

DEPARTMENT OF ZOOLOGY



CURRICULUM AND SYLLABUS FOR
UNDERGRADUATE PROGRAMMES
(with effect from 2015 admissions)



St Berchmans College
Founded 1922

AUTONOMOUS

College with Potential for Excellence | Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

DEPARTMENT OF ZOOLOGY

CURRICULUM AND SYLLABUS FOR UNDERGRADUATE PROGRAMMES (with effect from 2015 admissions)



St Berchmans College

Founded 1922

AUTONOMOUS

College with Potential for Excellence | Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101



BOARD OF STUDIES

Members

1. Dr. Jose D. Kaippallil (Chairman)

Associate Professor and HOD, Department of Zoology, St. Berchmans College, Changanassery

2. Dr. John T. Kocheril

Associate Professor, Department of Zoology, St. Berchmans College, Changanassery

3. Dr. Jomon K. V.

Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery

4. Dr. Joe Prasad Mathew

Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery

5. Dr. Monichan K. K.

Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery

6. Dr. Martin J. Babu

Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery

7. Dr. Pradeep Kumar G.

Scientist G, Department of Molecular Reproduction, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram

8. Dr. Sanalkumar M. G.

Associate Professor, Department of Zoology, NSS College, Pandalam

9. Dr. Ambika Devi

Professor, Regional Agricultural Research Station, Kumarakom, Kottayam

10. John Jacob

Assistant Manager, Matsyafed, Kottayam

11. Sajan Joseph K.

Thekkedethu, Kanjar P. O. Idukki



Brief Report

Board of Studies (UG) committee chaired by Dr. Jose D. Kaippallil on 9th January, 2015 in the Department of Zoology, St. Berchmans College, Changanassery had **Dr. John T. Kocheril**, Associate Professor, Department of Zoology, St. Berchmans College, Changanassery, **Dr. Jomon K. V.** Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery, **Dr. Joe Prasad Mathew**, Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery, **Dr. Monichan K. K.**, Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery, **Dr. Martin J. Babu**, Assistant Professor, Department of Zoology, St. Berchmans College, Changanassery, **Dr. Sanalkumar M. G.**, Associate Professor, Department of Zoology, NSS College, Pandalam, **John Jacob**, Assistant Manager, Matsyafed, Kottayam, **Sajan Joseph K.**, Thekkedethu, Kanjar P. O. Idukki as committee members.

The members were unanimous in ratifying the resolutions recommended on the day. The major resolutions were the introduction of a course in Wildlife Biology and imparting greater importance on the practical applications of the concepts studied at UG level. Practical sessions with 'Virtual labs' and other software were to be promoted. The human anatomy and physiological studies were introduced in a broad level in the UG curriculum. Field visits, ecological studies nurturing nature studies and visits to reputed scientific institutions were among the few important recommendations.

The committee meeting concluded with the understanding that innovations and paradigm shifts are needed in the UG curriculum to facilitate better learning. All the members were unanimous in recommending the resolutions.



PROGRAMME OBJECTIVES

The B.Sc. Zoology programme is designed to:

1. Impart basic knowledge in various branches of Zoology and General biology meant both for a graduate terminal course and for higher studies.
2. Inculcate interest in and love of nature with its myriad living creatures.
3. Understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance.
4. Acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation.
5. Acquire basic knowledge and skills in applied branches to enable them for self employment.
6. Impart awareness about the conservation of the biosphere.



PROGRAMME OUTCOME

The graduate of this programme should be able to

1. Develop respect for nature
2. Explain the importance of biodiversity
3. Identify and list out common animals
4. Understand the basic principles of evolution and adaptations in animals
5. Appreciate the influence of environment on the life of organisms
6. Explain various physiological & biochemical processes in our bodies
7. Understand the basic genetic mechanisms in organisms
8. Identify potential risk factors to health of human beings
9. Use tools of information technology for the study of biology
10. Develop the skills to pursue advanced studies in biology



REGULATIONS FOR UNDERGRADUATE PROGRAMME IN ZOOLOGY UNDER CREDIT SEMESTER SYSTEM (SB-CSS-UG) 2015

1. SHORT TITLE

- 1.1 These Regulations shall be called St. Berchmans College (Autonomous) Regulations (2015) governing undergraduate programme in Zoology under the Credit Semester System.
- 1.2 These Regulations shall come into force with effect from the academic year 2015 - 2016 onwards.

2. SCOPE

- 2.1 The regulation provided herein shall apply to undergraduate programme in Zoology conducted by St. Berchmans College (Autonomous) with effect from the academic year 2015 - 2016

3. DEFINITIONS

- 3.1 'University' means Mahatma Gandhi University, Kottayam, Kerala.
- 3.2 'College' means St. Berchmans College (Autonomous).
- 3.3 There shall be an Academic Committee nominated by the Principal to look after the matters relating to the SB-CSS-UG system.
- 3.4 'Academic Council' means the Committee consisting of members as provided under section 107 of the Autonomy Ordinance, Government of Kerala.
- 3.5 'Parent Department' means the Department of Zoology.
- 3.6 'Department Council' means the body of all teachers of the Department of Zoology.
- 3.7 'Faculty Mentor' is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities of the undergraduate programme undertaken in the Department.
- 3.8 'Programme' means a three year programme of study and examinations.
- 3.9 'Duration of Programme' means the period of time required for the conduct of the programme. The duration of undergraduate programme in Zoology shall be six (6) semesters.
- 3.10 'Semester' means a term consisting of a minimum of 450 contact hours distributed over 90 working days, inclusive of examination days, within 18 five-day academic weeks.
- 3.11 'Course' means a segment of subject matter to be covered in a semester. Each Course is to be designed under lectures/tutorials/laboratory or field work/seminar/project/ assignments/evaluation etc., to meet effective teaching and learning needs.
- 3.12 'Course Teacher' means the teacher who is taking classes on the course.



- 3.13 'Core Course' means a course that the student admitted to undergraduate programme in Zoology must successfully complete to receive the Degree and which cannot be substituted by any other course.
- 3.14 'Complementary Course' means a course which would enrich the study of core courses.
- 3.15 'Common Course I' means a course that comes under the category of courses for English.
- 3.16 'Common Course II' means additional language, which can be opted by a student, from among the languages offered by the College.
- 3.17 The selection of Common Course I and II is compulsory for all students undergoing undergraduate programme in Zoology.
- 3.18 'Open Course' means a course outside the field specialization of the student, which can be opted by a student.
- 3.19 'Elective Course' means a course, which can be substituted, by equivalent course from the same subject and the number of courses required to complete the programme shall be decided by the respective Board of Studies.
- 3.20 'Project' means a regular project work with stated credits on which the student conducts a project under the supervision of a teacher in the parent department / any appropriate research centre in order to submit a dissertation on the project work as specified.
- 3.21 'Plagiarism' is the unreferenced use of other authors' material in dissertations and is a serious academic offence.
- 3.22 'Seminar' means a lecture expected to train the student in self-study, collection of relevant matter from books and internet resources, editing, document writing, typing and presentation.
- 3.23 'Tutorial' means a class to provide an opportunity to interact with students at their individual level to identify the strength and weakness of individual students.
- 3.24 'Evaluation' means every student shall be evaluated by in-semester assessment (20%) and end-semester assessment (80%).
- 3.25 'Improvement Examination' is an examination conducted to improve the performance of a student in the courses of a particular semester.
- 3.26 'Supplementary Examination' is an examination conducted for students who fail in the courses of a particular semester.
- 3.27 'Improvement Course' is a course registered by a student for improving the performance in that particular course.



- 3.28 'Supplementary Course' is a course that is repeated by a student for having failed in that course in an earlier registration.
- 3.29 The minimum credits required for completing undergraduate programme in Zoology is one hundred and twenty (120).
- 3.30 'Credit' (C) of a course is a measure of the weekly unit of work assigned for that course in a semester.
- 3.31 'Course Credit': One credit of the course is defined as a minimum of one (1) hour lecture / minimum of two (2) hours laboratory / field work per week for eighteen (18) weeks in a semester. The course will be considered as completed only by conducting the final examination.
- 3.32 'Grade' means a letter symbol (A, B, C etc.) which indicates the broad level of performance of a student in a course/semester/programme.
- 3.33 'Grade Point' (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.
- 3.34 'Credit Point' (CP) of a course is the value obtained by multiplying the grade point (GP) by the credit (C) of the course.
- 3.35 'Semester Credit Point Average' (SCPA) of a semester is calculated by dividing total credit points obtained by the student in a semester by total credits of that semester and shall be rounded off to two decimal places.
- 3.36 'Cumulative Credit Point Average' (CCPA) is the value obtained by dividing the sum of credit points in all the courses obtained by the student for the entire programme by the total credits of the whole programme and shall be rounded off to two decimal places.
- 3.37 'Institution Average' is the value obtained by dividing the sum of the marks obtained by all students in a particular course by the number of students in respective course.
- 3.38 'Weighted Average Score' means the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.
- 3.39 'Grace Marks' means marks awarded to course/courses as per the choice of the student, in recognition of meritorious achievements of a student in NCC/NSS/Sports/Arts and cultural activities.
- 3.40 First, Second, Third, Fourth and Fifth position shall be awarded to students who come in the first five places on the basis of overall marks in the programme in the first chance itself.



4. PROGRAMME STRUCTURE

- 4.1 Students shall be admitted into six semester undergraduate programme in Zoology.
- 4.2 The programme shall include Core courses, Complementary courses, Common courses, Open course and Elective courses. There shall be a project with dissertation to be undertaken by all students. The programme will also include assignments, seminars, practical, viva-voce, field visit etc.
- 4.3 Total credits for the programme is one hundred and twenty (120). The credit distribution for the programmes is shown below.

i.	Programme duration	6 Semesters
ii.	Total Credits required for successful completion of the programme	120
iii.	Minimum credits required from Core + Complementary courses including Project	79
iv.	Minimum credits required from Common courses	38
v.	Minimum credits required from Open course	3
vi.	Minimum attendance required	75%

4.4 Study tour and visit to research institutes

Study tour and visit to research institutes shall be conducted preferably during the fifth semester. During the study tour, students are expected to visit different habitats, zoos, aquaria and other places of zoological importance. They must also visit research institutes to familiarize themselves with the process of research in biological sciences.

4.5 Project

All students shall do a project in the sixth semester. The project shall be done individually or as a group of maximum five (5) students. The projects shall be identified during the fourth semester of the programme with the help of the supervising teacher. The report of the project shall be submitted to the department during sixth semester and shall be produced before the examiners appointed by the College. The project report shall be subject to internal and external evaluation followed by a viva-voce.

4.6 Evaluations

The evaluation of each course shall contain two parts.

- i Internal or In-Semester Assessment (ISA)
- ii External or End-Semester Assessment (ESA)



Both ISA and ESA shall be carried out using indirect grading. The ISA:ESA ratio shall be 1:4, for courses with or without practical. There shall be a maximum of eighty (80) marks for external evaluation and twenty (20) marks for internal evaluation.

4.7 In-semester assessment

The components of the internal or in-semester assessment and their marks are as below.

For all courses without practical

There are three components for ISA, which include attendance, assignment/seminar/viva-voce and in-semester examination. All the three components of the internal assessment are mandatory.

Components of ISA	Marks
Attendance	5
Assignment/Seminar/Viva-Voce	5
In-semester examination ($2 \times 5 = 10$)	10
Total	20

Marks for attendance

% of Attendance	Marks
90 and above	5
85 - 89	4
80 - 84	3
76 - 79	2
75	1

(Decimals shall be rounded off to the next higher whole number)

For all courses with practical

In-semester assessment of theory courses

There are three components for ISA of theory courses, which include attendance, assignment/seminar/viva-voce and in-semester examination. All the three components of the internal assessment are mandatory.

ISA - Components of Theory	Marks
Attendance	2
Assignment/Seminar/Viva-Voce	3
In-semester examination ($2 \times 2.5 = 5$)	5
Total	10



Marks for attendance

% of Attendance	Marks
90 and above	2
75 - 89	1

(Decimals shall be rounded off to the next higher whole number)

Internal assessment of practical courses

The internal assessment of practical courses shall be conducted in each semester. The components for internal assessment are given below.

Internal assessment of practical courses evaluated in each semester

ISA - Components of Practical	Marks
Attendance	2
Lab involvement	2
Record*	3
Test (one)	1
Viva-Voce	2
Total	10

*Marks awarded for Record should be related to number of experiments/practicals recorded.

Marks for attendance

% of Attendance	Marks
90 and above	2
75 - 89	1

(Decimals shall be rounded off to the next higher whole number)

4.8 Assignments

Assignments shall be submitted for every course in the first four semesters. At least one assignment for each course shall be submitted in each semester.

4.9 In-semester examination

Every student shall undergo at least two in-semester examinations as class test as an internal component for every course.

- 4.10 To ensure transparency of the evaluation process, the ISA mark awarded to the students in each course in a semester shall be published on the notice board according to the schedule in the academic calendar published by the College. There shall not be any chance for improvement for ISA. The course teacher and the faculty mentor shall



maintain the academic record of each student registered for the course which shall be forwarded to the office of the Controller of Examinations through the Head of the Department and a copy should be kept in the office of the Head of the Department for at least two years for verification.

4.11 A student who has not secured minimum marks in internal examinations can redo the same before the end semester examination of the semester concerned.

4.12 **End-semester assessment**

The end-semester examination in theory and practical courses shall be conducted by the College.

4.13 The end-semester examinations shall be conducted at the end of each semester. There shall be one end-semester examination of three (3) hours duration in each lecture based course.

4.14 The question paper should be strictly on the basis of model question paper set by Board of Studies.

4.15 A question paper may contain short answer type/annotation, short essay type questions/problems and long essay type questions.

For all courses without practical

Section	Type of Questions	Number of Questions to be answered	Marks	Total Marks
A	Very short answer type	10 out of 10	1	10
B	Short answer type	8 out of 12	2	16
C	Short essay/problem solving type	6 out of 9	4	24
D	Essay type	2 out of 4	15	30
		26 out of 35	-	80

For all courses with practical

Section	Type of Questions	Number of Questions to be answered	Marks	Total Marks
A	Very short answer type	8 out of 8	1	8
B	Short answer type	6 out of 10	2	12
C	Short essay/problem solving type	4 out of 6	4	16
D	Essay type	2 out of 4	12	24
		20 out of 28	-	60



- 4.16 Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny as per the regulations in the examination manual.
- 4.17 Practical examination shall be conducted in each semester. The duration and frequency of practical examination shall be decided by the respective Board of Studies.
- 4.18 Practical examination shall be conducted by one external examiner and one internal examiner. The question paper setting and evaluation of answer scripts shall be done as per the directions in the examination manual of the College.
- 4.19 The marks for end-semester theory and practical examinations are given below

Course	Marks
Courses without practical	80
Courses with practical	60
Practical (assessment in each semester)	20

- 4.20 The project report shall be subject to internal and external evaluation followed by a viva-voce at the end of the programme. Internal Evaluation is to be done by the supervising teacher and external evaluation by an external evaluation board consisting of an examiner appointed by the College and the Head of the Department or his nominee. A viva-voce related to the project work shall be conducted by the external evaluation board and students have to attend the viva-voce individually.

Components of Project Evaluation	Marks
Internal Evaluation	20
Dissertation (External)	50
Viva-Voce (External)	30
Total	100

- 4.21 If the student fails in project evaluation, he or she shall submit the project report after modifying it on the basis of the recommendations of the examiners.

4.22 Field visit to biodiversity rich area (Core II- Zoology)

As a part of Core II - Zoology, a field visit to a biodiversity rich area shall be conducted during semester I. The visit is intended to study the biodiversity and conservation status of the area and forms a part of the practical course during semester I. Each student shall prepare a report of the visit, which will be evaluated during the practical examination at the end of the semester.

4.23 Study tour and visit to research institutes

A report of the study tour is to be prepared and submitted. The report shall be evaluated and a viva-voce shall be conducted along with the practical examination of 'Perspectives in Ecology' course at the end of Semester V.



Components of Study Tour Evaluation	Marks
Attendance (Internal)	10
Study tour report (External)	10
Viva-voce (External)	10
Total	30

4.24 **Wildlife biology field course**

A Wildlife biology field course with duration of not less than three days shall be conducted during the 6th semester of the programme. The field course is meant as a practical adjunct to the Wildlife Biology theory course offered during Semester VI and the students are expected to attain first-hand knowledge on various aspects of Wildlife Biology, its conservation and management. Each student is required to prepare a report of the visit which will be evaluated along with a viva-voce by an external examiner at the end of Semester VI.

Components of Wildlife Biology Field Course Evaluation	Marks
Attendance (Internal)	15
Field diary (Internal)	15
Field course report (External)	20
Viva-voce (External)	20
Total	70

4.25 For all courses (theory and practical) an indirect grading system based on a ten (10) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance	Grade Point
90 and above	A+	Outstanding	10
80 - 89	A	Excellent	9
70 - 79	B	Very Good	8
60 - 69	C	Good	7
50 - 59	D	Satisfactory	6
40 - 49	E	Adequate	5
Below 40	F	Failure	-



5. CREDIT POINT AND CREDIT POINT AVERAGE

5.1 Credit Point

Credit Point (CP) of a course is calculated using the formula

$$\text{CP} = \text{C} \times \text{GP}$$

where C = Credit; GP = Grade Point

5.2 Semester Credit Point Average

Semester Credit Point Average (SCPA) is calculated using the formula

$$\text{SCPA} = \text{TCP}/\text{TC}$$

where TCP = Total Credit Point of all the courses in the semester; TC = Total Credits in the semester

CPA shall be rounded off to two decimal places.

5.3 Cumulative Credit Point Average

Cumulative Credit Point Average (CCPA) is calculated using the formula

$$\text{CCPA} = \text{TCP}/\text{TC}$$

where TCP = Total Credit Point of all the courses in the whole programme; TC = Total Credit in the whole programme

CPA shall be rounded off to two decimal places.

Grades for the different semesters, Semester Credit Point Average (SCPA) and grades for overall programme, Cumulative Credit Point Average (CCPA) are given based on the corresponding Credit Point Average (CPA) as shown below:

CPA	Grade	Performance
9.00 and above	A+	Outstanding
8.00 - 8.99	A	Excellent
7.00 - 7.99	B	Very Good
6.00 - 6.99	C	Good
5.00 - 5.99	D	Satisfactory
4.00 - 4.99	E	Adequate
Below 4.00	F	Failure

5.4 A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass in a course.

5.5 For a pass in a programme, a separate minimum of grade E is required for all the individual courses.



5.6 If a candidate secures F Grade for any one of the courses offered in a semester/programme, only F grade will be awarded for that semester/programme until the student improves this to E grade or above within the permitted period.

