

FACULTY OF LIFE SCIENCES

Syllabus

For

B.Sc. (Hons. School) in Zoology

(Semester I-VI)

(Under Credit Based Continuous Evaluation Grading System)

Examinations: 2012-13



GURU NANAK DEV UNIVERSITY

AMRITSAR

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B.Sc. (HS) Zoology (Semester System)
(Under Credit Based Continuous Evaluation Grading System)

Scheme of Courses

Semester -I						
Course no.	C/E/I	Course Title	L	T	P	Total Credits
ZOL 101	C	Biology of Non Chordates-I	2	0	0	2
CYL192	C	Inorganic Chemistry	3	1	0	4
MTL 161	C	Differential Calculus	3	0	0	3
PHL 191	C	Optics	3	1	0	4
BSL 101	C	Cryptogams	3	0	0	3
	C	Communicative English-I	2	0	0	2
ZOP 121	C	Non Chordates (Practical -I)	0	0	1	1
CYP194	C	Inorganic Chemistry Lab (Qualitative Analysis)	0	0	3	3
PHP 192 *	C	Optic Lab	0	0	3	3
BSP 121	C	Cryptogams Lab	0	0	1.5	1.5
						26.5

Semester -II						
Course no.	C/E/I	Course Title	L	T	P	Total Credits
ZOL 151	C	Biology of Non Chordates -II	2	0	0	2
CYL191	C	Organic Chemistry	3	1	0	4
MTL 162	C	Integral Calculus	3	0	0	3
PHL 196	C	Modern Physics	3	1	0	4
BSL 151	C	Phanerogams	3	0	0	3
	C	Communicative English -II	2	0	0	2
ZOP 171	C	Non Chordates (Practical -II)	0	0	1	1
CYP193	C	Organic Chemistry Lab (Classical Qualitative Organic Analysis)	0	0	3	3
PHP 197*	C	Modern Physics Lab	0	0	3	3
BSP 171	C	Phanerogams Lab	0	0	1.5	1.5
						26.5

* The syllabus for course no. PHP 192 & PHP 197 (Practicals of optic Lab. & Modern Physics Lab.) has not been provided by the Physics department. As per the communication received from the said department, these practicals will be based on the syllabi of their respective theory paper.

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Scheme of Courses

Semester -III						
Course no.	C/E/I	Course Title	L	T	P	Total Credits
ZOL 201	C	Biology of Chordates -I	2	1	0	3
ZOL 202	C	Introductory Genetics	2	1	0	3
ZOL 203	C	Bio Molecules	2	1	0	3
ZOL 204	C	Animal Physiology	2	1	0	3
PBL 103/ HSL 101	C	Punjabi/ History and Culture of the Punjab	2	0	0	2
ESL 220	C	Environmental Studies	2	0	0	2
	I	Interdisciplinary Course	2	1	0	3
ZOP 221	C	Animal Diversity Lab-III	0	0	3	3
ZOP 222	C	Genetics Practical	0	0	1.5	1.5
ZOP 223	C	Physiology Practical	0	0	1.5	1.5
Total Credits						25

Semester -IV						
Course no.	C/E/I	Course Title	L	T	P	Total Credits
ZOL 251	C	Biology of Chordates -II	2	1	0	3
ZOL 252	C	Medical Zoology	2	1	0	3
ZOL 253	C	Endocrine Regulation	2	1	0	3
ZOL 254	C	Environmental Physiology	2	1	0	3
ZOL 255	C	Introductory Biotechnology	2	1	0	3
PBL 104/ HSL 102	I	Interdisciplinary Course Punjabi / History & Culture of the Punjab	2	0	0	2
CYL 291	C	Physical Chemistry	3	1	0	4
ZOP 271	C	Animal Diversity Lab-IV	0	0	3	3
CYP 292	C	Physical Chemistry Lab.	0	0	3	3
Total Credits						27

The syllabi for the subjects of Chemistry, Physics, Botany, English, Mathematics, Punjabi/Punjab history & Culture and Environmental studies shall be provided by the respective departments of the University.

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Semester-V

Course No.	C/E/I	Course Title	L	T	P	Credit
ZOL 301	C	Gamete Biology	3	1	0	4
ZOL 302	C	Minor Phyla	3	1	0	4
ZOL 303	C	Essential Immunology	3	1	0	4
ZOL 304	C	Comparative Anatomy of Chordates-I	3	1	0	4
ZOS 305	C	Seminar	0	0	2	2
	I	Interdisciplinary Course	3	1	0	4
ZOP 321	C	Zoology Lab. -I	0	0	3	3
			Total			25

Semester-VI

Course No.	C/E/I	Course Title	L	T	P	Credit
ZOL 351	C	Animal Biodiversity	3	1	0	4
ZOL 352	C	Embryology	3	1	0	4
ZOL 353	C	Basic Concepts of Evolution	3	1	0	4
ZOL 354	C	Comparative Anatomy of chordates-II	3	1	0	4
ZOS 355	C	Seminar	0	0	2	2
	I	Interdisciplinary Course	3	1	0	4
ZOP 371	C	Zoology Lab. -II	0	0	3	3
			Total			25

ZOL 101: Biology of Non Chordates–I

Credit 2-0-0

Unit–I

The Invertebrates: An Introduction

Phylum Protozoa

General Characters, Economic Importance

Detailed study of *Amoeba* and *Paramecium*

Phylum Porifera

General Characters, Economic Importance

Detailed study of Sycon / Scypha

Skeleton in Sponges

Canal System in Sponges

Unit–II

Phylum Coelenterata

General Characters, Economic Importance

Detailed study of *Obelia*

Polymorphism

Coral Reefs

Platyhelminthes

General Characters, Economics Importance

Detailed study of *Fasciola hepatica*

Unit–III

Aschelminthes

General Characters, Economic Importance

Detailed study of *Ascaris*

Annelida

General Characters, Economic Importance

Detailed study of *Pheretima* and *Hirudinaria*

Suggested Reading Material:

Barnes, R. D. (1980). The Invertebrate Zoology, Hotl-Saunder, Philadelphia, 4th ed.

Barth, R. H. and Brosherars, R. E. (1982). The Invertebrate World. Holt-Saunders, Tokyo, Japan.

Engemann, J. G. And Hegner, R. W. (1981). The invertebrate Zoology 3rd edition . Macmillan, New York.

Hyman, L. H. The invertebrates (Vol. I-VI)

Vol. I Protozoa through Ctenophora (1940)

Vol. II Platyhelminthes and Rhynchocoela (1951).

Vol. III Acanthocephala, Aschelminthes and Entprocta (1951).

McGraw Hill, New York.

Meglitsh, P. (1972). Invertebrate Zoology. Oxford Uni. Press, New York.

Parker, T. J. And Haswell, W.A. (1972). A text book of Zoology Vol. I (revised by Marshall) ELBS and the Macmillan Co. London.

B.Sc. (HS) Zoology (Semester-I)
(Under Credit Based Continuous Evaluation Grading System)

Russel- Hunter, W. D. (1968). A Biology of Lower Invertebrates. McMillan Co. New York.
Russel-Hunter, W. D. (1968). A Biology of Higher Invertebrates. MacMillan Co. New York.
Sherman, I. W. and Sherman, V. G. (1970). The Invertebrates, Function and form ,
MacMillan Co. New York.

Books of Indian Authors:

Dhami, P. S. And Dhami, J. K. (1988). Invertebrates Zoology, R.,Chand & Company,
New Delhi.
Kotpal, R. L., Aggarwal, S. K. & Khetarpal, R. P. (1986). Modern Text Book of Zoology
Invertebrates, Rastogi Publications, Meerut.

CYL-192 INORGANIC CHEMISTRY

**Credits: 3-1-0
(8 Hrs.)**

1. Co-ordinations Chemistry

Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries.

Factors affecting co-ordination numbers and stereo-chemistry

(a) Configurational Isomers (b) Conformational isomerism. VSPER theory, molecular orbital theory applied to homonuclear diatomic molecules and heteronuclear Diatomic molecules. **(5 Hrs.)**

2. Bonding in metal complexes

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B theory.

3. Stability of coordination compounds

(5 Hrs.)

Introduction, Stability constant, stepwise stability constant, overall stability constant. Factors affecting the stability of metal ion complexes with general ligands. HSAB principle.

4. Crystal Field Theory:- Splitting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands. Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the $10 Dq$ value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamic effects of C.F. splitting, variation in lattice energies. Hydration energies, Dissociation energies, Formation constants of hexammines. Site selection in spinels, Paramagnetism, diamagnetism, ferro and antiferromagnetism. Microstates and spectroscopic terms, a calculation of spectroscopic terms for $d^1 - d^{10}$ electronic configurations, L.S coupling, Hund's rule for finding the ground state terms. Electronic spectral properties of 1st transition series, Orgel Diagrams for $d^1 - d^{10}$ systems, for weak field octahedral and tetrahedral complexes, limitations of C.F.T

5. Molecular Orbital Theory:- Evidence for Covalent character in Bonding, MOEL diagram for octahedral and tetrahedral complexes involving bonding, charge transfer transitions. **(15 Hrs.)**

6. π Acid Ligands

(5 Hrs.)

Definition Carbon monoxide complexes, bonding in linear MCO groups, polynuclear metal carbonyls, vibrational spectra, Reactons, carbonyl hydrides and halides. Metal-metal bonding metal-metal multiple bonding, isolable analogies, Structure of high nuclearity carbonyl clusters, counting of electrons in carbonyl clusters.

7. Alkali metal and alkaline earth metal chelators

(7 Hrs.)

Macrocyclic ligands, macrocyclic effect, crown ethers and podands, coronands, cryptands, structure of 18 crown 6 complex with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions, sandwich formation, cryptands and their cation complexes, podands with aromatic donors and groups.

Text and Reference Books:

J.E. Huheey, Inorganic Chemistry, 3rd Ed.

F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry.

B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic chemistry.

