GURU NANAK COLLEGE(Autonomous)

VELACHERY ROAD, CHENNAI – 600042
(Re-accredited at 'A' grade by NAAC)

BACHELOR OF SCIENCE

DEPARTMENT OF ADVANCED ZOOLOGY & BIOTECHNOLOGY

(SEMESTER SYSTEM WITH CREDITS)

Regulations
&
Syllabus

B.Sc., DEGREE PROGRAMME IN ADVANCED ZOOLOGY AND BIOTECHNOLOGY

SEMESTER SYSTEM WITH CREDITS
(Effective from the Academic year 2016--17)

RULES AND REGULATIONS

1. CHOICE BASED CREDIT SYSTEM (CBCS) WITH GRADING

The College follows the CBCS with grades under the semester pattern. Every course paper is provided with a credit point based on the quantum of subject matter, complexity of the content and the hours of teaching allotment. This is done after a thorough analysis of the content of each subject paper by the members of the Board of studies and with the approval of the Academic Council. Students are also offered with a choice of a variety of Job-oriented courses, Elective courses and courses involving Soft-skills. Students are permitted to choose any course of their interest during the study period and earn extra credits and certificates in addition to the regular hardcore (compulsory) subjects.

The evaluation method under CBCS involves a more acceptable grading system that reflects the personality of the student. This is represented as Cumulative Grade Point Average (CGPA) and Grade Point Average (GPA) which are indicators of Academic Performance of the student. It provides students scope for horizontal mobility as well as empowers them with the flexibility of learning at their convenience.

2. ELEGIBILITY FOR ADMISSION

Candidates for admission to the first year of the UG programme shall be required to have passed the higher secondary examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras. Students applying for the PG programme should have taken the UG degree in the concerned subject from a recognized university.

3. DURATION OF THE COURSE

The UG course is of three year duration with six semesters and the PG course is of two year duration with four semesters. The odd semester include the period from June to November and the even semester from December to April. There shall not be less than 90 working days for each semester.

4. COURSE OF STUDY

The main subject of study for Bachelor's Degree shall consist of the following:

FOUNDATION COURSES :

PART – I Tamil or other Language (Hindi / Sanskrit/ French)

PART – II English

CORE COURSES

PART – III consisting of (a) Main subjects, (b) Allied Subjects, (c) Elective subjects related to the main subject of study and project work.

PART –IV

1. **(a)** Those who have not studied Tamil up to XII standard, and taken a non-Tamil language under **Part – I** shall take Tamil comprising of Two courses (level will be at 6^{th} standard).

(b) Those who have studied Tamil up to XII standard, and taken a non—Tamil language under **Part –I** shall take **Advanced Tamil** comprising of two courses.

(c) Others who do not come under a or b can choose **non-major elective comprising of two courses.**

2. Soft Skills. (I , II, III & IV Semesters **)**

3. Environmental Studies (IV Semester)

4. Value Education (V Semester)

PART –V Compulsory Extension Service

A candidate shall be awarded one credit for compulsory extension service.

All the students shall enroll for **NSS / NCC / NSO (Sports & Games) Rotract / Youth red cross or any other service organization** in the college and shall have to put in compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before **31st March in a year.** If a student LACKS **40 HOURS ATTENDANCE** in the first year, he / she shall have to compensate the same during the subsequent years. Literacy and population, educational field work shall be compulsory components in the above extension service activities.

5. COURSE STRUCTURE:

Sem.	Part	Course Component	Subject Name	Cdt	Hrs	CIA	ESE	Total
I	I	Language	Tamil I	3	6	50	50	100
	II	English	English I	3	4	50	50	100
	III	Core I	Diversity and Functional Anatomy of Invertebrates	4	6	50	50	100
			Practical I – Invertebrata and Chordata	-	2	*	*	*
		Allied I	Botany I	3	6	50	50	100
			Allied Botany Practical	-	2	*	*	*
	IV	1. NME/ Basic Tamil	Aquaculture	2	2		100	100
		2. Skill based subjects	Soft skill I	3	2		100	100
II	I	Language	Tamil II	3	6	50	50	100
	II	English	English II	3	4	50	50	100
	III	Core II	Diversity and Functional Anatomy of Chordates	4	6	50	50	100
			Practical I – Invertebrata and Chordata	4	2	50	50	100
		Allied II	Botany II	3	6	50	50	100
			Allied Botany Practical	4	2	50	50	100
	IV	1. NME/ Basic Tamil	Public health and hygiene	2	2		100	100
		2. Skill based subjects	Soft skill II	3	2		100	100
III	I	Language	Tamil III	3	6	50	50	100
	II	English	English III	3	4	50	50	100
	III	Core III	Cell and Molecular Biology	4	6	50	50	100
			Practical II- Cell Biology, Genetics and Evolution	-	2	*	*	*
		Allied III	Chemistry I	3	6	50	50	100
			Allied Chemistry Practical	-	2	*	*	*
	IV	1. Skill based subjects	Soft skill III	3	2		100	100
		2. EVS	Environmental science	-	2	*	*	*
IV	I	Language	Tamil IV	3	6	50	50	100
	II	English	English IV	3	4	50	50	100
	III	Core IV	Genetics and Evolution	4	6	50	50	100
			Practical II- Cell Biology, Genetics and Evolution	4	2	50	50	100
		Allied IV	Chemistry II	3	6	50	50	100
			Allied Chemistry Practical	4	2	50	50	100
	IV	1. Skill based subjects	Soft skill III	3	2		100	100
		2. EVS	Environmental science	2	2		100	100
V	III	Core V	Developmental Biology and Endocrinology	4	4	50	50	100
		Core VI	Biotechnology and Nanotechnology	4	4	50	50	100
		Core VII	Animal Physiology, Biochemistry and Immunology	4	4	50	50	100
		Core VIII	Biostatistics and Computer Applications for Life Sciences	4	4	50	50	100
		Core IX	Practical-III Animal Physiology, Biochemistry, Developmental Biology and Immunology	-	4	50	50	100
		Core X	Practical-IV- Environmental Biology, Biotechnology and Microbiology	-	4	*	*	*
		Elective – I	Medical Laboratory Technique	5	5	50	50	100
	IV	Value Education	Value education	2	1	*	100	100
VI	III	Core VIII	Taxonomy, Ecology and Paleontology	4	4	50	50	100
		Core IX	Recombinant DNA technology	4	4	50	50	100
		Core X	Microbiology and Industrial Biotechnology	4	4	50	50	100
		Core XI	Practical-III-Animal Physiology, Biochemistry, Developmental Biology and Immunology	4	4	50	50	100
		Core XII	Practical-IV Environmental Biology, Biotechnology and Microbiology	4	4	50	50	100
		Elective II	Sericulture and Apiculture	5	5	50	50	100
		Elective III	Economic Entomology and Pest Management	5	5	50	50	100
	V	Extension Activities		1	-	-	-	-

- Examination will be held in the even semester.

Under Part IV of the course, students are required to register separately for two Non-Major Elective papers, choosing preferably papers offered by other departments during the First and Second semester. The marks obtained under Part IV would not be included for classification of the candidate although a pass is mandatory. Students should have obtained the minimum credit under Part V to be eligible to receive the degree.

6. EXAMINATIONS

Continuous Internal Assessment (CIA) and End Semester Examination (ESE), each carrying 50% marks, will form the basis for grading student performance in each paper.

CONTINUOUS INTERNAL ASSESSMENT

Continuous assessment will be made by teachers responsible for the course they teach on dates centrally fixed by the college. Every semester has two centralized CIA examinations and one model examination for each paper. The Continuous Assessment Tests (CAT) of one and a half hour duration would be held on completion of 30 and 60 working days each semester. Students who fail to write one or more CATs will have to register for a re-test after obtaining clearance from the HOD and Dean Academics. Re-test is generally not allowed except in the case of students who miss CA tests because they were away on those days representing college in sports or cultural activities or for any justifiable reason acceptable to the Principal/Dean. Principal/Dean may grant special permission to such candidates for taking just one additional paper of three hour duration covering the entire syllabus of that paper. This test should be taken before the commencement of the End of Semester Examination of that semester. A Model exam of three hours duration will be held at the end of each semester. The schedule for these tests is as follows:

C.I.A. Test	Schedule	Syllabus Coverage
I	After 30 working days from the commencement of the semester	40%
II	After 60 working days of the semester	80%
III (model)	After 80 working days of the semester	95%

The components for the CIA are as follows:

Internal Components			
Assessment Type	**Nature**	**Maximum marks**	**% of Weightage**
CIA	Written test I	50	5
	Written test II	50	5
	Model examination	100	10
	Assignment		10
	Class activities		15
	Attendance		5
	Total		**50**

The class activity relates to a programme of accepted innovative techniques such as seminars, quiz, port folio creation, MCQ, power point presentation, objective tests, role play etc. This class activity for evaluation will be fixed before the commencement of the semester with the approval of the HOD.

A student should attend at least one test in order to declare him/her as pass in the internal assessment tests even though he/she has got pass marks in the overall internal components. Candidates who fail in a paper for want of sufficient marks in CIA will have to seek improvement by coming back to the semester for CA exams or repeating it after the completion of the course at the time of regular CIA.

A record of all such assessment procedures will be maintained by the department and is open for clarification by the students. Students will have the right to appeal to the Principal in case of glaring disparities in marking.

CIA marks for practical subjects will be awarded by the respective faculty based on the performance of the student in the model practical examination, observation notebook, submission of record books, regularity and attendance to the practical classes. The attendance particulars for practical classes will be maintained by the concerned faculty.