5.7 Candidate who secures E grade and above will be eligible for higher studies.

6. SUPPLEMENTARY/IMPROVEMENT EXAMINATION

There will be supplementary examinations and chance for improvement. Only one chance will be given for improving the marks of a course.

7. ATTENDANCE

7.1 The minimum requirement of aggregate attendance during a semester for appearing the end semester examination shall be 75%. Condonation of shortage of attendance to a maximum of ten (10) days in a semester subject to a maximum of two times during the whole period of undergraduate programme may be granted by the College.

7.2 If a student represents the College, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities such as College union/University union activities etc., he/she shall be eligible to claim the attendance for the actual number of days participated subject to a maximum of ten (10) days in a semester based on the specific recommendations of the Faculty Mentor and Head of the Department.

7.3 A student who does not satisfy the requirements of attendance shall not be permitted to appear for the end-semester examinations.

7.4 Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch.

8. BOARD OF STUDIES AND COURSES

8.1 The Board of Studies in Zoology shall design all the courses offered in the undergraduate programme in Zoology. The Board shall design and introduce new courses, modify or re-design existing courses and replace any existing courses with new/modified courses to facilitate better exposure and training for the students.

8.2 The syllabus of a course shall include the title of the course, contact hours, the number of credits and reference materials.

8.3 Each course shall have an alpha numeric code which includes abbreviation of the course in two letters, the semester number, code of the course and the serial number of the course.

8.4 Every Programme conducted under Credit Semester System shall be monitored by the Academic Council.



9. REGISTRATION

- 9.1 A student shall be permitted to register for the programme at the time of admission.
- 9.2 A student may be permitted to complete the programme, on valid reasons, within a period of twelve (12) continuous semesters from the date of commencement of the first semester of the programme.
- 9.3 The minimum strength of students for open courses is 15 and the maximum is 75 per batch.
- 9.4 Each student shall register for the open courses in the prescribed registration form in consultation with the faculty mentor during fourth semester. Faculty mentor shall permit registration on the basis of the preferences of the student and availability of seats.
- 9.5 Those students who possess the required minimum attendance and progress during an academic year/semester and could not register for the annual/semester examination in time are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next semester.

10. ADMISSION

- 10.1 The admission to undergraduate programme in Zoology shall be as per the rules and regulations of the College/University.
- 10.2 The eligibility criteria for admission shall be as announced by the College/University from time to time.
- 10.3 Separate rank lists shall be drawn up for seats under reservation quota as per the existing rules.
- 10.4 There shall be a uniform academic and examination calendar prepared by the College for the conduct of the programmes.

11. ADMISSION REQUIREMENTS

- 11.1 Candidates for admission to the first semester of the UG programme through SB-CSS-UG shall be required to have passed Plus Two or equivalent examination or any other examination of any recognized authority, accepted by the Academic council of Mahatma Gandhi University as equivalent thereto.
- 11.2 Students admitted under this programme are governed by the Regulations in force.

12. PROMOTION

A student who registers his/her name for the external examination for a semester will be eligible for promotion to the next semester.



13. MARK CUM GRADE CARD

13.1 The College under its seal shall issue to the students, a Mark cum Grade card on completion of each semester, which shall contain the following information.

- i. Name of the Student
- ii. Register Number
- iii. Photo of the student
- iv. Degree
- v. Programme
- vi. Semester and Name of the Examination
- vii. Month and Year of Examination
- viii. Stream
- ix. Course Code, Title and Credits of each course opted in the semester
- x. Marks for ISA, ESA, Total Marks (ISA + ESA), Maximum Marks, Letter Grade, Grade Point (GP), Credit Point (CP) and Institution Average in each course opted in the semester
- xi. Total Credits, Marks Awarded, Credit Point, SCPA and Letter Grade in the semester
- xii. Weighted Average Score
- xiii. Result

13.2 The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final Mark Cum Grade Card shall show the CCPA and the overall letter grade of a student for the entire programme.

14. AWARD OF DEGREE

The successful completion of all the courses with 'E' grade shall be the minimum requirement for the award of the degree.

15. MONITORING COMMITTEE

There shall be a Monitoring Committee constituted by the Principal to monitor the internal evaluation conducted by the College. The Course Teacher, Faculty Mentor, and the College Coordinator should keep all the records of the continuous evaluation, for at least a period of two years, for verification.

16. GRIEVANCE REDRESSAL MECHANISM

16.1 In order to address the grievance of students regarding ISA, a two-level Grievance Redressal mechanism is envisaged.



16.2 A student can approach the upper level only if grievance is not addressed at the lower level.

16.3 Department level: The Principal shall form a Grievance Redressal Committee in each Department comprising of course teacher and one senior teacher as members and the Head of the Department as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

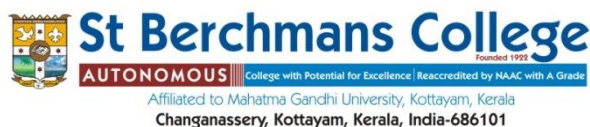
16.4 College level: There shall be a College level Grievance Redressal Committee comprising of Faculty Mentor, two senior teachers and two staff council members (one shall be an elected member) and the Principal as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

17. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of three years from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.



Model Mark cum Grade Card – Semester I



MARK CUM GRADE CARD

Date:

Name of the Candidate :
 Register Number :
 Degree : Bachelor of Science
 Programme : Zoology
 Stream : Model I
 Name of Examination : First Semester SB-CSS-UG Examination, Month YYYY

Photo

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
	Common Course - I												
	Common Course - II												
	Core Course												
	Complementary Course												
	Total Weighted Average Score												
	Semester Result SCPA												
	End of Statement												

Entered by:

Verified by:

Controller of Examinations

Principal



Model Mark cum Grade Card (Semester V)



St Berchmans College
Founded 1922
AUTONOMOUS

College with Potential for Excellence | Reaccredited by NAAC with A Grade
 Affiliated to Mahatma Gandhi University, Kottayam, Kerala
 Changanassery, Kottayam, Kerala, India-686101

MARK CUM GRADE CARD

Date:

Name of the Candidate :
 Register Number :
 Degree : Bachelor of Science
 Programme : Zoology
 Stream : Model I
 Name of Examination : Fifth Semester SB-CSS-UG Examination, Month YYYY

Photo

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
	Core Course												
	Open Course												
	Total Weighted Average Score												
	Semester Result SCPA												
	End of Statement												

Entered by:

Verified by:

Controller of Examinations

Principal



Model Mark cum Grade Card (Semester VI)



St Berchmans College
Founded 1992

AUTONOMOUS

College with Potential for Excellence | Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam, Kerala
 Changanassery, Kottayam, Kerala, India-686101

MARK CUM GRADE CARD

Date:

Name of the Candidate :
 Register Number :
 Degree : Bachelor of Science
 Programme : Zoology
 Stream : Model I
 Name of Examination : Sixth Semester SB-CSS-UG Examination, Month YYYY

Photo

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
	Core Course												
	Project												
	Total Weighted Average Score												
	Semester Result												
	SCPA												

Semester Results								Programme Part Results					
Semester	Marks Awarded	Maximum Marks	Credits	SCPA	Grade	Month & Year of Passing	Result	Course Category and Subject Studied	Marks Awarded	Maximum Marks	Credits	CCPA	Grade
I								Common Course I					
II								Common Course II					
III								Core Course					
IV								Complementary Course					
V								Complementary Course					
VI								Open Course					
								Project					
								Elective Course					
								Total					
Final Result													
Cumulative Credit Point Average (CCPA):													
Grade Awarded:													

Entered by:

Verified by:

Controller of Examinations

Principal



Reverse side of the Mark cum Grade Card (COMMON FOR ALL SEMESTERS)

Description of the Evaluation Process - Grade and Grade Point

The evaluation of each course comprises of internal and external components in the ratio 1:4 for all Courses. Grades and Grade Points are given on a ten (10) point scale based on the percentage of Total Marks (ISA + ESA) as given in Table 1.

(Decimals are to be rounded mathematically to the nearest whole number)

Percentage of Marks	Grade	Performance	Grade Point
90 and above	A+	Outstanding	10
80 - 89	A	Excellent	9
70 - 79	B	Very Good	8
60 - 69	C	Good	7
50 - 59	D	Satisfactory	6
40 - 49	E	Adequate	5
Below 40	F	Failure	-

Table 1

Semester Credit Point Average (SCPA) and Cumulative Credit Point Average (CCPA)

Grades for the different Semesters and overall Programme are given based on the corresponding CPA, as shown in Table 2.

CPA	Grade	Performance
9.00 and above	A+	Outstanding
8.00 - 8.99	A	Excellent
7.00 - 7.99	B	Very Good
6.00 - 6.99	C	Good
5.00 - 5.99	D	Satisfactory
4.00 - 4.99	E	Adequate
Below 4.00	F	Failure

Table 2

Credit Point (CP) of a course is calculated using the formula

$$CP = C \times GP$$

where C = Credit; GP = Grade Point

Credit Point Average (CPA) of a Semester/Programme is calculated using the formula

$$CPA = TCP/TC$$

where TCP = Total Credit Point; TC = Total Credit

CPA shall be rounded off to two decimal places.

A **separate minimum of 30% marks** is required for a pass for both internal assessment and external assessment in each course.

An **aggregate minimum of 40% marks** is required for a pass in each course.



PROGRAMME STRUCTURE

Semester I

Sl. No.	Course Title	Hours/ week	Credits	Marks
1	Common Course I	5	4	100
2	Common Course I	4	3	100
3	Common Course II	4	4	100
4	Core Course	2	2	70
5	Core Course Practical	2	1	30
6	Complementary Course : Chemistry	2	2	70
7	Complementary Course Practical: Chemistry	2	Evaluation in Semester II	
8	Complementary Course: Botany	2	2	70
9	Complementary Course Practical: Botany	2	1	30
	Total	25	19	570

Semester II

Sl. No.	Course Title	Hours/ week	Credits	Marks
1	Common Course I	5	4	100
2	Common Course I	4	3	100
3	Common Course II	4	4	100
4	Core Course	2	2	70
5	Core Course Practical	2	1	30
6	Complementary Course: Chemistry	2	2	70
7	Complementary Course Practical: Chemistry	2	2	60
8	Complementary Course: Botany	2	2	70
9	Complementary Course Practical: Botany	2	1	30
	Total	25	21	630

Semester III

Sl. No.	Course Title	Hours/ week	Credits	Marks
1	Common Course I	5	4	100
2	Common Course II	5	4	100
3	Core Course	3	3	70
4	Core Course Practical	2	1	30
5	Complementary Course: Chemistry	3	3	70
6	Complementary Course Practical: Chemistry	2	Evaluation in Semester IV	
7	Complementary Course: Botany	3	3	70
8	Complementary Course Practical: Botany	2	1	30
	Total	25	19	470



Semester IV

Sl. No.	Course Title	Hours/week	Credits	Marks
1	Common Course I	5	4	100
2	Common Course II	5	4	100
3	Core Course	3	3	70
4	Core Course Practical	2	1	30
5	Complementary Course: Chemistry	3	3	70
6	Complementary Course Practical: Chemistry	2	2	60
7	Complementary Course: Botany	3	3	70
8	Complementary Course Practical: Botany	2	1	30
	Total	25	21	530

Semester V

Sl. No.	Course Title	Hours/week	Credits	Marks
1	Core Course	3	3	70
2	Core Course	3	3	70
3	Core Course	3	3	70
4	Core Course	4	3	70
5	Open Course	4	3	100
6	Core Course Practical	2	1	30
7	Core Course Practical	2	1	30
8	Core Course Practical	2	1	30
9	Core Course Practical	2	1	30
10	Study Tour & Visit to Research Institutes	-	1	30
	Total	25	20	530

Semester VI

Sl. No.	Course Title	Hours/week	Credits	Marks
1	Core Course	4	3	70
2	Core Course	3	3	70
3	Core Course	3	3	70
4	Core Course	3	3	70
5	Core Course	4	2	100
6	Core Course Practical	2	1	30
7	Core Course Practical	2	1	30
8	Core Course Practical	2	1	30
9	Core Course Practical	2	1	30
10	Investigatory Project	-	1	100
11	Wildlife Biology Field Course		1	70
	Total	25	20	670
	Grand Total		120	3400



OUTLINE OF THE CORE COURSES FOR MODEL I AND MODEL III PROGRAMMES

Course Code	Title of the Course	Instructional hours/week	Instructional hours for the course	Credits	ISA	ESA	Total
Semester I							
ABZO101	Fundamentals of Biodiversity and Biosystematics (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	2	10	60	70
ABZO1P01	Fundamentals of Biodiversity and Biosystematics (P) (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	1	10	20	30
Semester II							
ABZO202	Evolutionary Biology and Zoogeography (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	2	10	60	70
ABZO2P02	Evolutionary Biology and Zoogeography (P) (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	1	10	20	30
Semester III							
ABZO303	Animal Diversity - Non Chordata (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	3	54	3	10	60	70
ABZO3P03	Animal Diversity - Non Chordata (P) (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	1	10	20	30
Semester IV							
ABZO404	Animal Diversity – Chordata (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	3	54	3	10	60	70
ABZO405	Research Methodology and Biostatistics (<i>For BSc Industrial Microbiology & Zoology programme</i>)	2	36	2	20	80	100
ABZO4P04	Animal Diversity – Chordata (P) (<i>Common for BSc Zoology and Industrial Microbiology & Zoology programmes</i>)	2	36	1	10	20	30



Course Code	Title of the Course	Instructional hours/week	Instructional hours for the course	Credits	ISA	ESA	Total
Semester V							
ABZO506	Research Methodology, Instrumentation and Biostatistics <i>(For BSc Zoology programme)</i>	3	54	3	10	60	70
ABZO507	Cell Biology and Molecular Biology <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	3	54	3	10	60	70
ABZO508	Perspectives in Ecology <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	3	54	3	10	60	70
ABZO509	Biochemistry and Physiology <i>(For BSc Zoology programme)</i>	4	72	3	10	60	70
ABZO510	Animal Physiology <i>(For BSc Industrial Microbiology & Zoology programme)</i>	3	54	3	10	60	70
ABZO5P05	Research Methodology, Instrumentation & Biostatistics (P) <i>(For BSc Zoology programme)</i>	2	36	1	10	20	30
ABZO5P06	Cell Biology and Molecular Biology (P) <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	2	36	1	10	20	30
ABZO5P07	Perspectives in Ecology (P) <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	2	36	1	10	20	30
ABZO5P08	Biochemistry and Physiology (P) <i>(For BSc Zoology programme)</i>	2	36	1	10	20	30
ABZO5P09	Animal Physiology (P) <i>(For BSc Industrial Microbiology & Zoology programme)</i>	2	36	1	10	20	30
ABZO5ST	Field Visit, Study Tour & Visit to Research Institutes	-	-	1	10	20	30
Semester VI							
ABZO611	Genetics, Biotechnology and Bioinformatics <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	4	72	3	10	60	70
ABZO612	Microbiology and Immunology <i>(For BSc Zoology programme)</i>	3	54	3	10	60	70
ABZO613	Endocrinology, Reproductive Biology and Ethology <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	3	54	3	10	60	70
ABZO614	Developmental Biology <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	3	54	3	10	60	70
ABZO615	Wildlife Biology, Conservation and Management <i>(For BSc Zoology programme)</i>	4	72	2	20	80	100
ABZO6P10	Genetics, Biotechnology and Bioinformatics (P) <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	2	36	1	10	20	30
ABZO6P11	Microbiology and Immunology (P) <i>(For BSc Zoology programme)</i>	2	36	1	10	20	30
ABZO6P12	Endocrinology, Reproductive Biology and Ethology (P) <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	2	36	1	10	20	30
ABZO6P13	Developmental Biology (P) <i>(Common for BSc Zoology and Industrial Microbiology & Zoology programmes)</i>	2	36	1	10	20	30
ABZO6FC	Wildlife Biology Field Course	-	-	1	30	40	70
ABZO6PJ	Investigatory Project	-	-	1	20	80	100



OUTLINE OF THE CORE COURSES FOR MODEL I BSc ZOOLOGY PROGRAMME

Course Code	Title of the Course	Instructional hours/week	Instructional hours for the course	Credits	ISA	ESA	Total
Semester I							
ABZO101	Fundamentals of Biodiversity and Biosystematics	2	36	2	10	60	70
ABZO1P01	Fundamentals of Biodiversity and Biosystematics (P)	2	36	1	10	20	30
Semester II							
ABZO202	Evolutionary Biology and Zoogeography	2	36	2	10	60	70
ABZO2P02	Evolutionary Biology and Zoogeography (P)	2	36	1	10	20	30
Semester III							
ABZO303	Animal Diversity - Non Chordata	3	54	3	10	60	70
ABZO3P03	Animal Diversity - Non Chordata (P)	2	36	1	10	20	30
Semester IV							
ABZO404	Animal Diversity – Chordata	3	54	3	10	60	70
ABZO4P04	Animal Diversity – Chordata (P)	2	36	1	10	20	30
Semester V							
ABZO506	Research Methodology, Instrumentation and Biostatistics	3	54	3	10	60	70
ABZO507	Cell Biology and Molecular Biology	3	54	3	10	60	70
ABZO508	Perspectives in Ecology	3	54	3	10	60	70
ABZO509	Biochemistry and Physiology	4	72	3	10	60	70
ABZO5P05	Research Methodology, Instrumentation and Biostatistics (P)	2	36	1	10	20	30
ABZO5P06	Cell Biology and Molecular Biology (P)	2	36	1	10	20	30
ABZO5P07	Perspectives in Ecology (P)	2	36	1	10	20	30
ABZO5P08	Biochemistry and Physiology (P)	2	36	1	10	20	30
ABZO5ST	Field Visit, Study Tour & Visit to Research Institutes	-	-	1	10	20	30
Semester VI							
ABZO611	Genetics, Biotechnology and Bioinformatics	4	72	3	10	60	70
ABZO612	Microbiology and Immunology	3	54	3	10	60	70
ABZO613	Endocrinology, Reproductive Biology and Ethology	3	54	3	10	60	70
ABZO614	Developmental Biology	3	54	3	10	60	70
ABZO615	Wild life Biology, Conservation and Management	4	72	2	20	80	100
ABZO6P10	Genetics, Biotechnology and Bioinformatics (P)	2	36	1	10	20	30
ABZO6P11	Microbiology and Immunology (P)	2	36	1	10	20	30
ABZO6P12	Endocrinology, Reproductive Biology and Ethology (P)	2	36	1	10	20	30
ABZO6P13	Developmental Biology (P)	2	36	1	20	10	30
ABZO6FC	Wildlife Biology Field Course	-	-	1	30	40	70
ABZO6PJ	Investigatory Project	-	-	1	20	80	100





SEMESTER I

ABZO101: FUNDAMENTALS OF BIODIVERSITY AND BIOSYSTEMATICS

Instructional Hours: 36

Credits: 2

PART I – BIODIVERSITY (24 hrs)

Module I - Introduction to Biodiversity (12 hrs)

Biodiversity and its significance; Biodiversity as a natural resource

Levels of biodiversity - species, domesticated, genetic, alpha, beta, gamma.

