

PROGRAMME PROJECT REPORT (PPR)

Name of the Programme: **MASTER OF SCIENCE IN ZOOLOGY
(M.Sc. in ZOOLOGY)**

Duration: Minimum 2 years
 Maximum 4 years

Recognition: This Programme was recognized by DEC-IGNOU and now by the UGC-DEB

A. PROGRAMME'S MISSION & VISION

Vision:

To provide comprehensive, relevant curriculum and train the Lerner/students in the field of Zoology. Enabling the Lerner take up career in academic (teaching and research), industry and government sector, along with conducting significant societal based research

Mission:

Through offering this programme to the interested Learners the following mission objective are intended

1. Explains the importance of animals (domestic animals and wild life), biodiversity, and ecosystems and their importance in rearing animals, agriculture and livestock forming.
2. Comparative Physiology of animals.
3. Explain how animals originated and evolved lower organism's higher organisms on their molecular mechanism
4. Identifying the animals and taxonomic classification.
5. To emphasize the unity and integration of plants and animals, celebrate the fundamental significance of the natural and also improve the economy of Human through apiculture, sericulture, fisheries, Perl culture, lac culture etc

Objectives:

- The major objective of the present course has been prepared keeping in view of the course requirements for the candidate seeking post Graduate distance Education in Zoology.
- Specific purpose of the course is to create awareness to students of Distance education Council about status of diversity of animals and their taxonomy.

- The zoology Department is a community of learners and teachers-scholars which has its mission to help all its students domestic and wildlife animals.

B. RELEVANCE OF THE PROGRAM WITH HEI'S MISSION AND GOALS

Kuvempu University is an affiliating State University in Karnataka. Established in 1987, it is the University with a distinctive academic profile, blending in itself commitment to rural ethos and a modern spirit. It has 37 Post-Graduate departments of studies in the faculties of Arts, Science, Commerce, Education and Law. It also has 4 constituent colleges at Shankaraghatta and Shivamogga, and two outlying regional Post-Graduate Centres at Kadur and Chikkamagalur.

The Vision and Mission of the University are:

Vision: Kuvempu University shall strive to become an international centre of excellence in teaching and research to provide high quality value based education to all through various modes to meet the global challenges.

Mission:

Foster creativity in teaching, learning and research to build a knowledge base and promote quality initiative.

Provide access to education to all.

Develop human resources to meet the societal needs.

The Distance Education Programmes are a part of the University's outreach programmes for the rural masses and also to foster University-Society relationship with the motto of "**Education for All**", to provide quality education at the doorsteps of desirous individuals who want to take up higher education, for the discontinued who could not take up formal education, housewives and employees who want to improve and enhance their knowledge. The University firmly believes that education and seeking knowledge is a **Lifelong Learning** concept.

Offering higher education through Distance Mode is an important step taken by Kuvempu University so as to help the student community in their zeal to pursue higher education both at UG and PG Level. The University felt the necessity of this when when a large number of students, who wanted seats for PG. Studies, could not be accommodated in our regular P.G. Programmes. The University believes that Distance Education Mode is an equally good avenue to be made available to interested students. With these views, Kuvempu University started offering courses through distance mode since 2002-2003. At present it is offering 31 Programmes (earlier called Courses) in various faculties at the U.G., P.G. and

PG Diploma levels. These courses were approved by the erstwhile DEC-IGNOU, and now by the UGC-DEB.

Goals & Objectives of Distance Mode Programmes

- Reach out to larger sections of the society who are willing to seek non-formal education.
- Capacity Building by using the non-formal mode platform.
- Concentrate on planning & constant upgradation of facilities to meet new challenges in education through Distance Mode.
- Provide counseling & consultancy to students.
- Offer area/ region wise educational requirements.
- Skill Development and Enhancement.
- To impart quality training through interactive learning module.
- Interactive Pedagogy of teaching-learning and flexible learning environment.
- Provide supportive academic environment and effective teaching.

C. NATURE OF PROSPECTIVE TARGET GROUP OF LEARNERS:

The study of Zoology helps provide students with a foundation for lifelong learning critical thinking and collaborative problem solving in professional and Business context.

Successfully completed students from this course have got the government job as forest officers, wildlife conservative officers, forensic science, medical representatives, medical fields, teachers, professors, etc. and also work in the line of the production and distribution of animals and their products have profound influence on the economic and social life of the country. Importance of animals and their products are silk cloths, oils, meat, egg, milk etc.

D. APPROPRIATENESS OF PROGRAMME TO BE CONDUCTED IN OPEN AND DISTANCE LEARNING MODE TO ACQUIRE SPECIFIC SKILLS AND COMPETENCE

M.Sc. in Zoology Programme helps to develop in prospective teacher educators, research scholars, scientists, educational administrators, and Heads of Schools and college's skills related to independent study of literature, research, academic writing, professional communication and team work it should also Endeavour to develop in the future practitioners a deep and critical awareness of professional ethics and an ability to critically engage in and reflect on practice. Further, the Programme develops ability to apply acquired knowledge and solve problems in new or unfamiliar surroundings within broader (or multi-disciplinary) contexts related to the area of study. The Programme will expose students to the diversity and variety of educational practices, policies, settings, and contexts in India. The Programme aims to build among our graduates capabilities for ongoing self motivated professional development. The Programme will strive to develop capabilities to plan independent educational interventions in various roles such as

those of curriculum developers, textbook/ material developers, teacher educators, and researchers. The programme would provide learners a wider and more comprehensive understanding of zoology as field of knowledge and would accommodate a wide variety of learning needs of learners.

E. INSTRUCTIONAL DESIGN:

(i) Programme Formulation:

Proposal from the concerned PG department to commence the programme was placed before Monitoring Committee of the DDE/Syndicate. Then it will be referred to the BOS concerned for formulation and approval of the syllabus scheme pattern, time allotment for each paper, marks allotment, scheme of examination etc., then it was placed in the Faculty meeting and then Academic Council (the highest body) of the University for its approval. After approval by both the bodies, the programme was introduced. The academic advisory body of DDE refers the matter to the concerned subject/parent department council for preparation of study material. The concern subject faculty will coordinate with the DDE and the department council, as he/she is on the member in it. Workshops for preparing study material in SLM mode are regularly conducted (with the help of IGNOU experts).

(ii) Curriculum design: The Programme is of 2 of year's duration with annual examinations. The maximum period allowed is 4 years (double the duration). The Programme structure is as below.

Year	Papers	Marks		
		Term End Exams	Continuous Evaluation/IA	Total
First Year	Course 1: Animal forms and functions, and Ecobiology	85	15	100
	Course 2: Physiology & Biological Chemistry	85	15	100
	Course 3: Parasitology & Animal Behaviour	85	15	100
	Course 4: Cytogenetics & Development Biology	85	15	100
	Practical - I : Based on Course I & II	75		75
	Practical - II : Based on Course III & IV	75		75
	Total marks	490	60	550
Second Year	Course 5: Aquaculture and Wildlife	85	15	100
	Course 6: Environmental Pollution & Ecotoxicology	85	15	100
	Course 7: Sericulture & Apiculture	85	15	100
	Course 8: Molecular Genetics and Biotechnology	85	15	100

	Practical - I: Based on Course V & VI	75		75
	Practical - II :Based on Course VII & VIII	75		75
	Total marks	490	60	550
	Total Marks - I Year & II Year	960	120	1100

(iii) **Medium of Instruction: English Only**

(iv) **Detailed syllabi:** Given as Appendix-01

(v) **Faculty and Supporting Staff Requirement**

Full time faculty in regular department will be involved in orientation and practical classes. Such programmes are scheduled during the vacation time of the regular department, which will meet the faculty availability and infrastructure need of ODL Programme. Coordinator of the programme, who is a regular faculty member and the Research and Teaching Assistant (RTA), will be in-charge of the Programme, who will address the day to day academic and learner/student support aspects of the Programme.

Regarding supporting staff, DDE has a separate and well equipped wing/office to take care of all the administration and delivery aspects of ODL Programmes.

There is a separate DDE wing in the Office of the Registrar (Evaluation) for all the evaluation and certification aspects headed by a Deputy/Assistant Registrar.

The DDE and Evaluation wings are fully computerized and technical staff assist in all the activities.

(vi) **Instructional Delivery Mechanism**

Instructional delivery mechanism is through study materials prepared by the experts in the subjects concerned. Study materials (SLM) are prepared in-house by the faculty of the department and the faculty from sister universities.

The study material provided is the general guide and covers the course content in order to make the learner to understand core content of the course concerned. Learner is advised to make use of the reference books in the list of books provided along with the syllabus.

Contact Programme: There will be a contact programme for a minimum duration of 21 days normally, A maximum of 25 days for instructed by experienced and scholarly faculty will be arranged for each paper, there shall be contact classes by lectures, simultaneously practical classes also going on, and mean while two practical record Book also written by the students. Practical

examination will be conducted for the candidates in each paper at the end of the contact programme.

Student support service: Students can interact with the Office/Faculty through e-mails and personal visits. SMS alert facility for the students regarding dissemination of information relating to conduct of PCPs/Orientation Programme and Production file submission deadlines etc. Student Support Service is provided through online mode and grievance handling mechanism is adopted with the help of supporting technical staff. All necessary and relevant information are uploaded in the dedicated website: www.kuvempuuniversitydde.org. Internal Assignments with Guidelines, previous years question papers, notifications timetables and results are available from the website and office cell phones.

F. PROCEDURE FOR ADMISSIONS, CURRICULAM TRANSACTION AND EVALUATION:

As outlined in Section-B, Kuvempu University has a policy to provide opportunity to maximum number of eligible and desirous candidate from all sections of the Society including a class having of low-level of disposable income, rural dwellers, women unskilled men minorities etc.