R. Hilgenfeld and W. Saengar, Topic in Current chemistry Vol-II

MTL-161 DIFFERENTIAL CALCULUS

Credits: 3-0-0

Functions , Domain and Range of a function, Graph of a function, Inverse functions, Exponential and logarithmic functions, Limit of functions, Algebraic computation of limits, Continuity of function at a point.

Differentiation: Derivability and Derivative, Derivatives of standard functions, Formulae on derivative of sum, difference, product and quotient of functions, Chain rule.

Derivative of trigonometric functions, inverse trigonometric functions, hyperbolic functions, exponential and logarithmic functions, Derivative of implicit functions. Derivative of functions expressed in parametric form. Logarithmic differentiation.

Derivative of higher order (upto 2nd order). Maxima and minima of a function of a single variable. Introduction to partial differentiation.

Book Recommended:

Shanti Narayan: Differential Calculus

PHL-191 Optics

Credits: 3-1-0

Interference: Young's experiment, Coherent Source, Phase and Path differences, Theory of interference fringes, Fresnel's biprism, thickness of thin transparent sheet, interference in thin film due to reflected and transmitted light colour of thin film, Newtons rings and their application, Michelson & Feby-Perot Interferometer, Anti reflection coatings, Holography.

Diffraction: Introduction, Franunhoffer diffraction at a single slit and its discussion, Fraunhoffer diffraction at double slit, missing orders in a double slit, Diffraction of N slits and its discussion, Diffraction grating, Missing orders, dispersive power, Rayleigh Criterion for resolving power, resolving power of a diffraction grating.

Polarization: Transverse nature of light, Polarization by reflection and refraction, Brewster's Law, Malus Law, Double refraction, Nicol Prism, Elliptically and circularly polarized light, Quarter-wave and half-wave plates, production and detection of polarized light, Optical activity, specific rotation. Half shade polarimeter.

Reference Books:

1. Text book of Optics : N. Subramanayam, B. Lal and M.N. Avadhamulu.
2. Fundamentals of Optics: Jenkins and White

BSL 101-Cryptogams

Credits 3-0-0

Algae:

1. History of algal studies in India, Habit and Habitats, General characters, classification and economic importance.
2. Important features and life histories of members of Cyanophyceae (*Oscillatoria*, *Nostoc*), Chlorophyceae (*Chlamydomonas*, *Volvox*, *Oedogonium*, *Coleochaete*).
3. Important features and life histories of members of Xanthophyceae (*Vaucheria*) Phaeophyceae (*Ectocarpus*, *Sargassum*), Rhodophyceae (*Batrachospermum*, *Polysiphonia*).

Fungi :

4. General characteristics, classification and economic importance.
5. Important features and life histories of members of Mastigomycotina (*Phythium*, *Phytophthora*); Zygomycotina (*Mucor*); Assocmyotina (*Saccharomyces*, *Eurotium*, *Chaetomium*, *Pezzia*); Basidomycotina (*Puccinia*, *Agaricus*); Deuteromycotina (*Cercospora*, *Colletotrichum*).
6. General account of Lichens.

Bryophyta :

7. General characters , classifications and economic importance.
8. Amphibians of plant kingdom, displaying heterologous alternation of generations.
9. Important features and life histories of members of Hepaticopsida (*Marchantia*), Anthocerotopsida (*Anthoceros*), Bryopsida (*Funaria*). Amphibians of plant kingdom, adaptive characters for land habitat. Classification and comparative study of classes as seen in Marchantia, Pellia, Porella, Anthoceros, sphagnum, Funaria and Polytrichum. Homologous and antithetic theories, Economic importance of Bryophytes.

Pteridophytes :

10. The first vascular plants, salient features of structures and life cycle of different classes as seen in Rhytnia, Psilolium, Equisetum, Pteris and Marsilea. Heterospory prevalence and seed habit, asexual and sexual reproduction. Range of stellar system, An elementary study of geological time scale and fossils, dating of fossils.

Suggested Readings:

- Alexopolous, J. and W. M. Charles 1988. Introduction of Mycology. Wiley Eastern, New Delhi.
- Dube, H.C. 1990. An Introduction of Fungi, Vikas Publishing House, Pvt. Ltd. Delhi.
- Pandey, B. P. 2001. College Botany, Vol. I : Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand and Company Ltd. , New Delhi.
- Puri, P. 1980. Bryophyta. Atma Ram and Sons. Delhi.
- Sharma, P. D. 1991. The Fungi, Rastogi and Co, Meerut.
- Sharma, O. P. 1992. Text Book of Thallophytes, McGraw Hill Publishing, Co. New Delhi.
- Smith, G. M. 1971. Cryptogamic Botany, Vol. I, Algae and Fungi, Tata McGraw hill Publishing Co., New Delhi.
- Smith, G. M. 1971. Cryptogamic Botany, Vol. II, Bryophytes and Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
- Thakur, A. K. and S. K. Bassi, 2008. A Textbook of Botany: Diversity of Mircoebes and Cryptogams S. Chand & Company Ltd, New Delh.
- Vashista, B. R. 1990. Botany for Degree Students : Fungi, S. Chand & Company Ltd, New Delhi.
- Vashista, B. R., A. K. Sinha and Adarsha Kumar, 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.
- Vashista, B.R., A. K. Sinha and V. P. Singh 2008. Botany for Degree Students: Algae. S. Chand & Company Ltd, New Delhi.

COMMUNICATIVE ENGLISH-I

Credits: 2-0-0

Objectives: To introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester-I, the students should be able to demonstrate adequate competence in comprehending the prescribed text and performing the given writing tasks.

Reading:

a) Developing habits of independent and fast reading:

Students will be required to read a prescribed prose anthology titled selections from Modern English Prose (Ed. Haladhar Panda published by University Press, Hyderabad). The essays in the anthology will be read by students at home with the help of glossary given in the book. Progressing from one lesson to another, they should learn to read fast. Students are supposed to keep a record of their reading in the form of notes, difficulties, summaries, outlines and reading time for each essay. Class teacher may use this record for award of internal assessment (if any).

b) Developing Comprehension Skills :

Teacher will provide guided comprehension of the prescribe texts in the class and help students in answering the questions given at the end of each lesson. Teacher can construct more questions of factual and inferential nature to enhance the comprehension skills of the students. The teacher shall also guide students to do the vocabulary and grammar exercises given at the end of each lesson.

Writing:

a) Developing skills in personal writing:

Students will be required to learn short personal write ups involving skills of description and narration. The types of composition task may include personal letter writing, telegram writing, notice writing, diary writing etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writing. The teacher may also prescribe any composition / writing book if so required.

b) Developing writing skills based on guided composition:

The students will be required to write a longish composition on a question from the essays of Selections from Modern English Prose. The composition will require presentation of ideas beyond the prescribed essays. Sample composition topics are given at the end of each lesson.

Question Paper: The following format is suggested for a 3-hour test
(Appropriate choices may be given where possible)

1. Short answer comprehension question (at least 5) based on the lesson included in Selection from Modern English Prose) **App. Weighting : 30%**
2. Questions on grammar and vocabulary (words, phrases, proverbs) **App. Weighting : 20%**
3. Two short writing tasks of app. 150 words. One a personal letter involving narration of a personal experience or description of objects, persons, places or events. The second may be a telegram or public notice or a diary entry about a personal or family achievement loss or celebration **App. Weighting : 30%**
4. One long composition of about 300 words on one of the topics discussed in Selections from Modern English Prose. Due consideration be given to the organization of details and coherence in writing. **App. Weighting : 20%**

Internal Assessment. The teacher may consider the following for award of internal assessment, if any.

1. Evidence of independent reading as given above. Teacher may suggest some special tasks to suit the needs of their students.
2. Students may be asked to keep diary of their daily or specific routines.
3. Students may be asked to write a certain number of compositions on selected topics during the semester.

ZOP 121: Non Chordates (Practical –I)

Credit 0-0-1

Protozoa:

a) Examining cultures / stained preparation of :

Amoeba
Paramecium
Trypanosoma
Euglena
Noctiluca
Leishmania
Plasmodium
Giardia
Eimeria
Monocystis
Nyctotherus
Balantidium
Opalina
Vorticella

b) To make temporary slides of *Opalina*, *Nyctotherus*, *Balantidium*.

Parazoa :

- To prepare permanent slides of gemmules of sponges.
- To study permanent prepared slides *T.S. Sycon*, *L. S. Sycon*, *Gemmule*, *spicules*.
- General Survey *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*.

Cnidaria :

- To make permanent slides of *Hydra*, *Obelia*, *Sertularia*, *Pulmularia*, *Bougainvillea*.
- To study permanent and prepared slides –*Hydra* (W.M.), *Hydra* with bud, *T. S. of Hydra*, *Bougainvillea*, *Tubularia*, *Sertularia*, *Plumularia*, *Obelia*, (Colony and Medusa), *Aurelia* (Sense organs and life history)
- General Survey – *Millipora*, *Physalia*, *Verella*, *Porpita*, *Aurelia*, *Alcyonium*, *Tubipora*, *Pennatula*, *Metridium*, *Madrepora*, *Favia*, *Fungia*, *Astraea*, *Zoanthus*.

Platyhelminthes :

- To study permanent prepared slides – *T. S. Taenia*, *T. S. Fasciola*, *T. S. Dugesia*, *Miracidium*, *Sporocyst*, *Redia*, *Cercaria*, *Scolex* and *Proglottid*, (Mature and gravid of *Taenia*.)
- General survey *Dugesia*, *Schistosoma*, *Fasciola*, *Taenia*, *Echinococcus*.

Aschelminthes :

- To study permanent slides – *T. S. Ascaris* (Male and Female).
- General survey *Trichinella*, *Ascaris*, *Ancylostoma*.

Annelida :

- Preparations of temporary mounts of spermatheca, setae. Ovary, nephridium of earthworm and nephridia of leech.
- Study of permanent slides *T. S. earthworm* (pharyngeal and typhlosolar region), setae, nephridia and spermatheca, *T. S. leech*.
- General Survey *Polynoe*, *Heteronereis*, *Aphrodite*, *Eunice*, *Chaetopteus*. *Arenicola*, *Pheretima*, *Hirudo*, *Pontobdella*, *Tubifex*.