Biodiversity distribution - tropical, temperate and polar

Biological hot spots- significance, global, Indian

Western ghats - ecological, social, cultural and economic aspects

Values of biodiversity; Threats to biodiversity; Role of invasive species

Module II - Conservation & Management of Biodiversity (8 hrs)

Need for biodiversity conservation; Global measures; 3Rs in biodiversity

Importance of wetlands; Types of wetlands; Significance of mangroves; Importance of Kuttanad biodiversity

Endemic species and their conservation; Red Data Book and its significance; Conservation methods: Ex- situ, In-situ

Module III - Biodiversity Estimation (4 hrs)

Biodiversity aspects: species richness, abundance, evenness

Biodiversity indices: Shannon- Weininger index, Simpson index, Pielou's index

Sampling techniques: Quadrats, Transect

Remote sensing

PART II - BIOSYSTEMATICS (12 hrs)

Module IV - Introduction to Biosystematics (4 hrs)

Importance of systematics; Animal classification-hierarchy; ICZN code; Nomenclature: Linnaean, Trinomial

Morphological, numerical and phylogenetic systems of classification; DNA bar-coding



Module V - Animal collection and preservation techniques

(8 hrs)

Collection and preservation techniques

Taxidermy - definition and methods, (reptiles, birds and mammals)

References:

1. Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.
2. Anne E. Magurran 2004. *Measuring Biological Diversity*. Blackwell Publishing, MA, USA.
3. Chapman J.L. & M. J. Reiss 2006 *Ecology, Principles and Applications*. Sec Edition Cambridge University Press.
4. Daily G.C. (Ed.), 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington D C.
5. Forman, R.T and M. Gordaon. 1986. *Landscape Ecology*. John Wiley & Sons, NY, USA.
6. Kapoor, V.C. 1998. *Theory and Practice of Animal Taxonomy*. Oxford and IBH Pub. Co, New Delhi
7. Karunakaran, C.K. 2003. *Politics of vanishing forests in Kerala*. Kerala Sastra Sahitya Parishat, Thiruvananthapuram.
8. *Land resource based perspective plan for 2020 AD*. Kerala State Land Use Board, Thiruvananthapuram
9. Myers, Norman. 1984. *The Primary Source: Tropical Forests and Our Future*. W.W. Norton & Company, NY.
10. Myers, N., Mittermeier, R.A., Mittermeier, C.G., Dea Fonseca, G.A.B and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.
11. Nair, K.N.S and Parameswaran, P. 1976. *Keralathinte Sampath (Wealth of Kerala)*. Kerala Sastra Sahithya Parishad, Trivandrum, Kerala.
12. Nair, M.P., Pushpangathan, P., Rajasekharan, S., Narayanan Nair.K. and Dan Mathew. "Jaivavaividhyam" (Biodiversity). State Institute of Languages, Thiruvananthapuram
13. Ramesh, B.R and Rajan Gurukkal., 2007. *Forest Landscapes of the Southern Western Ghats, India Biodiversity, Human Ecology and management Strategies*. French Institute of Pondicherry, India.
14. *State of the Environment Report, Kerala*. (Annual Publication), Kerala State Council for Science, Technology and Environment, Thiruvananthapuram
15. Supriyo Chakraborty. 2004 *Biodiversity*. Pointer Publishers, Jaipur, India.
16. Wilson E.O., 1988 (Editor). *Biodiversity*. National Academy press, Washington DC, USA.



PRACTICAL

ABZO1P01: FUNDAMENTALS OF BIODIVERSITY AND BIOSYSTEMATICS

Instructional Hours: 36

Credits: 1

1. Sampling
2. Quadrature study
3. Transect study
4. Species area curve
5. Identification of Biodiversity hot spots using Google Earth
6. Identification using keys (4 specimens each)
 - Insect
 - Fish
 - Snake
7. Taxa identification techniques
 - Bird body parts
 - Butterfly/ dragonfly body parts and venation
8. Simple identification of any 20 local animals representing different taxa
 - Common name and scientific name
9. Field study:
 - Visit a biodiversity rich area and submit a report on the biodiversity and conservation efforts there. (*Individual report should be submitted by each student.*)





SEMESTER II

ABZO202: EVOLUTIONARY BIOLOGY AND ZOOGEOGRAPHY

Instructional Hours: 36

Credits: 2

PART I – EVOLUTIONARY BIOLOGY (27 hrs)

Module I –Origin and History of life (3 hrs)

Introduction, Chemical evolution, Miller-Urey experiment, Haldane and Oparin theory
Geological time scale, Mass extinction

Module II – Theories of organic evolution (5 hrs)

Lamarckism- principles, examples and criticism
Darwinism- Natural selection theory, examples and criticism
Modern Synthetic theory (Neo Darwinism)
Neutral theory of molecular evolution

Module III – Evidences for evolution (5 hrs)

Evidences from morphology and anatomy, Physiology and biochemistry, Embryology, Palaeontology
Types of fossils, Dating of fossils

Module IV – Patterns of evolution (4 hrs)

Adaptive radiation, convergent evolution and parallel evolution
Microevolution, Macroevolution and Mega evolution
Gradualism, case study of horse evolution; Punctuated equilibrium, case study of foraminiferans

Module V – Population genetics and evolution (5 hrs)

Genetic basis of variation, Hardy Weinberg equilibrium, Change in gene frequencies, Factors affecting gene frequencies



Module VI – Species and speciation

(5 hrs)

Species concept – Morphological, biological, evolutionary and phylogenetic Speciation – types and mechanism; Isolating mechanisms

PART II – ZOOGEOGRAPHY (9 hrs)

Module VII – Zoogeographical Realms

(5hrs)

Origin of continents- Plate tectonics/ continental drift

Zoogeographical realms; Biogeography of India

Insular fauna: Continental Island- Madagascar; Oceanic Island- Galapagos

Module VIII – Animal Distribution

(4 hrs)

Kinds of animal distribution

Factors and means of animal distribution

Barriers in animal distribution

References:

Evolutionary Biology

1. Barnes, C.W. 1988. *Earth, Time and Life*. John Wiley & Sons, New York
2. Bendall, D. S. (ed.) 1983. *Evolution from Molecules to Man*. Cambridge University Press, U.K.
3. Bull J.J and H.A. Wichman. 2001. Applied Evolution. *Annu. Rev. Ecol. Syst.* 32:183-217 (Visit the Annual Reviews home page at www.AnnulReviews.org.)
4. Chattopadhyay Sajib. 2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd. Kolkata, India.
5. Goodwin, B. 1996. *How the Leopard Changed its Spots: The Evolution of Complexity*. Simon & Schuster, NY, USA.
6. Jerry A. Coyne and H. Allen Orr. 2004. *Speciation*. Sinauer Associates
7. Rob Desalle and Ian Tattersall 2008. *Human Origins: What Bones and Genomes Tell Us about Ourselves*. Texas A&M University Press, USA.
8. Sean B. Carroll and David M. Kingsley .2005 *Evolution: Constant Change and Common Threads*. Holiday Lectures on Science. Webcast or DVD available at www.hhmi.org/biointeractive/evolution.
9. Strickberger, M.W. 2000. *Evolution*. Jones and Bartlett, Boston.



10. Verma P.S. and Agarwal V.K 2007 *Cell biology, Genetics, Molecular Biology, Evolution and Ecology*, S. Chand & Company New Delhi

Zoogeography

1. A.R. Wallace, 1962. The geographical distribution of animals. Hafner Publ. Co.
2. Alfred Russel Wallace, 1876. The Geographical Distribution of Animals, With a Study of the Relations of Living and Extinct Faunas as Elucidating the Past Changes of the Earth's Surface. (New York: Harper and Brothers, 1876).
3. Bartholomew, J. G.; Grimshaw, Percy H.; Osgood, Wilfred H. Atlas of Zoogeography. *Science*, Volume 34, Issue 874, pp. 410-412.
4. Carl L. Hubbs (Editor), 1974. Zoogeography (Hardcover). 509 pages. Ayer Co Pub; Reprint edition (September 1974).
5. Frank Evers Beddard, 2008. A Text-Book of Zoogeography. Published by Biblio Bazaar, LLC, 2008. 192 pages.
6. Joachim Illies, 1974. Introduction to Zoogeography. Macmillan (January 1974).
7. John C. Briggs, 1974. Marine Zoogeography (Population Biology).
8. John R. Merrick, 2006. Evolution and Biogeography of Australasian Vertebrates. 942 pages. Publisher: Ausci (January 2006)
9. L F De Beaufort, 1951. Zoogeography of the Land & Inland Waters.
10. Miklos D. F Udvardy, 1969. Dynamic zoogeography: With special reference to land animals. 445 pages. Van Nostrand Reinhold (1969).
11. P.J. Darlington, 1957. The zoogeography: The geographical distribution of animals. Wiley Publ. New York. 675 pages. Krieger Pub. Co. (June 1980).
12. Paul Muller, 1974. Aspects of Zoogeography. Junk Pub. (January 1974).
13. S K Tiwari, Faunal Regions of the World. Vedams eBooks (P) Ltd (India) Shivkumar Tiwari, 1985. Readings in Indian Zoogeography (vol.1). Today & Tomorrow Printers & Publishers.
14. S. K. Tiwari, 2006. Fundamentals of World Zoogeography. Vedams eBooks (P) Ltd (India). 384 pages. (Sarup & Sons, Ansari Rd. Daryaganj, Delhi).
15. S.K. Tiwari, 1985. Zoogeography of India and South East Asia. International Book Dist. Dehra Dun.
16. S.K. Tiwari, Zoogeography of Indian Amphibians. Today & Tomorrow Printers and Publishers.
17. Wilma George, 1962. Animal geography. Heinemann Edu. Books Ltd. 142 pages.





PRACTICAL

ABZO2P02: EVOLUTIONARY BIOLOGY AND ZOOGEOGRAPHY

Instructional Hours: 36

Credits: 1

1. Identification of Zoogeographical realms using Google Earth
2. Study of endemic species of each realm
3. Study of evolution of animals using Virtual lab
4. Study of Homology / Analogy
5. Study of connecting links
6. Study of living fossils
7. Study of Geological time scale
8. Study of vestigial organs
9. Calculation of gene/ allele frequency using Hardy- Weinberg equilibrium
10. Identification of Drosophila mutants





SEMESTER III

ABZO303: ANIMAL DIVERSITY - NON CHORDATA

Instructional Hours: 54

Credits: 3

Module I - Introduction to invertebrates

(2 hrs)

Outlines of classification

Phylogeny- cell number, embryology and body symmetry, developmental pattern

Module II - Kingdom Protista

(7 hrs)

General characteristics and outline classification

Type: Paramecium

Life history of parasitic protozoan –Plasmodium

A brief description of Entamoeba, Trypanosoma, Leishmania.

Module III - Kingdom Animalia

(1 hr)

Outline classification; Mesozoa and Metazoa

Phylum Mesozoa - Rhopalura

Module IV – Subkingdom Metazoa

(2 hrs)

Levels of animal organization; Body layers; Symmetry; Coelom; Metamerism

Germ layers; Protostomes and Deuterostomes; Cephalisation

Body plan of animals- Blind sac and Tube within tube

Module V – Phylum Porifera & Placozoa

(2 hrs)

Phylum Porifera: General characteristics; Outline classification; Canal system in Sponges

Class Calcarea - Leucosolenia

Class Desmospongia - Spongilla

Class Hexactinellida – Euplectella

Phylum Placozoa - *Trypanopanax adherens*

Module VI – Phylum Coelenterata

(3 hrs)



General characteristics; Outline classification

Class Hydrozoa – Hydra, Obelia

Class Scyphozoa - Aurelia

Class Anthozoa - Sea Anemone

Polymorphism in Coelentrates; Coral reefs with reference to Indian ocean; Threats and conservation of coral reefs

Module VII – Phylum Ctenophora

(1 hr)

Major characteristics (Mention the affinities of Ctenophores)

Pleurobrachia

Module VIII - Phylum Platyhelminthes

(5 hrs)

General characteristics; Outline classification

Class Turbellaria - Bipalium

Class Digenea(Trematoda) - Fasciola and its life cycle

Class Aspidogastrea - Aspidogaster

Class Monogenea - Entobdella

Class Cestoda - Tape worm

Module IX – Phylum Aschelminthes

(4 hrs)

General characteristics; Outline classification

Class Nematoda - Ascaris

Class Nematomorpha - Gordius

Class Gastrotrichia - Chaetonotus

Class Kinorhyncha - Echinoderes

Brief study of parasitic nematodes -Enterobius, Blood fluke, Hook worm, Filarial worm

Module X – Phylum Annelida

(4 hrs)

General characteristics; Outline classification

Class Polychaeta - Nereis

Class Archiannelida - Polygordis

Class Oligochaeta - Earth worm

Class Hirudinea – Hirudinaria, Haemadipsa

Vermicomposting; Economically important earthworm species

Module XI - Phylum Arthropoda

(13 hrs)



General characteristics; Outline classification

Type: Penaeus

Subphylum Trilobitomorpha

Class Trilobita (Extinct)

Subphylum Chelicerata

Class Merostoma – Limulus

Class Arachnida – Spider

Class Pycnogonida – Nymphon

Subphylum Mandibulata

Class Crustacea – Daphnia

Class Chilopoda - Centepede

Class Symphyla - Scutigera

Class Diplopoda - Millipede

Class Pauropoda - Pauropus

Class Insecta – Butterfly

Beneficial Insects: Honey bee, Lac insect, Silk insect

Vectors and vector borne diseases: Dengue, JE, Chikungunya

Insect pests of agricultural importance – Paddy, Coconut

Pests of Fruits and Vegetables (Brief mention only)

Prawn and Lobster fisheries

Module XII - Phylum Mollusca

(4 hrs)

General characteristics; Outline classification

Class Monoplacophora - Neopilina

Class Amphineura - Chiton

Class Scaphopoda - Dentalium

Class Gastropoda - Pila

Class Bivalvia - Lamellidens

Class Cephalopoda - Loligo

Pearl culture and Mussel culture

Module XIII – Phylum Echinodermata

(3 hrs)

General characteristics; Outline classification

Class Asteroidea – Astropecten



Class Ophiuroidea - Ophiothrix

Class Echinoidea – Echinus

Class Holothuroidea – Cucumaria

Class Crinoidea – Antedon

Water vascular system in Echinoderms

Module XIV - Phylum Hemichordata

(1 hr)

General characteristics – Balanoglossus

Module XV - Minor Phyla

(2 hrs)

Sipunculida; Chaetognatha; Rotifera; Onychophora, Acantocephala

References:

1. Barnes, R.D., 1987. Invertebrate Zoology (W.B. Saunders, New York).
2. Barrington, E.J.W., 1967. Invertebrate Structure and function (ELBS and Nelson, London).
3. Dhami, P.S. and Dhami, J.K. 1979. Invertebrate Zoology (R. Chand and Co. New Delhi).
4. Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Invertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
5. Groove, A.J. and Newell, G.E. 1974. Animal Biology – Indian Reprint (University Book Stall, New Delhi).
6. Hyman, L.H. The Invertebrate vols. (McGraw-Hill) 1942. Comparative vertebrate Anatomy (The University of Chicago Press).
7. James R.D. (1987). Invertebrate Zoology, W.B. Saunders, New York.
8. Kapoor V.C. (1994). Theory and Practice of Animal Taxonomy.
9. Kapoor, V.C. 1994. Theory and Practice of Animal Taxonomy (Oxford and IBH Publishing Co., New Delhi.)
10. Kotpal R.L. Agarwal S.K. and R.P. Khetharpal (2002). Modern Text Book of Zoology.
11. Parker T.J and Haswell W.A. (1962). Text Book of Zoology Vol. I. Invertebrate (ELBS & Macmillan, London).
12. Marshall, A.J. and Williams, W.D. 1972. Text Book of Zoology Vol. Invertebrates (ELBS and Macmillan, London).
13. Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi.)



14. Nair, K.K. Ananthakrishnan, T.N. David, B.V. 1976. General and Applied Entomology (T.M.H. New Delhi).
15. Pechenik J A (2005) Biology of Invertebrates, Tata McGraw Hill Publishing Co., New Delhi





PRACTICAL

ABZO3P03: ANIMAL DIVERSITY - NON CHORDATA

Instructional Hours: 36

Credits: 1

Scientific Drawing:-

Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.