Marks for attendance will be awarded as per the following:

Percentage of General Attendance	Marks awarded
90-100	5
75-89	4
60-75	3
<60	0

END OF SEMESTER EXAMINATIONS (ESE)

- Examinations will be conducted during each semester after the completion of a minimum of 90 working days. Examinations will be held for all papers of the course in Nov/Dec and April/May for all UG and PG courses. Practical examinations will be conducted only during the end of the even semester either before the commencement of the theory exam or after the theory exams. The schedule for ESE Practical will be notified by the Controller of Examinations in consultation with the Dean of Sciences.
- A candidate will be permitted to appear for the End of Semester examinations for any semester if:
  - ❖ He / She secures not less than 75% of attendance in the working days during the semester.
  - ❖ His / Her conduct has been satisfactory
  - ❖ He / She should have applied for the examination
  - ❖ He / She should have paid the requisite examination fee

  .
- The attendance requirements to appear for the ESE is as follows:
  - Students must have **75%** of attendance in each part of the course of study to appear for the examination.

- Students who have **65% to 74.9%** of attendance shall apply for condonation in the prescribed form along with the prescribed fee after obtaining permission from the Dean. Students cannot claim condonation as a matter of right. Submission of medical certificate is normally not accepted to condone shortage of attendance.
- Students who have **50% to 64.9%** of attendance will fall under the "Withheld" category. Such students cannot take the ESE exams. They should apply to the Principal for permission to write the next supplementary examination and pay the requisite fee for this purpose.
- Students who have less than **50%** of attendance fall under the "detained" category and **are not** permitted to appear for the examination. **They shall redo the semesters after completion of the course and appear for the examination after securing the required percentage of attendance.** The decision of **Principal** remains final and binding in all respects.

- Students who do not get the minimum marks to pass in the ESE shall compulsorily re-appear for the paper in the subsequent semester after paying the required fee.
- Candidates who fail in any of the papers in the UG and PG End of Semester examinations shall complete the paper concerned within 5 years from the date of admission to the particular course. If they fail to do so, they shall re-register their names and take the examination in the revised regulations/syllabus of the paper in force at the time of their reappearance. In the event of removal of that paper consequent to change of regulation and/or curriculum after 5-year period, the candidate shall have to take up an equivalent paper in the revised syllabus as suggested by the Chairman, Board of Studies concerned.

Instant Examinations. (Special Supplementary Examination)

In order to provide an opportunity to the final UG and PG students to obtain the degree in the same year itself and to facilitate vertical mobility, special supplementary End of Semester examinations will be conducted in about 20 days from the date of publication of results every year for the final semester theory papers and also for the candidates who fail in only one theory paper of the previous semesters. Students, who wish to apply for special supplementary End of Semester examinations, can do so within 7 days from the date of publication of results.

Malpractice cases, if any, will not be permitted to appear for Supplementary Examination

The details of the ESE is as follows:

External Component			
Assessment type	**Comprehensive**	**Maximum mark**	**% of Weightage**
External Exam	3 hours examination	100	50
	Grand total (CIA+ESE)		**100**

7. CONDUCT OF EXAMINATION

- Chief Superintendent of exams will be the Principal or a person appointed by him. The conduct of end of semester examination lies with the team headed by the Chief Superintendent.
- Time-table for examinations will be finalized the office of the Controller of Examinations and will be displayed well in advance i.e., 20 days prior to the commencement of examination.
- The Hall tickets for eligible students will be issued **5** days prior to the commencement of examination.
- For Subjects like Environmental Studies, Value Education etc. End Semester Examinations may be conducted on-line or along with the regular ESE.

8. VALUATION

- Valuation of the answer scripts are undertaken at the central valuation camp lead by the Controller of Examination or the Camp Officer appointed by the Controller of Examinations.
- Single valuation of answer scripts by external examiners is adopted for both UG and PG courses.

9. PUBLICATION OF RESULTS

The Examination results will be published on the web during the second / third week of May for the II, IV and VI semester examinations and during the second / third week of December for the I, III and V semester examinations

PROVISION FOR OBTAINING PHOTOCOPY AND REVALUATION OF VALUED ANSWER SCRIPTS

- A student can request the Principal for a photocopy of the answer book within seven days from the announcement of the results. Such requests should be endorsed by the HOD and submitted along with the prescribed fees for forward transcription to the COE.
- Students intending to go for revaluation after obtaining the photocopy of the answer script, shall apply to the COE in the prescribed format along with fees duly endorsed by the HOD and Principal. The application should reach the COE within 7 days from receipt of the photocopy of the answer script.
- Revaluation /obtaining photocopy of answer scripts is permissible only for the current semester papers and not for any arrear paper.
- For re-valuation, the answer papers will be valued by two external examiners separately and the average mark of the valuations will be taken into account.
- The revaluation results will be forwarded to the Principal within 15 working days.
- Revised mark statement will be issued after withdrawing the previous one, if the marks obtained in revaluation are higher than the marks obtained earlier. In other cases, the original marks obtained earlier will be retained and the matter will be intimated to the student concerned as 'No change'.

10. CLASSIFICATION OF PERFORMANCE – GRADING SYSTEM FOR THE SEMESTER

A candidate shall be declared to have qualified for the award of the Degree provided the candidate has successfully completed the Programme requirements and has passed all the prescribed subjects of study in all the semesters.

Conversion of Marks to Grade Points and Letter Grade (Performance in a paper/course)

Range of Marks		Grade Points		Letter Grade		Description	
PG & UG		**PG & UG**		**PG & UG**		**PG & UG**	
90-100		9.0-10.0		O		Outstanding	
80-89		8.0-8.9		D+		Excellent	
75-79		7.5-7.9		D		Distinction	
70-74		7.0-7.4		A+		Very Good	
60-69		6.0-6.9		A		Good	
50-59		5.0-5.9		B		Average	
PG	**UG**	**PG**	**UG**	**PG**	**UG**	**PG**	UG
00-49	40-49	0.0	4.0-4.9	U	C	Re-appear	Satisfactory
	00-39		0.0		U		Re-appear
ABSENT		0.0		AAA		ABSENT	
B.Com (Hons)		**B.Com (Hons)**		**B.Com (Hons)**		**B.Com (Hons)**	
00-59		0.0		U		Reappear	

Classification of Grades

CGPA		GRADE		CLASSIFICATION OF FINAL RESULT	
PG & UG		**PG & UG**		**PG & UG**	
9.5-10.0		O+		First Class – Exemplary*	
9.0 and above but below 9.5		O		First class- outstanding*	
8.5 and above but below 9.0		D++		First Class with Distinction*	
8.0 and above but below 8.5		D+			
7.5 and above but below 8.0		D			
7.0 and above but below 7.5		A++		First Class	
6.5 and above but below 7.0		A+			
6.0 and above but below 6.5		A			
5.5 and above but below 6.0		B+		Second Class	
5.0 and above but below 5.5		B			
PG	**UG**	**PG**	**UG**	**PG**	**UG**
0.0 and above but below 5.0	4.5 and above but below 5.0	U	C+	Re – appear	Third Class
	4.0 and above but below 4.5		C		
	0.0 and above but below 4.0		U		Re- appear

*** The candidates who have passed in the first appearance and within the prescribed semester of the UG/PG Programme (Core, Allied, Elective, Project and Internship courses) alone are eligible.**

Grading For a Semester/Year:

GRADE POINT AVERAGE [GP] = $\sum_i C_i G_i / \sum_i C_i$

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses (passed) in a semester/year}}$$

For the entire programme:

CUMULATIVE GRADE POINT AVERAGE [CGPA] = $\sum_n \sum_i C_{ni} G_i / \sum_n \sum_i C_{ni}$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

(CGPA is calculated only if the candidate has passed in all the courses in the entire programme)

C_1 = Credits earned for course *i* in any semester / year.
G_1 = Grade Point obtained for course *i* in any semester / year.
n refers to the semester/year in which such courses were credited.
C_i = Credits earned for course i in any semester.
G_n = Grade Points obtained for course i in any semester.
n refers to the semester in which such courses were credited

Passing Minimum

- For all U.G.Programme except B.Com (Hons) passing minimum of each subject is 40% in CIA, 40% in E.S.E and 40% in aggregate i.e., CIA + ESE
- For B.Com (Hons)

a)No passing minimum for internal b) For ESE, passing minimum is 50% for languages, NME, value education, EVS and 60% for core subjects/internship/project and viva voce c) In aggregate the passing minimum (Ext + Int) is 50% for for languages, NME, value education, EVS and 60% for core subjects/internship/project and viva voce.

- Passing minimum of each subject/course under PG Programme is 50% in CIA, 50% in ESE and 50% in aggregate i.e., CIA + ESE
- Passing minimum of each subject under Career Oriented Programmes, Certificate Courses and Diploma courses is 40% in CIA and ESE and 40% in aggregate i.e., CIA + ESE. Both UG and PG students are at liberty to study these courses jointly
- Passing minimum for each PG Diploma course offered by a PG Department as a part of the curriculum to its students is 50% in ESE and 50% in aggregate i.e., CIA + ESE, since graduates alone are admitted to these Courses

.

11. **REQUIREMENT FOR PROCEEDING TO SUBSEQUENT SEMESTER**

(a) Candidates shall register their names for the first semester examination after admission in the UG courses.

(b) Candidates shall be permitted to proceed from the first semester up to final semester irrespective of their failure in any of the semester examinations subject to the condition that the candidate should register for all the arrear subjects of earlier semesters along with current (subsequent) semester subjects

12. ISSUE OF CERTIFICATES

1. Marksheet

Mark sheets will be issued every semester to all students who have taken the examination.

2. Consolidated Mark Sheet

Consolidated mark sheets will be given to final year students along with total credits earned only to those who have passed all the papers prescribed for the respective degree.

3. Transcript

Students who are desirous to obtain any other certificates like Transcript certificates for joining courses of study in other Universities in India or abroad or for obtaining scholarships, can obtain these certificates from the office of the Controller of Examinations. A requisition letter duly signed by the Student and forwarded by the Principal along with fee challan is to be submitted to the office of the Controller of Examinations. The certificates will be provided within 15 working days.

4. Provisional Certificate

A copy of the results of the successful final year students will be sent to the University of Madras in the prescribed format in July/August and the University will issue a Provisional Certificate through the College. This may take around 2 months.

5. Corrections in the Certificates

Any corrections like name, date of birth etc., can also be made in the certificate. A letter of request duly signed by the student, HOD and Principal along with the prescribed fee paid challan is to be forwarded to the office of the Controller of Examinations. The time line to update will be 15 working days. The amount once paid will not be refunded under any circumstances.

