



GULBARGA UNIVERSITY

"JANNA GANGA", GULBARGA - 585 106, KARNATAKA,
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ಕ್ರ.ಸಂ.ಗುವಿಕ/ವಿಮವಿ/ಬಿ.ಓಎಸ್/2018-19/753

ದಿನಾಂಕ: 10-7-2018

ಅಧಿಸೂಚನೆ

ವಿಷಯ: ಪ್ರಾಣಿಶಾಸ್ತ್ರ ಕೋರ್ಸಿಗಾಗಿ ಸಿಬಿಸಿಎಸ್ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ಅದಕ್ಕನುಗುಣವಾಗಿ ಪಠ್ಯಕ್ರಮವನ್ನು ಜಾರಿಗೊಳಿಸಿದ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ:1) ಸ್ನಾತಕ ಅಧ್ಯಯನ ಮಂಡಳಿಯ ಸಭೆಯ ದಿನಾಂಕ: 07.06.2018.

2) ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಸಭೆ ದಿನಾಂಕ: 14.06.2018.

3) ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಗೊತ್ತುವಳಿ ಸಂಖ್ಯೆ II ದಿನಾಂಕ.26.06.2018.

ಉಲ್ಲೇಖ (3) ರಲ್ಲಿನ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಗೊತ್ತುವಳಿ ಸಂಖ್ಯೆ II ನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸುತ್ತ; ಪ್ರಾಣಿಶಾಸ್ತ್ರ I ರಿಂದ VIನೇ ಸೆಮೆಸ್ಟರ್ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಧ್ಯಯನ ಮಂಡಳಿಯು ಪರಿಷ್ಕರಿಸಿ ಅನುಮೋದಿಸಿರುತ್ತದೆ. ದಿನಾಂಕ 14.06.2018. ರಂದು ಜರುಗಿದ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಸಭೆಯಲ್ಲಿ ಸದರಿ ಪಠ್ಯಕ್ರಮವನ್ನು 2018-19ನೇ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ ಜಾರಿಗೊಳಿಸಲು ಶಿಫಾರಸ್ಸು ಮಾಡಲಾಗಿದೆ.

ಆದರಂತೆ, 2018-19ನೇ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ ಪ್ರಾಣಿಶಾಸ್ತ್ರ ಸ್ನಾತಕ ಕೋರ್ಸಿನ I ರಿಂದ VIನೇ ಸೆಮೆಸ್ಟರ್ ಪಠ್ಯಕ್ರಮವನ್ನು ಪರಿಷ್ಕರಿಸಿ ಜಾರಿಗೊಳಿಸಲಾಗಿದೆ.

ಈ ಮಾಹಿತಿಯನ್ನು ಸಂಬಂಧಪಟ್ಟ ಶಿಕ್ಷಕರ ಹಾಗೂ ವಿದ್ಯಾರ್ಥಿಗಳ ಗಮನಕ್ಕೆ ತರಲು ಸೂಚಿಸಲಾಗಿದೆ. ಪಠ್ಯಕ್ರಮದ ವಿವರವನ್ನು ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್‌ಸೈಟ್ www.gug.ac.in ದಿಂದ ಪಡೆಯಬಹುದು.


ಕುಲಸಚಿವರು

ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕಲಬುರಗಿ

ಗೆ,

1. ಮುಖ್ಯಸ್ಥರು, ಪ್ರಾಣಿಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಗು.ವಿ.ಕಲಬುರಗಿ.
2. ಎಲ್ಲಾ ಪದವಿ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಂಶುಪಾಲರಿಗೆ.

ಪ್ರತಿಗಳು:

1. ಡೀನ್‌ರು, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯ, ಗು.ವಿ.ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ.
2. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ), ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ.
3. ನಿರ್ದೇಶಕರು, ಯೋಜನೆ, ಮೇಲ್ವಿಚಾರಣೆ ಹಾಗೂ ಮೌಲ್ಯಮಾಪನ ಮಂಡಳಿ, ಗು.ವಿ.ಕಲಬುರಗಿ.
4. ಗ್ರಂಥಪಾಲಕರು, ಗು.ವಿ.ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ
5. ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಎಲ್ಲಾ ವಿಭಾಗಗಳ ಮುಖ್ಯಸ್ಥರಿಗೆ
6. ಮುಖ್ಯಸ್ಥರು, ಗಣಕಕೇಂದ್ರ, ಗು.ವಿ.ಕಲಬುರಗಿ ಇವರಿಗೆ ಸದರಿ ಪಠ್ಯಕ್ರಮವನ್ನು ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್‌ಸೈಟ್ ನಲ್ಲಿ ಪ್ರಕಟಿಸಲು ತಿಳಿಸಲಾಗಿದೆ.
7. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ / ಕುಲಸಚಿವರ ಆಪ್ತ ಸಹಾಯಕರ ಮಾಹಿತಿಗಾಗಿ.