(i) Eligibility for the Programme

Any candidate who has passed the three year B.Sc. degree examination (compulsory zoology paper) of this University or any University is eligible for admission to the M.Sc. in zoology. B.Sc agriculture, Horticulture and Bachelor of Dental science are also eligible.

All the candidates who fulfill eligibility criteria are admitted to the programme. If university decides for maximum number of candidates for the Programme, admissions are made first come first basis.

(ii) Admission Process

- Notification issued by the Directorate of Distance Education (DDE) in Regional and National News papers and in the official website.
- Uploading of the Application by the candidate through Online only.
- Payment of fee through online (various options like net banking etc.) or through banks/post offices using printout of the bank challan.
- Submission of the printout of the application by the candidate to DDE along with original documents for eligibility, date of birth etc., and along with fee paid receipt.

- Verification of applications- for fulfillment of eligibility criteria (marks cards) documents, fee paid details.
- Approval of the admission and issue of self learning material (Study Materials) to the students.

(iii) Fee Structure

Figures in rupees as prescribed for the academic year 2017-18

SN	Fee Component	First Year	Second Year
Admission Orientation/Practicals and Other Components			
1	Registration	2520	-
2	Admission	980	980
3	Orientation/ Tuition fee	3080	3080
4	Study materials	4480	4480
5	Liaison	140	140
6	Practical classes	3080	3080
6	IA Books	490	490
7	Postage	420	420
	UDF	250	250
Examination , Certification and Other Components			
9	Examination	1450	1450
10	Practical Exam	485	485
11	PPC	-	365
12	Convocation	-	900
13	UDF	140	140
TOTAL (Rupees)		17515	16010

Financial Assistance:

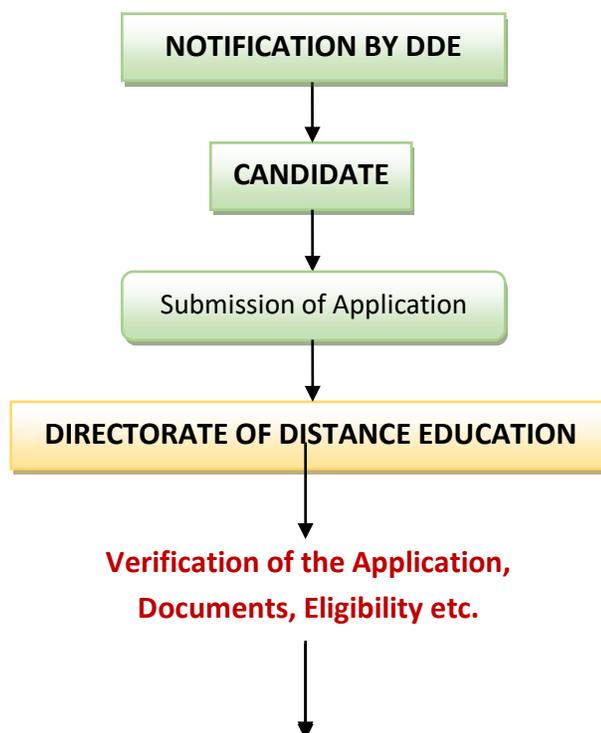
- SC/ST and OBC Students can avail scholarship/fee reimbursement from the concerned State Departments/Agencies
- Fee Concession to Physically Handicap Candidates.
- Fee concession to Employees of the University and their dependents.
- Fee concession to Ex- servicemen.
- Scholarships and education supports extended by various Governmental and Non-Governmental agencies.

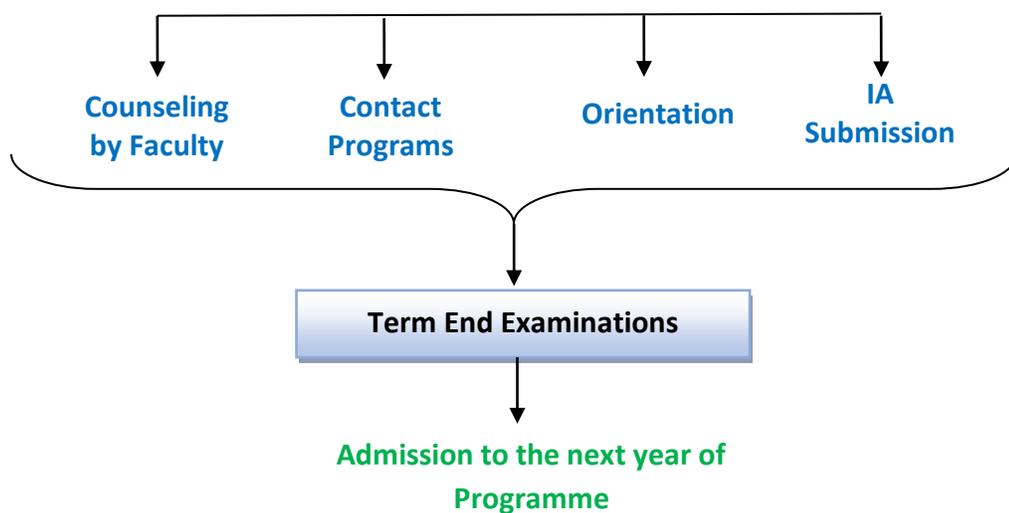
(iv) Academic and Activity Planner

Calendar Year-I

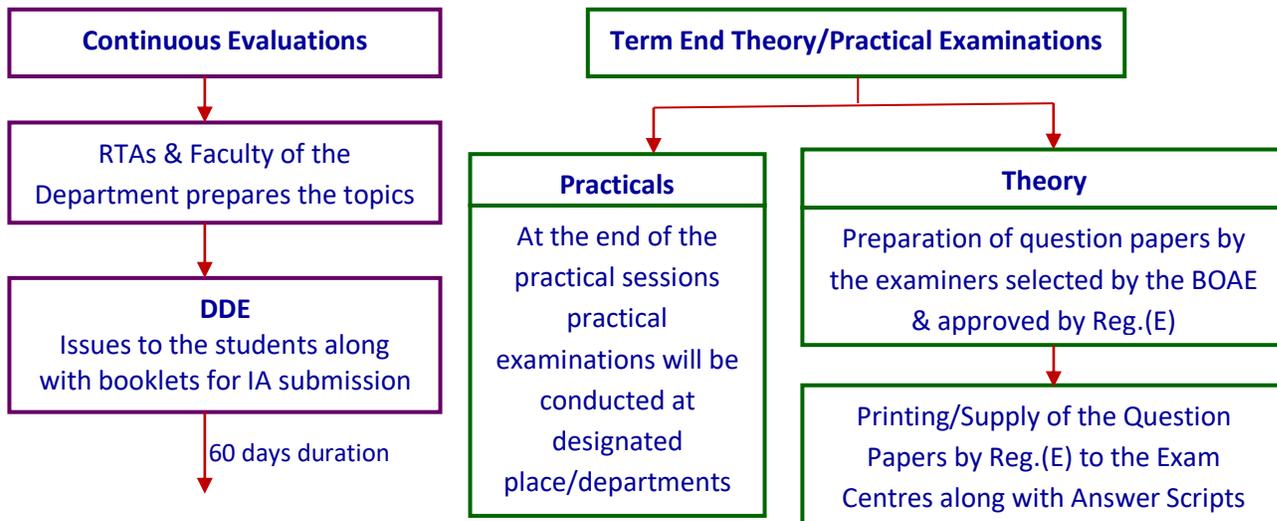
1	Issue of Notification	July / August
2	Commencement of Online Admissions	July / August
3	Last Date for submission of online applications by the students without Late Fee	October 31
4	Last Date for submission of online applications by the students with late fee	December 31
5	Issue of Study Material and Assignment Books (immediately after verification of the applications)	July to December
Calendar Year-II		
6	Issue of assignment topics Commencement of Counseling sessions	December - January
7	Commencement of Orientation and practical Sessions	February –March
8	Completion of all Orientation and practical Sessions	May 30
9	Last date for Submission of Internal Assignments/	April 30
10	Tentative date for commencement of Examination.	May / June
11	Declaration of Examination Results	August / September