6. Issue of Duplicate Mark Sheet

In case of loss of mark sheet / certificate, a duplicate may provided after submitting a non-traceable certificate issued from the Police station duly signed by an Inspector or Sub Inspector. A requisition letter duly signed by the Principal along with the requisite fees should also be submitted to the office of the Controller of Examinations. Certificates which are torn will not be replaced.

7. Duplicate Provisional Certificate / Degree Certificate :

Students have to apply directly to the University of Madras for duplicate provisional certificate and degree certificate.

8. Verification of Qualification

The agencies who requests for verification of educational qualifications of students under autonomous mode of this college and students who opt for higher studies / employment and who requires verification of educational qualification, shall apply to the Principal to this effect along with the prescribed fees. The letter of request has to be forwarded to the OCOE. The relevant certificate will be issued within 15 working days from the office of the Principal.

13. CONVOCATION AND NOTICE

1. Convocation

Students must apply for their Degree certificates along with copy of the provisional certificates in the application form issued by University of Madras and submit the same in the college office on or before the last date fixed by the college. Every year after the Convocation held by University of Madras, the college will hold a Graduation day / convocation in which the Degree certificates will be distributed to the students who are present. For others it will be issued through the college admin office.

2. Notice

Candidates who have completed the duration of the course and left the College, can get information regarding Supplementary Examinations, issue of examination application forms, certificates and application for Graduation day through the college web site and general notice board. Regular students will however be informed of the examinations by circulation, in addition to the modes mentioned above**.**

No candidate will be communicated individually.

The liability lies on the candidates for their certificates. The College shall not be liable for whatever lapse that occurs due to the ignorance of the candidates.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN FOR THEORY PAPERS WITHOUT PRACTICAL

QUESTION ALLOTMENT	**MAXIMUM 100 MARKS** **PASSING MINIMUM 40 MARKS** **THREE HOURS DURATION**
QUESTION 1-12 **Answer any 10 questions**	**PART-A (10X2=20 MARKS)** **ANSWER ANY 10 QUESTIONS** **EACH QUESTION CARRIES 2 MARK**
QUESTION 13-20 **Answer any FIVE out of 8**	**PART-B (5X 8=40)** **ANSWER ANY FIVE QUESTIONS** **EACH QUESTION CARRIES 8 MARKS**
QUESTION 21 TO 24 **Answer any TWO out of 4**	**PART-C (2X 20=40 MARKS)** **ANSWER ANY TWO QUESTIONS** **EACH QUESTION CARRIES 20 MARKS**

B.Sc ADVANCED ZOOLOGY AND BIOTECHNOLGY

SYLLABUS

PAPER I: DIVERSITY AND FUNCTIONAL ANATOMY OF INVERTEBRATES

Credit: 4

Objectives **90 Hrs**

To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acelluar to multicellular animals. Studies on this group of animals bring to light knowledge of basic functions of life viz., nutrition, respiration, excretion, reproduction etc. and how the organisms of various phyla structurally and functionally adapt themselves for surviving in different ecological conditions. Classification and general characters of the following phyla up to orders with a detailed study of the animals mentioned against each phylum.

UNIT-I **15 hrs**

Protozoa : *Paramecium, Plasmodium*

UNIT-II **18 hrs**

Porifera : *Sycon,* Canal System in Sponges

Coelenterata : O*belia, Aurelia,* Polymorphism

UNIT-III **18 hrs**

Platyhelminthes : *Fasciola, Taenia,* Parasitic Adaptations

Nematoda : *Ascaris*, *Enterobius*, *Ancylostoma*

Annelida : *Nereis,* Excretory Organs in Annelida

UNIT-IV **21 hrs**

Arthropoda : *Penaeus,* Larval Forms in Crustacea

Mollusca : *Pila,* Foot in Molluscs

UNIT-V **18 hrs**

Echinodermata : *Asterias,* Larval Forms

Hemichordata : *Balanoglossus* (External Characters Only) and its Systematic Position.

Books Recommended

1. Dhami, P.S. and Dhami, J.K., Invertebrates, 5th ed., R. Chand Publisher, 1979.
2. Kotpal, R.L., Invertebrates, Rastogi Publications, Meerut, 2005.
3. Parker, T.J. and Haswell, W.A., Text book of Zoology, Invertebrates, Vol. I edited by Marshall, A.J. and Williams, W.D., CBS Publication & Dist., Delhi, 1990.
4. Barnes, A., Invertebrate Zoology, Harcourt Publishers, International Company, 2001.
5. Chaudhry, S., Fundamental Invertebrate Zoology, S.Vikas & Co. Fatehpura, Jalandhar, 2003.
6. Ekambaranatha Ayyar, M and Ananthakrishnan, T.N. 1993, Outlines of Zoology, Vol.I, Part I and II, Viswanathan and Co. Madras.
7. T.C. Majpuria. 1990, Invertebrate Zoology, Pradeep Pub. Kitab Mahal.

PAPER II: DIVERSITY AND FUNCTIONAL ANATOMY OF CHORDATES

Credit: 4

Objectives **90 Hrs**

To acquaint the students about the structure and function of protochordates and chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates. Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

UNIT-I **15 hrs**

Urochordata : *Herdmania;* Development and Affinities:
Alternation of generation in Urochordata.

UNIT-II **20 hrs**

Cephalochordata : *Branchiostoma;* Development and affinities.
Cyclostomata : *Petromyzon;* Migration.

UNIT-III **20 hrs**

Pisces : *Labeo,* Accessory respiratory organs in fishes, Types of fins
Amphibia : *Rana,* Parental care.

UNIT-IV **20 hrs**

Reptilia : *Calotes,* Arcades and fossae
Aves : *Columba,* Migration in birds; Palate in birds.

UNIT-V **15 hrs**

Mammalia : *Oryctolagus,* Dentition in mammals.

Book Recommended

1. Dhami, P.S., Dhami, J.K., Chordate Zoology, Dinesh Publishers, Jalandhar, 1982.
2. Kotpal, R.L., Text Book of Zoology- Vertebrates, CBS Publishers, Delhi, 2000.
3. Parker, T.J., and Haswell, W.A., A Text Book of Zoology Vol. II- Vertebrates. Latest edition, CBS Publishers, Delhi edited by Late A.J. Marshall & Williams, W.D.
4. Dodson, E.O., A Text Book of Zoology, CBS Publishers & Distributors, Delhi, 1976.
5. Bhamrah, H.S. and Juneja, K., An introduction to fishes, Anmol Publications, New Delhi, 1990.

SEMESTER II

PAPER-III PRACTICAL I: INVERTEBRATA AND CHORDATA

I. DISSECTION

A. Cockroach:

1. External characters
2. Digestive system
3. Nervous system
4. Male Reproductive system
5. Female Reproductive system

B. Any Bony Fish:

6. External characters
7. Digestive system
8. Aortic arches

II. MOUNTING

Mouth parts of: 1. Cockroach 2. Mosquito 3. Prawn: appendages 4.*Mugil* : Ctenoid scale

III – SPOTTERS

A- Classify giving reasons up to order:

1. *Paramecium*
2. *Scypha*
3. *Obelia*
4. *Taneia Solium*
5. *Ascaris*
6. *Neanthes*
7. *Penaeus*
8. Asterias
9. *Balanoglossus*
10. *Amphioxus*
11. *Scoliodon sorrakowah*
12. *Rana hexadactyla*
13. *Calotes versicolor*
14. *Columba livia*
15. *Oryctolagus cuniculus*

B- Draw labelled sketches:

16.*Obelia* medusa
17. Nereis T.S
18. Bipinnaria larva
19. *Amphioxus* T.S
20. Quill feather

C- Comment on Biological significance:

21. *Entamoeba*
22. *Paramecium* – Conjugation
23. *Plasmodium*
24. *Ascaris* H
25. Heteronereis
26. *Peripatus*
27. Nauplius larva
28. *Sacculina* on crab
29. Sea anemone on Hermit crab
30. *Vipera russelli*
31. Bat

D – Relate structure and function:

32. Sponge – Spicules
33. Sponge – Gemmule
34. *Taenia* – Scolex
35. *Neanthes* – Parapodium
36. *Penaeus* – Petasma
37. Starfish - Tube foot.
38. Snake- Poison apparatus
39. Quill feather

E. Osteology / Palate in Birds / Dentition

Frog <u>Osteology</u>

40. Skull and lower jaw
41. Vertebral column
42. Pectoral girdle
43. Pelvic girdle
44. Forelimb
45. Hindlimb

Palate in Birds

46. Pigeon 47. Crow 48. Duck

Dentition 49. Rabbit 50. Dog – Dentition

PAPER IV : CELL AND MOLECULAR BIOLOGY

Credit: 4

Objectives **90 Hrs**

To enable the students to learn various aspects of cell biology.

UNIT I **20 hrs**

Plasma membrane: Different models of plasma membrane (in brief), Fluid mosaic model in detail, Differentiation at cell surface.

UNIT II **15 hrs**

Endoplasmic reticulum: Morphology, Chemical Composition, Morphological Differentiation, Functions and its Role During Mitosis.

Microbodies : Structure, Chemical Composition, Functions and Origin of Peroxisomes and Glyoxysomes.

UNIT-III **20 hrs**

Mitochondria : Morphology including vital examination, Light and Ultramicroscopic Structures, Structural Variations with Regard to Functions, Chemical Composition, Role in Cell Physiology, Mitochondria as Semi-autonomous Organoids.

Lysosomes: Morphology, Chemistry, Polymorphism in Relation to Cytosis, Cell Ageing and Cell Autophagy.

UNIT-IV **20 hrs**

Nucleus: Nuclear Envelope, Nuclear Permeability, Structure of Interphase Nucleus, Structure and Cytochemistry of Nucleus, Structure and Biogenesis of Ribosomes.

Centrioles : Basal bodies, Cilia, Flagella, Microtubules, Amoeboid movement.