**Gulbarga University,
Kalaburagi**
Department of PG Studies and Research in Zoology

**Syllabus
for
Ist to VIth Semester**

Choice Based Credit System (CBCS)

**Proposed for B.Sc. Course in Zoology
with effect from 2018-19**

Chairman
Department of PG Studies and Research in Zoology
Gulbarga University,
Kalaburagi – 585106.


Proceedings of the Meeting of the Board of Studies in Zoology (Undergraduate) held on 7th June 2018 to prepare Choice Based Credit System Syllabus for B.Sc. Zoology Course for the academic year 2018-19 and onwards.

Members Present:

- | | |
|-----------------------------|---------------|
| 1) Prof. K. Vijaykumar | Chairman, BOS |
| 2) Dr. Modse Sanjeeva Reddy | Member |
| 3) Dr. V.M. Chennshetty | Member |
| 4) Dr. Devadas Chetty | Member |
| 5) Dr. Malkanna | Member |
| 6) Mr. Md. Varis | Member |
| 7) Mrs. Vijaylaxmi Mathpati | Member |

Proceedings:

- 1) The CBCS Syllabus for the B.Sc. Zoology Course was drafted after several deliberations & discussion in the Departmental Council meeting and the workshop held at Karnatak College, Bidar. The same was placed in the meeting of Board of Studies in Zoology (Undergraduate) for approval and implementation from the academic year 2018 – 19 and onwards (Copy enclosed).
- 2) It was unanimously decided that the practical courses covering the theory papers mentioned in the scheme of teaching and examinations be evolved by the teacher(s) concerned during the beginning of the every academic year.
- 3) Each candidate shall under take compulsory “Animals in Nature” **Study tour** covering different institutions and Natural biomes with a stress on Biodiversity study. The duration of this tour shall be about 10 Days. The study tour shall be undertaken before the commencement of VIth Semester (during vacation). The **Study Tour Report** should be submitted in the VIth Semester practical examination.


Dr. K. Vijaykumar
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GULBARGA UNIVERSITY

Distribution of Courses/ Papers in Undergraduate Programme I to VI Semester as per Choice Based Credit System (CBCS) Proposed for B.Sc. ZOOLOGY: SYLLABUS: with effect from 2018-19