Anatomy:-

Study of sections

1. Hydra.
2. Ascaris (male or female)
3. Fasciola
4. Earthworm (TS through intestine)

Study of nervous system in Prawn

Study of digestive system in Cockroach

Identification of common mosquitoes (4 genuses)

Mounting:-

1. Mouth parts – House fly and Honey Bee
2. Prawn appendages.

Identification:-

General identification- The students are expected to identify the following Phylum –wise number of animals by their scientific names. Protista -2, Porifera-1, Coelenterata-2, Platyhelminthes-1, Annelida-2, Arthropoda-3, Mollusca- 2, Echinodermata-2





SEMESTER IV

ABZO404: ANIMAL DIVERSITY – CHORDATA

Instructional Hours: 54

Credits: 3

54 hrs - Credits 3

Module I - Introduction to Phylum Chordata (1 hr)

General characteristics

(Classification up to order – Sub Phylum, Super class, Class, Sub class, Order)

Module II - Sub phylum Urochordata (3 hrs)

Class I : Larvacea - Oikopleura

Class II: Ascidiacea - Ascidia (Mention Retrogressive Metamorphosis)

Class III: Thaliacea - Doliolum

Module III - Sub phylum Cephalochordata (1 hr)

Amphioxus

Module IV - Division Agnatha (2 hrs)

Class I: Ostracodermi - Cephalaspis

Class II: Cyclostomata - Petromyzon, Myxine

Module V - Division Gnathostomata (12 hrs)

Super class Pisces

Class I: Chondrichthyes

Sub class Elasmobranchi - Narcine

Sub class Holocephali - Chimaera

Class II: Osteichthyes

Sub class Choanichthyes

Order I: Crossopterygii - Latimeria

Order II: Dipnoi - Lepidosiren

Sub class Actinopterygii

Super order 1. Chondrostei - Acipenser



Super order 2. Holostei - Amia

Super order 3. Teleostei – Sardine

Accessory respiratory organs in fish; Scales in fishes; Common culture fishes of Kerala (traditional and recent trends)

Fresh water fishes of Kerala (Brief mention only)

Module VI - Super class Tetrapoda

(4 hrs)

Class: Amphibia

Order I: Anura - Euphlyctis

Order II: Urodela - Amblystoma (Axolotl larva and neoteny)

Order III: Apoda - Ichthyophis

Frogs and toads of Kerala (Brief mention only)

Module VII – Class Reptilia

(5 hrs)

Sub class I: Anapsida

Order Chelonia - Chelone

Sub class II: Parapsida - Ichthyosaurus

Sub class III: Diapsida

Order I Rhynchocephalia - Sphenodon

Order II Squamata - Chameleon

Sub class IV: Synapsida - Cynognathus

Identification of poisonous and non poisonous snakes; Snakes of Kerala

Module VIII - Class Aves

(6 hrs)

Sub class I: Archaeornithes - Archaeopteryx (Affinities)

Sub class II: Neornithes

Super order I: Palaeognathae - Struthio

Super order II: Neognathae - Brahminy kite

Flight adaptations in birds; Migration in Birds;

Birds of Kerala (Brief mention only)

Module IX - Class Mammalia

(20 hrs)

Type: *Homo sapiens*

Sub class I: Prototheria - Echidna

Sub class II: Metatheria - Macropus



Sub class III: Eutheria

- Order 1. Insectivora - Talpa
- Order 2. Dermoptera - Galeopithecus
- Order 3. Chiroptera - Pteropus
- Order 4. Primates - Loris
- Order 5. Carnivora - Panthera
- Order 6. Edentata - Armadillo
- Order 7. Pholibota - Manis
- Order 8. Proboscidea - Elephas
- Order 9. Hydracoidea - Procavia
- Order 10. Sirenia - Dugong
- Order 11. Perissodactyla - Zebra
- Order 12. Artiodactyla - Cameleus
- Order 13. Lagomorpha - Oryctolagus
- Order 14. Rodentia - Porcupine
- Order 15. Tubulidentata - Orycteropus
- Order 16. Cetacea - Delphinus

Dentition in Mammals; Aquatic Mammals

Mammals of Kerala (Brief mention only)

References:

1. Ashok Captain and Romulus Whitaker (2008). Snakes of India -The Field Guide. Draco Books.
2. Charpurey K. G. (2008). The Snakes of India. Fabri Press.
3. Daniel J.C (2002). The Book of Indian Reptiles and Amphibians First Edition. Oxford University Press
4. Daniel J.C (2005). Amphibians of Peninsular India, First Edition. University Press.
5. Dinesan Cheruvat et al (2006). Handbook on Mammals of Kerala, Z S I.
6. Ekambaranatha Iyer (2000). A Manual of Zoology Vol. II. S. Viswanathan and Co.
7. Jayson E.A (1996). Rare and Endangered Mammals of Kerala. KFRI.
8. Jhingran, V. G. (1982). Fish and Fisheries of India. Hindustan Publishing Corporation, Delhi.
9. Jordan E L and P.S. Verma (2002). Chordate Zoology S. Chand and Co. New Delhi.



10. Kotpal R.L. (2000). Modern Text Book of zoology, Vertebrates, Rastogi Publications, Meerut.
11. Mani, M. S. (1974). Ecology and Biogeography in India, W Junk Publishers, The Hague.
12. Murthy TSN (2009). A Pocket Book on Indian Reptiles (Crocodiles, Testudines, Lizards and Snakes). Nature Books India.
13. Murthy TSN (2010). The Reptile fauna of India. Neha Publishers & Distributors
14. Nigam and Sobti (2000). Functional Organization of Chordates. Shoban Lal Nagin Chand and Co. New Delhi.
15. Salim Ali (1996). The book of Indian birds. Bombay Natural History Society.
16. Sashikumar C (2011). Birds of Kerala: Status and Distribution. DC Books Pvt Ltd.
17. Vivek Menon (2009). Mammals of India. Princeton University Press.
18. Vivek Menon and J. C. Daniel (2003). A field guide to Indian mammals. Dorling Kindersley, India in association with Penguin Book, India
19. Young J.Z. (2006). The life of Vertebrates Oxford University Press (Third Ed.) India



PRACTICAL

ABZO4P04: ANIMAL DIVERSITY – CHORDATA

Instructional Hours: 36

Credits: 1

1. Morphology

Scientific Drawing: Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

Mounting of placoid scales/cycloid/ctenoid scales

2. Study of Human Anatomy using Virtual lab

1. Viscera
2. Digestive System
3. Heart
4. Respiratory System
5. Excretory System
6. Brain
7. Reproductive System – Male & Female

3. Study of sections

Human skin, Cartilage, Bone

4. Osteology

Human vertebrae (Typical, Atlas, Axis, Lumbar)

Pectoral and pelvic girdles of Man

5. Dentition in Mammals (Dog, Rabbit, Man)

6. Study of feathers

7. Identification:-

General identification of poisonous snakes (Cobra, Viper, Krait)

Non poisonous (Rat snake, Natrix, Python)

Identify animals by their scientific names: Protochordata-1, Pisces-4, Amphibia-3, Reptilia- 4, Aves-1, Mammalia-2.

8. Taxonomic identification with key:-

- i) Identification of fishes up to the level of order.
- ii) Identification of snakes up to family.





SEMESTER V

ABZO506: RESEARCH METHODOLOGY, INSTRUMENTATION AND BIOSTATISTICS

Instructional Hours: 54

Credits: 3

PART I - RESEARCH METHODOLOGY (26 hrs)

Module I - Introduction (5 hrs)

Basic concepts of research: Meaning, Objectives

Types of Research: Descriptive/Analytical, Applied/Fundamental, Quantitative/Qualitative, Conceptual/Empirical

Module II - Research Design (4 hrs)

Basic principles; Meaning, need and features of good design; Types of research designs

Module III – Research Documentation & Presentation (5 hrs)

Scientific documentation and communication; Research report writing (Thesis and dissertations, Research articles, Oral communications); Bibliography formats; Plagiarism

Presentation techniques: Assignment, Seminar, Debate, Workshop, Colloquium, Conference

Module IV – Measurements (8 hrs)

Units of measurements; Calculations and related conversions of measurement units

Metric system- length; surface; weight; Square measures; Cubic measures; Volumetric; Circular or angular measure

Concentration - percent volume; ppt; ppm

Chemical – Molarity, Normality

Temperature- Celsius, centigrade, Fahrenheit

Module V - Bioethics (4 hrs)

Introduction; Animal rights and animal laws in India; Animal use in research and education; Laboratory animal use, care and welfare; Animal protection initiatives; Animal Welfare Board of India

Working with Humans: harm, risk, and benefits; Consent



PART II - INSTRUMENTATION

Module VI - Research Tools (14 hrs)

Light microscopy – Simple and Compound, Phase Contrast Microscope, Electron Microscope: SEM and TEM, pH Meter, Centrifuge, Electrophoresis, Colorimeter, Chromatography
Computer simulation of biological systems

PART III – BIOSTATISTICS (14 hrs)

Module VII - Sample & Sampling techniques (6 hrs)

Collection of data; Classification of data; Frequency distribution tables
Graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves

Module VIII - Measures of Central Tendency (2 hrs)

Mean, Median, Mode (Direct method only)

Module IX- Measures of dispersion (6 hrs)

Range; Quartile Deviation; Mean Deviation; Standard Deviation; Standard error (Merits & demerits)

References:

Research Methodology

1. Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing. Wiley Eastern Ltd.
2. Baker Kathy (Ed.), 1998, At the Bench: A Laboratory Navigator, Cold Spring Harbor Laboratory Press, New York, 460 pp.
3. Day, R.A. 1993. How to write and publish a scientific paper. Cambridge University Press.
4. Day, R.A. 2000. Scientific English: A guide for Scientists and other Professionals. Universities Press.
5. Debbie Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press. Chapters.1-8.
6. Gupta K.C, Bhamrah, H.S and G.S. Sandhu 2006. Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.



7. Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.
8. Marie, M. 2005. Animal Bioethics: Principles and Teaching Methods Wageningen Academic Publishers
9. Ruxton, G.D. and Colegrave, N. 2006. Experimental design for the life sciences. Oxford University Press. Chapters 1-6.
10. Sateesh, M.K. 2008 Bioethics and Biosafety; I.K. International Publishing House

Instrumentation

1. Ghatak K.L. 2011. *Techniques and Methods in Biology*. PHI Learning Pvt. Ltd. New Delhi
2. Gupta A. 2009. *Instrumentation and Bio-Analytical Techniques*. Pragati Prakashan, Meerut.
3. Sandhu, G.S. 1990. *Research Techniques in Biological Sciences*. Anmol Publications, New Delhi
4. Weesner, F.M. 1960. *General Zoological Microtechniques*. The Williams & Wilkins Co., Baltimore, USA

Biostatistics

1. Bailey, N.T.J. 1994. *Statistical Methods in Biology* (3rd edn). Cambridge University Press.
2. Chap T.Le. 2003. *Introductory Biostatistics*. John Wiley & Sons, NJ, USA.
3. Daniel, W.W. 2006. *Biostatistics: A Foundation for Analysis in the Health Sciences* (7th edn). John Wiley & Sons, New York.
4. Sundar Rao, P.S.S and J.Richard. 2006. *Introduction to Biostatistics and Research Methods* (4th edn). Prentice Hall, New Delhi.
5. Zar, Jerrold H. 2008. *Biostatistical Analysis* (3rd edn.). Pearson Education Inc., New Delhi.



ABZO507: CELL BIOLOGY AND MOLECULAR BIOLOGY

Instructional Hours: 54

Credits: 3

PART I - CELL BIOLOGY (27 hrs)

Module I - Introduction

(2 hrs)

Cell theory

Eukaryote, Prokaryote; Mycoplasma; Virus; Viroid; Prion

Module II - Cell membrane & Permeability

(6 hrs)

Molecular models of cell membrane: Sandwich model; Unit membrane model; Fluid mosaic model

Modifications of plasma membrane: Microvilli; Tight junction; Gap junction; Desmosomes

Cell permeability – Diffusion; Osmosis; Passive transport; Active transport

Cell coat and Cell recognition

Module III - Ultra structure of Cytoplasm

(6 hrs)

Cytoskeleton: Microtubules; Microfilaments; Intermediate Filaments

Endoplasmic reticulum - Structure and functions

Ribosomes (Prokaryotic and Eukaryotic)

Golgi complex - Structure and functions

Lysosomes - Polymorphism; GERL concept; functions

Mitochondria - Structure and functions; Symbiont hypothesis

Module IV- Nucleus

(6 hrs)

Structure and functions of interphase nucleus

Nuclear membrane; Pore complex

Structure and functions of nucleolus

Chromosome structure; Nucleosomes; Heterochromatin; Euchromatin

Polytene chromosomes, Balbiani rings, Endomitosis; Lamp brush chromosomes

Module V - Cell Division

(3 hrs)

Cell cycle - G₁, S, G₂ and M phases

Mitosis, Meiosis and Amitosis

Module VI – Cancer & Ageing

(4 hrs)



Types of tumors-benign and malignant

Types of cancers-Carcinoma, Sarcoma, Lymphoma, Leukemia

Causes of cancer- Physical, Chemical and Biological

Properties of cancer cells

Brief account on Ageing, Theories of Ageing

PART II - MOLECULAR BIOLOGY (27 hrs)

Module VII - Nature of Genetic Material (9 hrs)

Discovery of DNA as genetic material – Griffith's transformation experiments; Hershey

Chase experiment of Bacteriophage infection

Structure and types of DNA & RNA

DNA replication

Modern concept of gene (Cistron, Muton, Recon, Viral genes)

Prokaryotic genome; Eukaryotic genome

Brief account of the following - Split genes (introns and exons), Junk genes; Pseudo genes;

Overlapping genes; Transposons

Module VIII - Gene Expression (12 hrs)

Central Dogma of molecular biology; one gene-one enzyme hypothesis; One gene-one polypeptide hypothesis

Characteristics of genetic code; Contributions of Hargobind Khorana

Protein synthesis - Transcription (Prokaryotic and eukaryotic); Reverse transcription; Post transcriptional modifications

Translation, Post translational modifications

Module IX - Gene Regulation (6 hrs)

Prokaryotic: Operon concept - Lac operon and Tryptophan operon; Catabolite repression (Glucose effect).

Brief account of Eukaryotic gene regulation

References:

1. Ariel G Loewy Philip Sickevitz, John R. Menninger and Jonathan A.N. Gallants (1991) Cell structure and function. Saunder's College Publication
2. Arthur & Tania. (1991) DNA Replication. W.H. Freeman & Co. New York.



3. Arthur M Lesk. (1990) Introduction to Genomics. Oxford University Press
4. Carraway K.L. & C.A.C. Carraway. (2002) Cyto skeleton signalling, Oxford University Press
5. Charlotte J Avers. (1986) Molecular Cell Biology. The Benjamin / Cummings Publishing Company Inc.
6. Cohn N.S. 1979 Elements of Cytology (Freeman Book Company).
7. Daniel & Elizabeth. (1996) Genetics-Principle and Analysis. Jones & Bartlett Publishers
8. David A Micklos & Greg A Freyer. (2006) DNA Science. Cold Spring Harbor Laboratory Press
9. David Latchman. (2006) Gene Regulation. London Unwin Hyman
10. David M. J. Lilley. (2003) DNA-Protein Structural Interactions. Frontiers in Molecular Biology.
11. De- Robertis E.D. and De Robertis Jr.E.M.F (2002) Cell and Molecular Biology (Lea & Febiger/Info-Med)
12. Earl R Stadtman & P. Boon Chock. (2000) Current Topics in Cellular Regulation. Academic Press
13. Edwards & Hassall. Mc.Graw Hill Publishing Co.Ltd., U.K.
14. Finean & Michell. (1998) Membrane Structure. Holland Bio-Medical Press, Netherland.
15. Gardner E.J. and Snustand D.P. Principles of Genetics. John Wiley & Sons, New York.
16. Gupta M.L. & M.L. Gangir. (1998) Cell Biology. Agrobotanica
17. James Darnell. (1998) Molecular Biology. Scientific American Books Inc.
18. Karp G. (1996) Cell and Molecular Biology: Concepts and Experiments John Wiley and Sons m, New York
19. Kimball J.W. 1984 Cell Biology (Addison - Wesley Pub. Co.)
20. Kwang W Jeon. (1997) A Survey of Cell Biology. Academic Press
21. Malcolm N. Jones & Dennis Chapman. (1991) Micelles, Monolayers and Biomembranes. John Willey & Sons Inc. Publication
22. Michael T.A. Michael, E.R. and Toya S.K. (1975) Electron Microscopy and Cell Structure. Cambridge University Press
23. Mitchison J.M. (1991) The Biology of the Cell Cycle, Cambridge University Press
24. Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)
25. Rastogi S. C. (1998) Cell Biology. Tata Mc Graw Hill Publishing Co., New Delhi
26. Sinnot Dunn & Dobzhanasky. (1991) Principles of Genetics. T.M.H. New Delhi.
27. Sobti R.C. & G. Obe. (2000) Eukaryotic Chromosomes. Narosa Publishing House.



28. Stanley G. Schultz. (2002) Basic Principles of Membrane Transport. Cambridge University Press
29. Stephen L Wolfe. (1981) Biology of the Cell. Wadsworth Publishing Co. Inc.
30. Varma P.S. and Agarwal V.K. (1988) Cytology (S. Chand & Co., New Delhi)
31. Varma P.S. and Agarwal V.K. (2008) Genetics (S. Chand & Co., New Delhi)
32. Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ani Books, India
33. West I.C. (2002) Biochemistry of membrane transport. Chapman & Hall, London
34. William & Daphne. (2008) Biochemistry & Molecular Biology. Oxford University Press



ABZO508: PERSPECTIVES IN ECOLOGY

Instructional Hours: 54

Credits: 3

Module I - Introduction

(2 hrs)

Relevance of ecological studies. Autecology and synecology.

Module II - Ecosystem

(12 hrs)

Components and classification

Habitat ecology: Fresh water habitat types; Lentic and lotic.

Marine habitat: Intertidal zone, Rocky shore, Muddy shore, Sandy shore; Coral reefs; Open sea; Pelagic realm; Benthic realm

Wetland and Mangroves; Estuarine ecosystem; Ramsar sites in Kerala

Terrestrial biomes

Food chain; Detritus and grazing food chains

Energy flow through the ecosystem, Ecological pyramids and ecological efficiencies.

Module III - Population Ecology

(5 hrs)

Characteristics of population, population growth curves, r and k selections

Population regulation by density dependent and density independent factors; Life tables, survivorship curves.

Module IV - Community Ecology

(8 hrs)

Habitat and niche concept

Compartmentation in communities: Trophic levels, guild structure and food webs.

Ecotone and edge effect, Keystone species and dominant species concept

Animal associations with reference to competition, predation. Predator-prey oscillation

Antibiosis, Protocooperation, Commensalism, Mutualism.

Module V - Biogeochemical Cycles

(3 hrs)

The Phosphorus Cycle, Nitrogen Cycle, Carbon Cycle, Sulphur Cycle.



