mounting of wings, legs, sting apparatus and mouthparts.
03	Study the langstroth hive box/ bee box in apiary.
04	To study the tools and instruments of apiculture
05	Visit to nearby bee keeping centre.
06	To aware the purity of apiary products like honey, wax, propolis, royal jelly etc. and its importance.
07	Apply your skill entrepreneurship.

Learning Resources:

1. Abrol,D.P.(1997) Bees and Beekeeping. Kalyani Publisher, New Delh.
2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher,New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4. Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests.

Predator and their management. M.J.P Publisher, Chennai.

5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Chcrian R, & K.R. Ramanathan, 1992 – Bee keeping in India,
7. Mishra, R.C., 1985 – Honey bees and their Management in India, ICAR.
8. Singh, S.1982-Bee keeping – ICAR 4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Chandigarh
9. Rare, S. 1998-Introduction. to bee keeping, Vikas publishing house.

**SEC-2: Practical based on SEC-1
(Animal Micro technique)**

Total Contact Hours: 30

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i To prepare the slides as whole mounts of microscopic fauna.
- ii To adapt preservation of animal tissues for sectioning and histological study
- iii To learn hydration, dehydration and use of clearing agent for mount the slides.
- iv To develop skill of microtechnique in medical purpose.

Course Outcomes (COs): After completion of the course, students will be able to –

- i Understand the selection of nuclear and cytoplasmic stains.
- ii Understand the proper histological structure of animal tissue.
- iii Understand the different types of cell and learned physiological structure.
- iv The skill learner will get opportunities in the field of Health institutes, Hospitals and Pathological labs.

Expt. No.	Name of Experiments
01	Rotary and Rocking microtome- its uses, precautions and handling, Microtome knives
02	Section cutting- Defects, Possible causes and remedies during section cutting, .
03	Affixing and processing of sections

04	Staining, , Clearing and Mounting .: Preparation of Haematoxylin, Eosin stain and Giemsa stain, Mordants, Double staining, use of mounting media-DPX and Canada balsam.
05	Preparation of permanent slides.
06	Observation and Identification of mounted slides.
07	Use of camera Lucida and morphometry.

Learning Resources:

1. Weesner., F.M. (1968), General zoological microtechniques. Maryland, U.S.A.: The Williams & Wilkins Company
2. Mr. Jeremy Sanderson (1994) Biological Microtechnique by Garland Science publishers: First edition • Baker F.I and R.E Silverton,
3. R.Marimuthu(2011) Microscopy and Microtechnique published by Mjp
4. Vonnie D.C.Sheild and Thomas Heinbokel Microtechnique.
5. Peter Gray(1952) Basic Microtechnique published by The blakiston company,toronto.
6. Dr.M.K.Prasad (2000) Outlines of Microtechnique published by Emkay.
7. Brian Bracegirdle(1978) A History of Mirotechnique published by Heinemann Educational books Ltd.
8. Richard W.Horobin(1982) Histochemistry published by Butterworth Educational books Ltd.

This course will be available for the students of other faculty

GE/OE-1: Vectors, Diseases and Management

Total Contact Hours: 30

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To study the general features of harmful insect vector and their adaptations.
- ii Understand the systemic position of insect vectors.
- iii To learn common vector borne diseases and their etiology.
- iv Application of vector management strategies.

Course Outcomes (COs): After completion of the course, students will be able to –

- i To develop awareness about the causative agents and control measures of many commonly vector borne diseases
- ii Recognize the symptoms and proper identification of vectors.
- iii Learn feeding mechanism and causing ideas.
- iv Understand the strategies for the management of vector borne diseases by Chemical, Biological and IPM.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Introduction to insects: General features of insects; Morphological features- Head, Eyes, Antenna, Mouthparts. Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Adaptations as vectors, Host Specificity.	05 Hrs
II	Insect as vectors: Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera. Study of important insect vectors and its borne diseases and control measures: Mosquito, House fly, Fleas, Head louse, Blood sucking bugs	05 Hrs
III	Vector management strategies: Control of vector flies by screening, fly traps, electrocution, poison baits and outdoor residual sprays; biological control, Chemical control and Integrated pest management.	05 Hrs

Learning Resources:

1. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK. Electronic Instrument Handbook by Clyde F. Coombs
2. Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK.
3. Mathews, G.(2011). Integrated Vector Management: Controlling Vectors of Malaria and other Insect
4. Vector borne Disease. Wiley-Blackwell Belding, D.L.(1942). Textbook of Clinical parasitology

SEMESTER – II

DSC-3: Animal Diversity-II

Total Contact Hours: 30

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To understand the basic concepts of lower and higher vertebrate animals.
- ii To learn the classification, characters and general organization of chordates.
- iii To understand the diversity and complexity of life from protochordata to the class mammalia.