Semester No	Code	Title of the Paper	Marks			Teaching hours / week			Credit	
			Sem Exam	IA	Total	L	T	P		
FIRST	AECC-1a	Kannada/MIL-1	80	20	100	2	1	-	3	
	AECC-1b	English-1	80	20	100	2	1	-	3	
	AECC-1c	Environmental Studies	40	10	50	2	-	-	2	
	DSC-1C	Chemistry	80	20	100	4	-	-	4	
	DSC-1B	Botany	80	20	100	4	-	-	4	
	DSC-1Z	Zoology: Animal Diversity	80	20	100	4	-	-	4	
	DSC-1CP	Chemistry Practical	40	10	50	-	-	2	2	
	DSC-1BP	Botany Practical	40	10	50	-	-	2	2	
	DSC-1ZP	Zoology Practical	40	10	50	-	-	2	2	
	Total Marks for First Semester:					700				26
SECOND	AECC-2a	Kannada/MIL-2	80	20	100	2	1	-	3	
	AECC-2b	English-2	80	20	100	2	1	-	3	
	AECC-2c	Indian Constitution	40	10	50	2	-	-	2	
	DSC-2C	Chemistry	80	20	100	4	-	-	4	
	DSC-2B	Botany	80	20	100	4	-	-	4	
	DSC-2Z	Zoology: Comparative Anatomy & Developmental Biology	80	20	100	4	-	-	4	
	DSC-2CP	Chemistry Practical	40	10	50	-	-	2	2	
	DSC-2BP	Botany Practical	40	10	50	-	-	2	2	
	DSC-2ZP	Zoology Practical	40	10	50	-	-	2	2	
	Total Marks for Second Semester:					700				26
THIRD	AECC-3a	Kannada/MIL-3	80	20	100	2	1	-	3	
	AECC-3b	English-3	80	20	100	2	1	-	3	
	DSC-3C	Chemistry	80	20	100	4	-	-	4	
	DSC-3B	Botany	80	20	100	4	-	-	4	
	DSC-3Z	Zoology: Physiology & Biochemistry	80	20	100	4	-	-	4	
	DSC-3CP	Chemistry Practical	40	10	50	-	-	2	2	
	DSC-3BP	Botany Practical	40	10	50	-	-	2	2	
	DSC-3ZP	Zoology Practical	40	10	50	-	-	2	2	
	Total Marks for Third Semester:					650				24
	FOURTH	AECC-4a	Kannada/MIL-4	80	20	100	2	1	-	3
AECC-4b		English-4	80	20	100	2	1	-	3	
DSC-4C		Chemistry	80	20	100	4	-	-	4	
DSC-4B		Botany	80	20	100	4	-	-	4	
DSC-4Z		Zoology: Genetics & Evolution	80	20	100	4	-	-	4	
DSC-4CP		Chemistry Practical	40	10	50	-	-	2	2	
DSC-4BP		Botany Practical	40	10	50	-	-	2	2	
DSC-4ZP		Zoology Practical	40	10	50	-	-	2	2	
Total Marks for Fourth Semester:					650				24	
FIFTH		SEC-1Z	Apiculture / Public Health	30	-	30	1	-	-	1
	SEC-2Z	Aquatic Biology / Aquarium Fish Keeping	30	-	30	1	-	-	1	
	DSE-1C	Chemistry	80	20	100	4	-	-	4	
	DSE-1B	Botany	80	20	100	4	-	-	4	
	DSE-1Z	Zoology: Cell & Molecular Biology	80	20	100	4	-	-	4	
	SEC-1ZP	Zoology Practical	20	-	20	-	-	1	1	
	SEC-2ZP	Zoology Practical	20	-	20	-	-	1	1	
	DSE-1CP	Chemistry Practical	40	10	50	-	-	2	2	
	DSE-1BP	Botany Practical	40	10	50	-	-	2	2	
	DSE-1ZP	Zoology Practical	40	10	50	-	-	2	2	
Total Marks for Fifth Semester:					550				22	
SIXTH	SEC-3Z	Sericulture / Immunology	30	-	30	1	-	-	1	
	SEC-4Z	Medical Diagnostics / Insect vector & Diseases	30	-	30	1	-	-	1	
	DSE-2C	Chemistry	80	20	100	4	-	-	4	
	DSE-2B	Botany	80	20	100	4	-	-	4	
	DSE-2Z	Zoology: Ecology, Wildlife Biology & Animal Behavior	80	20	100	4	-	-	4	
	SEC-3ZP	Zoology Practical	20	-	20	-	-	1	1	
	SEC-4ZP	Zoology Practical	20	-	20	-	-	1	1	
	DSE-2CP	Chemistry Practical	40	10	50	-	-	2	2	
	DSE-2BP	Botany Practical	40	10	50	-	-	2	2	
	DSE-2ZP	Zoology Practical	40	10	50	-	-	2	2	
Total Marks for Sixth Semester:					550				22	
Total Credits for the Course					3800				144	

Note : Course = paper; AECC: Ability Enhancement Compulsory Course; DSC: Discipline Specific Core Course;

GEC=Generic Elective Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

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P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective. SEC=Skill Enhancement Course; DSE= Discipline Specific Elective, L= Lecture; T=Tutorial; P= Practical. Additional 2 credits shall be given for the successful completion of two years of NSS (144+2=146)

AECC-1c and AECC-2c papers shall be approved by the BOS of Environmental Science and Political Science.
Tutorial/batch=20 student, Practical/Batch=10 students. AECC-a and AECC-b papers cover communicative skills

I semester – DSC – 1Z
ANIMAL DIVERSITY: THEORY (04 Credits)

(60 h)