CYP-194 INORGANIC CHEMISTRY

Credits: 0-0-3

Identification of cations and anions in a mixture which may contain four ions (2 cations and 2 anions)

Perform systematic group analyses to identify the cations in the mixture. Any cation from Group I, Group II (Group IIA and IIB) Group IV, Group V and Group VI may be present.

Book: Vogel's book on Inorganic Qualitative Analysis.

***PHP 192: Optics Lab.**

BSP 121 Cryptogams Lab.

A study of the occurrence, habitat, morphology and life cycle in the following members :

1. Algae : Oscillatoria, Nostoc, Chlamydomonas, Volvox, Oedogonium, Coleochaete, Vaucheria, Ectocarpus, Sargassum, Batrachospermum, Polysiphonia.
2. Fungi : Pythium, Phytophthora, Mucor, Saccharomyces, Eurotium, Chaetomium, Peziza, Puccinia, Agaricus, Cercospora, Colletotrichum.
3. Bryophyta : Marchantia, Anthoceros, Funaria, Riccia, Pellia, Porella.
4. Pteridophytes : Psilotum, Selaginella, Lycopodium, Equisetum, Pteris.
5. Symptoms of common plant disease caused by Fungi : Tikka disease of groundnut, late Blight of potato, Ergot of bajra, Brown spot of rice, Red rot of sugarcane, Wheat rust etc.
6. Enumeration and examination of important algal and fungal products.

Biofertilizers, protein capsules (Spirulina), antibiotics, mushrooms, Single cell protein agar-agar etc.
7. Field visits of algal / fungal interest (Mushroom cultivation, Water bodies etc.)

ZOL 151: Biology of Non Chordates –II

Credit: 2-0-0

Unit -I

Arthropoda:

General Characters, Economic Importance
Detailed study of *Periplaneta*
Metamorphosis in Insects
Social Organization in Insects

Unit –II

Mollusca:

General Characters, Economic Importance
Detailed study of *Pila*
Molluscan Larvae
Shell in Mollusca

Unit –III

Echinodermata:

General Characters, Economic Importance
Detailed study of Starfish
Echinoderm Larvae

Hermichordata:

General Characters, Economic Importance
Detailed study of *Balanoglossus*
External characters and Affinities

Suggested Reading Material:

- Barnes, R. D. (1980). The Invertebrate Zoology, Holt-Saunders, Philadelphia, 4th ed.
Barth, R. H. and Brosherars, R. E. (1982). The Invertebrate World. Holt-Saunders, Tokyo, Japan.
Engemann, J. G. And Hegner, R. W. (1981). The invertebrate Zoology 3rd edition . Macmillan, New York.
Hyman, L. H. The invertebrates (Vol. I-VI)
Vol. I Protozoa through Ctenophora (1940)
Vol. II Platyhelminthes and Rhynchocoela (1951).
Vol. III Acanthocephala, Aschelminthes and Entprocta (1951).
McGraw Hill, New York.
Meglitch, P. (1972). Invertebrate Zoology. Oxford Uni. Press, New York.

B.Sc. (HS) Zoology (Semester-II)
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Parker, T. J. And Haswell, W.A. (1972). A text book of Zoology Vol. I (revised by Marshall) ELBS and the Macmillan Co. London.

Russel- Hunter, W. D. (1968). A Biology of Lower Invertebrates. McMillan Co. New York.

Russel-Hunter, W. D. (1968). A Biology of Higher Invertebrates. MacMillan Co. New York.

Sherman, I. W. and Sherman, V. G. (1970). The Invertebrates, Function and form , MacMillan Co. New York.

Books of Indian Authors:

Dhami, P. S. And Dhami, J. K. (1988). Invertebrates Zoology, R.,Chand & Company, New Delhi.

Kotpal, R. L., Aggarwal, S. K. & Khetarpal, R. P. (1986). Modern Text Book of Zoology Invertebrates, Rastogi Publications, Meerut.

Kotpal, R. L. Zoology, Phylum Books, Rastogi Publications, Meerut.

CYL -191 INORGANIC CHEMISTRY

Credits: 3-1-0

1. Stereochemistry

(12 Hrs.)

Molecular chirality, enantiomers/symmetry in archiaral structures, chiral centres in chiral molecules, properties of chiral molecules –optical activity, absolute and relative configuration, the Cahn-Ingold Perlog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantiomers, chiral centres other than carbon.

2. Chemistry Alkanes and alkenes:

(9 Hrs.)

Conformations of alkanes and cycloalkanes: conformational analysis of ethane, butane, cyclohexane, monosubstituted and disubstituted cyclohexane, conformation of small, medium and large ring cycloalkanes and of polycyclic ring systems. Stereochemistry of alkenes, naming stereo isometric alkenes by the E-Z system, mechanism of hydrogenation of alkenes. Stereochemistry of hydrogenation of cycloalkenes, Dehydration of alcohols and regioselectivity of these reactions . Acid catalysed dehydration of alcohols with complete mechanistic discussion. Mechanism of dehydrohalogenation of alkythalides (E mechanism), stereoselective and antielimination in E reactions, the E Mechanism, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism, free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.

3. Alkynes:

(4 Hrs.)

Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes, with detailed discussion of mechanism of these reactions, the diels Alder reaction, orbital symmetry and the diels Adler reaction.

4. Nucleophilis substitution and addition reaction

(8 Hrs.)

(a) Functional group transformation by nucleophilic substitution, the biomolecular (SN), mechanism of nucleophilic substitution, stereochemistry of SN reactions, how SN reactions occur, steric effect in SN reaction, nucleophils and nucleophilicity, the unimolecular (SN) mechanism of nucleophilic substitution, carbocation stability and the rate of substitution, by the SN mechanism stereochemistry of SN reactions, carbocation real arrangements in SN reactions, solvent effect, substitution and elimination as competing reactions.

(b) Principles of nucleophilic addition to carbonyl groups: Hydration acetal formation , cyanohydrins formation; reactions with primary and secondary amines, Witting reaction, stereoselective addition to carbonyl groups mechanism of halogenations, acid and base catalysed cholization, haloform reaction, aldol condensation, conjugate nucleophilic addition to unsaturated carbonyl compounds.

5. Spectroscopy**(12 Hrs.)**

Principles of molecular spectroscopy, electromagnetic radiation, quantized energy states, NMR (H) Spectroscopy, nuclear shielding and chemical shift measurements chemical shift and molecular structure, interpreting proton NMR spectra, spin- spin splitting in NMR and conformations carbons- 13 nuclear magnetic resonance, the sensitivity problem, interpretation of spectra. Infrared spectroscopy, ultraviolet visible (UV-VIS) spectroscopy and mass spectrometry.

Text and Reference Books:

R.T. Morison and R.N Boyd, Organic Chemistry.

I.L. Finar, Organic Chemistry, Vol. I IV ed.

Advanced Organic Chemistry, Reactions Mechanism and Structure by J. March.

Schaum's Outlines Series Theory and Problems of Organic Chemistry.

Problems and their solution in Organic Chemistry by I.L. Finar, Modern Organic Chemistry by J.D. Robbert and M.C. Caserio

Organic Chemistry by D.J. Cram and G.S. Hammond.

J.E. Banks, Naming Organic Compounds Programmed Introduction to Organic Chemistry.

E.L. Eliel, Stereochemistry of carbon compounds.

W. Camp, Organic Spectroscopy

F.A. Carey, Organic Chemistry

MTL-162 INTEGRAL CALCULUS**Credits: 3-0-0**

Integration as inverse of differentiation. Indefinite integral of standard forms. Integration by parts. Integration by substitution.

Integration using method of partial fractions (of algebraic rational functions).

Definite integral and geometric interpretation of definite integral as an area.

Differential Equations: Definition. Solution of differential equations of first order and first degree (Variables separable, homogeneous equations, linear equations and equations reducible to the linear form). Applications of first order differential equations to biology.

Book Recommended:

Shanti Narayan: Integral Calculus

PHL-196: MODERN PHYSIC

Credits: 3-1-0

Dual nature of Matter and Radiation: De Broglie's hypothesis, electron diffraction experiments of Davission and Germer, Wave group and particle velocities Heisenberg's uncertainty principle, principle of the electron microscope, Diffraction of X-rays from crystals, Planck's quantum hypothesis, Bragg's law of determination of structure of simple crystals.

Radioisotopes and their Application: Radioactive decay laws, Uranium and Carbon dating, introduction to α , β and γ decays, Radioisotopes, their production and separation, mass spectrograph, uses of radioisotopes in medicine, agriculture and geology Radiation doses and their units, Biological effects of radiation.

Elementary Particles: Uses of ionization chamber, cloud chamber, Scintillation counter and photographic emulsions as detectors, Classification of elementary particles and their properties, conservation laws. Antiparticles, Origin and general characterization of cosmic rays (Primary and Secondary)

Reference Books:

1. Concepts of Modern Physics: A. Beiser
2. Essentials of Modern Physics: V. Acota and C.L Grown
3. Fundamentals of Modern Physics: B.D. Duggal and C.L. Chhabra

BSL151-Phanerogams

Credits 3-0-0

Gymnosperms

Classification of plants into major groups as cryptogams, Phanerogams, embryophytes and tracheophytes. A study of major evolutionary events in the geological past. Geological time scale, Biostratigraphic categories.

Origin and classification of gymnosperms upto order level and distribution in time and space with special reference to India. Structure and life cycle of some representative types namely *Pinus*, *Ginkgo*, *Cycas*, *Taxus*, *Pinus* and *Ephedra*. Pollen and pollination in gymnosperms. Physical and anatomical characters of common gymnosperms woods.

Angiosperms

Angiosperms, origin and evolution, Classification system of Bentham and Hooker and phylogenetic systems of Engler and Prantl and Cronquist. Hutchinson's principles. Principles of plant classification, parallelism, convergence and divergence.