Course Outcomes (COs): On completion of the course, students will be able to,

- i. Understand general organization of vertebrate animals.
- ii. Recognize diversity, migration and adaptive radiation of vertebrate. animal.
- iii. Acquire deep knowledge and importance of biodiversity conservation.
- iv. Develop the capacity to understand biological importance and their conservation methods.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	<p>An Introduction of Phylum Chordata: Outline classification and general characters of phylum chordata (Protochordata and Euchordata)</p> <p>Cyclostomata (Agnatha): Outline classification and General characters, Study of Petromyzon and myxine with its affinities.</p> <p>Pisces: General characters and outline classification up to orders with examples. Scoliodon: External features, Digestive, respiratory and blood Vascular System, Types of scales and fins of fishes, Migration in fishes.</p>	10 Hrs.
II	<p>Amphibia & Reptilia : General characters and outline classification up to orders with examples. Development of frog: - Fertilization, Cleavage and Blastulation Neoteny and Parental care in amphibia.</p> <p>Calotes (External features), Identification of poisonous and non-poisonous snakes, snake venom, symptoms and first aid treatment of snake bite.</p>	10 Hrs.
III	<p>Aves & Mammals : General features and outline classification up to order level,</p> <p>Columba livia: External features, Structure of feathers and kinds of feathers, Respiratory system, Flight adaptation in birds, Migration in birds</p> <p>Ratus ratus: External features, Blood Vascular System, Urino-genital System and Adaptive radiation in mammals, Economic importance of mammals.</p>	10 Hrs.

Learning Resources:

1. A Text Book of Chordate Zoology – R.C. Dalela – Jaiprakashnath Publication Meerut. □ Chordate Zoology – E.L. Jordan and P.S. Verma, S. Chand and Company New Delhi
2. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill.
3. Biological Science, 3rd Ed. D. J. Taylor, N. P. O. Green and G. W. Stout, Cambridge Univ. Press. Low priced Ed.
4. Jordan and Verma (2014). Chordate Zoology, S. Chand and Company Pvt. Ltd., New Delhi.
5. Lal S. S. (1996) Text book of Practical Zoology, Vertebrates, Rastogi Publication.
6. Modern Text Book of Zoology Vertebrate – R.L. Kotpal, Rastogi Publication Meerut.
7. Verma & Agarwal- chordate Embryology – S. Chand publication.
8. Young J. Z. (2004) the life of Vertebrates. III Edition. Oxford University press.

**DSC-4: Practical Based on DSC-3
(Animal Diversity-II)**

Total Contact Hours: 60

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To familiarize students with identification of museum specimens and their characteristics features.
- ii To enable students to study mounting and anatomy of vertebrate animal species.
- iii To prepare students for taxonomical work and research in the areas of biodiversity.

Course Outcomes (COs): On completion of the course, students will be able to,

- i Understand systemic position, habit and habitat of vertebrate animals.
- ii Understand the adaptive features of fishes, birds.
- iii Understand the physiological and anatomical study of vertebrate animals.
- iv Develop skills to recognize biodiversity of animals and their importance.

Expt. No.	Name of Experiments
01	Museum study of vertebrates (At least 20). (Identification, classification, sketches, General characters and biological importance.
02	Dissection of Scoliodon / Labeo (Experimental or Demonstration) E/D Afferent and efferent, Cranial Nerves. Brain
03	Dissection of Rat / Frog (Experimental or Demonstration) E/D Urinogenital system, Arterial system, Venous System, Brain
04	Mounting of Placoid, Cycloid and Ctenoid scales of fish.
05	Key for the identification of Poisonous and non-poisonous snakes.
06	Study of the following to relate structure and function: Types of beaks and feet of birds, Feather of pigeon or any birds.
07	Arrange study tour to visit Zoological survey of Inida/ Museum/ National Park/bird sanctuaries and after, assigned to the students for report writing.

Learning Resources:

1. Lal S. S. (1996) Text book of Practical Zoology, Vertebrates, Rastogi Publication.
2. Modern Text Book of Zoology Vertebrate – R.L. Kotpal, Rastogi Publication Meerut.
3. Verma & Agarwal- chordate Embryology – S. Chand publication..