Unit 1: Kingdom Protista	04
General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa	
Unit 2: Phylum Porifera	03
General characters and classification up to classes; Canal System in Sycon	
Unit 3: Phylum Cnidaria	03
General characters and classification up to classes; Polymorphism in Hydrozoa	
Unit 4: Phylum Platyhelminthes	03
General characters and classification up to classes; Life history of <i>Taenia solium</i>	
Unit 5: Phylum Nemathelminthes	05
General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	
Unit 6: Phylum Annelida	03
General characters and classification up to classes; Metamerism in Annelida	
Unit 7: Phylum Arthropoda	05
General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects	
Unit 8: Phylum Mollusca	04
General characters and classification up to classes; Torsion in gastropods	
Unit 9: Phylum Echinodermata	04
General characters and classification up to classes; Water-vascular system in Asteroidea	
Unit 10: Protochordates	02
General features and Phylogeny of Protochordata	
Unit 11: Agnatha	02
General features of Agnatha and classification of cyclostomes up to classes	
Unit 12: Pisces	04
General features and Classification up to orders; Osmoregulation in Fishes	
Unit 13: Amphibia	04
General features and Classification up to orders; Parental care	
Unit 14: Reptiles	04
General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes	


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Unit 15: Aves **05**

General features and Classification up to orders; Flight adaptations in birds

Unit 17: Mammals **05**

Classification up to orders; Origin of mammals

Note: Classification of Unit 1-9 to be followed from "Barnes, R.D. (1982). Invertebrate Zoology, Vth Edition"

ANIMAL DIVERSITY: PRACTICAL (02 Credits)

1. Study of the following specimens: Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris
2. Study of the following permanent slides: T.S. and L.S. of Sycon, Study of life history stages of Taenia, T.S. of Male and female Ascaris
3. Key for Identification of poisonous and non-poisonous snakes

An "**animal album**" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.



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II semester – DSC – 2Z

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES: THEORY (04 Credits)

(60 h)

Unit 1: Integumentary System	04
Derivatives of Integument: epidermal scales, glands and digital tips	
Unit 2: Osteology	05
Vertebral column, limb bones, girdles	
Unit 3: Digestive System	04
Brief account of alimentary canal and digestive glands	
Unit 4: Respiratory System	04
Brief account of Gills, lungs, air sacs and swim bladder	
Unit 5: Circulatory System	04
Evolution of heart and aortic arches	
Unit 6: Urinogenital System	03
Succession of kidney, Evolution of urinogenital ducts	
Unit 7: Nervous System	03
Comparative account of brain	
Unit 8: Sense Organs	03
Types of receptors	
Unit 9: Early Embryonic Development	12
Gametogenesis: Spermatogenesis and oogenesis in mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.	
Unit 10: Late Embryonic Development	10
Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.	
Unit 11: Control of Development	08
Fundamental processes in development (brief idea) – Gene activation, Determination, Induction, Differentiation, Morphogenesis, Intercellular Communication, Cell movements and Cell death	


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COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES: PRACTICAL (02 Credits)

1. Osteology:
 - a) Disarticulated skeleton of fowl and rabbit
 - b) Carapace and plastron of turtle /tortoise
 - c) Mammalian skull: One herbivorous and one carnivorous animal.
2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

SUGGESTED READINGS


- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
- Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.


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III Semester – DSC – 3Z

PHYSIOLOGY AND BIOCHEMISTRY: THEORY (04 Credits)

	(60 h)
Unit 1: Nerve and muscle	08
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction.	
Unit 2: Digestion	05
Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids	
Unit 3: Respiration	05
Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood	
Unit 4: Excretion	05
Structure of Nephron, Mechanism of Urine formation, Counter-current Mechanism	
Unit 5: Cardiovascular system	06
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle	
Unit 6: Reproduction and Endocrine Glands	07
Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: Hormonal control of menstrual cycle, Structure and function of Pituitary, Thyroid, Parathyroid, Pancreas and Adrenal	
Unit 7: Carbohydrate Metabolism	08
Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain	
Unit 8: Lipid Metabolism	05
Biosynthesis and β - oxidation of palmitic acid	
Unit 9: Protein metabolism	05
Transamination, Deamination and Urea Cycle	
Unit 10: Enzymes	06
Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation	


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PHYSIOLOGY AND BIOCHEMISTRY: PRACTICAL (02 Credits)

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian Pituitary, Thyroid, Pancreas, Adrenal gland
3. Study of permanent slides of Spinal cord, Duodenum, Liver, Lung, Kidney, Bone, Cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry's method.
3. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw Hill.