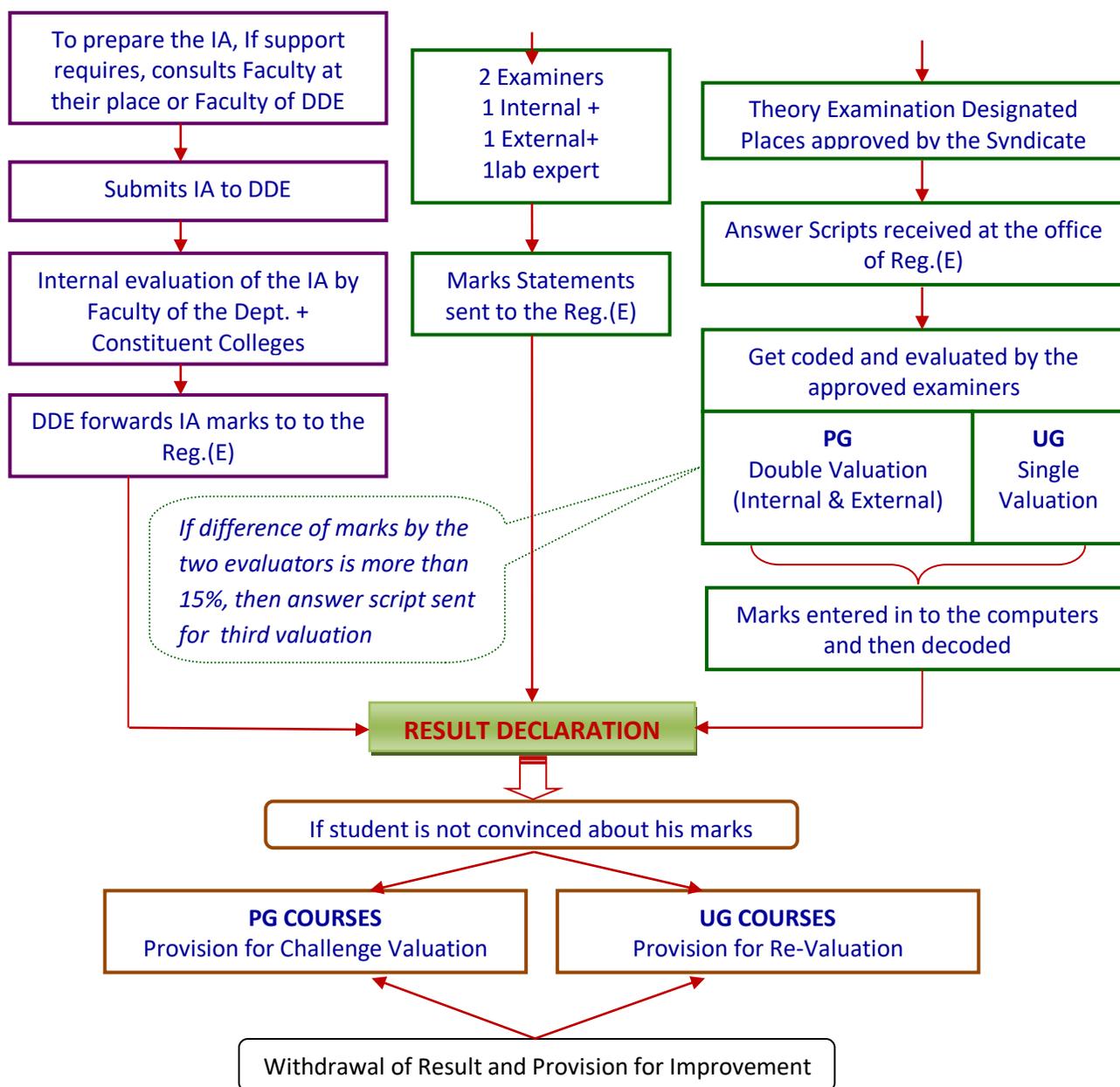
Generalized Academic Flow Chart for the Distance Mode Learners





(v) **Evaluation of Learner Progress** :Evaluation Process is given here in the form of Flowchart. This Flowchart is common to all Programme at UG, PG and PG Diploma level offered by the University.





Internal Assessments:

- As a part of continuous assessment the candidates will have to complete assignments in the booklets provided by DDE and submit them to the Directorate of Distance Education within the specified date. The Topics & Instructions for I.A. will be notified in the Students Corner section of the website and also issued to the students directly or through Student Counseling Centres.

- It is mandatory to submit the I.A. in the same year of registration. However, if the candidate failed to take up the theory examination, for any reason, such candidate can submit the I.A. in the next year with prior permission from the DDE.
- All students are expected to complete the above assessments before taking the Term end Examination.
- There is no provision for resubmission of I.A.

Provision for class tests and workout exercises: during (Orientation/Contact) classes programmes.

(vi) Term End (written) Examination:

Duration: Duration: 3 hours, **Maximum marks:** 85

Questions pattern

Section	Type of Questions	Marks	Total
A	Five long answer type with internal choice	15x 4	60
B	Two short answer type questions out of 4	3x 5	15
C	One compulsory question	1x10	10
Total			85

Practical Questions pattern

Duration: 4 hours, **Maximum marks:** 75

Section	Type of Questions	Marks	Total
Practical	Major experiment	15x1	15
	Minor experiment	10x1	10
	Identification & Spotting	5x6	30
	Viva	10	10
	Record	10	10
Total marks			75

Declaration of class: At the completion of course evaluation (the Programme) the class will be awarded on the basis of the aggregate of marks at both previous and final examinations taken together.

- Pass Class : 40% of marks or above but below 50% of marks.
 Second class : 50% of marks or above but below 60% of marks.
 First Class : 60% of marks or above.

Separate Ranks and Medals are awarded to ODL Learners. Policy for awarding ranks and medals are same as the one followed for the Regular Programme.

Reappearing for Exams: The unsuccessful candidates at the P.G. Examinations of a particular year are required, to reappear for those papers/examinations only as per the syllabus of that year. The repeaters are therefore advised to preserve the syllabus and study material until they pass the final year of the course.

Candidates will have to complete all the exams within double the duration of the course (and not the number of attempts). The double the duration is reckoned from the year of registration.

A candidate is permitted to register for the final year examination irrespective of the number of courses failed at the previous theory exams.

(vii) Other Policy/Provisions

Renewal of Registration: Students of II year who have failed to pay the II year programme fee in the respective year are permitted to renew their registration by paying the specified course fee along with registration renewal fee and continue their programme. However they should complete the programme with in the maximum permissible period i.e., 4 years.

Bonafide student certificate: Those candidates who require Bonafide Certificate/ Study Certificate can obtain by submitting a written request or a filled in prescribed application form (available from the KUDDE website) along with a fee of Rs. 100/- paid either through Bank Challan or Demand Draft.

Change of Address: Any change in the address of the students should be intimated to the Directorate with a fee of Rs. 100/- paid through a challan of Electronic Transfer. No change of address will be entertained once the students receive their examination hall ticket. The Directorate of Distance Education is not responsible for missing correspondence due to change of address without getting address changed at DDE.

Name Correction: Change of Name, if any required, candidate has to make a written request along with relevant documents as proof of change of name, and by paying specified fee.

Duplicate Registration Card: For issue of duplicate Admission/Registration/ Enrollment card- Rs. 200/- will be charged.

Transfer Certificate: A Transfer Certificate is not required for admission to any of the KUDDE courses. The Directorate will also not issue Transfer Certificate at the time of completion of the course. However, for Lateral Entry admissions a migration and transfer certificate will be required from such students.

Change of Examination Centre: DDE will not entertain any change of exam centre unless there is a proof of change of address and it is permissible.

Discrepancies in Marks cards and certificates: In case of any discrepancies observed in the marks card/ certificates etc., candidates have to bring it to the notice of the Director, DDE through a written request within a period of 3 months from the date of issue of the document.

Miscellaneous: All the original certificates submitted by the candidates in connection with their admission, registration will be returned to them from the Office of the DDE along with the registration certificate. In case any of their certificates are not received back, they must bring the same to the notice of The Director, DDE, Kuvempu University, immediately. The original records will be maintained for a minimum period of three months. If the candidates ask for the originals before three months, their requests will not be entertained.

Preservation of Answer Scripts / IA Scripts: The answer scripts of Theory Exams will be preserved for a maximum duration of 6 months from the date of announcement of results/ revaluation / challenge valuation results. Any query or request for verifications may be submitted, through a written request, within the notified period only.

Similarly, written IA Scripts of the students will be preserved for a period of six months from the date of announcement of the results (First announcement of results). Any discrepancy observed regarding IA marks may be informed to DDE through a written request within three months from the date of issue of results. Later request may not be accepted.

Students are advised to refer the website for notifications regarding preservation of various documents, issued from time to time.

Notwithstanding any conditions mentioned above the University reserves the right to change, alter, and amend any of the above clauses/conditions. In matters of fees for unforeseen issues / certificates/ endorsements the University may fix the amount subject to the existing fee structure or change it from time to time.

Post-Examination Related Issues: Submission of applications for - Convocation (Degree) Certificates, Duplicate Marks Cards, Provisional Pass Certificate (PPC), Name Correction, Consolidated Marks Cards, removal of NCL, Academic Transcript, verification of genuineness of Marks Cards and Certificates, and Processing Certificates For all matters regarding post-examination Certificates are made through online. Learners can directly apply for the same. For all enquiries and clarifications regarding said issues Learners can contact the DDE Section of the Office of the Registrar (Evaluation). Contact details, telephone and e-mail ID, of the Helpdesk at the O/o the Registrar (Evaluation) are given in the website.

G. LIBRARY RESOURCES

A well established library facility shall be made available with the support of the university library. In the campus we have modern and well equipped library in Kuvempu University with excellent infrastructure facilities for reading, browsing and reference to the students, teachers and research scholars. The library has kept pace with modernisation by introducing CD ROM data base, internet and e-mail facilities. It is also a nodal centre for INFLIBNET, access is available to 10,000 + e-journals online under the UGC- infonet Consortia. There is a well developed digital library and campus network interconnecting all the Post-Graduate departments and offices in the campus.

Further, the DDE will made special effort to upgrade the existing DDE Library exclusively for distance learners with an emphasis on distribution of information and course material online by making use of the state-of-art information and communication technologies.

Library Card: Candidates who are desirous to avail themselves the facilities of Kuvempu University Main Library on the campus will be permitted. They have to obtain a separate Library / ID card on payment of Rs. 100/- (through Challan of Electronic Transfer). However, no books will be issued to them.