Module VI - Resource Ecology

(6 hrs)

Natural resources and its sustainable management

Renewable and non-renewable energy resources; Mineral resources; hydropower; tidal power

Green building concept and green technology concept

Module VII - Environmental issues

(7 hrs)

Global Issues: Global warming and Climate change; Ozone depletion; Greenhouse effect; Acid rain; Nuclear accidents; Carbon trading carbon credit; Carbon sequestration; IPCC/UNFCC

Local issues: Sand mining; Wetland reclamation; Landscape changes; Deforestation; Threats to fresh water resources of Kerala; Tourism and its impact on environment

Module VIII - Pollution

(6 hrs)

Air pollution; Water pollution; Land pollution; Sound Pollution; Pesticide pollution; Municipal solid waste management; e-waste and its management

Module IX - Disaster Management

(5 hrs)

Introduction to hazards; Hazards classification; Types of hazards: natural and anthropogenic

Disaster management- introduction; Earthquakes; Cyclone; Tsunami; Floods; Landslides; Droughts

References:

1. Ahuwalie V.K., Sunita Malhotra, 2009 Environmental science, Ane Books Pvt. Ltd.
2. Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues. International students edition Sec. Edition Oxford University Press.
3. Andrew S. Pullin 2002 *Conservation Biology*. Cambridge University Press, Cambridge, UK
4. Banerjee, L.K., Sastry, A.R.K. and Nayar, M.P. 1989. Mangroves in India: Identification manual. Botanical Survey of India.
5. Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission
6. Erach Bharucha 2008 (UGC).Test Book of Environmental Studies of Undergraduate course. University Press



7. Kaufman G. Donald and Cecilia M. Franz. 2000. *Biosphere 2000 Protecting Our Global Environment*. Kendall/Hunt Publishing Company. Iowa, US
8. Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.
9. Misra S.P., Pandey S.N. 2009 *Essential Environmental Studies*, Ane books Pvt. Ltd.
10. Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.
11. Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders College Publishing, Philadelphia.
12. Pandey Kamleshwar, J.P. Shukla and S.P. Trivedi. 2005. *Fundamentals of Toxicology*. New Central Book Agency (P) Ltd. Kolkata, India
13. Rajagopalan, R. 2005. *Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.
14. Robert May & Angela Mc Lean 2007 *Theoretical Ecology. Principles and Application*, Oxford University press (India Ed.)
15. Santra, S.C. 1994. *Ecology Basic and Applied*. M.D. Publications Pvt. Ltd. New Delhi.
16. Sharma, P.D. 2007. *Ecology and Environment*. Rastogi Publishers
17. Stern, Nicholas. 2006. *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge, UK.
18. Stiling Peter, 2002. *Ecology: Theories and applications*. Prentice Hall of India Pvt. Ltd. New Delhi



ABZO509: BIOCHEMISTRY AND PHYSIOLOGY

Instructional Hours: 72

Credits: 3

PART I – BIOCHEMISTRY (18 Hrs)

Module I – General Biochemistry & Biomolecules

(5 hrs)

Carbohydrates, protein and lipids – structure of basic compounds, classifications with examples and its biological importance.

Module II - Metabolism

(9 hrs)

Carbohydrate metabolism- Glycolysis, glycogenolysis, gluconeogenesis, glycolysis –citric acid cycle, ATP synthesis, Hexose monophosphate shunt

Lipid metabolism- Biosynthesis and oxidation of fatty acids- Beta oxidation, Physiologically important compounds synthesized from cholesterol.

Protein metabolism- Deamination, transamination, transmethylation, decarboxylation, ornithine cycle and Uric acid synthesis

Module III – Enzymes

(4 hrs)

Chemical nature of enzymes, mechanism of enzyme action, factors influencing enzyme action (temperature, pH, enzyme concentration, substrate concentration), enzyme activation, enzyme inhibition, allosteric enzyme, isoenzymes, co-enzyme.

PART II – PHYSIOLOGY (54 Hrs)

Module IV - Nutrition

(7 hrs)

Types of nutrition; Major and minor nutrients; Importance of fiber in diet; Digestion and absorption of carbohydrates, proteins and lipids; Nervous and hormonal control of digestion; Special modes of digestion: ruminant and symbiotic

Balanced diet; Nutritional disorders: Overnutrition, malnutrition, undernutrition, Defects of modern food habits, Obesity, Anorexia, acidity and ulcers, flatulence.

Module V - Respiration

(8 hrs)

Respiration in animals: cutaneous, tracheal, branchial, pulmonary.

Exchange and transport of respiratory gases. Respiratory pigments in animals: hemoglobin(mention structure), myoglobin, hemocyanin, haemerythrin, chlorocruorin.



Exchange and transport of respiratory gases, Oxy-hemoglobin curve, Bohr effect, reverse Bohr effect and Haldane effect.

Respiratory disturbances and disorders: Dyspnoea, asthma, emphysema, Anoxia, hypoxia, cyanosis, hypocapnia, hypercapnia and asphyxia; Carbon monoxide poisoning

Respiratory adaptations to high altitudes, Physiological adaptations of deep sea animals, Physiological problems of deep sea diving.

Module VI – Circulation

(9 hrs)

Organs and mechanism of circulation- Types of heart

Cardiac cycle, Control and rhythmicity of the heart beat- Pacemakers, Pulse, Blood pressure and disorders, Neural and Hormonal control.

Human Blood and its constituents, Buffer system in blood, Blood clotting mechanism: intrinsic and extrinsic pathways, clotting factors, disorders of blood clotting, anticoagulants, blood groups and transfusion.

Circulatory disorders- Myocardial infarction, angina pectoris, cardiac arrest, thrombus and embolus, arteriosclerosis and atherosclerosis.

Clinical analysis- Electrocardiogram (ECG), Erythrocyte sedimentation rate (ESR), Haematocrit, Total and differential blood cell count

Module VII – Excretion

(7 hrs)

Patterns of nitrogen excretion in animals: ammonotelism, ureotelism, uricotelism.

Structure of nephron, formation of urine, counter current mechanism, water and salt balance, acid-base control and homeostasis; Hormonal control of kidney functions.

Composition of urine- normal and abnormal constituents, Diseases of the kidney - Kidney stones, Proteinuria, Nephrosis, Pyelonephritis.

Artificial kidney (haemodialysis), Peritoneal dialysis and Kidney transplantation.

Module VIII – Muscle Physiology

(7 hrs)

Muscular movements, Types of muscles

Vertebrate skeletal muscle: Structure and function; Mechanism, Biochemistry and Energetics of muscle contraction

Neuromuscular junction

Electrophysiology of muscle, threshold and spike potentials, simple muscle twitch, whole muscle contraction, isotonic and isometric contraction, latent and refractory periods,



summation, beneficial effect, tetanus, tonus, staircase phenomenon, fatigue, oxygen debt, rigor mortis.

Module IX – Neurophysiology

(6 hrs)

Structure and types of neurons, Nerve fiber and impulse propagation, Synaptic transmission & properties of synapses, neurotransmitters, role of dopamine and serotonin. Neuroreceptors. Reflexes and types of reflexes.

Central nervous system, Peripheral nervous system and Autonomous Nervous System

Electroencephalogram (EEG)

Neural disorders- Parkinson's disease, Dementia, Alzheimer's disease, Dyslexia, Epilepsy, Schizophrenia.

Module X – Sensory Physiology

(5 hrs)

Chemoreceptors: Gustatory receptors- taste buds, Olfactory receptors

Mechanoreceptors: statoreceptors

Phonoreceptors- Physiology of hearing

Touch receptors

Photoreceptors- Physiology of vision

Thermoreceptors

Module XI – Environmental Physiology

(5 hrs)

Body Temperature and its Regulation, Poikilotherms, Homeotherms

Physiological adaptation to Cold; Shivering; Dormancy; Hibernation; Aestivation

Photoperiodism

Stress Physiology- Stress factors (internal & external), Stress adaptations

References:

Biochemistry

1. Creighton, T.E. *Protein Structure and Molecular Properties*. 1993. W.H. Freeman & Co, NY.
2. Deb, A.C. 2004. *Fundamentals of Biochemistry*. New Central Book Agency (P) Ltd. New Delhi.
3. Elliott, W.H. and C. Elliott. 2003. *Biochemistry and Molecular Biology*. Oxford University Press, Oxford, UK.



4. Eric E. Conn, Paul K. Stumpf, George Bruening, Roy H. Doi. 2007. *Outlines of Biochemistry*. (5th edn). John Wiley & Sons Inc., NY.
5. Garret, R.H. and C.M. Grisham. 1995. *Biochemistry*. Saunders College Publishers, USA.
6. Lehninger, A.L. 2008. *Principles of Biochemistry*. (5th edn). CBS Publishers and Distributors, New Delhi.

Physiology

1. Bentley, P.J. 1998. *Comparative Vertebrate Endocrinology* (3rd edn). Cambridge University Press
2. Bray, J.J., Cragg, P. A, Macknight, A.D, Mills, R.S and Taylor, D.W 1986. *Lecture Notes on human Physiology*. ELBS, New Delhi.
3. Brijlal Gupta and J.A. Ramsay, 1977. *Transport of Ions and Water in Animals*. Academic Press, New York.
4. Chatterjee, C.C. 1997. *Human Physiology*. Medical allied agency, Calcutta.
5. Ganong, W.F 1987. *Review of Medical physiology*. Appleton and lang, Norwalk.
6. Guyton, A.C. 1996. *Text Book of Medical physiology*. Prism Books Pvt. Ltd. Bangalore
7. Hill, W.R., Wyse, G.A and Anderson, M. 2007. *Animal Physiology* (2nd edn). Sinauer Associates Inc. Publishers, MA, USA.
8. Hoar, W.S. 1983. *General and Comparative Physiology*. Prentice Hall of India, New Delhi.
9. Hochachka, P.W. and Somero, G.N 2002. *Biochemical Adaptation: Mechanism and Process in Physiological Evolution*. Oxford University Press, New York.
10. Ian Kay. 1998. *Introduction to Animal Physiology*. Bios Scientific Publishers Ltd., Oxford, UK
11. Keele, C.A, Neil, E. and Joels, N. 1982. *Samson Wright's Applied Physiology*. Oxford University Press
12. Knut Schmidt-Neilsen. 1997. *Animal physiology: Adaptations and Environment* Cambridge University Press
13. Larsson, P.R. et al., 2002. *William's Text Book of Endocrinology* (10th edn). W.B. Saunders, Philadelphia
14. Moyers, D.C and Schulte, P.M. 2007. *Principles of Animal Physiology* (2nd edn). Benjamin Cummings, CA, USA
15. Prosser, C.L and Brown, F.A. 1973. *Comparative Animal Physiology*. W.B Saunders Company, Philadelphia



16. Randall, D., Burgrenn, W. and French, K. 1997. *Eckert Animal physiology*. W.H. Freeman & Co, New York.
17. Squires, E.J. 2003 *Applied Animal Endocrinology*, CABI Publications, UK.
18. Timothy J. Bradley. 2009. *Animal Osmoregulation*. OABS, Oxford University Press, UK.
19. Wilmer, P., G. Stone and I. Jonston. 1997. *Environmental Physiology of Animals* (2nd edn). Blackwell Publishers, NY, USA.





PRACTICAL

ABZO5P05: RESEARCH METHODOLOGY, INSTRUMENTATION AND BIOSTATISTICS

Instructional Hours: 36

Credits: 1

1. Magnification and focusing of objects using light microscopes
2. Phase contrast microscopy
3. Micrometry – calibration and measurement of microscopic objects
4. Camera Lucida (draw a few diagrams using Camera Lucida)
5. Paper chromatography
6. Instrumentation
 - Determination of pH using pH meter
 - Separation of colloids using centrifuge
 - Principle and applications colorimeter
 - Principle and applications of Electrophoresis
7. Graphical representation of data using MS Excel
 - Line diagram
 - Bar diagram
 - Pie diagram



ABZO5P06: CELL BIOLOGY AND MOLECULAR BIOLOGY

Instructional Hours: 36

Credits: 1

1. Study of tissues using permanent slides of epithelial tissues (Squamous, Cuboidal, Columnar), striated muscle, smooth muscle, neuron, cartilage and bone.
2. Isolation, staining and mounting of striated muscle fibre.
3. Squash preparation of onion root tip and identification of mitotic stages.
4. Mounting of polytene chromosome (*Drosophila*/*Chironomus*).
5. Identification of meiotic stages using permanent slides.
6. Preparation of human blood smear and identification of blood cells.
7. Study of tonicity using RBC.
8. Comparative study of prokaryotic and eukaryotic cells.
9. Identification of cell organelles.
10. Models (DNA, DNA replication, RNA – Different types)



ABZO5P07: PERSPECTIVES IN ECOLOGY

Instructional Hours: 36

Credits: 1

1. Estimation of dissolved oxygen
2. Estimation of dissolved carbon dioxide
3. Collection and identification of freshwater/ marine plankton
4. Plankton count(Fresh water/ marine)
5. Extraction of soil organisms
6. Study of soil types
7. Identification of minerals and rocks
8. Transparency measurements using Secchi disc
9. Study of pond ecosystem and preparation of food web



ABZO5P08: BIOCHEMISTRY AND PHYSIOLOGY

Instructional Hours: 36

Credits: 1

BIOCHEMISTRY

1. Qualitative analysis of sugars – glucose, fructose, lactose, maltose, starch and glycogen
2. Qualitative analysis of lipids (Sudan III) and Cholesterol (Liebermann Burchard test)
3. Estimation of serum glucose by Biuret method (Colorimetric)
4. Determination of amylase activity in time intervals (starch-iodine test)

PHYSIOLOGY

1. Determination of haemoglobin content of blood
2. Total RBC count using Haemocytometer
3. Total WBC count using Haemocytometer
4. Estimation of PCV
5. Instruments: Sphygmomanometer and Stethoscope (principle and use)
6. Measurement of blood pressure using a sphygmomanometer



SEMESTER VI

ABZO611: GENETICS, BIOTECHNOLOGY AND BIOINFORMATICS

Instructional Hours: 72

Credits: 3

PART I - GENETICS (36 hrs)

Module I - Introduction

(2 hrs)

Gene and alleles, genotype and phenotype, homozygous and heterozygous, wild type and mutant alleles, Chromosome theory of heredity

Module II - Mendelism

(3hrs)

Mendel's laws, Dominant and recessive traits, test cross and back cross, reciprocal cross, Mendelian traits in man

Module III - Interaction of genes

(5 hrs)

Allelic: Incomplete dominance, Co-dominance

Non allelic interactions: Complementary, supplementary

Epistasis: Dominant (feather colour in fowl), Recessive (coat colour in mice)

Polygenes (Skin colour inheritance in man)

Pleiotropism; Modifying genes; Lethal genes (Brief account with one example each)

Multiple alleles (coat colour in rabbits, ABO blood group, Rh factor and its inheritance)

Module IV - Linkage and Recombination

(3hrs)

Morgan's work in *Drosophila* (Complete and incomplete linkage)

Arrangement of linked genes-cis and trans

Recombination

Cytological evidence of crossing over (Stern's Experiment)

Module V - Sex determination

(3hrs)

Sex chromosomes and autosomes

Chromosomal mechanism sex determination (XX-XO, XX-XY, ZW-ZZ)



Sex determination in man; Barr bodies and Lyon hypotheses (Dosage compensation); Role of Y chromosome

Sex determination in honey bees; Sex determination in Drosophila; Intersex; Gynandromorphs

Hormonal influence on sex determination; Sex reversal

Environmental influence; Genic balance theory; Hermaphroditism

Module VI - Sex linked inheritance (1 hr)

Definition, Characteristics of sex linked inheritance (criss-cross inheritance)

Haemophilia and colour blindness

Pseudoautosomal genes (incompletely sex-linked genes)

Holandric genes; Sex limited and sex influenced traits in man

Module VII - Mutations (5hrs)

Types of Mutations: Somatic and germinal; Induced and random

Chromosomal mutations - structural and numerical changes

Gene mutation (point mutation)

Molecular basis of gene mutations: Transversions, Transitions, Frame shift

Mutagens: Physical, Chemical, Biological

Module VIII - Extra nuclear inheritance (2hrs)

Kappa particles in Paramecium

Maternal effect genes in snail

Module IX - Bacterial Genetics (4 hrs)

Bacterial genome

Recombination in Bacteria

Bacterial transformation; Transduction; Conjugation; F mediated sexduction

Module X - Human Genetics (8hrs)

Pedigree Analysis; Karyotyping- Normal human chromosome complement

Aneuploidy and Non disjunction

Genetic disorders in Man: Chromosomal anomalies- Autosomal: Down syndrome; Edward's syndrome; Cri-du-chat syndrome



Sex chromosomal - Klinefelter's syndrome; Turners syndrome

Single gene disorders (Brief mention): Sickle cell anaemia and Brachydactyly

Inborn errors of metabolism: Phenylketonuria; Alkaptonuria; Albinism and Tyrosinosis

Multifactorial disorders: Polygenic traits - Cleft lip and cleft palate.