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IV Semester – DSC – 4Z

GENETICS AND EVOLUTION: THEORY (04 Credits)

(60 h)

Unit 1: Introduction to Genetics

03

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Unit 2: Mendelian Genetics and its Extension

08

Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex linked inheritance, Extra-chromosomal inheritance.

Unit 3: Linkage, Crossing Over and Chromosomal Mapping

09

Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics - an alternative approach to gene mapping

Unit 4: Mutations

07

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,

Unit 5: Sex Determination

04

Chromosomal mechanisms, dosage compensation Unit 6: History of Life 2 Major Events in History of Life

Unit 7: Introduction to Evolutionary Theories

04

Lamarckism, Darwinism, Neo-Darwinism

Unit 8: Direct Evidences of Evolution

05

Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of Horse

Unit 9: Processes of Evolutionary Change

08

Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

Unit 10: Species Concept

05

Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

Unit 11: Macro-evolution

03

Macro-evolutionary Principles (example: Darwin's Finches)

Unit 12: Extinction

04

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution


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IV Semester

GENETICS AND EVOLUTION: PRACTICAL (02 Credits)

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
 - a) Phylogeny of Horse with diagrams/ cut outs of limbs and teeth of Horse ancestors
 - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report.

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates


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V Semester
SKILL ENHANCEMENT COURSES
SEC 1

APICULTURE: THEORY (01Credit)

(16 h)

Unit 1: Biology of Bees

03

History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees

05

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
Bee Pasturage
Selection of Bee Species for Apiculture

Bee Keeping Equipment

Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

03

Bee Diseases and Enemies
Control and Preventive measures

Unit 4: Bee Economy

02

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit 5: Entrepreneurship in Apiculture

03

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial
Beehives for cross pollination in horticultural gardens

APICULTURE: PRACTICAL (01 Credit)

1. Study of different types of Honey Bees and classification.
2. Bee keeping equipments.
3. Study on Bee diseases and enemies.
4. Study on products of Apiculture industry.
5. Visit to Bee keeping places and submit report.

SUGGESTED READINGS

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

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SEC – 3Z

SERICULTURE: THEORY (01 Credit)

(30 h)

Unit 1: Introduction

(03)

Sericulture: Definition, history and present status; Silk route. Types of silkworms

Unit 2: Biology of Silkworm

(02)

Life cycle of Bombyx mori, Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms

(06)

Selection of mulberry variety and establishment of mulberry garden, Rearing house and rearing appliances, Disinfectants: Formalin, bleaching powder, RKO, Silkworm rearing technology: Early age and Late age rearing, Types of moults, Spinning, harvesting and storage of cocoons

Unit 4: Pests and Diseases

(03)

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial. Control and prevention of pests and diseases

Unit 5: Entrepreneurship in Sericulture

(02)

Prospectus of Sericulture in India: Sericulture industry in different states, employment potential in mulberry and non-mulberry sericulture. Visit to various sericulture unit.

SUGGESTED READINGS

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
 - Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
 - Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
 - Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

SERICULTURE: PRACTICAL (01 Credit)

1. To study the life cycle of Bombyx mori
2. To study pests of silkworm.
3. To study protozoan, viral, fungal and bacterial diseases.
4. Visit sericulture unit.


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SEC- 3Z

IMMUNOLOGY: THEORY (01 Credit)

(30 h)

Unit 1: Overview of the Immune System

03

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Unit 2: Cells and Organs of the Immune System

02

Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

Unit 3: Antigens

02

Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

Unit 4: Antibodies

03

Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

Unit 5: Working of the immune system

03

Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

Unit 6: Immune system in health and disease

02

Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

Unit 7: Vaccines

01


General introduction to vaccines, Various types of vaccines

PRACTICAL

1. Demonstration of lymphoid organs
2. Histological study of Spleen, Thymus and Lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO- blood group determination.
6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
 - a) ELISA
 - b) Immunoelectrophoresis

SUGGESTED READINGS

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.


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SEC – 4Z

MEDICAL DIAGNOSTICS: THEORY (01 Credit)

Unit 1: Introduction to Medical Diagnostics and its Importance	(30 h) 01
Unit 2: Diagnostics Methods Used for Analysis of Blood	03
Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)	
Unit 3: Diagnostic Methods Used for Urine Analysis	02
Urine Analysis: Physical characteristics; Abnormal constituents	
Unit 4: Non-infectious Diseases	03
Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit	
Unit 5: Infectious Diseases	03
Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis	
Unit 6: Tumours	03
Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).	