Brief history and approaches to taxonomy, alpha and omega taxonomy, role of phytochemistry, cytology, and embryology. Identification keys, manual and electronic. Salient features of the International Code of Botanical Nomenclature, the type concept and the principle of priority.

Diversity of angiosperms as illustrated by members of the families Ranunculaceae, Brassicaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae, Apocynaceae, Euphorbiaceae, Liliaceae and Poaceae. Role of taxonomic literature, herbaria, biometrics, figurative representation of taxonomic affinities, cladistics.

Suggested Readings:

1. Arnold, C.A. (1974). An Introduction to Palaeobotany. McGraw Hill Book Company, New York.
2. Bhatnagar, S.P. and Moitra, A (1996) .Gymnosperms. New age international, Private Limited.
3. Biswas, C and Johri, B.M. (1997) Gymnosperms. Narosa Publishing House, New Delhi.
4. Brown, H.P. (1989) An Elementary Manual of Indian Tree Technology, Dehradun.
5. Chamberlin, C.J. (1935) Gymnosperms. Structure and Evolution CBS Publishers and Distributors, N. Delhi
6. Coulter, J.M. and Chamberlain, C.J. (1917) Morphology of Gymnosperms (Reprinted) Central Book Depot, Allahabad.
7. Davis P.H. and Heywood V.H. (1973) Principles of Angiosperms Taxonomy. Robert E. Kreiger Pub. Co., New York.
8. Esau, K. (1977) Anatomy of Seed Plants, 2nd edition. John Wiley and Sons, New York. Fahn, A, 1974. Plant Anatomy, 2nd edition. Pergamon Press, Oxford.
9. Harrison, H.J. (1971) New concepts in Flowering Plant Taxonomy, Hieman Educational Books, Ltd., London.
10. Heslop-Harrison, J. (1967) Plant Taxonomy. English language Book Society & Edward Arnold Pub. Ltd. UK.
11. Jeffery, C. (1982) An Introduction to plant Taxonomy, Cambridge University Press, Cambridge.
12. Jones, S.B. Jr. And Luchisinger A.E. (1986). Plant systematic (2nd Edition). McGraw Hill Book Co. New York.

B.Sc. (HS) Zoology (Semester-II)
(Under Credit Based Continuous Evaluation Grading System)

13. Krihnan, D.H. (1969) Geology of India and Burma. CBS Publisher and distributors, New Delhi.
14. Lawrence, D.H. (1969) Taxonomy of Vascular Plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
15. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publishing Company Inc., Menlo Park, California.
16. Nair, M.N.B (1998) Wood Anatomy and Major Uses of Wood, Faculty of Forestry, Univesiti Putra, Malaysia, 43400 Serdang, Selangor D.E. Malaysia.
17. Nair, P.K.K (1970) Pollen Morphology of Angiosperms, Vikas Publishing House, New Delhi.
18. Saklani, P.S. (1991) Elementary Geology. Today's & Tomorrow's Printers and Publishers, New Delhi.
19. Singh, H. (1978) Embryology of Gymnosperms. Encyclopaedia of Plant Anatomy X, Gebruder Bortraeger, Berlin.
20. Solbrig O.T. and Solbrig D.J. (1979) Population Biology and Evolution. Addison-Wesley Publishing Co. Inc. USA.
21. Solbrig, o.T. (1970) Principles and methods of plant Biosystematics. MacMillan Company, Collier Macmillan Limited, London.
22. Sporne, K.R. (1965) The Morphology of Gymnosperms, B.I. Publications, New Delhi.
23. Swain, T. (1963) Cghemical plant Taxonomy, Academic Press London.
24. Takhtajan, A.L. (1997) Diversity and classification of Flowering Plants, Columbia University Press, New York.
25. Thomas, P. (2000) Trees: Their Natural History. Cambridge University Press, Cambridge.
26. Tipppo, O. And Stern, W.L. (1977). Humanistic Botany. W.W. Norton, New York.
27. Trotter, H. (1982). The Common Commercial Timbers of India and their Uses (Reprint) Govt. Of India Press, Nasik.
28. Woodland, D.W. (1991). Contemporary Plant Systematics. Prentice Hall, New Jersey.

COMMUNICATIVE ENGLISH-II

Credits: 2-0-0

Objectives: To introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester-II, the students should be able to demonstrate adequate competence in comprehending an unseen passage and performing the prescribed communication/ writing tasks.

Prescribed Reading: Vandana R. Singh. *The Written Word*, Oxford University Press, New Delhi (Selected chapters)

“Orient Longman: Wisdom and Experience”

a) Developing Comprehension Skills:

Students will be required to read sample comprehension passage as given in chapter *critical reading and comprehension* of the prescribed book, teacher will help students in handling text and answering questions given at the end of each passage. Teacher can bring in more texts and construct questions of factual and inferential nature to enhance the comprehension skill of the students.

b) Developing Habits of Additional Reading :

The students will be required to show evidence of additional independent reading. They will maintain a scrapbook consisting of such readings as clippings from newspapers and magazines, short articles, stories etc. The minimum quantum of such additional reading will be decided by the class teacher, who will also test students individually on their additional reading (and appropriately award internal assessment, if required).

Writing:

a) Developing Vocabulary and Using it in the Right Context

Students will be required to pay special attention to build up their vocabulary; They should master the contents of the chapter on vocabulary in the prescribed book. Teacher will help the students learn the correct and appropriate use of the given set of words/phrases/expressions.

b) Developing skills in formal

Students will be required to do write-ups involving skills of making formal complaints, requests, orders etc., reporting, note taking, summarizing and transcoding. The types of composition task may include business and public interest letters, new/feature writing, speeches, minutes, instructions, summary reports etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings, the following chapters in the prescribed book may be consulted for exercise materials on these tasks:

- ❖ Paragraph and Essay Writing
- ❖ Report Writing
- ❖ Letter Writing
- ❖ Note Making and Summerising
- ❖ Transcoding

B.Sc. (HS) Zoology (Semester-II)
(Under Credit Based Continuous Evaluation Grading System)

Question Paper: The following format is suggested for a 3-hour test.

(Appropriate choices may be given where possible)

1. One unseen passage of app. 300 words with at least five questions for testing comprehension (at least three of them may be multiple choice)
App. Weighting 20%
2. Vocabulary and other expressions
App. Weighting 20%
3. Two writing tasks pertaining to formal letter writing, reporting, note taking, summary writing etc.
App. Weighting 40%
4. One task involving transcoding from dialogue to prose or prose to dialogue
App. Weighting 20%

Internal Assessment: The teacher may consider the following for award of internal assessment, if any.

- 1) Evidence of independent and additional reading as given above teacher may suggest some special reading list to suit the needs of their student.
- 2) Classroom tests on vocabulary and suggested writing tasks.
- 3) Project writing involving the communication skills referred in writing tasks.

ZOP 171: Non Chordates (Practical –II)

Credit 0-0-1

Arthropoda :

- a) Dissection of cockroach and prawn.
- b) To make stained slide of mouthparts and trachea of cockroach.
- c) To make permanent slides : head and mouthpart of butterfly , cockroach, housefly, honeybee, mosquito.
- d) General Survey *Peripatus, Apus, Cyclops, Daphnia, Lepas, Balanus, Sacculina, Prawn, Crab, Lobster, Eupagurus, Millipede, Scolopendra, Lepisma, Periplaneta, Schistocerca, Poecilocerous, Gryllus, Mantis, Cicada, Foricula, Dragonfly, Bug, Moth, Beetle, Polistes, Apis, Bombyx, Peduculus, Palamnaeus, Limulus, Aranea.*

Mollusca :

- a) Dissection of *Unio, Pila*
- b) To prepare permanent (stained) slides of radula of *Pila*
- c) To study permanent slides –Radula of *Pila*, *Golchidium* larva.
- d) General survey *Chiton, Dentalium, Solen, Mytilus, Ostrea. Cardium, Pholas, Pecten, Patella, Haliotis, Aplysia, Doris, Limax, Loligo, Nautilus, Octopus.*

Echinodermata :

- a) Dissection of starfish
- b) To study permanent slides – T. S. Arm of *Asterias*.
- c) General survey – *Asterias, Ophiothrix, Echinus, Cucumaria, Antedon, Asteropecton.*

CYP- 193 ORGANIC CHEMISTRY LAB
CLASSICAL QUALITATIVE ORGANIC ANALYSIS

Credits: 0-0-3

The preliminary examination of physical and chemical characteristics (Physical state, colour, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity other than acid-base test, preparation of derivatives for given pure organic compounds.

The following categories of compounds should be analyzed

- phenols, carboxylic acids
- carbonyl compounds- ketones aldehydes
- carbohydrates
- aromatic amines
- amides, ureas and anilides
- aromatic hydrocarbons and their halo-derivatives.

Suggested Book:

1. Practical Organic Chemistry by F.G.Mann and B.C. Saunders

***PHP 197: Modern Physics Lab.**

BSP 171: Phanerogams Lab

Credits 0-0-1.5

Suggested Laboratory Exercises

Angiosperms

A taxonomic study of the following materials:

1. Ranunculaceae: *Ranunculus*, *Delphinium*
2. Brassicaceae: *Brassica*, *Iberis*
3. Malvaceae: *Hibiscus*, *Abutilon*
4. Rutaceae: *Murraya*, *Citrus*
5. Fabaceae: : *Lathyrus*, *Cajaninus*, *Melilotus*, *Caesalpina*, *Cassia*, *Prosopis*, *Mimosa*,
Acacia.
6. Apiaceae: *Coriandrum* *Foeniculum*, *Anenthum*
7. Apocynaceae: *Vinca*, *Thevetia* *Nerium*
8. Sonanaceae: *Sonamum* *Withania* *Datura*
9. Duphorbiaceae: *Euphorbia*, *Phyllanthus*
10. Liliaceae: *Asphodelus*, *Asparagus*
11. Poaceae: *Triticum*, *Hordeum* *Sorghum*

The students should be made familiar with herbarium techniques and the use of identification keys including computer in taxonomy.