Prenatal Diagnosis: Amniocentesis; Choriovillus sampling; Ultrasound scanning; Fetoscopy;

Genetic counselling

Eugenics, Euphenics and Euthenics

PART II – BIOTECHNOLOGY (18 hrs)

Module XI - Tools and Techniques of Genetic Engineering (14 hrs)

Tools: Enzymes- Restriction enzymes and DNA ligases

Vectors: Plasmids and Phage vectors

Production of recombinant DNA (Briefly mention)

Gene transfer: Virus mediated and DNA mediated

PCR technique and DNA amplification

Blotting Techniques: Southern Blotting; Northern Blotting; Western Blotting

DNA hybridization: Fluorescence *in-situ* Hybridization (FISH), Colony hybridization

DNA finger printing and its applications

RFLP- markers and applications

Gene libraries; Genomic and cDNA libraries

Potential uses of stem cells

Module XII - Applications of Biotechnology (4 Hrs)

Tissue culture – Principle and uses

Single cell protein (SCP)

Biotechnology and Medicine: Therapeutic cloning; Gene therapy; Monoclonal antibodies;

Humulin

Antibiotics; DNA Vaccines

Biotechnology in agriculture: Microbial insecticides; GMO

Problems in Biotechnology: Hazards of genetic engineering; Ethical issues; Biowar

PART III - BIOINFORMATICS (18 hrs)

Module XIII – Biological Information Management (9 hrs)

Introduction, DNA, RNA and Proteins as information molecules



Genome sequencing projects; Storing, accessing and annotating sequence data, role of databases and internet

Bioinformatics Databases - NCBI GenBank, PDB

Database searching

Module XIV - Sequence Analysis

(5 hrs)

Sequence alignment: Pair-wise alignment - BLAST, Multiple sequence alignment- CLUSTAL Omega

Molecular Phylogenetics

Module XV – Structural Bioinformatics

(4 hrs)

Protein Structure prediction- Computer Aided Drug Discovery

Molecular Visualization Software – Rasmol

References:

Genetics & Biotechnology

1. Bala Subramanian D., C.F & Bryle & K. Dharmarajan J. Green Kunthala Jayaraman, Concept in Biotechnology. University Press 2007
2. Benjamin Lewin 2004 Gene VIII Oxford University Press
3. Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford)
4. C.W. Fox, J.B. Wolf Evolutionary Genetics Concept of Case Studies, Oxford university Press 2006
5. Colin Ratledge & Bjorn Kristiansen, Basic Biotechnology 3rd ed. Cambridge University (2008)
6. De Robertis E.D. and De. Robertis E.M. 1987 cell & Molecular Biology (Lea & Febby / Info- Med)
7. Desmand S.T. Nicholi An introduction to Genetic Engineering Cambridge Sec, Ed. 2007.
8. Frank H, Stephenson Calculation for Molecular Biology and Biotechnology. Academic press 2006
9. Gardner E.J. and Snustand D.P. 1984. Principles of Genetcis (John Wiley & Sons New York.)
10. Gerhard Fuchs. Biotechnology & in Corporative Perspective. Study in global Competition series, Ane Book 2003



11. Jan Vijay Aging of the Genome The dual role of DNA in life and Deaths. Oxford university Press 2008
12. Janarthanan S & Vincent S., Practical Biotechnology, Method of Protocols. University Press. 2007
13. John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005
14. Madingan , Martinko and Parker 2002, Biology of Microorganisms , Brock Eighth Ed. Prentice Hall
15. Powar. C.B. 1983. Cell biology (Himalaya Publishing company)
16. Prave D. Faustu and Sitting W and Subasten D.A (Eds) 1987 Fundamentals of Biotechnology (VCH publishers. Germany)
17. R.C. Sobte and Suparna. S. Pachauri. Essentials of Biotechnology Ane Book Pvt. Ltd. 2009
18. Singh B.D. Biotechnology 2002, Kalyan Publishers New Delhi.
19. Sinnat Dunn & Dobzhansky 1959. Principles of Genetics (T.M.H. New Delhi)
20. Stern C. 1973. Principles of Human Genetics (W.H. Freeman and Co.)
21. Strickberger W.M. 1990. Genetics (Mac Millan Publishing Co.)
22. Sudha Gangal Biotechnology Principles And & practice of Animal Tissue culture, Universities Press 2007
23. Susantha Gosnalibke – Merged Evolution (Long term implication of Biotechnology and Information Technology) Gordon & Breech Pub. 2005
24. Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008
25. Verma P.S. and Agarwal V.K. 1988 Genetics (S. Chand and Co. New Delhi)
26. Winchester A.M. 1966. Genetics (Oxford & IBH Publications).

Bioinformatics

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
3. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
4. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers
5. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.
6. Rashidi, Hooman H. and Buehler, Lukas K. 2001. *Bioinformatics*:



7. *Basics applications in biological science and medicine*, CRC Press, Washington, D.C.
8. Xiong, Jin. 2006, *Essential Bioinformatics*, Cambridge University Press, New York.



ABZO612: MICROBIOLOGY AND IMMUNOLOGY

Instructional Hours: 54

Credits: 3

PART I - MICROBIOLOGY (27 hrs)

Module I - Introduction to Microbiology (2 hrs)

Scope of Microbiology; Outline classification of bacteria, fungi and viruses

Module II - Methods in Microbiology (8 hrs)

Methods of sterilization and disinfection: Physical; Chemical

Preparation of culture media: Selective media; Enrichment media; Enriched media; Differential media

Plating techniques and isolation of pure colonies; Aerobic and anaerobic cultivation

Culture preservation techniques: Refrigeration, Deep freezing, Freezing under liquid nitrogen; Lyophilization

Module III - Basic Bacteriology (4 hrs)

Morphology and fine structure of bacteria; Flagella, Pili, Capsule, Cell wall and its composition; Cytoplasmic membrane; Protoplast; Spheroplast; Nuclear material, Cell inclusions, Bacterial spores

Module IV - Basic Virology (4 hrs)

Viruses -Structure of Viruses; Human, Animal, Plant and Bacterial Viruses; Replication of viruses – Lytic and lysogenic cycle

Module V- Microbial Infections (3 hrs)

Primary and secondary infections; Cross infection; Nosocomial infection; Endogenous and exogenous infections

Epidemic, endemic and pandemic; Modes of transmission of diseases: by food, water, air and vectors

Module VI - Microbial Diseases (6 hrs)

A brief study of the following microbial diseases:-



Bacterial: Tuberculosis & Typhoid

Viral: Swine Flu, Bird Flu, Dengue, Chikungunya

Fungal: Dermatophytoses & Candidiasis

PART II - IMMUNOLOGY (27 hrs)

Module VII - Introduction to Immunology

(4 hrs)

Types of immunity; Acquired immunity- passive & active

Innate immunity - Mechanism of innate immunity, Barriers

Phagocytosis; Inflammation

Module VIII - Antigens and Antibodies

(6 hrs)

Types of antigens; haptens; antigenic determinants

Basic structure of immunoglobulins

Different classes of immunoglobulins and functions

Complement system, biological effects of complement

Module IX - Antigen-antibody reactions

(5 hrs)

Precipitation test; Agglutination Test

Clinical applications of antigen - antibody reaction: Widal test; VDRL; ELISA; Complement fixation test; Coombs test

Module X - Immune Response system

(5 hrs)

Primary and secondary lymphoid organs

Cells and tissues of the immune system

Primary and secondary responses

Monoclonal antibodies; Hybridoma technology

Module XI – Immunopathology

(7 hrs)

Hypersensitivity - types of hypersensitivity reactions

Autoimmunity - causes; Graves disease; Hashimoto thyroiditis; Pernicious anemia

Immunodeficiency- primary and secondary

Transplantation immunology; Graft rejection

Major Histocompatibility complex; Human leukocyte antigen system

Immunohaematology, Immunology of blood transfusion, Erythroblastosis foetalis



References:

Microbiology

1. Ananthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.
2. Arora, D.R. and Arora, B. 2008. *Text Book of Microbiology*. CBS Publishers and Distributors, New Delhi
3. Chakraborty, P. A.2009. *Text Book of Microbiology*. New Central Book Agency. New Delhi
4. Hans G. Sch Legal General Microbiology Seventh Ed. Cambridge Low Price
5. Harma and Kanika.2009.*Manual of Microbiology Tools and Techniques*. Ane Books Pvt. Ltd. NewDelhi
6. Heritage, J., E.G.V. Evaus & R.A. Killungten 2007: Introductory Microbiology Cambridge University Press
7. Ingraham, J. L. and Ingraham, C. A. 2000. *Microbiology* (2ndedn). Brooks/Cole-Thomson Learning, MA, USA
8. K. Park, Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications
9. Kanika Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009
10. Keith Wilson and John Walker, 2009, Principles and Techniques of Biochemistry and Molecular Biology Sixth Ed. Cambridge University Press
11. Laning, M Prescott. John,P. Harley and Donald A Klein. 2008. *Microbiology* (7thedn). McGraw Hill International, NJ, USA
12. Mangi, E.M.T El. C.F.A Bryca, A.L Demain, A.K. Allman Fermentation Microbiology & Biotechnology Sec. Ed. Taylor Framics London New York 2006
13. Michael J. Pelczar ECS, Chan & Noel. R. Kreig, Microbiology, Tata McGraw Hill 5th ed. 1996.
14. Monica Cheesbrough: Laboratory Manual for Tropical Countries. Vol.II Microbiology, ELBS – Cambridge Ed. 1986.
15. Prakesh Arora M. Anes Illustrated Dictionary of Immunology, Ane Book India. 2002
16. Prescott. (2013)Microbiology 9 edition McGraw-Hill Higher Education; New York, USA
17. Talaro, Park. Kathelee, N and Talaro,Arthur. 2002. *Foundations of Microbiology*. McGraw Hill Higher Education, NY



18. Wheelis, Mark. 2010. *Principles of Modern Microbiology*. Jones and Bartlett Publishers, NY, USA.

Immunology

1. Abbas, A.K., Lichtman, A.K and Pober, J.S. 1997. *Cellular and Molecular Immunology*. W.B. Saunders Co. New York
2. Ashim K. Chakravarty. 1998. *Immunology*. Tata McGraw-Hill, New Delhi.
3. Chakraborty, A.K. 2006. *Immunology and Immunotechnology*. Oxford University Press, New Delhi
4. Darla, J, Wise & Gordeon, R.Carter. 2004. *Immunology- A Comprehensive Review*. Iowa State University Press. A Blackwell Science Co, USA
5. David Male, Jonathan Brostoff, David Roth and Ivan Roitt. 2006. *Immunology*. Mosby, Edinburgh, UK
6. Goldsby, R.A., Kindt, T.J. and Osborne, B.A.2000. *Immunology* (4th edn.). W.H. Freeman and Co. NY, USA.
7. Hannigan, B. M., Moore, C. B. T. and Quinn, D. G. 2010. *Immunology*. Viva Books, New Delhi.
8. Helen Chappel and Maused Harney, 2006. *Essentials of Clinical Immunology* (5th edn.) Blackwell Scientific Publications
9. Ivan M. Roitt, 2002. *Essential of Immunology*. ELBS, New Delhi.
10. Khan. F.H. 2009. *The Elements of Immunology*. Pearson Education. New Delhi.
11. Kuby J, 2000. *Immunology* (7th edn.). WH Freeman & Co. New York.
12. Richard Coico and Geoffrey Sunshine. 2009. *Immunology: A short course*. Wiley-Blackwell, CA, USA



ABZO613: ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY AND ETHOLOGY

Instructional Hours: 54

Credits: 3

PART I- ENDOCRINOLOGY (20 hrs)

Module I – General Principles (6 hrs)

Hormones as messengers; classification and types of hormones

Mechanism of hormone action, Concept of hormone receptors, Hormonal control of homeostasis.

Module II – Endocrine Glands (14 hrs)

Secretion, regulation, functions and disorders of hormones of Hypothalamus, Hypophysis, Pineal, Thyroid, Parathyroid, Thymus, Islets of Langerhans, Adrenal, Gonads, Placenta
Gastro intestinal hormones

Part II - REPRODUCTIVE BIOLOGY (16 hrs)

Module III - Reproductive Organs and Gametogenesis (8 hrs)

Human reproductive organs; Ultra structure of testes and ovary

Spermatogenesis and oogenesis; Structure of human sperm and egg; Hormonal control of gametogenesis

Module IV - Sexual cycle (8 hrs)

Estrus cycle (non-primate) and menstrual cycle (primate cycle); Hormonal control of menstrual cycle

Puberty; Menarche; Menstrual cycle; Pregnancy; Parturition; Lactation; Menopause and associated physiological changes

Part III - ETHOLOGY (18 hrs)

Module V - Introduction (1 hr)

Scope and branches of Ethology

Module VI – Learning & Motivation (5 hrs)

Instinct; Taxes; Kineses

Types of learning with examples; latent learning; Lorenz experiments; Pavlov's experiments in classical conditioning; short and long term memory; Types of motivation



Module VII - Communication

(4 hrs)

Origin and evolution of communication system

Types of communication with examples-electrical, chemical, olfactory, auditory, visual, echolocation, pheromonal communication in social insects and primates

Module VIII - Orientation and navigation

(5hrs)

Definition; significance of migration; Migration in fishes, birds and wild animals

Types of migration; Navigational cues

Module IX - Biological rhythm

(3hrs)

Types of biological rhythms with specific examples: circadian, circannual, lunar, tidal; Biological clock

References:

Endocrinology

1. Barrington, E.J.W. General and Comparative Endocrinology, Oxford, Clarendon Press.
2. Bentley, P.J. Comparative Vertebrate Endocrinology, Cambridge University Press.
3. David O. Norris Vertebrate Endocrinology 3th Edition,
4. Gorbman, A *et. al.* Comparative endocrinology, John Wiley & Sons.
5. Hadley, M.E. 2000. Endocrinology, 5th ed. Prentice Hall, Upper Saddle River, NJ. Martin, C.R. Endocrine Physiology, Oxford University Press
6. Norris, D.O. 1997. Vertebrate Endocrinology, 3rd ed. Academic Press, Sand Diego, CA.
7. Williams, R.H. Textbook of Endocrinology, W.B. Saunders

Reproductive Biology

1. Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.
2. Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hill
3. Berry A. K - An introduction to embryology.
4. Chatterjee C.C.: Human Physiology, Vol I & II Medical Allied Agency
5. Dutta 2007 Obstetrics , Chuch Livingston 17 Ed
6. Gibbs (2006). Practical guide to developmental biology.
7. Gilbert S. F - Developmental biology
8. Guyton : Text Book of Medical Physiology Saunders



9. Majumdar N. N - Vertebrate embryology
10. Mackenna & Callander: Illustrated Physiology, Churchill Livingstone
11. Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006
12. Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.
13. Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008
14. Vijayakumarn Nair K. and P. V George. A manual of developmental biology, Continental publications, Trivandrum.
15. Werne A Muller. Dev. Biology, Springer Verlag New York 2008
16. Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II)

Ethology

1. Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press. NJ, USA.
2. David McFarland. 1999. *Animal Behaviour*. Pearson Education Ltd. Essex, England.
3. Dawkins, M.S. 1995. *Unravelling Animal Behaviour*. Harlow: Longman.
4. Dunbar, R. 1988. *Primate Social Systems*. Croom Helm, London.
5. Manning Aubrey and Marian Stamp Dawkins 1998. *An Introduction to Animal Behaviour*. Cambridge University Press, UK.
6. Paul W. Sherman and John Alcock., 2001 Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA, USA.
7. Wilson, E.O. 1975. *Sociobiology*. Harvard University Press, Cambridge, Mass. USA

.



ABZO614: DEVELOPMENTAL BIOLOGY

Instructional Hours: 54

Credits: 3

Module I - Early History

(1 hr)

Preformation, Epigenesis, Biogenetic law

Comparative embryology; Evolutionary embryology

Module II - Classification of Eggs

(5 hrs)

Classification of eggs based on the amount, distribution and position of yolk; Mosaic and regulative, Cleidoic and non cleidoic egg

Influence of yolk on development

Egg polarity; Egg symmetry

Module III - Fertilization and Zygote formation

(5 hrs)

Attraction of sperm and the egg; Binding of spermatozoa- fertilization tube formation;

Cortical reactions; Activation of the egg; Amphimixis; Significance of fertilization

Parthenogenesis: Natural parthenogenesis; Arrhenotoky; Thelytoky; Obligatory and Facultative; Artificial Parthenogenesis; Significance of parthenogenesis

Module IV - Cleavage

(3 hrs)

Planes of cleavage - Meridional, vertical, equatorial and latitudinal

Types - Holoblastic and Meroblastic

Patterns - radial, bilateral and spiral

Determinate and indeterminate

Cleavage laws

Factors affecting cleavage

Module V - Cell lineage

(1hr)

Significance; Method of cell lineage with an example

Module VI - Morulation and Blastulation

(4 hrs)

Formation of morula; Blastula formation, Types of blastula; Factors affecting blastulation

Module VII - Fate maps

(4 hrs)



Concept of fate maps; Significance of fate map; Construction of fate maps; Natural and artificial fate maps

Vital staining, carbon particle, Radioactive labeling, Histochemical, Cytological and genetical

Fate maps of frog and chick

Module VIII - Gastrulation

(5 hrs)

Events of gastrulation

Morphogenetic cell movements: Epiboly and Emboly (invagination, involution , delamination , infiltration convergence, divergence, ingression, constriction, extension and concrescence).

Module IX - Tubulation

(1 hr)

Neurogenesis and neural crest cells; Notogenesis; Mesogenesis

Module X – Germ Layers

(2 hrs)

Concept of germ layers and their derivatives

Module XI - Stem Cells

(2 hrs)

Properties and type of stem cells

Totipotency, Pluripotency, Unipotency of embryonic cells

Module XII - Early embryology of Frog

(5 hrs)

Gametes, fertilization, cleavage, blastulation, fate map, gastrulation, notogenesis, neurulation, development of nervous system and eye

Module XIII - Embryology of Chick

(6 hrs)

Brief account of 18 hour chick embryo and 24 hour chick embryo.

Extra embryonic membranes in chick.

Module XIV - Mammalian Development

(7 hrs)

Blastocyst; Implantation

Foetal membranes and placenta; Placenta in mammals; Functions of placenta



Classification of placenta based on nature of contact, mode of implantation and histological intimacy of foetal and maternal tissue

Contraception & birth control; MTP

Infertility- Causes of infertility-male and female; IVF, test tube babies, GIFT & ZIFT;

Embryo transfer technology

Module XV - Experimental Embryology

(3 hrs)

Spemann's constriction and transplantation experiments

Organizer and embryonic induction

References:

1. B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.
2. Berril, N.J and Kars G. 1986. Developmental biology, Mc Graw Hill
3. Berry A. K - An introduction to embryology.
4. Dutta 2007 Obstetrics, Churchill Livingstone 17 Ed
5. Gibbs (2006). Practical guide to developmental biology.
6. Gilbert S. F - Developmental biology
7. Harrison, Harrison's Book of Internal Medicine Churchill Livingstone 17th Ed.
8. Jain P. C - Elements of developmental biology.
9. John Rigo Fundamental Genetics Cambridge University Press. 2009
10. Julio Collado Vides & Ralf Hofstadter Gene Regulation and Metabolism Post genomic Computed Approaches, Ane Book 2004
11. Majumdar N. N - Vertebrate embryology
12. Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford university press (Int. student edition) 2006
13. Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New Delhi.
14. Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008
15. Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications, Trivandrum.
16. Werner A Muller. Dev. Biology, Springer Verlag New York 2008
17. Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II, Module III)
18. Suresh.C. Goel. *Principles of Animal Developmental Biology*. Himalaya Publishing House.