UNIT-V **15 hrs**

Golgi complex: Morphology, Chemical Composition, Relationship with other cell components, its function with special reference to cell secretion.

Books Recommended

1. DeRobertis, EDP, De Robertis,E.M.F. Cell Biology and Molecular Biology. Eighth Edition. W.B. Saunders Co., Philadelphia, 1995.
2. Powar, C.B., Cell Biology, Himalaya Publishing House, Bombay.
3. Alberts, B. Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. Molecular Biology of the Cell Gerland Publ. Inc., New York.
4. Darnell, J., Lodish, JH. & Beltimore, D. Molecular Cell Biology, Oxford & IBH Publishing Co., New Delhi.

PAPER V: GENETICS AND EVOLUTION

Credit: 4

Objectives **90 Hrs**

To enable the students to learn various aspects of heriditary. To give an insight into evolution of genetic material, its functional aspects and changes in the environment that bring about evolution.

UNIT-I **20 hrs**

Physical basis of heredity – Mendelism, interaction of genes, multiple alleles, chromosome structure and function in Eukaryotes (except in chemistry, models and concepts). Polytene chromosomes, lampbrush chromosomes.

UNIT-II **20 hrs**

Sex determination - Chromosomes & Sex Chromatin

Chromosomal changes- Structural aberrations and its significance. Numerical changes, Polyploidy and its types. Nature of genes-Double helix structure of DNA, Mechanisms of DNA replication. Changes in genes-Spontaneous mutations and Induced Mutations, Physical and Chemical Mutagens.

UNIT-III **15 hrs**

Linkage of genes, Crossing over, Sex linkage in *Drosophila* and Man, Criss-cross inheritance, Colour blindness and Haemophilia. Cytoplasmic inheritance. Human Genetics-Normal and abnormal karyotypes.

UNIT – IV : Evolution **20 hrs**

Lamarckism and Neo-Lamarckism – Darwinism and Neo-Darwinism – Mutation Theory – Geological time scale – Dating of Fossil – Living and Extinct Fossils. Mimicry & Colouration – Batesian and Mullerian – Convergent, Divergent and Parallel Evolution – Co-evolution, Adaptive radiation in mammals.

UNIT – V **15 hrs**

Isolating mechanisms – different types – Species Concept – definition and origin of species – Allopatric and Sympatric speciation – Genetic drift – Founder's Principle. Evolution of Man.

Books recommended

1. U. Goodenough: Genetics. IIIrd Edition, Washington University, Saunders College Publishing.
2. O.P. Swanson, Timothy Herz and William, J. Young : Cytogenetics-The chromosome in division, inheritance and evolution, Prentice Hall.
3. B.S. Gardner & D.P. Smustad : Principles of Genetics, John Wiley &Sons. Sixth Edition.
4. A.M. Winchester. Genetics-A survey of the Principles of Heredity, Oxford &IBH Publishing Co., New Delhi.
5. P.K. Gupta : Genetics, Rastogi Publishers, Meerut.
6. P.K. Gupta : Cytology Genetics, and Molecular Biology; Rastogi Publishers, Meerut.
7. Verma, P.S. and V.K. Agarwal, 2002, Concept of Evolution, S. Chand & Co., Ram Nagar, New Delhi – 110 055.

PAPER VI: PRACTICAL II. CELL BIOLOGY AND GENETICS

CELL BIOLOGY

1. Micrometry – Use of Microscopes- Microscopes – Light microscope, Camera Lucida, Stage and Ocular Micrometer.
2. Blood smear preparation – Differential Count of WBC.
3. Counting of RBC and WBC using Haemocytometer (Demonstration)
4. Mounting of Buccal epithelium and observing living cells using vital staining.
5. Mitosis in Onion root tip squash
6. Meiosis in grasshopper testis squash (Demonstration)
7. Study of prepared slides of histology

a. Columnar epithelium	b. Ciliated epithelium	c. Glandular epithelium
d.Connective tissue	e. Cartilage T.S.	f. Bone T.S.
g. Cardiac tissue	h. Striated muscle	i. Non-striated muscle
j. Nervous tissue	k. Ovary T.S.	l. Testis T.S.

GENETICS

1. Observation of common mutants of Drosophila
2. Preparation of mount of salivary gland chromosomes of Chironomus larva
3. Identification of human blood groups
4. Study on Normal Karyotype - male and female, Down syndrome, Turner and Klinefelter syndrome

PAPER VII : DEVELOPMENTAL BIOLOGY AND ENDOCRINOLOGY

Credit: 4

Objectives **60 Hrs**

To enable the students to know about the development of all the vertebrates from an egg to the embryo. To acquaint the students with the functions of various endocrine glands and their secretions i.e. hormones

UNIT I **12 hrs**

Origin of germ cells- Process of Spermatogenesis and Oogenesis; Structure of human sperm, Types of sperms, Types of eggs.

UNIT II **12 hrs**

Mechanism and Physiology of Fertilization. Early development- Cleavage, Blastulation, Gastrulation and Tubulation in Frog and Chick. Presumptive areas, Organizers and Inductors.

UNIT III **12 hrs**

Development of membranes and Formation of placenta. Types of placentae in mammals, pregnancy tests. Bio-chemical basis of embryology, regeneration, metamorphosis.

UNIT-IV **12 hrs**

Introduction to hormones and their mode of action. Gonadal hormones in Mammals. Hormonal control of metabolism, Development, Somatic pigmentation and Reproduction in insects.

UNIT-V **12 hrs**

Structure of Endocrine Glands-Pituitary, Thyroid, Adrenal and Pancreas of Vertebrates. Biological Actions of Hormones of Pituitary, Thyroid, Adrenal and Pancreas.

Books Recommended

1. An Introduction to Embryology, Saunders Company.
2. Turner, C.D. and Bagnars, W.B. (1976) General Endocrinology, Saunders Company.
3. Highnam, K.C. and Hill, L.(1981) Comparative Endocrinology of invertebrates, Enwaral Arnold Ltd.., London.
4. Golds Worthy, G.J. Robinson, J. and Mordue, W. 1981. Endocrinology, John Wiley and Sons, New York.
5. Tombes, A.S.(1970) An Introduction to invertebrates endocrinology, Academic Press, New York.

PAPER VIII: BIOTECHNOLOGY AND NANOTECHNOLOGY

Credit: 4

Objectives **60 Hrs**

To enable students to be familiar with the basics of biotechnology together with a fundamental knowledge on the application of nanotechnology

UNIT I **12 hrs**

Definitions and history of Biotechnology. Structure of *E.coli*, Bacterial conjugation, Transduction, Transformation, Structure of Bacteriophage – Lytic and Lysogenic Cycle. Major areas of Biotechnology – Agriculture, Food and Pharmaceutical industry and Beverages. Indian scenario in Biotechnology – Centers, Activities Achievements and Bio-industries in India

UNIT II **12 hrs**

Vectors – Types, plasmids (pBR 322, pBR 327), Phage – M13, Cosmid insertion vectors, Replacement vectors, Shuttle vectors and High expression vectors. DNA fragment, Enzymes – Nucleases, Restriction enzymes, Polymerase and Ligases.

UNIT III **12 hrs**

Gene cloning in *E.coli*. Isolation of DNA – Insertion of DNA – Use of Linkers and Adapters – Transformation – Uptake of DNA by host cell – Selection of clones identification of recombinants insertional inactivation.

UNIT IV **12 hrs**

Tissue culture: Culture media – Composition and Preparation. Principles and techniques of plant and animal cell culture. Importance of cell line culture.

UNIT V **12 hrs**

Nanotechnology: Definition - Nanoscience and nanotechnology. Applications of nanotechnology – Nanomaterials in medicine – Medical implants – Nanomaterials for water purification – Nanomaterials in food – Nanomaterials for the environment - Elimination of pollutants – Veterinary applications.

TEXT BOOKS:

1. Purohit Mathur, 1999 .Biotechnology Fundamental and applications. Botanica Publications.
2. Shah H.A and Tokeer Ahmad' 2011. Principles of nanoscience and nanotechnology. Narosa Publishing House.

REFERENCE BOOKS:

1. T.A. Brown .2010. Gene cloning and Introduction. Wiley Blackwell.
2. Brown J.A. 2001 – Genetics – A Molecular approach 3rd edition – Nelson Tornes.
3. Old R. W and S.B. Primrose. 1994. Principles of Gene manipulation – 5th edition – Blackwell Scientific publications.
4. John. R. W. Masters 2000. Animal cell culture – A practical approach 3rd Edition. Oxford univ press.
5. Glick B.R. and Jack J. Pasternak, 1994 . Molecular biotechnology ASM press.
6. P Ramdoss, 2009.Animal Animal Biotechnology Recent Concepts and Developments, MJP Publishers.
7. Subbiah Balaji, 2010. Nanotechnology. MJP Publishers.
8. S Shanmugam, 2011. Nanotechnology. MJP Publishers.
9. Rakesh Rathi, Nanotechnology, S. Chand & Co.
10. B K Parthasarathy, 2007.Nanotechnology in Life Science Gyan Books.
11. Kumar, 2010. Principles of Nanotechnology, Scitech Publication (India).

PAPER IX: ANIMAL PHYSIOLOGY, BIOCHEMISTRY AND IMMUNOLOGY

Credit: 4

Objectives **60 Hrs**

To make the students understand the physiological and biochemical processes going on inside the vertebrates together with an exposure to immunological components.

UNIT-I **7 hrs**

Enzymes: Classification, Nomenclature, General Properties, Regulation of Enzyme Activity, Enzyme inhibition. Digestion: Intracellular and extracellular digestion, digestive enzymes, Digestion by means of symbionts, Intestinal absorption.

UNIT-II **15 hrs**

Respiration: Nature of Respiratory Organs, Transport of Respiratory Gases, Control of Respiration. Muscle: Muscle contraction – Physiology and Chemistry. Excretion: Structure of Kidney and Nephron, Physiology of urine formation. Circulatory System: Blood components, Functions of components, Cardiac output and Heart rate, Physiology of heart, Control of Cardiovascular function. Nervous system : Structural elements, Nerve impulse, Resting and Action potentials, Conduction of Action Potential, Synaptic Transmission.