H. COST ESTIMATE OF THE PROGRAMME AND THE PROVISIONS

Cost Estimated of the Programme is based on following components
– calculated for an admission of 100 Students:

SN	Component	Estimate in Lakh
1	Study Material Development – Course Writer honorarium, Review setting, editing, SLM conversion etc	8.96
2	Printing and Distribution of SLM	5.38
3	Publicity, Awareness Information Decimation Programmes*	0.08
4	Conduction of Counselling, Orientation/Face to Face/ Practical Sessions etc.	11.34
5	Student Support Services*	0.34
6	TA/DA Meeting Expenses*	0.25
7	Continuous Evaluation / IA	0.29
8	Examination and Certification	3.39
9	Office Automation/ICT/ Communication Related Infrastructure*	0.50

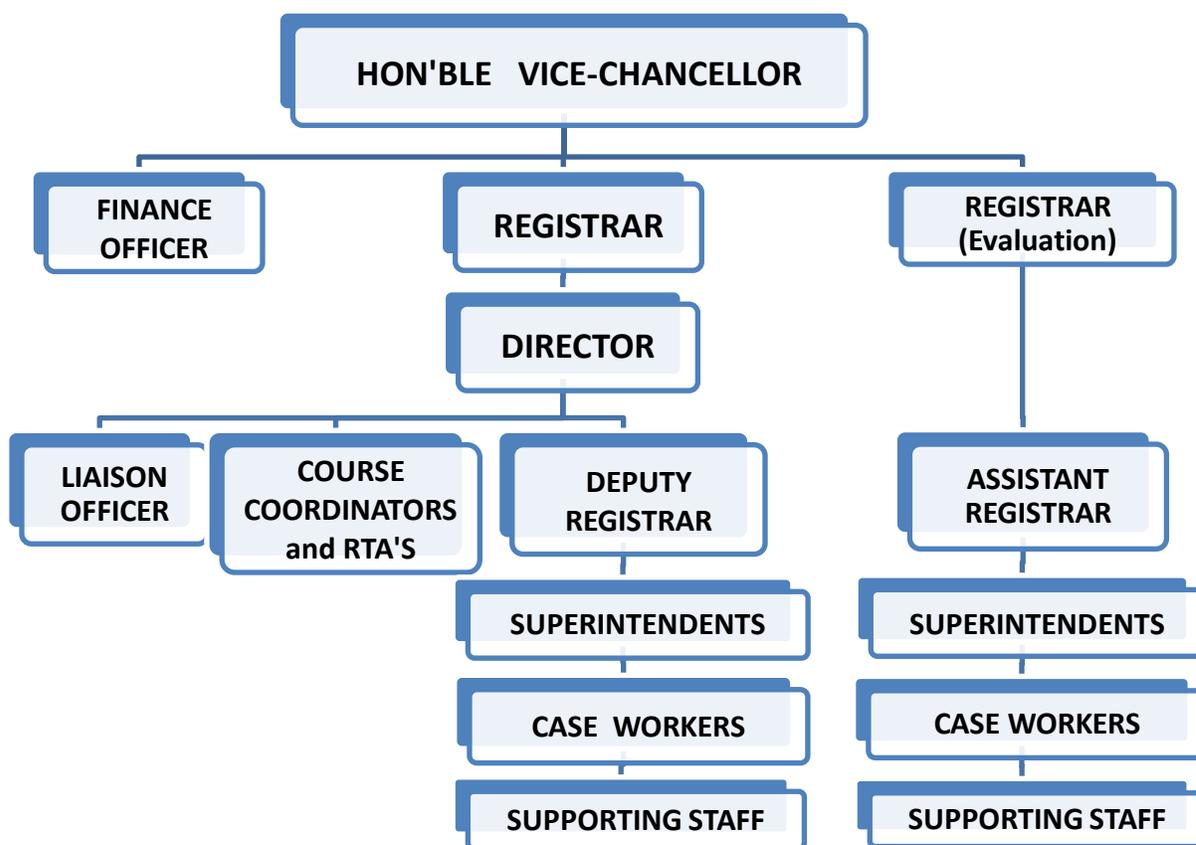
10	Library*	0.45
11	Staff Salaries/ Remunerations/ Other Honorariums – Teaching, Non-Teaching/Technical/Supporting*	1.57
12	Office Infrastructure*	0.39
13	Laboratory Development and Expenditures	0.62
14	Learner Centre Expenses*	0.31
15	Others – Office Contingence, Post/Courier, Vehicle Maintenance, Fee reimbursement and such others.*	0.67

Note: * costs that will be incurred collectively for all the Programmes, but given here are the fractions of the total, considering 100 students admission to the Programme.

I. QUALITY ASSURANCE MECHANISM AND EXPECTED PROGRAMME OUTCOMES

(a) Organizational Structure, Management and Monitoring Mechanism

The Organizational Structure of the Kuvempu University Directorate of Distance Education (KUDDE) is given below in the form of flowchart.



Academic Advisory Committee (AAC) of the DDE will review the academic programme performance, content delivery mechanism. Issues regarding course content and syllabi revision of all the Programme offered in ODL mode are discussed and decided in AAC. The Registrar will be the Chairman of the AAC, and Registrar (Evaluation), Chairpersons of all BOSs of the concerned Departments will be the members. The Director/ Deputy Director of the DDE is the Organising Member.

All the major decisions including financial, planning and implementation which are discussed in the MC meeting are placed before the Syndicate of the University and after its approval they will come into force.

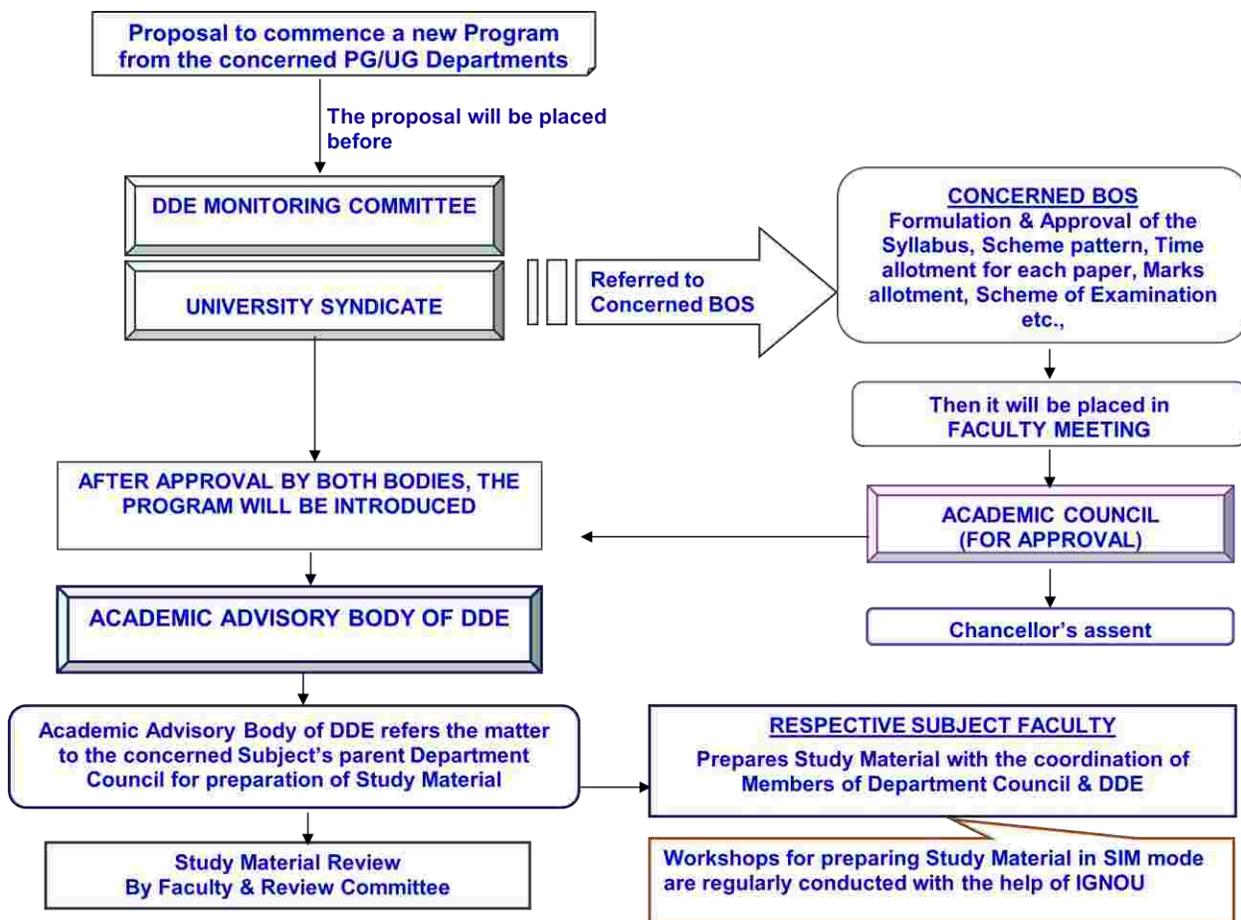
The decisions taken by the AAC are placed through the concerned bodies like, BOS/ Examination wing (for evaluation and certification issues) and finally placed before the Academic Council of the University for its approval.

For the internal quality assurance mechanism there is a Internal Quality Assurance Cell of the University.

(b) Programme Development and Approval Processes.

Proposal from the concerned PG/ UG department to commence a new Programme will be placed before Monitoring Committee of the DDE/ Syndicate. Then it will be referred to the BOS concerned for formulation and approval of the syllabus, programme structure, time allotment for each paper, marks allotment, scheme of examination etc., then it will be placed in the Faculty meeting and then Academic Council for its approval. After approval by both the bodies, the programme will be introduced. The Academic Advisory Body of DDE refers the matter to the concerned Subject's/ parent Department Council for preparation of Study Material. The concern subject Faculty will coordinate with the DDE and the Department Council, as he/ she is one of the member in it. Workshops for preparing Study Material in SLM mode are regularly conducted (with the help of IGNOU experts) and preparation of course material in SLM mode is in progress.

The various steps involved in programme development, approval and implementation are depicted in the flowchart given below.



(c) Programme Monitoring and Review

As a part of the regular monitoring mechanism, feedback from the Learners is obtained at the end of each of the face-to-face programmes - both through discussion and through written feedback form. Feedback form includes mainly three aspects – about appropriateness/ usefulness of learning (study) materials, effectiveness of orientation/ face-to-face programmes and internal assessments/continuous assessment process. Learner can give their opinion, suggestions and complaints, if any, through the feedback form. Issues raised in feedback are addressed at appropriate level.

There is also Student Support Service and Grievance Cell in DDE in order to address the day-to-day issues faced by the Learners. The Research and Teaching Assistants at DDE and the Coordinator in the concerned subjects are available for the learner support services. These apart, regular meetings of concerned faculty are conducted in order to plan the orientation and practical session's activity.