19. Arumugam. N. *Text Book of Embryology*. Saras Publication. (Module I, Module II, Module III)
20. Sastry & Shukal. *Developmental Biology*. Rastogi publications (Module I, Module II, Module III)



ABZO615: WILDLIFE BIOLOGY, CONSERVATION AND MANAGEMENT

Instructional Hours: 72

Credits: 2

Module I - Introduction to Wildlife Biology (2 hrs)

Definition of Wildlife, its scope and importance

Values of Wildlife: ecological, scientific, economic, cultural, ethical and aesthetic values

Module II - Wildlife Habitats (12 hrs)

Importance of forest; Roles of invertebrate fauna in forest ecosystem; Forest types in India; Extent of forest in India

Susceptibility of forest to damages, nature of damage, cause, preventive and protective measures; Forest fires: harmful and beneficial effects; control measure against fires

Important National Parks, Wildlife Sanctuaries and protected areas in India and their prominent fauna

Module III - Sociobiology of Wild Animals (8 hrs)

Competition; Scent marking; Social spacing; Aggression; Territory; Migration and migration corridors

Dominance: determinants, intergroup, interspecies

Social insects; Social behaviour of Ungulates, Wild dogs, Primates and Elephants

Module IV - Diversity & Distribution of Indian Wildlife (12 hrs)

Important Indian wild fauna and their distribution: Asiatic Lion, Indian Tiger, Indian one horned Rhinoceros, Indian Elephant, Gaur, Lion-tailed Macaque, Dhole, Red Panda, Sloth Bear, Indian Wild Ass, Nilgiri Tahr, Malabar Giant Squirrel, Great Indian Bustard, Hornbill, Gangetic Dolphin.

Module V - Wildlife Monitoring (12 hrs)

Capturing and marking techniques: entrapping, darting, tagging and banding

Population enumeration: line transect, capture – recapture, pellet count, pug mark & PIP, scat analysis, call track count, radio telemetry



Field studies and photography: Still and video photography, aerial photography, types of photographic equipments, camera traps, use and care of photographic equipments; Field requirements: equipments, field clothing-use of hides

Module VI - Major threats to Wildlife

(12 hrs)

Human interaction; Habitat destruction; Human-wildlife conflicts; Tourism; Fragmentation; Degradation; Exotic species introduction; Feral animals; Overexploitation

IUCN Red List criterion and categories: indeterminate, rare, vulnerable, endangered, critically endangered and extinct, their status in India- especially in Western Ghats

Prevention of Wildlife poaching and trade

Diseases of wildlife: microbial, parasitic, pathogenic and their control, Foot and mouth disease.

Module VII - Wildlife Conservation and Management

(14 hrs)

Zonation and management of wildlife habitat: cores, buffers and corridors; Habitat utilization pattern

Analysis of wildlife management problems in plantations and exploited forests; Conservation induced displacement and rehabilitation of human settlements

In-situ conservation: Establishment of protected areas, Biosphere reserves, Critical wildlife habitats (CWH)

Ex-situ conservation: Captive breeding and repopulation programme, Role of Zoos, Parks, Oceanarium; Gene banks and germplasm conservation; Regional, national and global conservation efforts

National and international conventions – CITES, TRAFFIC

Laws in wildlife conservation; Wildlife (Protection) Act – 1972

Brief study of Project Tiger, Project Elephant, Gir Lion Sanctuary Project, Crocodile Breeding Projects, Project Hangul

Governmental and Non Governmental Organizations in Wildlife conservation, management and research: MoEF, WII, WWF, WCS, BNHS.

References:

1. Aaron, N.M (1973) Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A.
2. Ali, Salim,(1997) The Book of Indian Birds, Oxford University Press, Mumbai



3. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly (2006) Wildlife Ecology, Conservation and Management, Blackwell Publishing, U.S.A.
4. Apte, Deepak, The Book of Indian Shells. Oxford University Press, Mumbai.
5. Arora and Bipul Chakraborty B.M. (2008) Colorful Atlas on Indian Wildlife Diseases and Disorders, IBDC, Lucknow.
6. Arora B. M.(2002) Indian Wildlife Yearbook AIZ & WV, Bareilly
7. Dasmann RF, (1982) Wildlife Biology, John & Wiley & Sons, New York
8. Ellermann JR, (1961) The Fauna of India, Manager of Publications, New Delhi
9. Gee EP, (1964) The Wildlife of India Collins, London
10. Giles RF, (1971) Wildlife Management and Techniques –Prepared by Wildlife Techniques Manual Committee, Wildlife Soc., Washington, DC
11. Giles RH, (1971) Wildlife Management Techniques, Wildlife Society, Washington, DC
12. Gopal, Rajesh (1992) Fundamentals of Wildlife Management Justice Home, Allahabad, India.
13. Grzimek (1988) Encyclopedia of mammals, McGraw Hill Publishing House, New Delhi.
14. Hosetti, B.B.(1997) Concepts in Wildlife Management, Daya Publishing House, Delhi.
15. Jairajpuri M.(1990) Collection and preservation of animals., Zoological Survey of India
16. Johnsingh A. J. T. and Nima Manjrekar (2012) Mammals of South Asia, Volume 1. Universities Press (India) Pvt Ltd, Hyderabad, India
17. Katwal/Banerjee (2002) Biodiversity conservation in managed and protected areas. Agrobios, India
18. Krishnan M, (1972) India's Wildlife, Bombay Natural History Society
19. Mani MS, (1974) Ecology and Biogeography of India Junk Publ., The Hague
20. Mukherjee AK, Endangered animals of India, Zoological Survey of India, Calcutta
21. Nair SM, (1992) Endangered animals of India, National Book Trust, India
22. Negi, S.S.(1993) Biodiversity and its conservation in India Indus Publishing Co., New Delhi.
23. Noen AN, (1973) Wildlife Ecology: An analytical approach, WM Freeman & Co.
24. Prater SH (1971) The Book of Indian Animals, BNHS
25. Prater, S.H., Book of Indian Animals. Bombay Natural History Society, Mumbai.
26. Primack RB, Essentials of Consr. Bio, Sunderland, Bostan University, MA, USA
27. Sagreiya KP (1967) Forests and Forestry, National Book Trust, India
28. Shah JH, (1975) Introduction to Wildlife Management, McGraw Hill, New York



29. Stracey PD, (1963) Wildlife in India: Consr. and Control, Ministry of Agri., Govt. of India
30. Tiwari, S.K., Zoogeography of India and Asia. CBS Publisher and Distributors, New Delhi.
31. Usher MB, Wildlife Conservation and Evaluation, Chapman & Hall, London





PRACTICAL

ABZO6P10: GENETICS, BIOTECHNOLOGY AND BIOINFORMATICS

Instructional Hours: 36

Credits: 1

1. Genetic problems – (Problems from each type)
 - a. Mono and Dihybrid cross (b) Back cross (c) Multiple alleles.
2. Study of barr body in human buccal epithelium.
3. Study through photographs of the Karyotype- Turner's syndrome, Klinefelter's and Down's syndrome.
4. 4. Sex linked inheritance (color blindness, hyper trichosis, ichthyosis, hemophilia)
5. Autosomal disorders (sickle cell anemia, brachydactyly)
6. Sexing of *Drosophila melanogaster*
7. Isolation of genomic DNA
8. Downloading Nucleotide and Protein sequence files from databases
9. Downloading structure files and visualizing using Rasmol
10. Sequence Analysis using BLAST, CLUSTAL Omega



ABZO6P11: MICROBIOLOGY AND IMMUNOLOGY

Instructional Hours: 36

Credits: 1

1. Instruments –Autoclave, Hot air oven, Laminar Air Flow, Bacteriological incubator – Working and use in Microbiology lab.
2. Cleaning and sterilization of glassware
3. Preparation of solid and liquid media for microbial cultures. (Ingredients, pH and method of preparation) (Demonstration)
 - (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
 - (b) Liquid Media (1) Nutrient broth (2) Peptone water.
 - (c) Semi solid agar
 - (d) Firm agar
4. Culture methods
 - (a) Streak plate technique
 - (d) Pour plate culture
 - (e) Liquid culture
5. Examination of microbes in living condition

Hanging drop method for demonstrating motility of bacteria.
6. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
7. Determination of ABO blood groups and Rh factor (Antigen –antibody Reaction)



ABZO6P12: ENDOCRINOLOGY, REPRODUCTIVE BIOLOGY AND ETHOLOGY

Instructional Hours: 36

Credits: 1

1. Study of permanent histological slides of endocrine glands.
 - T.S. of Pituitary gland
 - T.S. of Thyroid gland
 - T.S. of Adrenal Gland
 - T.S. of Islets of Langerhans
 - T.S. of Testis
 - T.S. of Ovaries
2. Study of pituitary gland of fishes
3. Study of male and female reproductive system of a teleost fish
4. Pheromone traps
5. Skinner box/T Maze
6. Identification of behaviour showing pictures
7. Experiment to demonstrate phototaxis using *Drosophila*/House fly



ABZO6P13: DEVELOPMENTAL BIOLOGY

Instructional Hours: 36

Credits: 1

1. Study of egg types
2. Embryological studies- Blastula (frog, chick)
3. Amniocentesis
4. Study of mammalian sperm and ovum
5. Study of placenta- rabbit and man
6. Study of 18 hour & 24 hour chick embryo slides
7. Egg candling
8. Mounting of chick embryo (36 - 48 hr)



COMPLEMENTARY COURSES

(Common for Model I Botany & Model III Biotechnology and Botany programmes)

Course Code	Title of the Course	Instructional hours/week	Instructional hours for the course	Credits	ISA	ESA	Total
Semester I							
ADZO101	Animal Diversity – Non Chordata	2	36	2	10	60	70
ADZO1P01	Animal Diversity – Non Chordata (P)	2	36	1	10	20	30
Semester II							
ADZO202	Animal Diversity – Chordata	2	36	2	10	60	70
ADZO2P02	Animal Diversity – Chordata (P)	2	36	1	10	20	30
Semester III							
ADZO303	Human Physiology and Immunology	3	54	3	10	60	70
ADZO3P03	Human Physiology and Immunology (P)	2	36	1	10	20	30
Semester IV							
ADZO404	Applied Zoology	3	54	3	10	60	70
ADZO4P04	Applied Zoology (P)	3	36	1	10	20	30





SEMESTER I

ADZO101: ANIMAL DIVERSITY – NON CHORDATA

Instructional Hours: 36

Credits: 2

Module I- Introduction

(1 hr)

General Introduction; five kingdom classification

Module II - Kingdom Protista

(3 hrs)

Salient features

Pathogenic Protista – Plasmodium, Entamoeba, Leishmania

Module III – Subkingdom Mesozoa & Parazoa

(2 hrs)

Phylum Mesozoa- Rhopalura

Parazoa: Phylum Porifera – Leucosolenia

Phylum Placozoa – *Trycoplax adherens*

Module IV - Phylum Coelenterata

(4 hrs)

Salient features, Classification up to classes

Class Hydrozoa – Physalia

Class Scyphozoa – Aurelia

Class Anthozoa – Adamsia

Corals and coral reefs; Polymorphism in Coelenterata

Module V - Phylum - Platyhelminthes

(2 hrs)

Salient features, classification up to classes

Class Turbellaria – Planaria

Class Trematoda – Fasciola

Class Cestoda – *Taenia solium*

Module VI – Phylum Aschelminthes

(4 hrs)

General characteristics; Outline classification



Class Nematoda - Ascaris

Class Nematomorpha - Gordius

Class Gastrotrichia - Chaetonotus

Class Kinorhyncha - Echinoderes

Brief study of Parasitic nematodes -Enterobius, Hook worm, Pin worm

Module VII - Phylum Annelida

(2 hrs)

Salient features, classification up to classes

Class Polychaeta - Nereis

Class Archiannelida - Polygordius

Class Oligochaeta – Earthworm – Pheretima

Class Hirudinomorpha – Hirudinaria

Module VIII - Phylum Arthropoda

(10 hrs)

Salient features, classification up to classes

Subphylum Trilobitomorpha

Class Trilobita (Extinct)

Subphylum Chelicerata

Class Merostoma – Limulus

Class Arachnida – Spider

Class Pycnogonida – Nymphon

Subphylum Mandibulata

Class Crustacea – Daphnia

Class Chilopoda - Centepede

Class Symphyla - Scutigereilla

Class Diplopoda - Millipede

Class Pauropoda - Pauropus

Class Insecta – Butterfly

(Detailed account of examples is not necessary)

Larval forms of Crustacea

Insect pests

1. Pests of coconut – *Oryctes rhinoceros*, *Rhynchophorus ferrugineus*, *Nephantis serinopa*,
Eriophid mite

2. Pests of paddy – *Leptocorisa acuta*, *Spodoptera mauritius*



3. Pests of stored grains - *Trogoderma granarium*, *Tribolium castaneum*, *Sitophilus oryzae*
Insect vectors and vector borne diseases- Mosquito, Rat flea, House fly, Sand fly, Glossinia
Phylum Onychophora – Peripatus (Mention its affinities)

Module XI - Phylum Mollusca

(3 hrs)

General characteristics; Outline classification

Class Monoplacophora - Neopilina

Class Amphineura - Chiton

Class Scaphopoda - Dentalium

Class Gastropoda - Pila

Class Bivalvia - Lamellidens

Class Cephalopoda –Loligo

Module X - Phylum Echinodermata

(4 hrs)

Salient features, classification up to classes

Class 1. Asteroidea – Astropecten

2. Ophiuroidea - Ophiothrix

3. Echinoidea – Echinus

4. Holothuroidea – Cucumaria

5. Crinoidea – Antedon

Water vascular system in Echinodermata

Module XI - Phylum Hemichordata

(1 hr)

Salient features; Balanoglossus

References:

1. Barnes, R.D. 1987. Invertebrate Zoology (W.B. Saunders, New York).
2. Barrington, E.J.W., 1967. Invertebrate Structure and function (ELBS and Nelson , London).
3. Dhami, P.S. and Dhami, J.K. 1979. Invertebrate Zoology (R. Chand and Co. New Delhi).
4. Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Invertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
5. Groove, A.J. and Newell, G.E. 1974. Animal Biology – Indian Reprint (University Book Stall, New Delhi).



6. Hyman, L.H. The Invertebrate vols. (McGraw-Hill) 1942. Comparative vertebrate Anatomy (The University of Chicago Press).
7. James R.D. (1987). Invertebrate Zoology, W.B. Saunders, New York.
8. Kapoor V.C. (1994). Theory and Practice of Animal Taxonomy.
9. Kapoor, V.C. 1994. Theory and Practice of Animal Taxonomy (Oxford and IBH Publishing Co., New Delhi.)
10. Kotpal R.L. Agarwal S.K. and R.P. Khetharpal (2002). Modern Text Book of Zoology.
11. Parker T.J and Haswell W.A. (1962). Text Book of Zoology Vol. I. Invertebrate (ELBS & Macmillan, London).
12. Marshall, A.J. and Williams, W.D. 1972. Text Book of Zoology Vol. Invertebrates (ELBS and Macmillan, London).
13. Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi.)
14. Nair, K.K. Ananthakrishnan, T.N. David, B.V. 1976. General and Applied Entomology (T.M.H. New Delhi).



PRACTICAL

ADZO1P01: ANIMAL DIVERSITY – NON CHORDATA

Instructional Hours: 36

Credits: 1

Scientific Drawing:-

Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.

Anatomy:-

Study of sections

1. Hydra.
2. Ascaris (male or female)
3. Fasciola
4. Earthworm (TS through intestine)

Study of nervous system in Prawn

Study of digestive system in Cockroach

Identification of common mosquitoes (4 genus)

Mounting:-

Mouth parts – House fly and Honey bee.

Prawn appendages.

Identification:-

General identification- The students are expected to identify the following Phylum –wise number of animals by their scientific names: Protista -2, Porifera-1, Coelenterata-2, Platyhelminthes-1, Annelida-2, Arthropoda-3, Mollusca- 2, Echinodermata-2





SEMESTER II

ADZO202: ANIMAL DIVERSITY – CHORDATA

Instructional Hours: 36

Credits: 2

Module I - Phylum Chordata

(10 hrs)

General characters of the Phylum Chordata; Classification up to classes

Sub phylum I Urochordata: General characters

Class 1 Larvacea - Oikopleura

Class 2 Ascidiacea - Ascidia

Class 3 Thaliacea - Salpa

Retrogressive metamorphosis

Subphylum II Cephalochordata: General characters - Brachiostoma

Subphylum III Vertebrata: General characters

Division I Agnatha: General characters

Class 1 Cyclostomata - Petromyzon

Class 2 Ostracodermi – Cephalaspis

Division II Gnathostomata: General characters

Super class Pisces and Super class Tetrapoda

Module II – Super class Pisces

(7 hrs)

General characters

Class 1. Chondrichthyes - Narcine

Class 2. Osteichthyes - Sardine, Latimeria

Lung fishes; Accessory respiratory organs in fishes; Migration in fishes; Scales in fishes

Module III - Super Class Tetrapoda

(4 hrs)

General characters

Class: Amphibia General characters

Order I Urodela - Amblystoma

II Anura - Bufo

III Apoda - Ichthyophis

Parental care in Amphibians



Module IV - Class Reptilia

(5 hrs)

General characters

Sub class I: Anapsida - Chelone

Sub class II Diapsida - Chameleon

Subclass III Parapsida - Ichthyosaurus

Poisonous and non-poisonous snakes of India

Module V - Class Aves

(5hrs)

General characters

Sub class I: Archaeornithes - Archaeopteryx

Sub class II. Neornithes - Pigeon

Flight adaptations of birds; Migration in birds; Flightless birds

Module VI - Class Mammalia

(5 hrs)

General characters

Sub class I Prototheria - Echidna

Sub Class II Metatheria - Macropus

Sub class III Eutheria - Elephas

Aquatic mammals, Dentition in mammals

References:

1. Deoras, P.J. 1981. Snakes of India (National Book Trust of India.)
2. Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
3. Groove, A.J. and Newell, G.E. 1974. Animal Biology - Indian Reprint Universal Book Stall, New Delhi.
4. Induchoodan, 1986, Kweralthile Pakshikal (Kerala Sahitya Academy, Trichur).
5. Kapoor, V.C. 1994, Theory and Practice of Animal Taxonomy (Oxford and IBM Publishing Co. New Delhi.
6. Lagler, K.F., Bardach, J.E., Miller, R.R. Passino, D.R.M. 1977 Ichthyology (John Wiley and Sons).
7. Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co. New Delhi.
8. Newman, H.H. 1939. Phylum Chordata, (Macmillan Pub. Co. New York)



9. Nigam H.C. 1978, Zoology of Chordata (S. Chand and Co. New Delhi).
10. Parker, T.J. and Haswell W.A. 1962. Text Book of Zoology Vol. II Vertebrates (ELBS and Macmillan, London).
11. Parter S.H. 1971. The Book of Indian Animals (Bombay Natural History Society).
12. Salim Ali, 1969. Birds of Kerala (Oxford University Press).
13. Sinha A.K., Adhikari S. Ganguly, B.B. 1988. Biology of Animals Vol. II (New Central Book Agency, Calcutta.)
14. Whitaker, R. 1978 Common Indian Snakes – A field Guide Macmillan and Co. of India Ltd.)
15. Young J.Z. 1981. The life of Vertebrate s (Oxford University Press).
16. Young J.Z. Life of Mammals (Oxford University Press).