UNIT III **8 hrs**

Metabolism: Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis and Glycolysis; Kreb's cycle, Regulation of Carbohydrate Metabolism, Electron Transport Chain, Oxidative Phosphorylation; Lipid Metabolism, Protein Metabolism

Unit – IV **15 hrs**

Overviews of immune system – Historical perspectives, Innate and Acquired immunity. Cells of the Immune System: Hematopoiesis and Differentiation, B-lymphocytes, T-lymphocytes, Macrophages, Dendritic cells, Natural Killer Cells and Lymphocyte Activated Killer Cells, Eosinophils, Neutrophils & Mast Cells. Organs of the Immune System: Primary and Secondary Lymphoid Organs: Thymus, Bursa of Fabricii, Spleen, Lymph Nodes, Lymphatic System, Mucosa Associated Lymphoid Tissue (MALT), Cutaneous-Associated Lymphoid Tissues. Complement system: Major Histocompatibility Complex.

UNIT V **15 hrs**

Antigens – types, properties- Haptens – Adjuvants – Vaccines – Types – Toxoids – Antitoxins – Immunoglobulins – structure, types, and properties – Theories of antibody production – Complement structure, properties, function and pathway – Antigen-antibody reaction – in-vitro methods – Agglutination – Precipitation – Complement fixation – Immuno-fluorescence – ELISA – RIA.

Books Recommended

1. Guyton, A.X. (1986) Text Book of Medical Physiology, 7th edition, Saunders Company.
2. Best, J.P. (1985) Best and Taylor's physiological basis of medical practice (11th ed.) William and Wilkins.
3. Hoar, W.S. (1983) General and comparative physiology, Adaptation and Environment (3rd ed.) Cambridge University Press.
4. Roitt I.M. 2000. Essential Immunology. Blackwell Scientific Publishers
5. Chakravarthy, A. K.1996. Immunology, Tata Mc Graw Hill, New Delhi.
6. Lehninger A.L., Nelson D.L., Cox M.M. (2005). Principles of biochemistry (W. H. Freeman, USA).
7. Stryer L, J. M. Berg, J.L. Tymoczko (2001). Biochemistry (W.H. Freeman and Company, New York).
8. Rawn J.D. (1989). Biochemistry (Neil Patterson).
9. Voet D., Voet, J.G. (2004). Biochemistry (John Wiley & Sons).
10. Voet, D., Voet, J.G. and Pratt, C.W. (2008). Fundamentals of biochemistry: Life at the molecular level (John Wiley & Sons).

PAPER X BIOSTATISTICS AND COMPUTER APPLICATION IN LIFE SCIENCE

Credit: 4

Objective: **60 Hrs**

All the data generated in biological sciences needs statistical verification to prove its significance so computer aided analysis of the same is need of the hour. Therefore knowledge of computer in 1st year is important.

UNIT – I **12 hrs**

An introduction, Types of data, Collection, Classification and Tabulation of the Primary data, Secondary Data, Discrete data and Continuous data, Diagrammatic and Graphical representation of grouped data, Frequency Distribution {univariate and bivariate}, Cumulative frequency distribution and their graphical representation, Histogram frequency polygon. Concept of central tendency or location and measures of dispersion

UNIT – II **12 hrs**

Normal distribution. Simple Correlation. Hypothesis testing- Student's t-test; Chi-square analysis.

UNIT – III **12 hrs**

Computers: General introduction to computers, Organization to computers, Digital and Analogue computers, Computers algorithms: Milestones in hardware and software-batch oriented/online/real time applications.

UNIT – IV **12 hrs**

Data storage devices: Primary storage: Storage addressed and capacity, ROM, RAM, Input/output devices: Key-tape/diskette devices, light pen Mouse, Joystick, Source data automation. Printed outputs: Serial, line, page, Printers, Plotters, Voice Response Units.

UNIT V **12 hrs**

MS – Word: File operations – New, Open, Save & Print – Editing – Cut, Copy, Paste, Find & Replace – Insert – Page numbers & Pictures – Format – Font, Bullet and Numbering, Paragraph & Background – Tools – Spelling & Grammar – Data – Sort.

MS – Excel: Presentation of Biostatistical data using Excel – Auto-sum, Paste function, Chart wizard, Sort function & Drawing. Uses of Internet, Networking of computers.

Reference Books:

1. P.N. Arora & P.K. Malhotra (1996). Biostatistics (Himalaya Publishing House, Mumbai).
2. Sokal & Rohlf(1973). Introduction to biostatistics (Toppan Co. Japan).
3. W.J. Evens, G.R. Grant (2005). Statistical methods in bioinformatics: An introduction (Springer).
4. P.K. Sinha (2004). Computer fundamentals (BPB).
5. Suresh K. Basandra (2008). Computers today (Galgotia Publications Pvt. Ltd., New Delhi).

PAPER – XI : TAXONOMY, ECOLOGY & PALAEONTOLOGY

Credit: 4

Objectives **60 Hrs**

To enable the students to identify, classify and name the organism according to international code of zoological nomenclature. To acquaint the student with different procedures of taxonomy and different methods of analysis of variations and theories of classification. To educate the students about the basic environmental phenomena and enable them to understand the adaptations of the animals to their environment. To make the students understand the importance of Palaeontology and to acquaint the students with origin of different vertebrates and ancestries of some vertebrates.

UNIT-I **12 hrs**

Definitions and perspectives of systematics, Classification and Taxonomy; History, Goals and Importance of Taxonomy; Procedures of taxonomy-identification, Classification, Nomenclature, Phena, Taxa, Category; Key and its significance; Higher taxa and Linnean hierarchy; History and Theories of Classification; International Code of Zoological Nomenclature-Principles and Objectives and Rules for Nomenclature, Type system and Priority for different taxa. Population structure of species; Polytypic species, Race, Variety, Cline, Subspecies, Semi-species, Super species.

UNIT-II **12 hrs**

Ecology-Definition, Subdivision of Ecology and Scope of Ecology. Ecological Factors-Temperature and Light as Ecological Factors. Ecosystem - Definition, Components of Ecosystem, Grazing and Detritus type of food chain, Food Web and Trophic levels. Ecological pyramids-Pyramids of number, Biomass and Energy.

UNIT-III **12 hrs**

Energy flow-Flow of energy through a food chain in relation to laws of thermodynamics. Biogeochemical cycles – Nitrogen and Phosophorous Cycle. Laws of limiting factor-Leibigs's law of minimum, Shelford's law of tolerance and concept of limiting factors. Ecological niche – Concept of ecological niche. Ecological succession – Definition, Types of succession.

UNIT – IV **12 hrs**

Freshwater habitats – Lentic and Lotic; Marine habitat- Zonation

National and International Environmental Organizations, Red Data Book. Wildlife Management

UNIT –V **12 hrs**

Introduction to Palaeontology : Stratigraphy ; Principles, Importance, Successive stratigraphic steps, History, Fossils and fossilization. General account of Palaeo-Meso- and Cenozoic Eras with a mention of important fossil groups in different Eras, Periods and Epochs.

Books Recommended

1. Dobzhansky, T., Genetics and the origin of species. Columbia, Univ. Press, New York.
2. Mayr, E., Systematics and the origin of species, Columbia Univ. Press, New York.
3. Mayr, E., Principles of Systematic Zoology, McGraw-Hall, New York.
4. Kreb, J.C., Ecology, Harper & Row, Publ., New York.
5. Odum, E.P., Fundamentals of Ecology, Saunders College Publishers, Philadelphia.
6. Kendeigh, S.C., Ecology with special reference to animals, Prentice-Hall of and New Delhi.
7. Smith, Ecology, Harper & Row Publishers, New York.
8. Stirton, R.A., Time, life and man, C.B.S. Publishers & Distribution, Delhi.
9. Colbert, E.H., Evolution of Vertebrates, C.B.S. Publishers & Distribution, Delhi

PAPER XII GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY

Credit: 4

Objectives **60 Hrs**

To facilitate students to understanding the basic concepts involved in genetic manipulation and the application of rDNA technology

Unit –I **12 Hrs**

Introduction to Gene Cloning, DNA Manipulative Enzymes-Nucleases, Ligases, Polymerases, Modifying Enzymes, Restriction Enzymes and its Nomenclature, reverse transcriptase, topoisomerases, plasmids- Basic features of plasmids, Plasmid Classification, Blunt And Sticky Ends, Linkers Adapters, Homopolymer Tailing.

Unit – II **12 Hrs**

Vectors: Cloning vectors for *E. coli*- Nomenclature, pBR 322, pBR 327, pUC 8, pGEM3Z. Methods of identification of recombinants: Insertional inactivation, Blue/white selection. Bacteriophages: Basic features, Phage and its vector, Lytic & Lysogeny, Linear and Circular forms of Lambda Vector, Insertion and Replacement Vectors; Identification of Recombinant Phages, Cosmid, Phagemid, Bacterial Artificial Chromosomes (BACs), Shuttle Vectors.

Unit – III **12 Hrs**

Cloning vectors for yeast and fungi, YEp, YIp, YRp, artificial chromosomes, YAC, application of YAC, Identification of a recombinants from a gene library, Methods of clone identification, Radioactive and non- radioactive DNA and RNA labeling techniques, Nick translation , Random priming, Site directed mutagenesis (Cassette , Primer Extension, RT, Real Time, Multiplex, Inverse).

Unit- IV **12 Hrs**

Southern, Northern and western blotting, colony hybridization, *In situ* hybridization , Genomic Cloning, Transformation of *E. coli*, Yeast and Plant cells. PCR: Types, Applications and Limitations. Applications of rDNA Technology to Medicine, Agriculture & Environment.