VSC-1: Poultry Farming

Total Contact Hours: 15

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i Understanding the fundamental and economic importance of Zoology.
- i To impart training on Modern Poultry Farming Technology
- ii To create knowledge on self-employment opportunity.

Course Outcomes (COs): On completion of the course, students will be able to,

- i Understand the status of Indian Poultry Industry.
- ii Learn the Scientific Poultry farming.
- iii Applied diversified Poultry practices.
- iv Recognize the different breeds of chicken.

Module No.	Topics/Actual contents of the syllabus	ContactHours
I	External morphology of variety of fowls such as Plymouth Rock, light Sussex, Minorca, Rhode Island, Red and White Leghorn. Classification of fowls based on their use: meat type such as Broilers, Egg type such as white leghorn and commercial layers, Dual purpose varieties, game and ornamental purpose varieties.	05 Hrs
II	Feeding poultry – Management of Egg Layers – Management of Broilers in large scale farms	05 Hrs
III	Poultry diseases viral, Bacterial, fungal, Protozoan and parasitic Lice etc. Prevention and precautions during vaccination. Management of a modern poultry farms – Progressive plans to promote poultry as a self-Employment venture.	05 Hrs

Learning Resources:

1. Jull Morley, A. 1971: Poultry Husbandry, Tata –McGraw Hill Publ. Co New Delhi – India.
2. Sastry, Thomas and Singh, 1982: Farm Animals Management and Poultry production – Vikas Publ. co. New Delhi – India.
3. Harbans Singh and Earl. N. Moore, 1982: Livestock and poultry production – prentice hall India Publ. Co., New Delhi – India.
4. Banarjee, G.C. 1986: poultry, Oxford – IBH publ. co., New Delhi – India. B.Sc. Z

VSC-1: Aquarium Fish Keeping

Total Contact Hours: 15

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i. Understanding the principles and scope of aquarium fish keeping.
- ii. Learn about exotic and endemic fish species and their management.
- iii. Learn about the preparation and composition of fish food.
- iv. Gain practical experience in designing the fish aquarium.

Course Outcomes (COs): On completion of the course, students will be able to,

- i. Explore the potential of aquarium fish industry.
- ii. Familiarize the fish breeding and fish food technology.
- iii. Recognize the fish diseases for the management of fish keeping.
- iv. Understand the transportation techniques for fish market.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Introduction and Scope: The potential scope of Aquarium Fish industry as a Cottage Industry. Exotic and Endemic species of Aquarium Fishes. Aquarium plants, Water quality management in Aquarium, Accessories used in Aquarium	05 Hrs
II	Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel Fish, Blue Morph, Anemone fish and Butterfly fish. Food and feeding of Aquarium fishes – use of live fish feed organisms. Preparation and composition of formulated fish feeds, Diseases in Aquarium Fishes	05 Hrs
III	Live fish transport – Fish handling, packing and forwarding techniques. General Aquarium maintenance – budget for setting up an aquarium fish farm as a cottage Industry	05 Hrs

Learning Resources:

1. Day, F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.
2. Hall, C.B. 2005: Ponds and Fish culture – Agrobios – Jodhpur – India.
3. Hem Raj. 2022. A Text Book of Aquarium Fish Keeping, S.Vinesh & Co.
4. Jayashree, K.V., Thara Devi, C.S. and Arumugam, N.2020.Home Aquarium and Ornamental Fish Culture, Aras Publication, Nagercoil, Tamil Nadu.
5. Jingran V.G., 1991: Fish and fisheries in India – Hindustan Publ. co New Delhi – India.
6. Mathur, S., Sharma, L.L. and Mathure, A.K.2006. Hand Book of Freshwater Ornamental Fishes, Yash Publishing House, Bikaner.
7. Mill Dick, 1993: Aquarium fish, DK Publ. Co, Inc. New York –USA
8. Sanjib Saha. 2022. Concept of Aquarium fish keeping, Techno World Publishers.
9. Shanmugam K. 1992, Fishery Biology and Aqua Culture – Leo Pathipagam – Chennai- India.
10. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi – India

**VSC-2: Practical Based on VSC-1
(Poultry Farming)**

Total Contact Hours: 30

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i. Understanding the fundamental and economic importance of Zoology.
- ii. To impart training on Modern Poultry Farming Technology
- iii. To create knowledge on self-employment opportunity.