PRACTICAL

ADZO2P02: ANIMAL DIVERSITY – CHORDATA

Instructional Hours: 36

Credits: 1

Morphology

Scientific Drawing- Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

Mounting of placoid scales/cycloid/ctenoid scales

Study of feathers

Study of sections

Amphioxus T. S. through pharynx/T.S. through intestine

Osteology

Frog vertebrae

Pectoral and pelvic girdles of Frog

Dentition in Mammals (Dog, Rabbit, Man)

Identification:-

General identification of poisonous snakes(Cobra, Viper, Krait) non poisonous(Rat snake, Natrix, Python)

General identification-

Identify all the animals by their scientific names: Protochordata-1, Pisces-4, Amphibia-3, Reptilia- 4, Aves-1, Mammalia-2.

Taxonomic identification with key:-

Identification of fishes up to the level of order.





SEMESTER III

ADZO303: HUMAN PHYSIOLOGY AND IMMUNOLOGY

Instructional Hours: 54

Credits: 3

Part I - HUMAN PHYSIOLOGY (36 hrs)

Module I – Nutrition

(4 hrs)

Digestive organs and associated glands in man, Balanced diet, Recommended Dietary Allowance (RDA, Importance of fiber in diet, Malnutrition disorders, Vitamin deficiencies, Mineral deficiencies (Iron, Calcium and Iodine)

Module II - Respiration

(4 hrs)

Respiratory organs in man: exchange and transport of respiratory gases Respiratory pigments: hemoglobin (mention structure), myoglobin

Respiratory disorders – Dyspnoea, Hypoxia, Asphyxia, Hypo and Hypercapnia, CO poisoning, smoking and its physiological effects

Module III - Circulation

(6 hrs)

Structure of human heart

Blood – Composition and function, Brief account of mechanism of blood clotting, Blood groups and transfusion

Haemophilia, Cerebral and pulmonary thrombosis, Cerebral haemorrhage

Blood pressure, ECG

Cardiovascular disorders – Arteriosclerosis, Myocardial infarction, Angiogram and Angioplasty

Module IV – Excretion

(6 hrs)

Structure of human nephron, Composition of urine – normal and abnormal constituents

Urine formation (ultra filtration, selective reabsorption, tubular secretion and counter current mechanism), Hormonal control of renal function

Kidney disorders – myelonephritis, glomerular nephritis, nephrotic syndrome; Dialysis

**Module V - Neurophysiology****(6 hrs)**

Structure of typical neuron, myelinated and non myelinated nerve fibres; Nerve impulse – initiation and propagation of nerve impulse, All or none law, Saltatory conduction, Synaptic transmission, Neurotransmitters, Brain waves, Electroencephalogram

Neural disorders – Parkinson's disease, Epilepsy, Alzheimer's disease, Dyslexia

Module VI - Muscle Physiology**(4 hrs)**

Striated, Non striated and Cardiac muscle, Ultra structure of striated muscle fibre, Mechanism of muscle contraction, Threshold and spike potential, simple muscle twitch, Fatigue, Rigor mortis

Module VII - Endocrinology**(6 hrs)**

Endocrine glands and their hormones, mode of action (in brief) , Hypothalamus, Pituitary, Thyroid, Parathyroid, Thymus , Islets of Langerhans, Adrenal, Testis and ovary , Hormonal disorders

Part II – IMMUNOLOGY (18 hrs)**Module VIII - Introduction to immunology****(3 hrs)**

Types of immunity: Innate, Acquired, Passive and Active

Mechanism of innate immunity (Barriers, phagocytosis , inflammation) Complement System, biological effects of complements

Module IX - Antigens and antibodies**(5 hrs)**

Types of antigens; Haptens; Antigenic determinants.

Basic structure of immunoglobulins, Different classes of immunoglobulins and functions.

Module X - Antigen antibody reactions**(5 hrs)**

Precipitation test, Agglutination test, Clinical applications of antigen-antibody reaction, Widal, VDRL, HIV test (ELISA), Complement Fixation Test, and Coombs test.

Module XI - Immunity**(5 hrs)**

Brief accounts of the following:

Immune response system

Primary and secondary lymphoid organs



Cells of Immune system – Leucocytes, lymphocytes, T&B cells, Macrophages, Plasma cells, Memory cells, MHC, Antibody synthesis, Monoclonal antibodies, Hybridoma technology
Immune disorders – Hypersensitivity, Auto immunity & Immunodeficiency; AIDS
Vaccines - Major types of vaccines (BCG, DPT, Polio vaccine and TAB vaccines); Recent trends in vaccine preparation.

References:

Human Physiology

1. Ananthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.
2. Bray, J.J., Cragg, P. A, Macknight, A.D, Mills, R.S and Taylor, D.W 1986. *Lecture Notes on Human Physiology*. ELBS, New Delhi.
3. Brijlal Gupta and J.A. Ramsay, 1977. *Transport of Ions and Water in Animals*. Academic Press, New York.
4. Chatterjee, C.C. 1997. *Human Physiology*. Medical allied agency, Calcutta.
5. Ganong, W.F 1987. *Review of Medical physiology*. Appleton and Lang, Norwalk.
6. Guyton, A.C. 1996. *Text Book of Medical physiology*. Prism Books Pvt. Ltd. Bangalore
7. Hill, W.R., Wyse, G.A and Anderson, M. 2007. *Animal Physiology* (2nd edn). Sinauer Associates Inc. Publishers, MA, USA.
8. Hochachka, P.W. and Somero, G.N. 1984. *Biochemical Adaptation*. Princeton University Press, New Jersey.
9. Hochachka, P.W. and Somero, G.N 2002. *Biochemical Adaptation: Mechanism and Process in Physiological Evolution*. Oxford University Press, New York.
10. Keele, C.A, Neil, E. and Joels, N. 1982. *Samson Wright's Applied Physiology*. Oxford University Press
11. Knut Schmidt-Neilsen. 1997. *Animal physiology: Adaptations and Environment* Cambridge University Press
12. Larsson, P.R. *et al.*, 2002. *William's Text Book of Endocrinology* (10th edn). W.B. Saunders, Philadelphia
13. Moyers, D.C and Schulte, P. M. 2007. *Principles of Animal Physiology* (2nd edn). Benjamin Cummings, CA, USA
14. Squires, E.J. 2003 *Applied Animal Endocrinology*, CABI Publications, UK.
15. Timothy J. Bradley. 2009. *Animal Osmoregulation*. OABS, Oxford University Press, UK.



Immunology

1. Abbas, A.K., Lichtman, A.K and Pober, J.S. 1997. *Cellular and Molecular Immunology*. W.B. Saunders Co. New York
2. Ashim K. Chakravarty. 1998. *Immunology*. Tata McGraw-Hill, New Delhi.
3. Chakraborty, A.K. 2006. *Immunology and Immunotechnology*. Oxford University Press, New Delhi
4. Darla, J, Wise & Gordeon, R. Carter. 2004. *Immunology- A Comprehensive Review*. Iowa State University Press. A Blackwell Science Co, USA
5. David Male, Jonathan Brostoff, David Roth and Ivan Roitt. 2006. *Immunology*. Mosby, Edinburgh, UK
6. Goldsby, R.A., Kindt, T.J. and Osborne, B.A. 2000. *Immunology* (4th edn.). W.H. Freeman and Co. NY, USA.
7. Hannigan, B. M., Moore, C. B. T. and Quinn, D. G. 2010. *Immunology*. Viva Books, New Delhi.
8. Helen Chappel and Maused Harney, 2006. *Essentials of Clinical Immunology* (5th edn.) Blackwell Scientific Publications
9. Ivan M. Roitt, 2002. *Essential of Immunology*. ELBS, New Delhi.
10. Khan. F.H. 2009. *The Elements of Immunology*. Pearson Education. New Delhi.
11. Kuby J, 2000. *Immunology* (7th edn.). WH Freeman & Co. New York.
12. Richard Coico and Geoffrey Sunshine. 2009. *Immunology: A short course*. Wiley-Blackwell, CA, USA



PRACTICAL

ADZO3P03: HUMAN PHYSIOLOGY AND IMMUNOLOGY

Instructional Hours: 36

Credits: 1

- 1 Preparation of Human blood smear & identification of leucocytes
- 2 Qualitative analysis of Reducing Sugar, Protein and Lipid
- 3 Action of Salivary amylase on Starch
- 4 Estimation of Haemoglobin
- 5 Identification of human blood groups, A, AB, B and O, Rh factor
- 6 Instruments (Principle & use)– Sphygmomanometer , Stethoscope Measurement of blood pressure using Sphygmomanometer





SEMESTER IV

ADZO404: APPLIED ZOOLOGY

Instructional Hours: 54

Credits: 3

Module I – Introduction to Aquaculture

(4 hrs)

Advantages and salient features of aquaculture; Types of aquaculture

Biotic and abiotic factors of water; Importance of algae in aquaculture

Module II – Pisciculture

(14 hrs)

Construction and maintenance of culture pond

Common cultivable fishes of Kerala; Economic importance and morphology of culturable species: Catla, Rohu, Mrigal, Etroplus & Tilapia.

Carp culture

Composite fish culture; Integrated Fish Culture

Induced breeding in fishes

Important Fish Diseases; Fish preservation and processing

Module III - Aquarium management

(3 hrs)

Setting up of an Aquarium; Types of filtration

Styles in Aquarium setting

Common species of Aquarium fishes; Aquarium plants

Module IV - Prawn culture, Mussel culture & Pearl culture

(3 hrs)

Prawn culture: *Penaeus indicus*, *Macrobrachium rosenbergii*

Mussel culture: *Perna viridis*, *Perna indicus*

Pearl culture: *Pinctada fucata*

Module V - Sericulture

(12 hrs)

Four species of silkworms, Life history of silkworms

Silkworm Rearing Techniques; Mounting of worms; Harvesting and stifling of cocoons

Diseases and Pests of silkworms

Silkworm diseases; Preventive and control measures



Module VI - Vermiculture

(6 hrs)

Species of Earthworms suitable for vermiculture

Reproduction and life cycle of earth worms

Physical and Chemical effects of Vermiculture

Vermicomposting: Site Selection, Cement pit; Soil pit; Preparation of pit; Maintenance and Monitoring of pit

Module VII - Apiculture

(12 hrs)

Species of Honey bees

Organization of honeybee colony

Bee keeping methods and equipments

Apiary management and maintenance

Stingless bee keeping (Meliponiculture)

Bee pasturage, Pollination by honey bees

Byproducts of honey bees and their uses

Diseases and pests of honey bees, control measures.

References:

1. Alikunhi, K.H., Fish Culture in India (ICAR, New Delhi)
2. Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Zoological Survey of India, 1994, earthworms Resources and Vermiculture
3. Edwards, C.A. & Lafty, J.R. 1972 Biology of Earthworms (Chapman and Hall Led. London)
4. Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)
5. Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)
6. Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board Bangalore)
7. Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)
8. Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.
9. Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum)



10. Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms
11. Padmanabha Aiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13-76 An Account of the Oligochacta of the Travancore
12. Shiggen, K., 1969, Problems in Prawn Culture (American publ. Co., New Delhi)
13. Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)
14. Andhra Pradesh Agricultural University, Hyderabad)
15. Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi)
16. Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)
17. Singh, V.P.P. and Ramachandran, V., 1985 Freshwater Fish Culture (ICAR, New Delhi)
18. Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)
19. Ullal, S. R. and Narasimahanna, M.N., Handbook of Practical Sericulture (Central Silk Board Bombay.)
20. Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)





PRACTICAL

ADZO4P04: APPLIED ZOOLOGY

Instructional Hours: 36

Credits: 1

1. General Identification, Economic importance, Morphology, scientific names and common names of the following
 - a. Economic importance and morphology of culturable species
(Catla, Rohu, Grass carp, Common carp, Etroplus, Tilapia)
Penaeus indicus, *P.monodon*,
Perna viridis/*P.indicus*
Pinctada fucata
 - b. Aquarium equipments- Power head, power filter, canister, aerators
 - c . Two species of earthworms used in Vermiculture
 - d. Two species of honey bees
 - e. Silkworm. Cocoon/Adult
2. Castes of bees
3. Bee keeping equipment
4. Beeswax, Honey, Silk, Vermicompost (Identification-Uses)
5. Chandrika /Natrika used in sericulture
6. Fish diseases (any 2diagrams/specimens)
7. Fish Parasite (any one)





OPEN COURSE

Course Code	Title of the Course	Instructional hours/week	Instructional hours for the course	Credits	ISA	ESA	Total
AOZO501	Human Health and Genetics	4	72	3	20	80	100





AOZO501: HUMAN HEALTH AND GENETICS

Instructional Hours: 72

Credits: 3

PART I - HUMAN HEALTH (58 hrs)

Module I – Introduction (2 hrs)

Definition and meaning of health; Dimensions and determinants of health

Module II - Food & Nutrition (4 hrs)

Importance of nutrition; Macro and micro nutrients: Carbohydrates, Proteins, Lipids, Water, Minerals, Vitamins

Meal pattern; Balanced diet; BMR; Malnutrition

Module III - Health & Exercise (3 hrs)

BMI; Diet and Exercise; Physical activity and health benefits; Effect of exercise on body systems

Module IV- Life style diseases (4 hrs)

Obesity: causes and preventing measures

Diabetes: causes and management

Cardiovascular disorders: prevention and management

Cancer: different types, causes of cancer, carcinogens, diet & cancer

Module V - Food borne diseases and their prevention (5 hrs)

Food Safety: General principles of hygiene

Important food borne illness: Staphylococcal food poisoning, Botulism, Salmonellosis, Shigellosis, Amoebiasis

Module VI - Water quality & Water borne diseases (5 hrs)

Water quality parameters; Water purification techniques; Waste water management

Pathogenic microorganisms transmitted by water; Cholera and Typhoid; Prevention of water borne diseases



Module VII - Common infectious diseases (5 hrs)

Tuberculosis; Hepatitis; Swine flu (H1N1); Bird flu (H5N1); Chikungunya; Dengue fever; Leptospirosis; Role of vectors in spread of diseases

Module VIII - Immunity & Vaccination (2 hrs)

Basic concepts of immunology; Immunity to infection; Vaccination

Module IX - Replacement & Restoration therapies (2hrs)

Organ transplantation; Cell replacement therapy; Gene therapy

Module X –Reproductive Health & Infertility (7 hrs)

Pre-natal diagnosis:- Amniocentesis, Chorionic Villus Sampling, Ultra sound scanning, Fetoscopy; Genetic counseling

Umbilical cord banking

Causes of human infertility; ICSI, IVF & test tube babies

STDs, HIV, AIDS – causes & preventive measures

Module XI - Mental Health & Disorders (6 hrs)

Concept of mental health; Emotional adjustment and well being; Yoga; Meditation and Relaxation

Anxiety disorders; Bipolar disorder; Depression; Schizophrenia; Treatments for mental disorders

Module XII - Drug Abuse (4 hrs)

Tobacco use, Tobacco related illnesses and tobacco control; Alcoholism; Drug and substance abuse; Abuse related illnesses and their control

Addiction; De-addiction

Module XIII - Old age and associated problems (5 hrs)

Biology of ageing; Health problems of the elderly: Osteoporosis; Arthritis; Hypertension; Alzheimer's disease; Parkinson's disease

Module XIV - Safety & First Aid (4 hrs)

Accident prevention; Health and Safety in daily life; Health and Safety at work; First aid and emergency care; Common injuries and their management



PART II - HUMAN GENETICS (14 hrs)

Module XV - Genetic Disorders

(7 hrs)

Human normal chromosome complement; Chromosomal anomalies- Down Syndrome and Cri-du-chat syndrome; Sex chromosomal anomalies – Klinefelter's Syndrome and Turner's Syndrome

Single gene mutation disorders- Sickle cell anaemia

Polygenic – Cleft lip and palate

Sex linked inheritance – Haemophilia and Colour blindness

Module XVI – Genetics in Daily life

(7 hrs)

Human blood groups and their inheritance pattern; Rh factor

Blood transfusion – Universal Donor, Universal recipient

DNA finger printing and applications – Probing for criminals, method to resolve paternity and maternity disputes

Human genome project – a brief account

Eugenics and Euthenics; Genetically Modified Organisms

References:

1. Arora, D.R. and Arora, B. 2008. *Text Book of Microbiology*. CBS Publishers and Distributors, New Delhi
2. Fashey, Tomas D, Insel, Paul M and Roth Walt (2005) *Fit and Well*. New York; McGraw Hill Inc
3. Greenberg, Jerol S and Dintiman George B (1997) *Wellness Creating a life of Health and Fitness*, London Allyn and Bacon Inc.
4. Guyton, A.C. 1996. *Text Book of Medical physiology*. Prism Books Pvt. Ltd. Bangalore
5. Das, H.K. 2007. *Text book of Biotechnology*. Wiley India Pvt. Ltd. New Delhi
6. Edlen Gordon Janes and Barttlet. *Human Genatics a Modern Synthesis*. Published by Boston.
7. Hannigan, B. M., Moore, C. B. T. and Quinn, D. G. 2010. *Immunology*. Viva Books, New Delhi
8. Monica Cheesbrough, *Laboratory Manual for Tropical Counties Vol.II LBS*.
9. Norman Bezzaant *HELP First Aid for everyday emergencies*. Jaico Publishing House, Bombay, Delhi
10. Pelczar M.J. Jr. E.C.S. Chane & N.R. Krieg, *Microbiology (Concept & Applications)*
11. Rai. B.C. *Health Education and Hygiene*. Published by Prakashan Kendra, Lucknow



St Berchmans College

Founded 1922

AUTONOMOUS

College with Potential for Excellence | Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101