Unit V **12 Hrs**

DNA sequencing- Restriction fragment probe, Sanger Coulson Method. Maxman Gilbert Method- RFLP- Techniques and Application. Genetic Finger Printing- Polymerase Chain Reaction- Taq Polymerase Primers, Human Genome Project. Applications of Genetic Engineering- Alcohol Production, Medicine- Insulin and Hepatitis Vaccine Production

Text book:

1. Dubey, R.C. 1995, A Text Book of Biotechnology, S.Chand & Co. Ltd., Ram Nagar, New Delhi – 110 055.

Reference Books:

1. J. Sambrook, D.W.Russell (2001). Molecular cloning: A laboratory manual (Cold spring Harbour Laboratory Press).
2. R.M. Old, S.B. Primrose (2001). Principles of gene manipulation (Wiley- Blackwell).
3. B. D. Hames, S. J. Higgins (1995). Gene probes: A. practical approach (Oxford University Press).
4. Tuan Rocky S. (1997). Recombinant gene expression protocols (Edition Illustrated, Publisher Springer).
5. White Bruce A. (1997). PCR cloning protocols: from molecular cloning to genetic engineering (Humana Press).
6. Sandy B. Primrose, Richard Twyman (2006). Principles of gene manipulation and genomics (Wiley Blackwell).
7. Terence A. Brown (2006). Gene cloning and DNA analysis: An introduction (Wiley-Blackwell).

PAPER XIII MICROBIOLOGY AND INDUSTRIAL BIOTECHNOLOGY

Credit: 4

Objective: **60 Hrs**

Microbes are playing significant role in understanding medical science and industries so study of microbes from basic to advance level, with understanding of biochemistry, cell structure and application makes this paper significant.

UNIT – I **12 hrs**

History of Microbiology: A. Leewenhook, L. Pasteur, R. Koch, J. Lister, J. Tyndall. Biogenesis Vs abiogenesis, Koch Postulates, Discovery of Antibiotics. Principle of Microscopy: Bright field, Dark field, Phase Contrast, Fluorescent, Electron Microscopy.

UNIT – II **12 hrs**

Microbial Classification: Bacteria, Fungi and Algae. Morphology of Bacteria, Viruses and Fungi with major emphasis on bacterial structure specially cell wall. Gram positive and Gram negative bacteria. Microbial spores, Sporulation/ germination process.

UNIT – III **12 hrs**

Microbial growth, Nutritional biodiversity, Phases of growth, Generation time, Growth rate. Chemostat and Turbidostat, Microbes in extreme environment like high temperature and high/ low pH values, Sterilization.

UNIT –IV **12 hrs**

Dairy Microbiology – Pasteurization – Milk products – Curd, Butter and Cheese; Food Microbiology – Fermented food - Food spoilage - Food poisoning – Physiochemical methods in food preservation. Soil Microbiology – Common soil microbes – Symbiotic and asymbiotic organisms. Water Microbiology - Microbiology of drinking water – Waterborne diseases.

UNIT V **12 hrs**

Production of Industrial Enzymes such as Proteases, Amylases, Lipases, Cellulases. Biopreservatives (Nisin) Cheese, Biopolymers (Xanthan Gum, PHB), Antibiotics, (penicillin). Production of Recombinant Proteins having Therapeutic and Diagnostic Applications, Products of Plant and Animal Cell Culture.

Text Books:

1. Dubey, R.C. 1995, A Text Book of Biotechnology, S.Chand & Co. Ltd., Ram Nagar, New Delhi – 110 055.
2. Sundara Rajan, S, 2002, College Microbiology – Vol. I to IV, Vardhana Publications, Bangalore – 560 095.

Reference Books:

1. Pelczar Jr. M.J. Chan E.C.S. and Kreig N.R. 2001 Microbiology – McGraw Hill Inc. New York.
2. Stainer R.Y., Ingraham J.L., Wheelis M.L. and Painter P.R. 1999 General Microbiology – Macmillan Education Ltd. London.
3. Purohit Mathur. 1999. Biotechnology Fundamentals and applications. Botanica Publications.
4. Higgins I.J., Best G.J., and Jones J. 1996, Biotechnology – Principles and applications, Blackwell Scientific Publications, Oxford London.
5. Gupta P.K. Elements of Biotechnology 2001, Rastogi Publications, Meerut.
6. Rittmann, B.E. and P.L. McCarty, 2001. Environmental biotechnology: principles and applications. Mcgraw- Hill, New York.
7. Ahmed, N., F.M.Qureshi and O.Y. Khan, 2001. Industrial environmental Biotechnology, Horizon Press.

PAPER ELECTIVE 1: MEDICAL LABORATORY TECHNIQUES AND BIOINSTRUMENTATION

Credit: 5

Objectives: **60 Hrs**

To familiarize students with various laboratory techniques undertaken before medical intervention and the instruments utilized in common laboratories.

Unit I **12 hrs**

Introduction – Scope of the subject. Collection of specimens, Records and Preparation of reports. Cleaning, Maintenance and Care of Glasswares.

Unit II **12 hrs**

Sterilization – Physical and Chemical Methods. Disposal of Specimens and Infected Materials, Safety Precautions and First Aid Treatment for Superficial wounds, Burns, Chemical Poisoning, Contamination of infected microbiological specimens and Electric shock.

Unit III **12 hrs**

Urine: Analysis of urine samples, Chemical parameters routinely required to be analysed. Pregnancy test. Analysis of stools, semen, Cerebrospinal fluid for chemical investigation.

Unit IV **12 hrs**

Pathology: Organisms causing infectious diseases. Viruses – Measles, Poliomyelitis, Hepatitis, HIV. Bacteria – Tuberculosis, Whooping cough – Tetanus – Diptheria, Cholera. Protozoans – Amoebic dysentery, Malaria, Leismaniasis. Helminths – filariasis, Cysticercasis.

Unit V **12 hrs**

Principles use and maintenance of laboratory instruments like Autoclave, Hot air oven, Incubators, Water bath, Refrigerator, Centrifuge, Colorimeter, pH meter, Haemoglobinometer, Haemocytometer, Microtomes, Balances.

Text book:

1. Sood Ramnik, 1985. Medical Laboratory Technology. Jaypee brothers, New Delhi, 384 pp.

Reference Book:

2. Baker F.J. and Silverton R.E. Introduction to Medical Laboratory Technology.

ELECTIVE II SERICULTURE AND APICULTURE

Credit: 5

Objectives: **60 Hrs**

Silkworm and honey bee rearing, besides being a favorite past time, has also become a small scale cottage industry. This paper enables students to understand the culture techniques

Unit I **12 hrs**

History of Sericulture: Types of Silkworm – Mulberry, Tasar, Muga and Eri. Mulberry Silkworms: Morphology and Life cycle of silkworms. Silkworm rearing: Rearing house and equipments.

Unit II **12 hrs**

Silk reeling: Selection of raw material for reeling – Storage and preservation of raw materials. Marketing and the role of Central Silk Board in the Development of sericulture.

Unit III **12 hrs**

Apiculture: Bee keeping down the ages – Present status of Apiculture in India – Species of Honey bees. Embryology and life history – Anatomy and Physiology of honey bee.

Unit IV **12 hrs**

Bee colony, Castes. Natural colonies and their yield. Types of beehives – structure – location, care and management.

Unit V **12 hrs**

Honey yield in national and international market. Uses of honey and beeswax in Indian medicine.

Reference Books:

1. Manual of Silkworm Rearing: Manual of Mulberry Cultivation by Food and Agricultural Organization (FAO), United States.
2. Yoshimaro Tanaka. Sericology, central Silk Board, 99-B, Meghdoot, Merine Drive, Bombay.
3. Yokoyama, T. synthesized science of Sericulture.
4. Kovaleve, P.A. Silkworm breeding Stocks, Central Silk Board, Merine Drive, Bombay.
5. NPCS Board of Consultants & Engineers. 2007 Publisher: NIIR PROJECT CONSULTANCY SERVICES.
6. Singh, D., Singh, D. Pratap. 2006. A Handbook of Beekeeping. AGROBIOS (INDIA)
7. Sardar Singh. Bee keeping in India.
8. Cherian and Ramanathan, S. Bee keeping in south India.
9. Sharma P.L. and Singh, S.H. Book of Bee keeping

ELECTIVE III : ECONOMIC ENTOMOLOGY AND PEST MANAGEMENT

Credit: 5

Objectives: **60 Hrs**

India being an agricultural oriented country, economic losses through agriculture is a major concern. This study facilitates an understanding of insects pests and diseases of major crops cultivated in India and their management strategies.

Unit I **12 hrs**

Brief account of morphology, Classification (Major orders) and Development (Metamorphosis) of insects.

Unit II **12 hrs**

Beneficial and Harmful Insects. Economic importance of Honeybees, Silkworm and Lac insect – Parasitic and Predatory Insects. Damages to plants, animals and man by insects. Brief account of any three pests of 1. Rice, Cholam and Pulses 2. Sugarcane 3. Cotton 4. Groundnut, Gingely and Coconut 5. Brinjal, Tomato and Lady's finger 6. Cardomam, Chilies, Tea and Coffee 7. Mango and Citrus.

Unit III **12 hrs**

Insect pests of stored grains – Insect vectors of plants, animals and man – Other insects affecting the health of man domestic animals.

Unit IV **12 hrs**

Insect pest control methods (Physical, mechanical, biological and chemical) – Classification of pesticides and their modes of action.

Unit V **12 hrs**

Plant protection appliances used – Basic principles of insecticide formulations and their application in pest control. Pesticides and environmental pollution – Precautions in handling pesticides.

Text book: David, B.V. and T. Kumarasamy, 1984. Elements of Economic Entomology, Popular Book Depot, Madras, 536 pp.

Reference Books:

1. Nayar, K.K., T.N. Ananthakrishnan and B.V. David. 1992. General and Applied Entomology. Tata McGraw Hill Publishing Co., Ltd., New Delhi – 110 051.
2. David, B.V., 1992. Pest Management and Pesticides Indian Scenario, Namratha Publications, Madras.
3. Metcalf, C.L. and W.P. Flint, 1973. Desctructive and Useful Insects. 4th Ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi – 110 051, 1087 pp.
4. Roya D.N. and A.W.A. Brown (Eds), 1981. Entomology Medical and Veterinary (3rd Ed.) The Bangalore Printing and Publishing Company, Bangalore –18.
5. Ramakrishna Iyer, T.V., Economic Entomology, Government Publications. Madras.