It is the policy of the KUDDE to make available the expert faculty of the PG Departments/ Colleges (for UG) and experts from the sister universities in the state who are regular faculty in the respective subjects for the ODL programmes. The same is followed for the Learner Support Centres (LSC). Programme delivery/academic activities at the LSC are also monitored from the Headquarter.

DDE organize Coordinators Meet every year wherein all the issues related to ODL programmes – academic, examination, learners related and administration are discussed and remedial measures are considered under the ODL framework of the university. During the Meet academic activities/learners' issues at the LSC are also reviewed.

Detailed Syllabi of M.Sc. Zoology First Year

Annexure 1

Course 1 : Animal Forms & Functions & Ecobiology

A - Animal Forms & Functions

Unit 1: Organization of coelom: Acoelomate, Pseudocoelomate, Coelomate

Unit 2: Origin of metazoa

Unit 3: Locomotion: Flagella and ciliary movements in protozoa, Hyddrostatic movement in Annelida and Echinodermata

Unit 4: Respiration : organs of respiration- gills, lungs and trachea

Unit5: Excretion: Organs of excretion – coelom, coelomoducts, Nephridia and malphigian tubules, Mechanism of excretion.

Unit 6: Nervous system: Primitive nervous system – coelenterata and echinodermata; Advanced nervous system –Annelida, Arthropoda and molluska

Unit 7: Origin of chordata

Unit 8: Concepts of Protochordata, interrelationships of protochordata

Unit 9: Vertebrate integument and its derivatives: Structure and functions of skin. Skin derivatives scales, horns, claws, nails, hoofs, feathers and hairs

Unit 10: General account of Brain in vertebrates.

Unit 11: Evolution of heart and aortic arches in vertebrates

Unit 12: Comparative account of vertebral column, limbs and girdles

Unit13: Evolution of urinogenital system in vertebrates.

B – ECOBIOLOGY

Unit 1: Introduction: History, scope, application of ecology, components, structure, trophic levels, food-chain and food webs, ecological pyramids.

Unit 2: Habitat and ecological niche: concepts, types, Gause principle, Intra-specific and Inter-specific competition, species co-existence.

Unit 3: Energetics: Solar radiation, Laws of thermodynamics applicable to energetics, energy flow patterns, energy flow models, methods to study energy flow, Biomass and productivity, measurement and factors affecting productivity.

Unit 4. Population interactions: Mutualism, evolution of Mutualism, Communalism, symbiosis, predator and prey, parasitism, parasite and host relationships.

Unit 5. Population regulation: Extrinsic and intrinsic mechanisms, case studies in population dynamics (two examples), Density dependent and density independent causes for population change.

Unit 6: Ecological adaptations: Different types of adaptations. Detailed account on volant, cursorial and cave adaptations.

Unit 7: Population ecology:

7.1: Natality: General concept, Human birth rate in India, Fertility: factors determining fertility, fertility trends in developing countries, causes of low fertility rate in developed countries, theories on fertility.

7.2. Mortality: General concepts, Human Mortality rate in India, factors determining reduction in mortality, infant mortality and child mortality.

7.3: Population growth patterns

Unit 8: Population Control Measures and Family welfare:

8.1: Family planning: Natural Methods, Contraceptives: Intrauterine devices, Oral contraceptives, Non oral hormonal contraceptives, Vaginal rings, post-coital contraception, Male and female sterilization, Pregnancy termination. Efficiency of implementation of family planning in India.

8.2: Family welfare: Age of marriage, duration of married life, spacing of children, pregnancy and abortion, child woman ratio, family size, sex roles and division of labour, parent child relationship, male and female sterility and treatment .

Unit 9: Communities: Concepts, Structure and organization, main types of communities (Marine and fresh water) biotypes, ecological dominance, ecotone and edge effect.. Primary and secondary ecological succession.

Course 2: PHYSIOLOGY & BIOLOGICAL CHEMISTRY

A – PHYSIOLOGY

Unit1: Feeding and Nutrition: Feeding habits in animals, hunger and appetite, Digestion and mechanisms of absorption of dietary carbohydrates, proteins and lipids. Regulatory mechanisms of digestion, absorption, Gastrointestinal disorders such as peptic ulcer and diarrhea.

Unit 2: Circulation: Types of hearts, body fluids (blood and lymph), Physiology and patterns of circulation, regulatory mechanisms of circulation,

Unit 3: Respiration: Types, Chemistry and functions of respiratory pigments, Major trends in aquatic and terrestrial respiration, Transport of oxygen and carbon dioxide, regulatory mechanisms of respiration,

Unit 4: Osmoregulation and excretion: Osmoregulation in aquatic and terrestrial animals. General patterns of nitrogen excretion in animals, Physiology of urine formation in mammals.

Unit 5: Muscle physiology: Types of muscles, Structure and functions of striated and non- striated muscles, Ultra structure and molecular mechanisms of muscle contraction, Structural and regulatory proteins of skeletal muscles, Muscle atrophy and dystrophy.

Unit 6: Thermoregulation: Physiological effects of temperature change, cryophily and thermophily, mechanisms of heat transfer between body and environment- Temperature compensation in poikilotherms, Thermoregulation in homeotherms.

Unit 7: Neurophysiology: Neuron- diversity and structure; conduction of Nerve impulse, Synapses and synaptic transmission, Neurotransmitters: physiology of cholinergic and adrenergic synapses, Reflex mechanisms, Functions of CNS and autonomic nervous system,

B. BIOLOGICAL CHEMISTRY

Unit1: Introduction, scope, chemical bonds- covalent, coordinate, ionic and hydrogen bonds. Vander-waal's forces, hydrophobic interactions, normality and molarity of solutions.

Unit 2: Nucleic acids: Properties, chemistry, synthesis and metabolism.

Unit 3: Carbohydrates :

3.1: Properties, classification and chemistry.

3.2. Metabolism: Embden-Meyer pathway, Glycolysis, Citric acid cycle, Glyconeogenesis, Glycogenolysis, Glycogen synthesis.

3.3 Regulation of blood sugar; Impaired glucose tolerance, Glycosuria, Insulin, Glucagon, Diabetes mellitus, Lactic acidosis, Glycated haemoglobin. Inborn errors associated with carbohydrate metabolism

Unit 4: Proteins:

4.1: Properties, classification and chemistry.

4.2: Metabolism: Transamination, Deamination, oxidative deamination, Urea cycle and Transmethylation.

c) Protein folding and denaturation

Unit 5:Lipids:

5.1:Properties, classification and chemistry.

5.2:Metabolism: Oxidation of fatty acids (alpha and beta oxidation), Prostaglandins, Cholesterol, Hypercholesterolemia, Lipoproteins, Atherosclerosis.

(a) Disorders of lipid metabolism

Unit 6. Enzymes: Properties and classification of enzymes. Co-enzymes, Mechanism of enzyme action. Activation and Inhibition. Enzyme Kinetics, Clinical and industrial applications of enzymes.

Course 3: PARASITOLOGY & ANIMAL BEHAVIOUR

A. PARASITOLOGY

Unit 1: Introduction: Classification, Distribution, and types of parasites. Origin and evolution of parasites, Types of habitats of parasites.

Unit 2: Culture techniques of parasites.

Unit 3: Entry of pathogens via Digestive tract, Urinogenital tract, Skin, and Bites.

Unit4: Habitat, Life cycle, Pathogens transmitted & control of vectors -

(a) Fleas, (b) Mites, (c) Ticks, (d) Lice. e) Mosquitoes

Unit 5: Geographical Distribution ,Morphology, Life cycle, Transmission, athenogenicity, and Prophylaxis of (a) Protozoa : *Trypanosoma*, *Plasmodium*, and *Leishmania*. (b) Nematode: *Ascaris*, *Anchylostoma* and *Wucheraria*. (c) Trematodes: *Fasciola*, *Schistosoma*, (d) Cestodes: *Echinococcus*, *Hymenolephis*.

Unit 6: Host- Parasite Relationship – Cellular & Physiological.

Unit 7: Manipulation of host behaviour, Parasitism and altruism, Parasites and social behaviour of host, Parasitic effects benefiting the host.

Unit 8: Parasitoids: Types, Chemical cues with suitable examples.

B. ANIMAL BEHAVIOUR

Unit 1: Introduction: Ethology as a branch of biology, approaches to the study of behaviour, ethograms.

Unit 2: Reflexes and complex behaviours : Latency, after discharge, summation, warm up, fatigue, Inhibition and feedback control.

Unit 3: Instinctive behaviour: Fixed action patterns, sign stimuli and release, types of sign stimuli.

Unit 4: Learning and imprinting behaviour: Definition, categories of learning, habituation, conditioning, latent learning, insight learning, social learning. Imprinting: imprinting as learning, functional aspects of imprinting.

Unit 5: Memory: Short term memory and long term memory, loss of memory, drugs and memory.

Unit 6: Biological communications: Nature and functions, forms and signals- Vision, audition, chemical, pheromones in insects and mammals.

Unit 7: Sexual behaviour: Sex ratio, seasonality, courtship signals, courtship as conflict behaviour, hormones and sexual behaviour, sexual selection (male choice and female choice).

Unit 8: Social organisation: Quasi social, semi social and eusocial, social organisation in insects and primates.

Unit 9: Genes & Behaviour; single gene & behaviour, polygenic inheritance Of behaviour and heredity of behaviour

Unit 10 Biological rhythms: Types of rhythms, biological clocks and their significance.