PRACTICAL

1. To study Blood compositions.
2. To study preparation of blood sample.
3. To study platelet count using haemocytometer
4. To study infectious disease in Tuberculosis
5. Visit to Medical diagnostics centre.

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

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SEC – 4Z

INSECT VECTORS AND DISEASES: THEORY (01 Credit)

(30h)

Unit I: Introduction to Insects

02

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts, feeding habits.

Unit II: Concept of Vectors

03

Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit III: Insects as Vectors

02

Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit IV: Dipteran as Disease Vectors

03

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes. Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly, Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit IV: Siphonaptera as Disease Vectors

02

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit V: Siphunculata as Disease Vectors

02

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

Unit VI: Hemiptera as Disease Vectors

02

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

PRACTICAL

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors : Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phthirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and diseases transmitted

SUGGESTED READINGS

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell


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Vth Semester

DSE – 1Z

CELL AND MOLECULAR BIOLOGY: THEORY (04 Credits)**UNIT – I****(60h)****20**

- 1.1 Cell theory; Differences of Prokaryotic and Eukaryotic cells.
- 1.2 Ultrastructure of animal cell; Structure and functions of plasma membrane proteins.
- 1.3 Structure and functions of cell organelles – Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus.
- 1.4 Chromosomes – Structure, types, giant chromosomes.
- 1.5 Cell Division - Mitosis, Meiosis; Cell cycle and its regulation.

UNIT – II**20**

- 2.1 DNA (Deoxyribo Nucleic Acid) – Structure; DNA Replication.
- 2.2 RNA (Ribo Nucleic Acid) - Structure, types.
- 2.3 Protein Synthesis – Transcription and Translation.
- 2.4 Gene Expression – Genetic Code; Operon concept.
- 2.5 Molecular Biology Techniques - Polymerase Chain Reaction, Electrophoresis

UNIT – III**20**

- 3.1 Mendel's laws of Inheritance and Non-Medelian Inheritance; Linkage and Crossing over.
- 3.2 Sex determination and sex-linked inheritance
- 3.3 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy.
- 3.4 Gene mutations- Induced versus Spontaneous mutations.
- 3.5 Inborn errors of metabolism; One gene one enzyme, one gene one polypeptide theory.

CELL AND MOLECULAR BIOLOGY: PRACTICAL (02 Credits)

1. Preparation and Identification of slides of Mitotic divisions with onion root tips
2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes
3. Identification and study of the following slides
 - i). Different stages of Mitosis and Meiosis
 - ii) Lampbrush and Polytene chromosomes
4. DNA sequencing & synthesis by Polymerase Chain Reaction (PCR) technique using Thermocycler.
5. Gene transfer by electrophoresis.

Laboratory Record work shall be submitted at the time of practical examination

An "Album" containing photographs, cut outs, with appropriate write-up about Genetics and Evolution.

Computer aided techniques should be adopted as per UGC.

SUGGESTED MANUALS

Manual of laboratory experiments in cell biology Edward, G.


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SUGGESTED READINGS

1. Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell 'Molecular Cell Biology' W.H. Freeman and company New York..
2. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
3. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
4. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
5. Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
7. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
8. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
9. Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
10. Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
11. Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
12. Minkoff, E. (1983). *Evolutionary Biology*. Addison-Wesley.
13. James D. Watson, Nancy H. Hopkins 'Molecular Biology of the Gene'
14. Jan M. Savage. *Evolution*, 2nd ed, Oxford and IBH Publishing Co., New Delhi.
15. Gupta P.K., 'Genetics'


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VI Semester

DSE – 2Z

ECOLOGY, WILDLIFE BIOLOGY & ANIMAL BEHAVIOUR:

THEORY (04 Credits)

(60h)

Unit – I: Ecology

30

Ecosystem structure and functions.
Types of Ecosystems –Aquatic and Terrestrial.
Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water.
Energy flow in ecosystem; Food chain, food web and ecological pyramids.
Animal Associations - Mutualism, commensalism, parasitism, competition, predation.
Concept of Species, Population dynamics and Growth curves.
Community Structure and dynamics; Ecological Succession.
Ecological Adaptations.
Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise pollution.
Zoogeographical regions of the world, their Climatic and faunal peculiarities.
Wallace line.
Continuous & Discontinuous distribution.
Continental Drift.