Gymnosperms

Occurrence, habitat, morphology and reproductive stages of *Cycas*, *Pinus*, *Gnetum*, *Taxus*, *Ephedra*.

Anatomical study of these materials through TS of stem and root and VS of leaf and leaflet. Preparation of temporary and permanent mounts by free hand razor technique.

Types of pollen grains and modification for wind pollination, sulphur showeers. A study of radially and bilaterally symmetrical ovules and seeds through LS, bulbils, scales leaves and coralloid roots.

ZOL 201: Biology of Chordates –I

Credit- 3

Unit-I

Urochordata and Cephalochordata

General Characters, Economic Importance
Detailed study of *Herdmania* and *Amphioxus*
External Characters and Affinities

Unit-II

Pisces :

General Characters, Economic Importance
Detailed study of *Scoliodon* and *Labeo rohita*
External characters and affinities.

Unit-III

Amphibia:

General characters , Economic Importance
Detailed study of *Rana tigrina*
External characters and affinities

Suggested Reading Material:

- Saxena, R. K. and Saxena ., S. (2008). Comparative anatomy of vertebrates. Viva book.
Weichat, C. K. (1970). Anatomy of the chordates McGraw- Hill book company.
Dhami, P.S. and Dhami, J. K. (1994). A text book of Zoology. Pradeep publications.
Marshall, A. J. , Parker, T. J. and Haswell, W. A. (1972). Textbook of Zoology vertebrates. English language books Society and Macmillan.
Duggal, K. K. (1982). Pre – University Zoology.
Prasad, S. N. (1970). A text book of vertebrate Zoology. Kitab Mahal Allahabad.
Hairston, N.G. (1994). Vertebrate Zoology- An experimental field approach, Cambridge University press.
Vaughan, T.A. Mammology (1972). W. B. Sanders Company.
Orr, R. T. Vertebrate biology (1981). Saunders College Publishing.
Linzey, D. Vertebrate Biology (2004). McGraw-Hill Higher Education.
Clegg, P.C. & Clegg, A. G. Biology of the Mammal (1970). William Heinemann Medical Books.
Wetty, J. C. . The life of Birds (1985) W. B. Saunders Company.
Singh, G. and Bhaskar, H. Advanced Chordate Zoology Birds , Vol. -4, Campus books international (2002).
Bhamrah, H. S. & Juneja , K. An Introduction to Birds, Anmol Publications Pvt. Ltd. (2002).

ZOL 202: Introductory Genetics

Credit Hours -3

Unit-I

General Introduction and Mendelian Genetics

Mendel's experiments
Principle of segregation
Principle of Independent assortment
Interactions of genes

Unit-II

Linkage, Crossing over and Chromosome mapping:

Linkage and linkage groups
Complete and incomplete linkage
Cytological basis of crossing over
Construction of chromosomes maps

Unit-III

Sex determination :

Chromosome theory of sex determination
Genetic Balance theory
Cytoplasmic sex determination

Sex linked inheritance :

Sex linked inheritance in *Drosophila* and man
Sex limited and sex influenced genes

Extrachromosomal inheritance

Criteria for cytoplasmic Inheritance
Examples of cytoplasmic Inheritance

Suggested Reading Material :

- Ayala, F. J. and Kiger, Jr. J. A. (1980). Modern Genetics. The Benjamin Cummings Publishing Co. Inc.
- Brown, T. A. (1992). Genetics . A molecular approach , 2nd ed. Van Nostrand Rainhold (international).
- De-Robertis, F. D. P. and De-Robertis Jr., E. M.E. (1987). Essentials of cell and molecular biology, Saunders, Philadelphia.
- De-Robertis, F.D.P. and De-Robertis Jr. , E. M.E. (1987). Cell and Molecular Biology, Saunders, Philadelphia.
- Friefelder, D. and Malacinski, G. M. (1993). Essentials of Molecular biology , Jones and Barlett Publishers, Boston.
- Gardener, E. J. , Simmons, M. T. J. and Sunstad, D. P. (1999). Principles of Genetics , 8th ed. John Wiley and Sons, New York.
- Miglani, G. S. (2000). Basic Genetics Narosa Publishing House, New Delhi.
- Sambrook, J., Fritish, E. F. and Maniatis, J. (1989). Molecular cloning. A lab manual.
- Winter, P.C., Hickey, G. J. and Fletcher, H. L. (1999). Instant notes in Genetics .New Delhi.
- Satson, J. D. et al (1987). Molecular Biology of Genes, 4th ed. Vol. I and Vol. II. The Benjamin / Cummings Publishing Co. Inc.
- Weaver, R. F. and Hednick, P. W. (1992). Genetics Wm. C. Brown Publishers Dubuque.
- Zubay, U.G. (1987). Genetics . The cummings publishing Co. , Inc.

ZOL 203: Bio Molecules

Credit Hours – 3

Unit-I

Amino acid – Classification of amino acids, Amphoteric amino acids, Acid base properties of amino acid primary, secondary, tertiary.

Peptides : Ioniation behavior of peptides

Proteins : Structural and functional proteins , levels of protein structure and quaternary protease structure.

Unit-II

Carbohydrates : Mono, di and poly sacharides

Lipids : Storage and structural lipids

Lipids as signals, cofactors and pigments.

Unit-III

Nucleotides and Nucleic acids

Nucleic acids types.

Chemistry of nucleic acids.

Functions of nucleotides and nucleic acids

Suggested Reading Material

Abeles, R.H., Fray, P.A. and Jencks, W.P. (1992) Biochemistry, Jones and Bartlett Publishers, London.

Berg, J. M., Tymoczko, J.L. and Stryer (2002) Biochemistry (5th Ed.) W.H. Freeman and Co., NY.

Cohn, E.E., Stump.P.K., Bruening , G. and Doi, R.H. (1987) Outlines of Biochemistry (5th Ed)Johan Wiley & Sons, NY.

Elliott, W.H. and Elliot, D.C. (2001) Biochemistry & Molecular Biology (Second Edition) Oxford University Press, New York.

Horton , H.R., Moran, L.A., Ochs, R.S. Rawn, J.D. and Scrimgeour, K.G. (2002) Principles of Biochemistry (3rd Ed.) Prentice Hall Upper Saddle River N.J. 07458.

Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W.(2003) Harper's Illustrated Biochemistr (Twenty Sixth Edition) Mc Graw Hill.

Nelson, David L. and Cox Michael M. (2000). Lehninger Principles of Biochemistry (3rd Edition) Mc Millan Worth Publishers.

Rawn, J.D. (1983) Biochemistry. Harper and Raw Publishers, New York.

Vasudevan, D. M. and Sree Kumari, S. (2001) Text Book of Biochemistry (3rd Ed.) Jaypee Brothers Medical Publisher (P) Ltd. New Delhi.

Voet, D. and Voet, J.G. (2001) Biochemistry (3rd Ed.) John Wiley and Sons, NY.

Zubay, G. (1993). Biochemistry (3rd Edition) Wm.C. Brown Publishers, USA.

ZOL 204: Animal Physiology

Credit Hours -3

Unit-I

Physiology of Digestion:

Types of Nutrition
Ingestion
Digestion
Absorption
Assimilation

Physiology of Respiration:

Exchange of gases, in lungs and blood.
Respiratory pigments.

Physiology of Circulation:

Types of Circulatory systems
Circulation of Blood
Lymphatic System

Unit-II

Physiology of Nervous Tissue:

Propagation of Nerve impulse
Synaptic transmission

Physiology of Muscle Tissue:

Muscle contraction and fatigue

Physiology of Receptors:

Physiology of reception in different sense organs

Unit-III

Physiology of Endocrine Glands:

Different endocrine glands and their functions.

Physiology of Excretion:

Types of excretion and waste products
Formation of urea and urine.

Physiology of Reproduction:

Male reproductive system
Female reproductive system

Suggested Reading Material:

Schmidt – Nielsen, K. (1975). *Animal Physiology – Adaptation and Environment*. Cambridge University Press.

Prosser, C. L. (1984). *Comparative Animal Physiology*. W. B. Saunders Company.

Guthrie, M. J. and Andeeson, J. M. (1987). *General Zoology*, John Wiley and Sons, Inc.

Gordon, M.S., Bartholomew, G. A, Grinnell, A. D., Torqensen, C. B and White, F. N.

(1977). *Animal Physiology: Principles and Adaptations*. Macmillan Publishing, Co. Inc.

Hoar, W. S. (1984). *General and Comparative Physiology*. Prentice Hall of India. Private limited.

Wilson, J. A. (1979). *Principles of Animal Physiology* Macmillian Publishing Co., Inc.

Florey, E. (1966). *An Introduction to General and Comparative Animal Physiology*. W.

B. Saunders Company.

Storer, T. I and Vsinger, R. L. (1965). *General Zoology* McGraw Hill Book Company.

Goel, K.A. and Sastry, K. V. (1996). *A Book of Animal Physiology*. Rastogi

Publications.

Malbandov (1964). *Reproductive Physiology*.

Dennis, W. W. *Principles of Animal Physiology*, Edward Arnold London.

Hill, R. W., Wyse, G. A. and Anderson, M. (2008). *Animal Physiology*. Sinauer

Associate, Inc.

Naga Bhushanam., R. Kodarkar, M. S. and Sarojini, R. (1983). *Textbook of Animal Physiology*, Oxford and IBH Publishing Co. Pvt. Ltd.

Eckert, Randall, D., Burqqren, W. and French, K. (1977). *Animal Physiology*

Mechanisms and Adaptations. W. H. Freeman and Company.

Rastogi, S. C. (1988). *Essentials of Animal Physiology*, Wiley Eastern limited.