COURSE 4: CYTOGENETICS & DEVELOPMENTAL BIOLOGY

A-CYTOGENETICS

Unit 1 : (a) Origin and Evolution of prokaryotic and eukaryotic cells

(b) Ultrastructural organisation and functions of Plasma membrane and mitochondria

Unit 2: Organisation of eukaryotic chromosomes: (a) Types of chromosomes

(b) Molecular organisation of eukaryotic chromosomes (nucleosome, solenoid, radial loops, mini bands)

Unit 3: Cell cycle and Cell division:(a) Phases of cell cycle,

(b) Ultrastructure of centrosome (c) Chemistry and Ultrastructural organisation of microtubules (d) Metaphase and anaphase movements and motor proteins

Unit 4: Principles of Mendelism: (a) Laws of Segregation and Independent Assortment in diploid organisms (b) Deviations to Mendelian Principles: Interactions of genes, extra nuclear inheritance.

Unit 5: Linkage, Crossing over and Construction of linkage maps

Unit 6: Sex Chromosomes and Sex determination: (a) Sex chromosomes (b) Sex determination in *Drosophila* and Man

Unit 7: Fine Structure of the gene: (a) Classical concept (b) Studies in bar eye and Lozenge loci in *Drosophila*, Pseudoallelism (c) Benzer's work on rII locus in T-4 phages (d) The concept of cistron, recon and muton (e) Split genes

B - DEVELOPMENTAL BIOLOGY

Unit 1: Introduction to animal development (a) Problems of Developmental biology. (b) Developmental patterns in Metazoans (c) Development in Unicellular Eukaryotes.

Unit 2: Gametogenesis & Fertilization

Unit 3: Creating multicellularity. (a) Cleavage types. (b) Comparative account of Gastrulation.

Unit 4: Early Vertebrate Development (a) Neurulation and ectoderm (b) Endoderm and mesoderm.

Unit 5: Concept of Determination: Totipotency, Induction, Competence, Fate maps, and Organisers.

Unit 6: Role of Cytoplasm and Nucleus in Development: Nuclear transplantation experiments in Amphibia and *Acetabularia*.

Unit 7: Genetic basis of Differentiation and Morphogenesis: Early embryonic development of *Drosophila*, Role of maternal contribution in early embryonic development, Homeotic mutations and Homeobox, Imaginal discs, Differential gene activity during development and differentiation

Unit 8: Post embryonic Development: Metamorphosis in Amphibia, Regeneration, Teratogens

First Year Syllabus

PRACTICAL – I

(Based on Paper –I Animal forms & Functions & Ecobiology and Paper – II Physiology & Biochemistry)

1. Estimation of Glycogen
2. Estimation of protein

3. Estimation of Creatinine
4. Estimation of Cholesterol
5. Qualitative analysis of Carbohydrates
6. Qualitative analysis of proteins
7. Qualitative analysis of aminoacids
8. Population study of Drosophila
9. Population study of Termites
10. Contraceptive methods
11. Ecological adapted animals

PRACTICAL – II

(Based on Paper – III- Parasitology & Behaviour and Paper –IV-Cytogenetics and Developmental Biology)

1. Study of ticks
2. Study of mites
3. Study of lice
4. Study of Mosquitoes
5. Study of plasmodium
6. Study of Ascaris
7. Study of Fasciola
8. Study of mating behaviour of Drosophila
9. Morphology of D.Melanogaster.
10. Mounting of salivary gland chromosome of D.Melanogaster
11. Mutants of D.Melanogaster
12. Mounting of chick embryo
13. Meiotic chromosome preparation form Testis of grasshopper
14. Developmental stages of chick embryo

Final Year Syllabus

Course 5: AQUACULTURE AND WILDLIFE

A -AQUACULTURE

Unit1: Introduction: Definition, scope and status of aquaculture.

Unit 2:Culture:

2.1Techniques of culturing fishes

2.2: Culture of carps: Indian major and minor carps. Monoculture, polyculture Feeding techniques and mortality.

2.3: Culture of Ornamental fishes: Aquaria preparation and maintenance, Feeding techniques, breeding and caring .

2.4: Culture of shrimps and prawns: Major cultivable species, culture systems, larval rearing.

2.5: Culture of pearl oyster and Frogs.

Unit 3: Capture fishery (Fresh water) Methods of capture, Reservoir fisheries in India

Unit 4: Aquaculture systems : Inland farms, tank farms, pens and enclosures, design and construction of hatcheries.

Unit 5: Nutrition and Feeds: feeding habits and food utilization, energy requirements, live foods, artificial feeds.

Unit 6: Breeding of Fishes: Reproductive cycles, induced breeding, seed production, Cryopreservation

Unit 7: Diseases of fishes & their control: Crustacean : Protozoa, Fungal, bacterial, viral, environmental and nutritional, algal toxins, vitamin 'c' deficiency diseases.

Unit 8: Weeds, pests and predators and their control.

Unit 9: Fish preservation, Transport and marketing.

Unit 10: Farm management and economics: Concepts, economic principles of farm, management of Hatcheries, Nurseries, rearing ponds, and stocking ponds.

B - WILD LIFE STUDIES

Unit 1: Wildlife heritage and its importance in India: Important wildlife species of India, Range lands: status, types and management. Wildlife status: protected species, Endangered, Threatened, Vulnerable, rare, data deficient categories.

Unit 2: Biosphere reserves: National parks, Wildlife sanctuaries and wild life corridors of Karnataka and India.

Unit 3: Territoriality in wild life : Types, importance, scent markings in big cats, territoriality in monkeys.

Unit 4: Nesting: Types of nests, construction of nests and nest in weaver bird

Unit 5: Bird migration: Exploratory migration, seasonal and ontogenetic migration, orientation and navigation, map models, physiological preparation for migration, environmental factors, advances and evolutionary implications of migration.

Unit 6: Wild Life census: Census Methods for vertebrate species (mammals and birds)

Unit 7: Wild life conflicts: Conflicts between elephant and man, wolf and man, tiger and man.

Unit 8: Causes for depletion of wild life with examples.

Unit 9: Wildlife Conservation: Methods and strategies, Role of NGOs in wild life conservation, Ex-situ conservation, Special conservation projects- tiger, tiger forum, Lion, elephant, Musk deer, Thamin deer, Crocodile and Great Indian Bustard.

Unit 10: Wild life management: Case studies(Gudavi and Mandagadde bird sanctuary, Bhadra wild life sanctuary).

Unit 11: Wild life acts and legislation.

COURSE 6: ENVIRONMENTAL POLLUTION & ECOTOXICOLOGY

A - ENVIRONMENTAL POLLUTION

Unit 1: Concept of Biosphere and its components, hydrosphere, atmosphere, and lithosphere. Hydrological cycle

Unit 2: Water pollution: Definition and sources

2.1 Types and classification of pollutants. Effects of Water Pollution oxygen sag curves and eutrophication

2.2: Drinking water collection, purification and distribution.

2.3: Wastewater treatment: primary, secondary and tertiary treatment.

Unit 3: Atmospheric pollution: Primary and secondary air pollutants. Biological effects of Nox, SO_x, SPM, Hydrocarbons, acid rain, global warming, photochemical smog and ozone hole.

Unit 4: Solid waste and Hazardous waste: Types, Sources, collection, transport, treatment and Disposal methods.

Unit 5: Noise Pollution: Sources, biological effects, control measures and OSHA standards.

Unit 6: Radiation & Thermal pollution: Sources, types, effects, atmospheric fallout and abatement.

Unit 7: Soil Pollution: Soil pollutants and their effects, soil erosion- types and management, water shed management.

Unit 8: Environmental impact Assessment: Basic elements, Methods and criteria for industrial EIA, aquaculture related EIA, transport related EIA and water related EIA . Case studies: Konkan Railway, Silent valley, Bhopal Tragedy.

Unit 9: Anthropogenic activity and environment

Unit 10: Pollution and loss of biodiversity

B – ECOTOXICOLOGY

Unit 1: Scope of Toxicology, Bio assay methods to study toxicity, factors affecting toxicity, Dose response relationships.

Unit 2: Classification of pesticides. Toxicity of pesticides and metals (DDT, organophosphate, carbamate, mercury, Lead, cadmium): Sources and their effects on animals and man, Biomagnification.

Unit 3: Residual effects of Pesticides.

Unit 4: Biotransformation: Metabolism of toxic substances by animals and detoxification, Toxic risk assessment. Short term and long term impacts of Xenobiotics.

Biotransformation of DDT by insects, mouse and man

Unit 5: Studies on the toxins produced by plants (Parthenium, calotropis, nerium, opium), animal (Shellfish, tetradon) and microbes (fungal and bacterial) and their effects.

Unit 6: Tolerance limits and development of resistance in animals to xenobiotics

Unit 7: Statutory provisions and safety standards.

Unit 8: Statistical methods employed in toxicology: Mean, Mode, sd, SE, x^2 , Probit analysis, t-Test, Anova.

COURSE 7: SERICULTURE AND APICULTURE

A – SERICULTURE

Unit 1: Sericulture: Components, origin and development of the art and science of sericulture. Global silk production, quality and quantity of silk produced in India, economics of silk production, foreign exchange.

Unit 2: Classification, systematic position of sericigenous insects. Salient features of Saturniidae and Bombycidae. Races of mulberry silkworms, classification based on voltinism, moulting and geographic origin.

Unit 3: Morphology and life cycle of Bombyx mori. Structure and functions of Silk glands.

Unit 4: Silkworm genetics. Linkage, selective sex rearing. Silkworm as a laboratory tool for mutagenicity studies. Effects of radiations and chemicals on silkworm.

Unit 5: Brief account of the package and practices for cultivating the food Plants of silkworms. Use of Sericulture Waste in vermicomposte Verimicomposting techniques, agents and management.

Unit 6: Silkworm rearing: Building, equipments, disinfection, environmental factors, spacing, feeding and bed cleaning.

Unit 7: Modern rearing technology: Seed cocoons, preservation, grainage activity, LSPs, egg production, incubation, artificial hatching, seed organisation and seed area and bivoltine rearing.