Course Outcomes (COs): On completion of the course, students will be able to,

- i. Understand the status of Indian Poultry Industry.
- ii. Learn the Scientific Poultry farming.
- iii. Applied diversified Poultry practices.
- iv. Recognize the different breeds of chicken.

Expt. No.	Name of Experiments
01	Identify different Poultry & fowl breeds; Demonstrate different System of Poultry rearing as-Free range, semi intensive, intensive rearing prepare various model Structure of poultry breeder farm, hatcheries and commercial Poultry farms.
02	Cheap and Healthy Feed preparation by students based on government standards, Market study and Survey (Monitoring of daily price hike in poultry market and analysis)
03	Identify major Feed ingredients of Poultry; demonstrate various feeding requirements in various species of poultry, elaborate different forms of poultry feed.
04	Prepare schematic diagrammed of site and location of poultry farm, identify various types of Poultry houses & Ventilation system in poultry housing
05	Elaborate the principles and important factors in breeding, Incubation and Hatchery Management, Practices in Poultry farming; Identify various System of Raring in Broiler & Layer Poultry
06	Identification of various infectious diseases of Poultry i.e. Viral, Bacteria, Fungi, protozoa and Parasites. Various nutritional deficiency diseases of poultry
07	Field visit to a poultry farm

Learning Resources:

1. Jull Morley, A. 1971: Poultry Husbandry, Tata –McGraw Hill Publ. Co New Delhi – India.
2. Sastry, Thomas and Singh, 1982: Farm Animals Management and Poultry production – Vikas Publ. co. New Delhi – India.
3. Harbans Singh and Earl. N. Moore, 1982: Livestock and poultry production – prentice hall India Publ. Co., New Delhi – India.
4. Banarjee, G.C. 1986: poultry, Oxford – IBH publ. co., New Delhi – India. B.Sc. Z

**VSC-2: Practical Based on VSC-1
(Aquarium Fish Keeping)**

Total Contact Hours: 30

Credit: 01

Max. Marks: 50

Learning Objectives of the Course:

- i. Understanding the principles and scope of aquarium fish keeping.
- ii. Learn about exotic and endemic fish species and their management.
- iii. Learn about the preparation and composition of fish food.
- iv. Gain practical experience in designing the fish aquarium.

Course Outcomes (COs): On completion of the course, students will be able to,

- i. Explore the potential of aquarium fish industry.
- ii. Familiarize the fish breeding and fish food technology.
- iii. Recognize the fish diseases for the management of fish keeping.
- iv. Understand the transportation techniques for fish market.

Expt. No.	Name of Experiments
01	Introduction to Aquarium accessories and equipment's.
02	Identification of ornamental fishes.
03	Acclimatization of fish.
04	Preparation of formulated fish feed.
05	Identification of ornamental fish diseases and prophylactic measures.
06	Identification of aquarium plants.

Learning Resources:

1. Day, F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.
2. Hall, C.B. 2005: Ponds and Fish culture – Agrobios – Jodhpur – India.
3. Hem Raj. 2022. A Text Book of Aquarium Fish Keeping, S. Vinesh & Co.
4. Jayashree, K.V., Thara Devi, C.S. and Arumugam, N.2020. Home Aquarium and Ornamental Fish Culture, Aras Publication, Nagercoil, Tamil Nadu.
5. Jingran V.G., 1991: Fish and fisheries in India – Hindustan Publ. co New Delhi – India.
6. Mathur, S., Sharma, L.L. and Mathure, A.K. 2006. Hand Book of Freshwater Ornamental Fishes, Yash Publishing House, Bikaner.
7. Mill Dick, 1993: Aquarium fish, DK Publ. Co, Inc. New York – USA
8. Sanjib Saha. 2022. Concept of Aquarium fish keeping, Techno World Publishers.
9. Shanmugam K. 1992, Fishery Biology and Aqua Culture – Leo Pathipagam – Chennai- India.
10. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi – India

This course will be available for the students of other faculty

GE/OE-2: Dairy Production Technology

Total Contact Hours: 30

Credit: 02

Max. Marks: 50

Learning Objectives of the Course:

- i To give an account of different breeds of dairy cattle and their characteristics and performance.
- ii To study conventional dairy farm system.
- iii Understand health of cattle introduction of technology for artificial insemination and genomic testing.

Course Outcomes (COs): On completion of the course, students will be able to.