PBL103: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - I

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

Credit: 2-0-0

(I) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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| (ੳ) ਗੁਰਮੁਖ ਸਿੰਘ ਮੁਸਾਫਿਰ | : | ਗਟਾਰ |
| (ਅ) ਸੁਜਾਨ ਸਿੰਘ | : | ਪਠਾਣ ਦੀ ਧੀ |
| (ੲ) ਕਰਤਾਰ ਸਿੰਘ ਦੁਗਲ | : | ਉੱਚੀ ਅੱਡੀ ਵਾਲੀ ਗੁਰਗਾਬੀ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਗੁਰਮੁਖੀ ਔਰਥੋਗਰਾਫੀ ਦੀ ਜੁਗਤ, (ਪੈਂਤੀ; ਮੁਹਾਰਨੀ; ਬਿੰਦੀ, ਟਿੱਪੀ ਤੇ ਅੱਧਕ); ਵਿਰਾਮ ਚਿੰਨ੍ਹ, ਸ਼ਬਦ ਜੋੜ (ਸ਼ੁਧ-ਅਸ਼ੁਧ)

(II) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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| (ੳ) ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ | : | ਸਾਂਝੀ ਕੰਧ |
| (ਅ) ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ | : | ਉਜਾੜ |
| (ੲ) ਮਹਿੰਦਰ ਸਿੰਘ ਸਰਨਾ | : | ਜਥੇਦਾਰ ਮੁਕੰਦ ਸਿੰਘ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਲੇਖ ਰਚਨਾ (ਜੀਵਨੀ-ਪਰਕ, ਸਮਾਜਕ ਅਤੇ ਚਲੰਤ ਵਿਸ਼ਿਆਂ ਉਤੇ):
10 ਲੇਖ ਲਿਖਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਅਤੇ ਘਰ ਲਈ ਅਭਿਆਸ)

(III) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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|-----------------------|---|-----------|
| (ੳ) ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼ | : | ਮਾੜਾ ਬੰਦਾ |
| (ਅ) ਗੁਲਜ਼ਾਰ ਸਿੰਘ ਸੰਧੂ | : | ਕੁਲੱਛਣੇ |
| (ੲ) ਮੋਹਨ ਭੰਡਾਰੀ | : | ਘੋਟਣਾ |
| (ਸ) ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ | : | ਦਲਦਲ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਪੈਰਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉਤਰ ਦੇਣਾ
(ਆਤਮ ਅਨਾਤਮ ਪੁਸਤਕ ਦੇ ਕਹਾਣੀ ਭਾਗ ਵਿੱਚੋਂ 15 ਪੈਰਿਆਂ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ)

HISTORY & CULTURE OF THE PUNJAB (1450-1716)
(Special paper in lieu of Punjabi Compulsory)
HSL: 101

Credits: 2-0-0

Instructions for the Paper Setters/Examiners:

**Examination Minor–I shall cover Theme No. 1-3, Minor–II shall cover Theme No. 4-6.
The Major shall cover the entire syllabus.**

1. Land and the People
2. Bhakti Movement
3. Life and Teachings of Guru Nanak Dev.
4. Contribution of Guru Angad Dev, Guru Amar Das and Guru Ram Das.
5. Guru Arjun Dev.
6. Guru Hargobind
7. Martyrdom of Guru Tegh Bahadur
8. Guru Gobind Singh and the Khalsa
9. Banda Singh Bahadur: Conquests and Execution.

Suggested Readings:

1. Kirpal Singh (ed.): *History and Culture of the Punjab*, Part-II, Punjabi University, Patiala, 1990.
2. Fauja Singh (ed.): *History of Punjab*, Vol. III, Punjabi University, Patiala, 1987.
3. J.S. Grewal: *The Sikhs of the Punjab*, CUP, Cambridge, 1991.
4. Sukhwant Singh. *Agriculture Growth under Colonial Constraints: The Punjab 1849-1947*, Manpreet Publication, Delhi, 2000.
5. Khushwant Singh, *A History of the Sikhs*, Vol. I, OUP, New Delhi, 1990.

ESL 220 Environmental Studies (Compulsory Paper) **(Under Credit Based Continuous Evaluation Grading System)**

Credit 3-0-0

- 1. The Multidisciplinary Nature of Environmental Studies:** Definition, scope & its importance, Need for public awareness.
- 2. Natural Resources:** Natural resources and associated problems.
 - a) Forest Resources:** Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - b) Water Resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - c) Mineral Resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - d) Food Resources:** World food problems, change caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problem, salinity, case studies.
 - e) Energy Resources:** Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.
 - f) Land Resources:** Land as a resource, land degradation, soil erosion and desertification.
 - g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.**
- 3. Ecosystem:**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
- 4. Biodiversity and its Conservation:**

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts
Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

- a) Air Pollution
- b) Water Pollution
- c) Soil Pollution
- d) Marine Pollution
- e) Noise Pollution
- f) Thermal Pollution
- g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

- * From unsustainable to sustainable development
- * Urban problems related to energy
- * Water conservation, rain water harvesting, watershed management
- * Resettlement and rehabilitation of people; its problems and concerns. Case studies
- * Environmental ethics: Issues and possible solutions.
- * Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- * Wasteland reclamation
- * Consumerism and waste products
- * Environmental Protection Act
- * Air (prevention and Control of Pollution) Act
- * Water (prevention and Control of Pollution) Act
- * Wildlife Protection Act
- * Forest Conservation Act
- * Issues involved in enforcement of environmental legislation
- * Public awareness

7. Human Population and the Environment

- * Population growth, variation among nations
- * Population explosion-Family welfare programme
- * Environment and human health
- * Human rights
- * Value education
- * HIV / AIDS
- * Women and child welfare
- * Role of information technology in environment and human health
- * Case studies
- * **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs
- * **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

B.Sc. (HS) Zoology (Semester-III)
(Under Credit Based Continuous Evaluation Grading System)

- 8. Field Work:** Visit to a local area to document environmental assets—river / forest / grassland/ hill / mountain. Visit to a local polluted site—Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar

ZOP-221: Animal Diversity (Lab. III)

Credit Hours-3

Study of Museum specimens of

Hemichordata-*Balanoglossus*

Urochordata-*Oikopleura*, *Herdmania*, *Ascidia*, *Botryllus*, *Doliolum* , *Salpa*.

Cephalochordata – *Amphioxus*

Pisces – *Scoliodon*, *Rhinobatus*, *Raja*, *Chimaera*, *Polypterus*, *Acipenser*, *Mystus*,

Lepidosteus, *Labeo*, *Catla catla*, *Cyprinus corpio*, *Exocoetus*, *Diodon*, *Hippocampus*

Amphibia- *Ichthyophis*, *Amphiuma*, *Salamandra*, *Ambystoma*, *Triturus*, *Bufo*, *Proteus*,

Axolotle larva, *Hyla*.

Dissection of :

Herdmania

Scolidon

Frog

ZOP 222: Genetics Practical

Credit Hours-1.5

General Exercises based on-

- Dominance and recessive
- Incomplete dominance
- Lethal genes
- Law of independent assortment
- Interaction of genes
- Multiple alleles
- Sex linked inheritance.

Study of barr bodies in oral epithelium of human beings

Study of drumsticks from blood smear of Human.

Study of different stages of Mitosis in root tips of *Allium cepa* / bone marrow of rat.

Study of different stages of meiosis from permanent slides.

Temporary preparations of polytene chromosomes (third instar larva of *Zaprionus paravittiger*/ *Bactrocera cucurbitae*)

Preparations and study of human karyotype.

Study of pedigree analysis of a family.

Study of dermatoglyphics.

Study of some inherited morphogenetic characters in human beings.

ZOP 223: Practical (Animal Physiology)

Credit Hours -1.5

Estimation of bleeding and clotting time in blood.

Estimation of hemoglobin.

Preparation of haemin crystals

To demonstrate the process of osmosis.

Qualitative tests for carbohydrates, proteins and lipids.

Study of permanent slides of endocrine glands

ZOL 251: Biology of Chordates –II**Credit Hours -3****Unit-I****Reptilia :**

General characters, Economic Importance
Detailed study of lizard
External characters and affinities

Unit-II**Aves :**

General characters , Economic Importance
Detailed study of Pigeon
External characters and affinities.

Unit-III**Mammalia :**

General characters, Economic Importance
Detailed study of Rat
External characters and affinities

Suggested Reading Material:

Weichert, C. K. (1970). Anatomy of the Chordates MrGraw- Hill Book Company.
Dhami, P.S. and Dhami, J. K. (1994). A Text Book of Zoology. Pradeep Publications.
Storer, T. I, Usinger, R. L. and Nybakker (1968). Elements of Zoology. McGrawHill
Book Company.
Marshall, A. J., Parker, T. J and Haswell, W. A. (1972). Textbook of Zoology
Vertebrates. English Language Books Society and Macmillan.
Bellairs, A el' A (1968). Reptiles. Hutchenson University Library.
Prasad, S. N. (1970). A Text Book of Vertebrates Zoology. Kitab Mahal Allahabad.

ZOL 252 : Medical Zoology

Credit Hours-3

Unit-I

Brief introduction to pathogenic microbes, viruses, rickettsiae, spirochaetes and bacteria.

Life history, mode of infection and pathogenicity of Entamoeba, Plasmodium, Taenia solium and Fasciola hepatica.

Unit-II

Life cycle and control measures of arthropod vectors of human disease.

Malaria – Anopheles stephensi

Dengue – Aedes aegypti

Unit-III

Epidemic diseases, like cholera, small pox, typhoid: their occurrence and eradication programme.

Suggested Reading Material:

Baker, J. R. (1969). Parasitic Protozoa. Hutchinson University Library.

Kreier, J. P. and Baker, J. R. (1987). Parasitic Protozoa.

Allen and Union, Publisher, Ltd.

ZOL 253: Endocrine Regulation**Credit Hours-3****Unit-I**

Endocrine regulation of iono-osmotic balance in fishes.
Endocrine regulations in fresh water and marine fishes.

Unit-II

Endocrine regulation of amphibian metamorphosis.
Endocrinological basis for metamorphosis.
Endocrine factors and life histories of permanently aquatic urodeles.