Unit 8: Spinning, harvesting, transportation, testing and marketing of cocoons and silk reeling.

Unit 9: Non-mulberry silkworms: Types, morphology and life cycle, rearing and tribal welfare.

Unit 10: Silkworm pests and Predators: Uzi fly, Dermestid beetle, ants, lizard, birds and monkey.

Unit 11: Silkworm Pathology: Protozoan, Fungal, Viral and Bacterial diseases and their control measures.

B - APICULTURE

Unit 1: Introduction to Apiculture: Scope and its importance.

Unit 2: Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting.

Unit 3: Structural adaptations of mouth parts in bees, honey sac, Wax Glands, stinging apparatus and venom.

Unit 4: Entomophily: Bee plants, floral design, colour, smell, pollen and nectar production and composition. Pollen calendar. Relationship between floral design and mouth parts of honey bees. Pollen and nectar collection.

Unit 5: Social life in bees: Division of labour, sex separation, comb building, orientation of comb, communication, collection of propolis and water.

Unit 6: Honey and its chemical composition, medicinal importance.

Unit 7: Honey bee pests and Predators: Greater wax moth, Wasp, Mites, Birds, Lizards, Bear, Monkeys, Pseudoscorpions.

Unit 8: Honey bee diseases: Nosema, Sac brood, American foul brood, European foul brood and Fungal diseases and their control measures.

Unit 9: Effects of pesticides on bees.

Unit 10: Beekeeping: Rearing of honey bees, equipments, comb foundation, queen rearing (rearing techniques, feed contents, feeding and economics of queen rearing, requeening), bee nursing, honey and wax extraction.

Unit 11: Management of Beekeeping: Management during summer, rainy and winter seasons, desertion, division and uniting of colonies, migratory beekeeping. Flora management.

Unit 12: Economic importance of honey, wax, bee pollination, pollen and venom

Unit 13: Apitherapy.

Unit 14: Apiculture and rural development.

Course 8: MOLECULAR GENETICS & BIOTECHNOLOGY

A -MOLECULAR GENETICS

Unit 1: History and Scope of Molecular Genetics.

Unit 2: Structure of DNA, models of DNA, Unique sequences, repetitive sequences, Palindromic sequences, structure of RNA, three dimensional structure of tRNA.

Unit 3: Central dogma of molecular biology.

Unit 4: DNA replication: Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication, Enzymes and accessory proteins involved in DNA replication.

Unit 5: Transcription: Prokaryotic transcription, Eukaryotic transcription, RNA Polymerases, General and Specific transcription factors, Regulatory Elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene slicing.

Unit 6: Post – transcriptional modifications in RNA: 5'Cap formation, Transcription termination, 3'end processing and polydenylation, Splicing, editing, Nuclear export of mRNA, mRNA stability.

Unit 7: Translation: Genetic code, Prokaryotic and eukaryotic translation, translational machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, Co-and post – translational modifications of proteins.

Unit 8: Antisense and Ribozyme technology; Molecular mechanisms of antisense molecules, Inhibition of splicing, polyadenylation and translation, Disruption of RNA structure and capping, Biochemistry of ribozyme; hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, Application of antisense and ribozyme technologies,

Unit 9: Gene regulation: Operon concept, negative and positive regulation, Gene regulation in eukaryotes.

Unit 10: Genome analysis:

10.1: C-value paradox, detailed account of various models of prokaryotic genomes,

10.2: Genome analysis of Microbial, yeast, Drosophila, human.

B – BIOTECHNOLOGY

Unit 1: Introduction: History, Scope of biotechnology, Biotechnological process and products.

Unit 2: Genetic engineering: a) Definition, objectives and outline of genetic engineering procedure. Restriction enzymes, DNA ligase and DNA polymerase in genetic engineering. Cloning Vectors: Plasmids, Phages, Cosmids and Phagemids, Artificial chromosomes (YAC, BAC, HAC), animal viruses and Expression vectors.

Unit 3:

3.1: Construction of Genomic and cDNA libraries.

3.2: Selection and screening of Recombinants: Genetic selection, Use of chromogenic substrates, Insertional activation. Analysis of cloned genes: Characterization of clones, Restriction Mapping, Gene identification, Nucleic acid hybridization, Southern Hybridization, Polymerase chain reaction, DNA sequencing.
d) Cloning; Sheep (Dolly), Polly, Pig.

Unit 4: Hybridoma Technology: Scope of the technique, production of Monoclonal antibodies and its applications.

Unit 5: Animal cell and Tissue culture:

5.1: Introduction, Principles of cell culture, cell and tissue types, cell lines, transformation.

5.2: Cell and tissue culture media: Natural and defined, role and component of serum in culture.

Unit 6: Applications of tissue culture: Tissue culture in biomedical research karyological studies, amniocentesis, mutagenesis, Cytotoxicity Assays.

Unit 7: Transgenic Animals: Drosophila, fish, and mouse.

Unit 8: Applications of Biotechnology: Production of medicinally important products – Insulin, vaccines, hormones, Gene therapy, AIDS. Biofertilizers, biopesticides, silkworm cloning.

References:

1. Agarwal K.C.1999: Biodiversity. Agrobotanical Publishers, Bikaner, India.
2. Alberts B., Bray D, Lewis J., Rabt M., Robert K, and J.D.Watson. 1989 Molecular Biology of the Cell, IIEdn. Garland Publishing Inc. London.
3. Alexander N.Glazer, Hiroshi Nikaido 1998. Microbial Biotechnology: Fundamentals of Applied Microbiology. W.H. Freeman and Company, NY.
4. Ali S.and Ripley S.D.1969: Handbook of Birds of India and Pakistan. Oxford University Press.Delhi.
5. APHA, AWWA and WEF. 1992: Standard Methods for Examination of Water and Wastewater, 18th Edition, American Public Health Association. NY, USA.
6. Athery, A.G., Girton, J.R and McDonald, J.F. 1999 The Science of Genetics. Saunders College Publ, New York.
7. Barnes, R.D.1974. Invertebrate Zoology, IIIedition. W.B.Saunders Co., Philadelphia.
8. Barrington, E.J.W, 1976. Invertebrate Structure and Function. Thomas Nelson and Sons Ltd., London.
9. Barrington, E.J.W.1965. The Biology of Hemichordata and Protochordata-Oliver and Boyd, Edinburgh.
10. Brooker R.J. 1999. Genetics; Analysis and Principles. Benjamin/Cummings. Longman Inc, London.
11. Brown T.A., 1989 Genetics- A Molecular Approach, Van Nostrand Co N.Y, USA.
12. Prosser C.L. and F.A.Brown. 1961. Comparative Animal Physiology, W.B.Saunders Co., London.
13. Chatrath, K.J.S. 1992. Wetlands of India, Ashish Publishing House, New Delhi.
14. Clark, G.L.1963. Elements of Ecology, Wiley Eastern Limited. New Delhi.
15. Conn E.E, Stumpt P.K, Bruencing G and Dol. R.G. 1995. Outlines of Biochemistry. John Wiley, Singapore.
16. Cooper, G.M. 1997. The Cell; A Molecular Approach. ASM Press, Washington, D.C.
17. David L.Nelson and M.M.Cox. 2000.Principles of Biochemistry. 3rd Edn. Worth Publishers, 41, Madison Avenue, NY.
18. Edward. 1996, Fundamentals of Microbiology. 4th Edition The Benjamin/Cumming Publication Corp.
19. Gardner E.J., Simmon, S. and Snustad: 1991. Principles of Genetics, 8th Edition, John Wiley and Sons Inc. New York.
20. Gerge M. Malacinski and David Frefielder 1998. Molecular Biology 3rd Edn Jones and Bartlett Publ. Sudburg, M.A.
21. Gilbert S. F. 1997. Developmental Biology 5th Edn Sinaur Association Inc Publ Sunderland.
22. Glover D.M.and B.D.Hames 1995. DNA Cloning: A Practical Approach 2nd Edn. Vol. 1-4.

23. Goodenough U. 1985. Genetics, W.H. Freeman and Co. New York.
24. Goodrich, E.S., 1958. Studies on the Structure and Development of Vertebrates. Vol.I and II, Dever Publications Inc., New York.
25. Griffith A.J.H., Miller J.H., Suzuki D.T., Lewontin R.C. and W.M. Gelbart. 1994. An Introduction to Genetic Analysis. W.H.Freeman and Co. New York.
26. Harper H.A. 1993.A Review of Physiological Chemistry, Lange Medical Publication, 2nd Edn.
27. Hartel D.L. 1994. Genetics 3rd Edn Jones and Bartlett Publ. Boston.
28. Heywood V. H. (Eds) 1995. Global Biodiversity Published for UN Environmental Programme. Cambridge University Press.
29. Hosetti, B.B. 1996. Concepts in Wildlife Management. Daya Publishing House, Delhi.
30. Hosetti, B.B. and Venkateshwarlu M. 2001: Wildlife Trends in Biodiversity, Conservation and Management. Daya Publishing House, Delhi-35, India.
31. Hosetti, B.B. and Kumar, A. 1998. Environmental Impact Assessment and Management Daya Publishing House Delhi-110035.
32. Hosetti, B.B. 2002. Glimpses of Biodiversity. Daya Publishing House, Delhi-35, India.
33. Hosetti, B.B 2002. Wetlands Conservation and Management. Pointer Publishers, Jaipur, India.
34. Jacquelyn G.Black.1996. Microbiology Principles and Applications.3rd Edn. Marymount University Prentice hall, NewJersy.
35. Jangir, O.P. 2002. Developmental Biology A Manual. Agrobios, Jodhpur, India.
36. Kapoor, V.C.1998. Theory and Practice of Animal Taxonomy. Oxford IBH Co. Pvt. Ltd., New Delhi, 1998.
37. Kathleen Talaro, Arthur Talaro.1998. Foundations in Microbiology. Wm.C.Brown Publishers.
38. Knutt Schmidt-Nelson. 1994. Animal Physiology: Adaptations and Environment, 3rd Edition, Cambridge University, U.K.
39. Kormondy, E.J.1992. Concepts of Ecology, Prentice Hall of India Pvt. Ltd., New Delhi.
40. Lehninger A.L, Nelson D.L and Cox M.M, 2nd Edn. 1993. Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
41. Lewin, B. 2000, Genes, VII Oxford University Press, Oxford.
42. Lubert Stryer. 1995. Biochemistry 4th Edn W.H.Freeman & Co.
43. M/S.Gordon.1972. Animal Physiology, Principles and Adaptations, 2nd Edn., Macmillan Press, NewYork.
44. Manning A and Dawkins M. 1997. An Introduction to Animal Behavior- IV Ed., Cambridge Univ. Press.
45. Mason C.F. 1989. Biology of Freshwater Pollution. Longman Publishers Pvt., Ltd., Singapore.
46. Mishra R.C. 1999. Perspectives in Indian Apiculture. Alloed Scientific Publ. Bikaner, India.
47. Moore, J.W. and Moore,E.A. 1976. Environmental Chemistry, Academic Press, New York.