Unit-II Wildlife Biology

15

Distribution of Wildlife in India : the Himalayan ranges, The Peninsular Indian sub region, Deccan Plateau, The Western Ghats, Eastern hill chain – Aravali ranges, The Indian desert, Tropical rain forests, wildlife in Andaman and Nicobar Islands.
Wildlife Problems: Hunting, over harvesting, habitat destruction due to overpopulation, degradation, habitat shrinkage, and possibilities of climatic changes, transgenic changes.
Wildlife Conservation : Need for wildlife conservation – Agencies engaged in wildlife conservation. Government organization and non-government organizations (NGOs). Wildlife (Protection) Act 1972.
CITES (Convention on International Trade in endangered species of wildlife flora and fauna – endangered). Fauna and flora of India. Red data book.
Ramsar convention. CBD (Convention on Biological Diversity). Project Tiger.

Unit-III Animal Behaviour

15

Types of Behaviour- Innate(Inborn) and Acquired(learned)
Innate:Taxes, Kineses, Instinctive and Motivated behavior.
Acquired: Habituation, Imprinting, trial and error & Conditioned reflexes (Classical conditioning & Instrumental conditioning).
Social behavior, Communication, Pheromones.
Brief account on Courtship, Nesting, Migration and Parental care in Birds.
Mimicry: Definition & types.


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Chronobiology: Biological clock, Biological rhythms (Circadian & Cicannual rhythms).

Suggested Readings

M.P.Arora, 'Ecology' Himalaya Publishing company.

P.D.Sharma, 'Environmental Biology'.

P.R.Trivedi and Gurdeep Raj. 'Environmental Ecology'

Buddhadev Sarma and Tej Kumar, 'Indian Wildlife Threats and Preservation

Chapman J.L. and Reiss M.J, 'Ecology Principles and Applications, Second Ed., Cambridge University Press, London.

Benny Joseph, 'Environmental Studies, TATA McGraw Hill Com., New Delhi.

Eugene P. Odum, 'Fundamentals of Ecology' Third Ed., Natara J Publishers, Dehradun.

Veer Bala Rastogi, "Ecology and Animal Distribution"

P.K. Gupta, "Text Book of Ecology and Environment"

Bhatnagar and Bansal, "Ecology and Wildlife biology

Dasmann, "Wild life Biology"

Reena Mathur, "Animal Behaviour"

Alocock, "Animal Behaviour- an Evolutionary Approach

Aubrey Manning & Marian Stamp Dawkins: An Introduction to Animal Behaviour

ECOLOGY, WILDLIFE BIOLOGY & ANIMAL BEHAVIOUR:

PRACTICAL (02 CREDITS)


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1. Study of tropical pond as an ecosystem: Study of fauna and flora and interaction between the various constituents (Notes and Figures).
2. Study of aquarium as an ecosystem: Study of fauna and flora and interaction between the various constituents (Notes and figures).
3. Study of community: By quadrat methods to determine frequency, density and abundance of different species present in the community. Alpha diversity.
4. Estimation of dissolved oxygen, carbon dioxide.
5. Study of ecological adaptations and morphological peculiarities: Hermit crab, Stick insect, and Glow worm, Sting bug, Puffer fish, Anglerfish, Exocoetus, Phrynosoma, Draco, Chameleon and Bat.
6. Study of biotic relationship: Leguminous plants, Termites, Liver fluke, Tape worm, Exocoetus, Sucker fish, Insectivores plants.
- A. Zoogeography :
7. Study of landscapes, waterscapes, great lakes, desert, grass land, evergreen forest on India and World map (Peculiar animals in them).
8. Location of species of zoological interest on the Indian map and World map Flightless birds, Tiger, Lions, Gorilla, Hippopotamus, Rhinoceros, Dipnoi and Peripatus.
9. Location of Tiger Reserves, National Parks, Biosphere Reserves, Wildlife.
10. Study of threatened animals of India (by models, pictures, charts) : Tiger, Lion One Horned Rhinoceros, Gaur, Golden Langur, Lion Tailed Monkey, Musk deer, and Mouse deer, hangul (Kashmir Stag), Great Indian Hornbill and Indian Rock Python.
11. Preparation of Study Tour Report.


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