Unit-III

Endocrine factors and migratory behavior
Migration in Salmonid fishes
Migration in urodele amphibians
Migration in Birds

Suggested Reading Material:

- David O. Norris, (1985) Vertebrate Endocrinology, 2nd Edition. Lea and Febiger, Philadelphia.
- Welby, (1985). The life of Birds, 3rd Edition. Saunders College Publishing, U.S.A.
- Hill, R. W. Wyse, G. A. and Anderson, M. (2008). Animal Physiology. Sinauer Associates, Inc.
- Bone, G. and Moore, R. H. (2008). Biology of Fishes Taylor and Francis.
- Yapp, W. B. (1970). An introduction to animal physiology oxford at the clarendon Press.
- Potts, W. T. W. and Parry, G. (1964). Osmotic and ionic regulation in animals – Pergamon Press.
- Turner, C. D. and Bagnara, J. T. (1976). General endocrinology. W. B. Saunders Company.

ZOL 254: Environmental Physiology

Credit Hours-3

Unit-I

Adaptation and Environment

Nature and levels of adaptation

Mechanism of adaptations
Significance of body size
Parasitic habitats

Unit-II

Marine adaptation

Fresh water and special aquatic habitat adaptation.

Unit-III

Terrestrial adaptations

Ionic and osmotic adaptations
Thermal adaptation
Respiratory adaptation
Reproductive and life cycle adaptation

Suggested Reading Material:

- Willmer, P., Stone, G. and Johnston, I. (2000). Environmental Physiology of Animals. Blackwell Science.
- Kardong, K. V. (1995). Vertebrates. Comparative anatomy, function, evolution, WNC Brown Publishers, Melbourne, Oxford.
- Sherman, I. W. and Sherman, V. G. (1970). The Invertebrates Function and Form – Macmillan Co., New York.
- Rastogi, S. C. (1988). Essentials of Animal Physiology, Wiley Eastern Limited.

ZOL 255: Introductory Biotechnology**Credit Hours-3****Unit-I****Biotechnology: General Features**

Origin and Definition of Biotechnology

Its Scope and importance

Cloning vectors for Recombinant DNA : Plasmids, Bacteriophages, Cosmids, F-factor based vectors, Plant and Animal viruses as vectors, transposons as vectors, Artificial chromosomes vectors.

Unit -II**Recombination DNA**

Restriction enzymes in cloning

Construction of chimeric DNA

Cloning in Bacteria and Eukaryotes Molecular probes.

Unit-III**Transfection Methods and Transgenic Animals**

Gene transfer or Transfection Methods.

Transgenic Animals: Mice, Sheep, Pigs, goats, cows and fish.

Suggested Reading Material:

Pape, H. and Rehm, H. J. (1986). Biotechnology, VCH Publishers, Germany.

Balasubramanian, D., Byrce, C.F.A., Dharmalingam, K., Green, J. and Jayaraman, K. (1996), Concepts in Biotechnology. Universities Press (India). Ltd. Hyderabad.

Wiseman, A. (1985), Principles of Biotechnology. Surrey University Press, New York.

Rana, S. V. S. (1988). Recent Trends in Biotechnology and Biosciences. Pragati Press, Muzaffarnagar.

PBL-104

ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ ਪੁਸਤਕਾਂ

Credits: 2-0-0

- (I) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠਾਂ ਲਿਖੇ ਕਵੀ
- (ੳ) ਭਾਈ ਵੀਰ ਸਿੰਘ
(ਅ) ਪ੍ਰੋ: ਪੂਰਨ ਸਿੰਘ
(ੲ) ਪ੍ਰੋ: ਮੋਹਨ ਸਿੰਘ
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ/ਮੂਲ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਪਿਛੇਤਰ, ਵਿਉਂਤਪਤ ਅਤੇ ਰੁਪਾਂਤਰੀ), ਸਮਾਸ ।
- (II) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ
- (ੳ) ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ
(ਅ) ਡਾ. ਹਰਭਜਨ ਸਿੰਘ
(ੲ) ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਕਲੱਸ ਵਿੱਚ 10 ਵਿਸ਼ਿਆਂ (ਸਭਿਆਚਾਰਕ, ਧਾਰਮਿਕ ਅਤੇ ਰਾਜਨੀਤਕ) ਤੇ ਪੈਰ੍ਹਾ ਰਚਨਾ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ ।
- (III) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ
- (ੳ) ਡਾ. ਜਸਵੰਤ ਸਿੰਘ ਨੇਕੀ
(ਅ) ਡਾ. ਜਗਤਾਰ
(ੲ) ਡਾ. ਸੁਰਜੀਤ ਪਾਤਰ
(ਸ) ਪਾਸ਼
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਮੁਹਾਵਰੇ ਤੇ ਅਖਾਣ (ਅਖਾਣ ਤੇ ਮੁਹਾਵਰਾ ਕੋਸ਼ ਵਿੱਚ) 200 ਮੁਹਾਵਰਿਆਂ ਅਤੇ 100 ਅਖਾਣਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿੱਚ ਵਰਤਣ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਤੇ ਘਰ ਲਈ) ।

HISTORY & CULTURE OF THE PUNJAB (1717-1947)
(Special Paper in lieu of Punjabi Compulsory)
HSL: 102

Credits: 2-0-0

Instructions for the Paper Setters/Examiners:

Examination Minor–I shall cover Theme no. 1-3, Minor–II shall cover Theme no. 4-6.

The Major shall cover the entire syllabus.

1. Sikh Struggle for Sovereignty
2. Ranjit Singh: Conquests, Administration and the Anglo-Sikh Relations
3. Anglo-Sikh Wars and the Annexation
4. The Punjab under the British: New Administration, Education and Social Change
5. Economic Changes: Agricultural
6. Socio-Religious Reform Movements
7. Role of Punjab in the Freedom Struggle
8. Fairs and Festivals
9. Folk Dances and Legends

Suggested Readings:

1. Kirpal Singh (ed.): *History and Culture of the Punjab*, Part-II, Punjabi University, Patiala, 1990.
2. Fauja Singh (ed.): *History of Punjab*, Vol. III, Punjabi University, Patiala, 1987.
3. J.S. Grewal: *The Sikhs of the Punjab*, CUP, Cambridge, 1991.
4. Sukhwant Singh. *Agricultural Growth under Colonial Constraints: The Punjab 1849-1947*, Manpreet Publication, Delhi, 2000.
5. Khushwant Singh, *A History of the Sikhs*, Vol. I, OUP, New Delhi, 1990.

ZOP 271 : Animal Diversity (Lab. IV)**Credit Hours-3****Study of Museum specimens of :**

Reptilia : *Chelone, Testudo, Chameleon, Hemidactylus, Varanus, Heloderma, Vipera, Naja, Bungarus, Crocodilus.*

Aves: *Archaeopteryx, Columba livia, Kingfisher, Beads and Claws, Feathers.*

Mammalia: *Echidna, Bat, Manis, Loris, Lemur.*

Dissection of :

Lizard

Rat

ZOL 301: Gamete Biology

L	T	P	Credit
3	1	0	4

Unit-I

Morphology of Gonads, sperm and ovum.
Spermatogenesis, Semen (composition and formation).

Unit-II

Oogenesis, vitellogenesis, ovulation Superovulation.
Fertilization, prefertilization events and post fertilization events. In vitro fertilization (Introduction).

Unit-III

Cleavage
Biology of sex determination and sex differentiation.
Barriers to fertilization

Suggested Reading Material

- Balinsky, B. I. (1981), An introduction of Embryology, Saunders, Philadelphia.
 Bellairs, R. (1971), Development Processes in Higher Vertebrates, University of Miami Press , Miami.
 Berril, N. J. (1971), Development Biology. McGraw Hill, New Delhi.
 Dawnpart, Development Biology.
 Ebert, J. D. & Sussex , I. M. (1970), Interacting Systems in Development, Holt, Rinehart and Winston, New York.
 Elder, K. and Dale, B.(2001). In vitro fertilization 2nd edition. Cambridge University Press, Cambridge.
 Gilbert, S.F. (2003), Developmental Biology, Sinauer – associates, Inc. USA.
 Goel, S. C (1984), Principles and Animal Developmental Biology, Himalaya, Bombay.
 Grant, P. (1978). Biology of Developing System.
 Jangir, O.P. (2005). Developmental Biology. A manual. Agrobios (India)
 Karp, G. & Berrill, M. J. (1981), Development McGraw Hill, New Delhi.
 Loomis, W. F. (1986), Developmental Biology Macmillan, New York.
 Miller, W. A. (1986), Developmental Biology Springer Verlag, New York, Inc.
 Oppenheimer, J. M. and Willer , B. H. (1964), Foundation of Experimental Embryology, Prentice – Hall, New Delhi.
 Pritchard, D. J. (1986), Foundation of Development Genetics, Taylor and Francis, London.
 Saunder, J. W. (1982), Developmental Biology, Patterns, Principles, Problems, MacMillan, New York.
 Spratt, N. T. Jn. (1971), Developmental Biology. Macmillan, New York. Waddigton, C. H. (1966), Principles of Development and Differentiation. Macmillan, New York.

ZOL 302: Minor Phyla

L	T	P	Credit
3	1	0	4

Unit-I

Introduction
Difference between major and minor phyla
Groups of Minor Phyla
Relationships
Phylum Mesozoa
Phylum Ctenophora
Phylum Nemertinea
Phylum Entoprocta
Phylum Acanthocephala

Unit-II

Phylum Nematomorpha
Phylum Rotifera
Phylum Gastrotricha
Phylum Kinorhyncha
Phylum Bryozoa
Phylum Brachyopoda

Unit-III

Phylum Phoronida
Phylum Chaetognatha
Phylum Priapulida
Phylum Sipunculida
Phylum Echiuroidea
Phylum Pogonophora

Suggested Reading Material:

- Brusca, R. C. and Brusca, G. J. (2003), Invertebrates second edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
Kotpal, R. L. (1989), Minor Phyla. Rastogy Printers, New Delhi.
Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology 3rd Ed. Oxford University Press, New York.
Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ., Philadelphia.