48. Neilson K.S. 1995. Animal Physiology: Adaption and Environment-IV Ed. Cambridge Univ. Press.
49. Old R.W. and S.B.Primose, 1996. Principles of Gene Manipulation: An Introduction to Genetic Engineering. Blackwell Scientific Publications.
50. Panday, K and J.P. Shukla. 1991. Elements of Toxicology. Neel Kamal Prakasan, New Delhi.
51. Parker, T.J.Haswell, W.A.1961. Text book of Zoology, Vol. I, 2nd Edition.Macmillon Co., London.
52. Paul Colinvaux, 1986: Ecology. John Wiley and Sons, New York.
53. Plummer, D.T. 1993. Practical Biochemistry, 3rd Edn. Tata McGraw Hill Publishing Co., Ltd. New Delhi.
54. Prescott, L.M, J.P.Harley and D.A. Klein. 1996. Microbiology, 3rd Edition. Wim C. Brown Publishers.
55. Purohit S.S. 1998. Microbiology: Fundamentals and Applications. 6th Edn. Agro Batanica, Bikaner.
56. R.Eckert and D.Randall. 1983. Animal Physiology, 2nd Edn. W.H. Freeman and Co.
57. Rao, A.S. 1999 Introduction to Microbiology. Prentice-Hall of India, Pvt., Ltd., New Delhi.
58. Robert C. Tait 1997. An Introduction to Molecular Biology Horizon Scientific Press. Norfolk England.
59. Roger L. Miesfeld 1999, Applied Molecular Genetics Wiley-Liss Publication New York.
60. Ronald M. Atlas.2001. Basic and Practical Microbiology, MacMillon Press.
61. Russel-Hunter, W.D.1969.A Biology of Higher Invertebrates, The Macmillon, Co., Ltd., London.
62. Russo, V.E.A, Brody, S. Cove, D. Ottolenghi, S., 1992 Development; The Molecular Genetic Approach. Springer-Verlog, Berlin.
63. Scnmitz, R.J. 1996. Introduction to Freshwater Biology. Gulf Publishing Company, New Delhi.
64. Sedgwick, A 1966. A Student TextBook of Zoology.Vol.I, II and III. Central Book Depot, Allahabad.
65. Shlegel H.G. 1995. General Microbiology, 7th Edition, Cambridge University Press.
66. Simpson, G.G.1965. Principles of Animal Taxonomy. Oxford Book Co., New Delhi.
67. Smyth, J.D 2000. Animal Parasitology, Cambridge low Edition.U.K.
68. Snedecor D.W. and Cochran W.G. 1967. Statistical Methods. Ed. VI. Oxford and IBH Publishing Co., New Delhi.
69. Snustad D.P and M.J.Simmons. 1997. Principles of Genetics. John Wiley and Sons, Inc. NY.
70. Stanbury P.F, Whitaker A and Hall S.J, 1998. Principles of Fermentation Technology 2nd Edn. Aditya books (P) Ltd. New Delhi.
71. Strickberger M.W. 2000. Evolution. Jone and Bartlet Publishers, Boston, London.
72. Strickberger M.W., 1996 Genetics, Mac Millan Publishing Co,N.Y
73. Subramoniam T. 2002 Developmental Biology. Narosa Publishing House.
74. Tom Strachan and Andrew P. Read 1999. Human Molecular Genetics John Wiley & Sons. Publishers New York.

75. Trivedy, R.K. and Goel, P.K. 1984. Chemical and Biological Methods for Water Pollution Studies. Environmental Publications. Karadi.
76. W.S. Hoar. 1983. General and Comparative Animal Physiology, 3rd Edn, Prentice Hall Inc.
77. Watson J.D., N.H.Hopkins, J.W. Roberts, J.A.Steitz and A.M.Weiner. 1987. Molecular Biology of Genes. The Benjamin/Cummings Publishing Company.Inc.Tokyo.
78. Watson, J.D, M.Gilman, J.Witkowski and M. Zollar 1992. Recombinant DNA 2nd Edn Scientific American Books (W.H.Freeman& Co).
79. Weichert, C.K., and Presch. W., 1975. Elements of Chordate Anatomy, 4th Edn.McGraw Hill Book Co., NewYork.
80. Wilson K and Walker J. Principles and Techniques in Practical Biochemistry 1995.4th Edn. (Low Price). Cambridge University Press, Cambridge,UK.
81. Wolfe.A. 1995. Chromatin: Structure and Function. Academic Press, NY.
82. Young, J.Z., 1950. Life of Vertebrates-The Oxford University Press, London.
83. Young, J.Z., 1957. Life of Mammals, Oxford University Press, London.

PRACTICAL-IV Based on Paper-VII and Paper-VIII (Apiculture and Sericulture, Molecular Biology and Biotechnology)

I. Molecular Biology and Biotechnology

1. Isolation of fibrous DNA in the given tissue.
2. Estimation of DNA.
3. Isolation of RNA.
4. Estimation of RNA.

II. Apiculture

1. Morphology of honey bee
2. Mouth parts and sting of honeybee.
3. Digestive system of honeybee.
4. Structure of honeycomb.
5. Honey bee species.
6. Bee plants.
7. Honey bee equipments.
8. Honey products.

III. Sericulture

1. Silkworm plants.
2. Estimation of leaf protein by Lowry's method.
3. Estimation of total free aminoacids in mulberry leaf by ninhydrin method.
4. Life cycle of *Bombyx mori*.
5. Digestive system of silkworm larva (*B.mori*).
6. Nervous system of silkworm larva (*B.mori*).
7. Cocoons of different silkworm races.
8. Defective cocoons.

PRACTICAL - IV

Based on Paper-VII and Paper-VIII (Apiculture and Sericulture, Molecular Biology and Biotechnology)

Question paper pattern for Practical Examination

- | | |
|---|-----------------|
| 1. One major question from Molecular biology and Biotechnology. | 1 X 15 M = 15 M |
| 2. One major question from Apiculture. | 1 X 15 M = 15 M |
| 3. One major question from Sericulture. | 1 X 15 M = 15 M |
| 4. Five identifications. | 5 X 2 M = 10 M |
| 5. Viva. | 10 M |
| 6. Record. | 10 M |

PRACTICAL-III Based on paper-V and Paper-VI (Aquaculture and Wild life studies, Environmental Biology and Ecotoxicology)

I. Environmental Biology

1. Estimation of Dissolved Oxygen in the given water sample.
2. Estimation of Carbon dioxide in the given water sample
3. Estimation of Biological oxygen demand (B.O.D) in the given water sample
4. Estimation of Hardness by EDTA method of the given water sample.
5. Estimation of Phosphates in the given water sample.
6. Estimation of sulphates in the given water sample.
7. Estimation of total solids in the given water sample.
8. Estimation of total dissolved solids in the given water sample.
9. Estimation of total suspended solids in the given water sample.

II. Ecotoxicology

1. Estimation of iron in the given water sample.
2. Estimation of copper in the given water sample.
3. Estimation of Protein in the given treated tissue sample.
4. Estimation of Glycogen in the given treated tissue sample.

III. Aquaculture

Identification of fishes

- | | |
|-----------------------------|-----------------------------|
| a) <i>Catla Catla</i> | |
| b) <i>Anguilla</i> | h) <i>Cirrhinus flungee</i> |
| c) <i>Labeo rohita</i> | i) <i>Cirrhinus mrigala</i> |
| d) <i>Salstoma untrachi</i> | j) <i>Spine eel</i> |
| e) <i>Cyprinus carpio</i> | k) <i>Notepterus</i> |
| f) <i>Ompok bimaculatus</i> | l) <i>Clarius batrachus</i> |
| g) <i>Channa punctatus</i> | |

IV. Wildlife studies

- | | |
|--------------------------------------|----------------|
| a) Grosshopper | f) Chameleon |
| b) Mole cricket | g) Bat |
| c) Honey bee (<i>Apis dorseta</i>) | h) Cobra |
| d) Dragon fly | i) Krait |
| e) Butterflies | j) Green snake |

PRACTICAL - III

Based on paper-V and Paper-VI (Aquaculture and Wild life studies, Environmental Biology and Ecotoxicology)

Question paper pattern for Practical Examination

- | | |
|---|-----------------|
| 1. One major question from Environmental biology. | 1 X 13 M = 13 M |
| 2. One major question from Ecotoxicology. | 1 X 12 M = 12 M |
| 3. Five identifications from Aquaculture. | 5 X 3 M = 15 M |
| 4. Five identifications from Wildlife studies. | 5 X 3 M = 15 M |
| 5. Viva. | 10 M |
| 6. Record. | 10 M |