PAPER XIV: PRACTICAL III - ANIMAL PHYSIOLOGY, BIOCHEMISTRY, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

ANIMAL PHYSIOLOGY

1. Use of Kymograph unit, B.P. apparatus, Respirometer.
1. Survey of Digestive enzymes in cockroach.
2. Estimation of Oxygen consumption in a fish with reference to body weight.
3. Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine.

BIOCHEMISTRY

1. Qualitative analysis of sugar (Glucose, Fructose, Lactose, Starch, Dextrin)
2. Estimation of Glycogen (Anthrone method) (Demonstration)
3. Estimation of Protein (Biuret method) (Demonstration)

DEVELOPMENTAL BIOLOGY

Study of the following prepared slides, museum specimens and materials.

1. Sections of testis and ovary showing the maturation stages of gametes.
2. Slides of mammalian Sperm and Ovum.
3. Study of Egg types – Frog's egg, Hen's egg.
4. Slides of cleavage stages, blastula, gastrula and neurula of frog.
5. Slides of different stages of chick embryo. 18 Hours (primitive streak stage), 24 Hours, 48 Hours, 72 hours and 96 Hours.
6. Placenta of sheep, Pig and Man.

IMMUNOLOGY

1. Immuno electrophoresis-antigen, antibody reactions – agglutination - precipitation ring test. (Demonstration)
2. ABO, Rh typing

PAPER XV: PRACTICAL IV- ENVIRONMENTAL BIOLOGY, BIOTECHNOLOGY AND MICROBIOLOGY

ENVIRONMENTAL BIOLOGY

1. Estimation of O_2, salinity, pH, free CO_2, Carbonates and bicarbonates, Calcium in water samples.
2. Use of Rain guage, Maximum & minimum thermometer, Hygrometer, Anemometer and Barometer.
3. Plankton study – Fresh water and marine plankton.
4. Adaptations of aquatic and terrestrial animals based on a study of museum specimens - rocky, sandy, muddy shore animals, flying and burrowing animals.
5. Study of natural ecosystem and field report of the visit.

BIOTECHNOLOGY

1. Demonstration of PCR technique.
2. Blotting techniques
    (a) Southern blot
    (b) Northern blot
    (c) Western blot
3. Paper chromatography (Demonstration)
4. Instrumentation – Components and application of instruments – Centrifuge Electrophoresis – Colorimeter-Spectrophotometer.
5. Visit to industries, laboratory – report to be submitted.

MICROBIOLOGY

1. Media preparation- Broth, agar, slants, plating
2. Spotters: *Staphylococcus aureus, E.coli, Rhizopus, Aspergillus flavus, A.niger, Pencillium, Candida albicans.*
3. Instruments- Autoclave, culture plate, Inoculation chamber
4. Staining: Simple and differential staining.

NON-MAJOR ELECTIVES
AQUACULTURE

Credit: 2

30 Hrs

Unit – I **6 hrs**

History of aquaculture – Purpose and importance of aquaculture – Physical and chemical characteristics features of water bodies (Freshwater brackish water and marine water) – Types of culture systems (Traditional, intensive, semi-intensive and extensive).

Unit – II **6 hrs**

Selection criteria for cultivable species – Site selection for fish farming – Construction of fish and Prawn ponds – Types of fish ponds (breeding pond, hatchery unit, brooders pond, nursery pond, stocking pond and rearing pond) – Maintenance and management of different ponds. Feeds for cultivable species – natural, supplementary and artificial feeds.

Unit – III **6 hrs**

Types of culture – Monoculture, Monosex-culture & Poly culture – Integrated fish farming (paddy cum fish culture, paddy cum prawn culture and Duck cum pig cum fish culture) – Induced breeding in Indian major carps.

Unit – IV **6 hrs**

Culture of air-breathing fishes (Mullet and Cat fish) Sewage fed fish culture – Culture of Pearl Oyster and Edible Oyster.

Unit – V **6 hrs**

Culture of marine and freshwater prawns – Common fish diseases (bacterial, fungal, viral and parasitic diseases) – Prevention and treatment – Fishing technology (Crafts and gears) – Preservation and Processing of Fish and Prawn – Agencies involved in Aquaculture.

Text books:

1. R. Santhanam, N. Sukumaran and Natarajan, - A manual of fresh water aquaculture, Oxford and IBH Publishing Co Pvt. Ltd., Mumbai.
2. B.N. Yadav, - Fish and fisheries, Daya Publishing House, Delhi.

Reference books:

1. Mathew Landan, 1991. Introduction to aquaculture, John Wilay and Sons Inc..
2. V.R.P. Sinha, 1993. Acompendium of aquaculture Technologies for developing countries, Oxford and IBH Publishing Company PVT. Ltd.
3. V.G. Jhingran,1991. Fish and fisheries of India, Hindustan Publishing Corporation, Delhi.
4. T.V.R. Pillay – Aquaculture principles and practives, Fishing new Books, Blackwell Science Ltd., Oxford.
5. Shanmugam, K. 1990. Fishery Biology and Aquaculture, Hindustan Pub. Corporation, New Delhi.
6. C.V. Kurian and Sebastein – Prawn and Prawn fisheries of India, Hindustan Publishing House, New Delhi.
7. Elvire Balugal, A. 1984. Aquaculture systems and practices – A selected Review, Daya Publishing House, New Delhi.
8. B.N.Yadav, 1995. Fish Endocrinology, Daya Publishing House, New Delhi.

NME - PUBLIC HEALTH AND HYGIENE

Credit: 2

30 Hrs

Unit – I **6 hrs**

Scope of Public Health and Hygiene – Concepts of Health and Disease – History of Public Health in India. Nutrition and Health: Classification of foods – Nutritional deficiencies – Vitamin deficiencies – Balanced diet – Nutritional requirements of special groups.

Unit – II **6 hrs**

Environment and Health: water-sources, Pollution, purification – water quality standards. Air: Ventilation – Air pollution – Noise pollution – Radiation effects – Solid waste and excreta disposal – Sewage treatment.

Unit – III **6 hrs**

Communicable diseases: Respiratory infections: Measles, Rubella, Mumps, Diptheria. Intestinal infections: Poliomyletis, Cholera, typhoid, Amoebiasis. Arthropod infections: Malaria, Filariasis, Dengue. Zoonosis: Rabies, Plague Japanese encephalitis. Surface infections: Tetanus, Leprosy, STD and AIDS

Unit – IV **6 hrs**

Non-Communicable Diseases: Coronary heart Disease – Hypertension – Diabetes – Obesity – Blindness – stroke. Occupational Health Hazards: Physical, Chemical, Mechanical, Biological and Psychological. Mental health: Causes of mental ill-health-alcoholism and Drug dependence.

Unit – V **6 hrs**

Health Education: Health planning in India – Health programmes in India – WHO – Non-governmental Voluntary Health Organizations. First aid and Nursing: Methods –Dressing – care – Duties – Preparations.

Books for Reference:

1. Park and Park, 1995. Text Book of Preventive and Social Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur.
2. Verma S. 1998. Medical Zoology, Rastogi Publications, New Delhi.

NME – VERMITECHNOLOGY

Credits 2

30 Hrs

UNIT I: **6Hrs**

Introduction: Definition and concept of vermiculture. Soil: major types (red soil, black soil, alluvial soil). Influence of soil organisms in vermitechnology- bacteria, earthworms, entomofauna mites etc. Litter degradation and decomposition. Problems in vermiculture and remedial solutions.

UNIT II: **6Hrs**

Types of earthworms: Endemic and exotic species of earthworms. Ecological classification of earthworms- epigeic, anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in soil- drilospheres and vermicasts.

UNIT III: **6Hrs**

Vermicomposting- Vermicomposting materials, Vermicomposting methods (raised bed method and pot method). Establishment of vermiculture unit: materials required and maintenance of vermiculture unit.

UNIT IV: **6Hrs**

Vermicompost - harvesting of vermicompost - quality, properties and advantages over chemical fertilizers, packaging and marketing- cost benefit analysis.

UNIT V: **6 Hrs**

Natural enemies of earthworms- Pests, parasites and pathogens affecting earthworms. Uses of earthworms in food and medicine- ayurvedic and unani medicine. Recycling of food wastes in vermitechnology. Application and scope of vermitechnology.

Text Books:

1. Ismail,S.A. 1997. Vermicology. The biology of Earthworm.Orient Longman, India, 92 pp.

2. Ranganathan, L.S. – 2006 – Vermicomposting technology – from soil health to human health.

Reference books:

1. E.L. Jordan and P.S.Verma.1993. Invertebrate Zoology, 12 th Edition, S.Chand & Co., Delhi.

2. Naren kumar, Dutta ,Principles and practice of soil science.

3. N.S. Subba Rao, Soil Microbiology. 4. P.K.Gupta, Vermicomposting. 5. T.V Sathe , Vermiculture and Organic Farming

NME- HUMAN GENETICS

30 Hrs **Credits: 2**

Unit – I **6 Hrs**

Introduction: The growth of Human Genetics. Human chromosomes: preparation of human Chromosome complement; Banding techniques; Karyotype preparation; classification; application. Chromosome mapping; cytological maps; cloning and gene arrangement. Human genome project; Social ethical and legal implications. Modes of inheritance; Pedigree charts; construction of pedigree charts for autosomal dominant and recessive traits, sex linked recessive traits and Y linked traits.

Unit – II **6 Hrs**

Multiple allelic inheritance; ABO blood groups; Rh blood group and significance. Polygenic inheritance; skin colour in man and Intelligence. Sex determination – heterogametic theory; Hy antigens; SRY genes; Sex chromatin; Lyon hypothesis. Sex limited and sex influenced genes. Chromosome aromalies; Syndromes – Down, Klinefelter, Turner, XYY, Intersex, Cri-du-chat, Philadelphia.