ZOL 303: Essential Immunology

L	T	P	Credit
3	1	0	4

Unit-I

The Immunoglobulin
Synthesis of antibody

Unit-II

Antigen and Antibody interactions
Hypersensitivity

Unit-III

Autoimmunity
Immunity to infections

Suggested Reading Material:

1. Goldsby RA, Kindt TJ and Osborne BA (2000) Immunology, 4th Edition, WH Freeman and Company, NY.
2. Janeway C, Travers P, Capra JD, Walport MJ (1999) Immunobiology: The Immune System in Health and Disease, Garland Pub., USA.
3. Roitt IM, Brostoff J, Male DK (2001) Immunology, Mosby Inc, UK.
4. Janeway CA, Travers P, Walport M, Schlomchick M (2001) Immunobiology, The immune system in health and disease, 5th Edition, Garland Publications, USA

ZOL 304: Comparative Anatomy of Chordates -I

L	T	P	Credit
3	1	0	4

Unit-I

Integumentary System:

Introduction
General structure of integument
Comparative anatomy of skin
Comparative anatomy of Integumentary glands
Skin derivatives

Skeletal System:

Introduction
Type of skeleton

Unit-II

Digestive System:

Introduction
Comparative account of Alimentary canal
Digestive glands

Unit-III

Respiratory System:

External and Internal Respiration
Accessory respiratory Organs

Suggested Reading:

- Goodrich, E. S. (1958), Structure and Development of Vertebrates, Vol. I and II. D. E. Publication, New York.
- Hildebrand, M. & Goslow. Jr. G. E. (2001), Analysis of Vertebrates Structure John Wiley, New York.
- Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
- Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
- Jollie, M. (1968), Chordate Morphology, Reinhold, New York.
- Kardong, K. V. (1995), Vertebrates – Comparative Anatomy, Function, Evolution. W.B.C. Pub., Oxford.
- Kent, G. C. and Carr, R. K. (2001), Comparative Anatomy of the Vertebrates 9th Edition, McGraw Hill Higher Education, New York.
- Linzey, D. (2001), Vertebrate Biology. McGraw Hill Publishing Company, New York.
- Pough, F. H., Heiser, J.B. and McFarland, W. N. (1990), Vertebrate Life 3rd ed., Macmillan Pub. Co., New York.
- Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
- Young, J. Z. (1982), The Life of Vertebrates, New York.

ZOP 321: Practical Zoology Lab. I

L	T	P	Credit
0	0	3	3

1. Comparative anatomy through study of permanent slides.
2. Comparative anatomy through study of museum specimens.
3. Comparative study of various organs systems through models.
4. General methods of microscopic preparations.
5. Temporary mount of different scales of fish.
6. Study of different types of fins.
7. Study of different types of feathers.
8. Study of Appendicular skeleton.
9. Study of different kinds of skulls.
10. Study of different vertebrae.
11. To study the working of various microscopes.
12. To study the position of mouth according to feeding habit.
13. To study the differentiation of unfertilized egg and fertilized egg.

ZOL 351: Animal Biodiversity

L	T	P	Credit
3	1	0	4

Unit-I

Introduction, Importance and Definitions

Elements of Bio Diversity

Species Diversity

Ecosystem Diversity

Genetic Diversity

Services and Benefits of Biodiversity

Unit-II

Biodiversity Distribution

Latitudinal Gradient

Biodiversity Hotspots

Global List

Ecological Details of Hotspots in Indian subcontinent

Unit-III

Threats to Biodiversity

Habitat Destruction

Overexploitation

Population Increase

Exotic Species

Pollution

Protection and Restoration Methodologies

Protected Areas

Gene Banks

Wildlife Corridors

Agencies involved in Biodiversity Protection

Suggested Reading Material:

Aggarwal, (2000), Wildlife of India.

Ali, S. (1971), The Books of Indian Birds, Bombay Natural History Society, Bombay.

Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Beeby, A. (1992), Applying Ecology Chapman and Hall Madras.

Begon, M., Harper J. L. and Townsend, C. R. (1995), Ecology – Individuals, populations and

Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.

Burton, L. D. (2003), Fish and Wildlife: Principles of Zoology and Ecology. Delmar Thompson Learning Pb.

Chapman, J. L. and Resis, M. J. (1995), Ecology- Principles and applications, Cambridge University Press, Cambridge UK.

Dasmann, R. F., (1982), Wildlife Biology, Wiley Eastern, New Delhi.

Fulbright, Timothy, E. and Hewitt, D. G. (2008). Wildlife Science: Linking Ecological Theory and Giles, R. H. (1984), Wildlife Management Techniques, Natraj Publishers, Dehradun.

Gopal, R. (1992), Fundamental of Wildlife management Justice Home Allahabad.

Hosetti, B. B. (1997), Concepts in Wildlife Management, Chawla Press, Delhi.

Kaeighs, S. C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.

Odum, E. P. (1983), Basic Ecology.

Putmann, R. J. and Wratten, S. D. (1984), Principles of Ecology, Crown Helm, London.

Salanki, J., Jeffery E. and Hughes G. M. (1994), Biological Monitoring of the Environment (A manual of Methods) CAB International, Wallingford UK. Chicago Press, Chicago London. Communities, Blackwell Science, Cambridge UK.

Management Applications. CRC Press, Taylor and Francis: BocaRaton, F L.

ZOL 352: Embryology

L	T	P	Credit
3	1	0	4

Unit-I

1. Characteristics of Metazoan development.
2. Development of primitive multicellular organisms.

Unit-II

3. Development of Radiate animals
4. Development of Acoelomates and Pseudocoelomates

Unit-III

5. Development of protostome coelomates
6. Development of Deutrostome coelomates.

Suggested Reading Material:

- Balinsky, B. I. (1981), An introduction of Embryology, Saunders, Philadelphia.
- Bellairs, R. (1971), Development Processes in Higher Vertebrates, University of Miami Press , Miami.
- Berril, N. J. (1971), Development Biology. McGraw Hill, New Delhi.
- Dawnpart, Development Biology.
- Ebert, J. D. & Sussex , I. M. (1970), Interacting Systems in Development, Holt, Rinehart and Winston, New York.
- Elder, K. and Dale, B.(2001). In vitro fertilization 2nd edition. Cambridge University Press, Cambridge.
- Gilbert, S.F. (2003), Developmental Biology, Sinauer – associates, Inc. USA.
- Goel, S. C (1984), Principles and Animal Developmental Biology, Himalaya, Bombay.
- Grant, P. (1978). Biology of Developing System.
- Jangir, O.P. (2005). Developmental Biology. A manual. Agrobios (India)
- Karp, G. & Berrill, M. J. (1981), Development McGraw Hill, New Delhi.
- Loomis, W. F. (1986), Developmental Biology Macmillan, New York.
- Miller, W. A. (1986), Developmental Biology Springer Verlag, New York, Inc.
- Oppenheimer, J. M. and Willer , B. H. (1964), Foundation of Experimental Embryology, Prentice – Hall, New Delhi.
- Pritchard, D. J. (1986), Foundation of Development Genetics, Taylor and Francis, London.
- Saunders, J. W. (1982), Developmental Biology, Patterns, Principles, Problems, MacMillan, New York.
- Spratt, N. T. Jn. (1971), Developmental Biology. Macmillan, New York.
- Waddington, C. H. (1966), Principles of Development and Differentiation. Macmillan, New York.

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B.Sc. (HS) Zoology (Semester-VI)
(Under Credit Based Continuous Evaluation Grading System)

ZOL 353: Basic concepts of Evolution

L	T	P	Credit
3	1	0	4

Unit-I

Origin of Life
Evidences in favour for evolution of life
Introduction to theories of organic evolution

Unit-II

Basic patterns in Evolution (micro, macro and mega evolution)
Origin of chordates
Fossils

Unit-III

Evolution of camel
Evolution of Horse
Evolution of Elephant

Suggested Reading Material

- Freeman, S. and Herron, Jon C. (2007). Evolutionary analysis Pearson Prentice Hall, New Jersey.
Futuyma, D. J. (1998), Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
Meglitsch, P. A. (1991), Invertebrate Zoology (3rd edition), Oxford University Press.
Minkoff, E. C. (1983), Evolutionary Biology, Addison Wesley Pub. Co., London.
Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associates Inc. Pub. USA.

ZOL 354: Comparative Anatomy of Chordates –II

L	T	P	Credit
3	1	0	4

Unit-I

Circulatory system:
Blood vascular system
Lymphatic system
Comparative anatomy of Heart

Unit-II

Nervous system:
Nervous tissue
Comparative anatomy of brain
Sense organs

Unit-III

Urinogenital system:
Comparative account of excretory organs
Comparative account of reproductive organs

Suggested Reading Material:

- Goodrich, E. S. (1958), Structure and Development of Vertebrates, Vol. I and II. D. E. Publication, New York.
- Hildebrand, M. & Goslow. Jr. G. E. (2001), Analysis of Vertebrates Structure John Wiley, New York.
- Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
- Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
- Jollie, M. (1968), Chordate Morphology, Reinhold, New York.
- Kardong, K. V. (1995), Vertebrates – Comparative Anatomy, Function, Evolution. W.B.C. Pub., Oxford.
- Kent, G. C. and Carr, R. K. (2001), Comparative Anatomy of the Vertebrates 9th Edition, McGraw Hill Higher Education, New York.
- Linzey, D. (2001), Vertebrate Biology. McGraw Hill Publishing Company, New York.
- Pough, F. H., Heiser, J. B. and McFarland, W. N. (1990), Vertebrate Life 3rded. , Macmillan Pub. Co., New York.
- Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
- Young, J. Z. (1982), The Life of Vertebrates, New York.

ZOP 371: (Practical) Zoology Lab – II

L	T	P	Credit
0	0	3	3

1. Comparative anatomy through study of permanent slides.
2. Comparative anatomy through study of museum specimens.
3. Comparative study of various organs systems through models.
4. Study of embryological slides.
5. To make temporary mount of different developmental stages of insect.
6. To make temporary mount of different developmental stages of parasitic nematodes.
7. To study the various developmental stages of earthworm.
8. To study the evolutionary phenomenon with the help of specimens / slides.