- i Understand the pre-requisites for starting a Dairy farm.
- ii Recognize different breeds of Cows & buffaloes following safety precautions.
- iii Prepare and give recommended feed and water for livestock
- iv Maintain health of livestock along with productivity
- v Vaccination of cattle, nutrients requirements
- vi Entrepreneurship i.e., Effectively market dairy products
- vii Ensure safe and clean dairy farm and Standard safety measures to be taken in establishing an industry.
- viii Efficiently start and manage to establish or develop a Dairy Industry.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Introduction and Establishment of a Dairy Farm: Dairy development in India - Dairy Cooperatives (NDRI, NDDB, TCMPF) Constraints of Present Dairy Farming and Future Scope of Dairy Farmer. Selection of site for dairy farm; Systems of housing - Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm.	10 Hrs.
II	Livestock Identification and Management: Breeds of Dairy Cattle and Buffaloes — Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals. Systems of inbreeding and crossbreeding. Weaning of calf, Castration, Dehoming, Deworming and Vaccination programme Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and Bullocks.	10 Hrs.
III	Feed Management, Dairy Management, Cleaning and Sanitation: Basic Principles of Feed, Important Feed Ingredients, Feed formulation and Feed Mixing Operation Flood —Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients —Per Capita Milk production and availability in India and Andhra Pradesh -Methods of Collection and Storage of Milk—Labelling and Storage of milk products Cleaning and sanitation of dairy farm — Safety precautions to prevent accidents in an industry.	10 Hrs.

Learning Resources:

1. Dairy India 2007, Sixth edititon
2. Dairy Science: Peterson (W.E.) Publisher — Lippincott & Company
3. Economics of Milk Production — Bharati Pratima Acharya Publishers.
4. <http://www.asyi-infra.com/BooksPDF/Dairr@»20Farmer%J0or%20Entrepreneur.pdf>
5. <https://labour.gov.in/industrial-safety-health>
6. Indian Dairy Pproducts — Rangappa (K.S.) & Acharya (KT) — Asia Publishing House.
7. Principles and practices of Dairy Farm — Jagdish Prasad
8. S. Outlines of Dairy TeGhrtology — Sukumar (De) - Oxford University press
9. Text book of Animal Husbandry - G C Benarjee 4. Hand book of Animal Husbandry - ICAR Edition
10. The technology of milk Proceesing — Ananthakrishnan, C.P., Khan, A.Q. and Padmanablian, P.N. — Shri Lakshmi Publications.

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Basket 1: List of Major subjects in Science (DSC)

Students willing to pursue their bachelors in the **Faculty of Science and Technology** shall choose any three subjects (from the following options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)

Semester	Sr No	BOS / Ad hoc Board proposing the course.	Title of the Corse
1 st and 2 nd Semester (Students shall choose any three subjects (from these options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)	1	BOS in Botany	Botany
	2	BOS in Chemistry	Chemistry
			Analytical Chemistry
			Polymer Chemistry
	3	BOS in Mathematics	Mathematics
	4	BOS in Physics	Physics
			Non-Conventional and Conventional Energy
			Instrumentation Practice
	5	BOS in Zoology	Zoology
	6	BOS in Electronics	Electronics
	7	BOS in Fishery Science	Fishery Science
	8	BOS in Microbiology	Microbiology
	9	Ad Hoc Board in Statistics	Statistics
	10	Ad hoc Board in Industrial Chemistry	Industrial Chemistry
	11	Ad hoc Board in Dairy Science & Technology	Dairy Science & Technology
	12	Ad hoc Board in Biotechnology and Bioinformatics	Biotechnology
			Bioinformatics
	13	Ad hoc Board in Biochemistry	Biochemistry
	14	Ad hoc Board in Home Science	Home Science
	15	Ad Hoc Board in Agrochemical Fertilizers, Horticulture, Dry land Agriculture	Agrochemical Fertilizers
Horticulture			
16	Ad hoc Board in Forensic Science	Forensic Science	
		Forensic Science & Cyber Security	
17	Ad Hoc Board in Computer Science	Computer Science	
		Computer Application	
		Information Technology	
		Data Science	
18	Ad Hoc Board in Networking and Multimedia	Networking and Multimedia	
19	Ad Hoc Board in Environmental Science	Environmental Science	
20	BOS in Fishery Science	Fishery Science	

	21	Ad hoc Board in Automobile Technology / Workshop Technology / Refrigerator and Air Conditioning	Automobile Technology Workshop Technology Refrigerator and Air Conditioning
	22	Ad hoc Board in Geology	Geology

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3/4/2024