Unit – III **6 Hrs**

Common genetic disorders: Metabolic blocks in phenylalanine metabolism albinism. Genetic cause, diagnosis and treatment of the following disorders – thalassemia and sickle cell anemia, Haemophilia, muscular dystrophy, Diabetes and hypertension. G6PD and favism – Primaquine sensitivity. Congenital defects – Critical period in fetal development - chromosome anomalies and spontaneous absorption.

Unit – IV **6 Hrs**

Genes and mental illness; Schizophrenia and psychosis, self-multilation and Lesh Nyhan syndrome. Immunogenetics: Antibody diversity; histocompatiblity; HLA genes.
Heritability and Environment: Twin studies and impact of environmental factors on heredity. DNA polymorphism – DNA profiling and applications. Dermatoglyphics and genetic analysis.

Unit – V **6 Hrs**

Genetic counseling – Determining risk; consanguinity; Teratogen; age 35 threshold; strategies – Prenatal diagnosis: Ultrasound scanning; Amniocentesis; Chronic villus sampling; AFP Test; Triple test; genetic screening; options available. Management of genetic disorders: Therapeutic measures; Gene therapy; alternative reproductive technologies; stem cell therapy. Cancer and genes; protocogenes, oncogenes and artincogenes; BRAC genes.

Text Book:

1. Edlin.G. (1984) Human Genetics, Jones and Bartlett publishers, Boston.

Reference Books

1. Elane Mangae and Mangae (1993), Human genetics. Freeman and company.
2. Ricki. L. (1994) Human Genetics. WCB Publishers.
3. Sam Singer (1985) Human Genetics, Freeman and Company, New York.
4. Ursula Good enough (1985) Genetics. Holt Reinhart and Winstan New York. 36 36

NME- DAIRY FARMING

30 Hrs

Credits: 2

Unit – I **6 Hrs**

Dairy breeds & breeding: Scope of Dairy farming – Dairy breeds of India – cattle & buffaloes – Exotic cattle breeds. Selection of dairy cows. Systems of breeding – Hybrid vigour – grading-up, pure breeding .Merits and demerits of inbreeding and out breeding. Anatomy and physiology of mammary gland – milk secretion and milk let-down/ejection.

Unit – II **6 Hrs**

Feeding and Nutrition: Structure of digestive system and physiology of digestion. Importance of colostrums feeding. Common cattle feed ingredients and their nutritive values – minerals, feed additives. Fodder preservation methods- hay and silage making. Ration formulation. Computation of balanced ration.

Unit – III **6 Hrs**

Live stock diseases: Viral diseases – rinderpest, Foot and mouth disease and cow pox. Bacterial diseases – Mastitis, Anthrax, Tuberculosis, Haemorrhagic – septicaemia, Brucellosis. Metabolic disorders – Milk fever, ketosis and bloat. A brief account of external and internal parasites.

Unit – IV **6 Hrs**

Dairy Technology & Marketing: Milk – composition and Nutritive value – Techniques to detect milk adulteration – Spoilage of milk – pasteurization of milk – Preparation of Dahi, Butter and Ghee. Role of Co-operative societies in milk production& Marketing.

Unit – V **6 Hrs**

Farm management: housing and equipment for dairy cows. care and management of newborn calves – technique of producing quality milk. Structure of reproductive system and physiology of reproduction . Artificial insemination – Semen collection, storage & insemination Techniques.

Text Book:

1. G.C. Banerjee – A Text book of Animal Husbandry – Oxford & IBH Publication, New Delhi. Books for **Reference**:
1. GH Schmidt; T.D. Van Vleck, - Principles of Dairy science – Surget Pvt. Ltd., 1982.
2. N.S.R. Sasting or C.K.Thamos – Farm Animal Management – Vikas Publishing House P. Ltd., 1976.
3. Dr. A.K. Sachetic – Animal Reproduction and Artificial insemination: NCERT, 1989.
4. M.M. Rai, - Dairy Chemistry and Animal Nutrition – Kalrant Publishers, 1985.
5. C.K.Thomas and N.S.R.Sastry, 1990.Dairy Bovine Production, Kalyani Publishers, New Delhi. 6. ICAR, 2002 Handbook of Animal Husbandry- The Indian Council of Agricultural Research, New Delhi.

NME -POULTRY SCIENCE AND MANAGEMENT

Credits 2

30 Hrs

Unit – I **6 Hrs**

External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system. Genetics of fowls: Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character – breeding methods – systems of breeding – modern method of breeding.

Unit – II **6 Hrs**

Poultry industry in India– choosing commercial layers and broilers – Poultry housing – deep litter and cage system-merits and demerits.

Unit – III **6 Hrs**

Practical aspects of chick rearing –brooding management- grower and layers – management of broilers – lighting, summer winter management – debunking.

Unit – IV **6 Hrs**

Poultry Nutrition: Energy – protein and aminoacids – Vitamins – essential organic elements – Non – nutrition feed additives – feed stuffs for poultry – feed formation.

Unit – V **6 Hrs**

Diseases: Viral, bacterial, fungal and parasitic disease of poultry. Vaccines and vaccination programme.

Reference Books :

1. Gopalakrishnan C.A and G.Murley Mohan Lal 1997, Livestock and Poultry enterprises for rural development, Vikash, New Delhi.
2. Gnaanamani M.R., 1998 Modern aspects of commercial poultry keeping, Giri.
3. Banarjee G.C., 1992 Poultry, Oxford and IBH, New Delhi.
4. Chauhan H.V.S. and S.Roy, Poultry diseases, diagnosis and treatment New Age International, 1996.
5. John William S. (Ed) 2003. Poultry for sustainable Food Production and Livelihood. Loyola Publication,

SYLLABUS - ALLIED ZOOLOGY I (THEORY)

Credit: 3

Paper – I **90 Hrs**

Unit – I: **20 Hours**

Introduction: Invertebrata- General characters and Classification.
Protozoa – Type study: *Plasmodium vivax*
Porifera – Type study *:Scypha* (sycon)
Coelenterata – Type study: *Obelia geniculata*
Platyhelminthes- Type study : *Taenia solium*

Unit – II: **20 Hours**

Annelida – Type study: Leech
Arthropoda – Type study: Prawn
Mollusca – Type study: Unio
Echinodermata – Type study: Starfish

Unit – III: **15 Hours**

Chordata – General characters& Classification
Prochordates – *Amphioxus* – Structure and affinities
Vertebrates- Pisces- Type study : Shark

Unit – IV: **20 Hours**

Amphibia- Type study: Frog. Reptilia: Calotes.

Unit – V: **15 Hours**

Aves- Type study: Pigeon; **Mammalia-** Type study: Rabbit.

1. **Text Book**: Ekambaranatha Ayyar, M and Ananthakrishnan, T.N. 1993, Outlines of Zoology, Vol.I and II, Viswanathan and Co. Madras.

Reference Books:

2. P.S. Dhami and J.K. Dhami – Invertebrate Zology – S. Chand and Co. New Delhi.
3. Jordan, E.K. and P.S. Verma, 1993. Chordate Zoology, 12th edition, S. Chand & Co. Ltd., Ram Nagar, New Delhi.

SYLLABUS - ALLIED ZOOLOGY II (THEORY)

Credit: 3

Paper – II **90 Hrs**

Unit – I: **20 Hours**

Cell Biology – Structure of animal cell, Mitochondria, nucleus and nucleolus and Golgi bodies. **Genetics:** Molecular structure of Genes – Gene concept – Gene function – Inborn errors of metabolism – Genetic Engineering and its applications – X and Y – linked inheritance.

Unit – II: **20 Hours**

Developmental Biology: Gametogenisis – Fertilization - Cleavage and gastrulation of chick and pig.

Unit – III: **20 Hours**

Human Physiology: Digestion, Excretion, kidney failure and transplantation. Structure of heart, Cardiac cycle, composition of blood, Blood pressure. Heart diseases – Ischemia, Myocardial infarction, Rheumatic heart disease, Stroke. Endocrine glands – Hormones-feedback mechanism – Pituitary, thyroid, Islets of Langerhans, adrenal, sex organs.

Unit – IV: **15 Hours**

Environmental Biology: Physico-Chemical factors – Environmental Degradation treatment methods on sewage, effluents – Green house effect.

Unit – V: **15Hours**

Evolution – Lamarkism and Neo-Lamarckism – Darwinism and Neo-Darwinism - Factors responsible for speciation.

Text book:

1. Verma, P.S. and V.K. Agarwal, 2010 Reprint, Cell Biology, Genetics, Molecular Biology, Physiology, Evolution and Ecology, S. Chand & Co., New Delhi – 110 055.

Reference books:

1. Sambasiviah, I, Kamalakara Rao, A.P. Augustine Chellapa, S (1983). Text book of Animal Physiology, S. Chand & Co, New Delhi.
2. Verma, P.S. and Agarwal, V.K. (1983). Animal Ecology, S. Chand & Co, New Delhi.
3. Verma, P.S. and Agarwal, V.K. and Tyagi, B.S. (1991). Chordate Embryology S. Chand & Co, New Delhi.
4. Rastogi, V.B. and Jayaraj, M.S. (2000). Text book of Genetics, Kedarnath Ramnath Publishers, Meerut.
5. T.S.Gopalakrishnan, Itta Sambasivaiah and A.P.Kamalakararao,1984 Principles of organic Evolution, Pearl publications, Chennai.

ALLIED ZOOLOGY
PRACTICAL

I. Dissection:

1. Cockroach: Digestive and Nervous system

II. Mounting:

1. Mouth parts of cockroach
2. Mouth parts of Mosquito

III. Spotters:

Plasmodium, *Sycon*, *Obelia geniculata*, *Taenia solium* (Entire & Transverse section), Leech (Entire & Transverse section), Fresh water mussel, *Amphioxus*, Shark (Placoid scale), Pigeon (feathers) and Rabbit.

EXTERNAL PRACTICAL – 50 MARKS

1. Dissection	=	20 marks
2. Mounting	=	10 marks
3. Spotters	=	10 marks
4. Record	=	10 marks
Total	=	50 marks

INTERNAL PRACTICAL – 50 MARKS