KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME - Under CBCS System
Scheme wef A.Y: 2019-20

Subject: ZOOLOGY

FIRST YEAR

SEMESTER – I

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS101	AECC-1	Environmental Science	2	2	10	40	-	50
BS102	FL-1A	English	4	4	20	80	-	100
BS103	SL-1A	Second Language	4	4	20	80	-	100
BS104	DSC-1A	**Animal Diversity - Invertebrates**	4	4	20	80	25	125
		Lab -I	1	3				
BS105	DSC-2A	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS106	DSC-3A	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – II

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS201	AECC-2	Basic Computer Skills (Taught by: Computer Science)	2	2	10	40	-	50
BS202	FL-2B	English	4	4	20	80	-	100
BS203	SL-2B	Second Language	4	4	20	80	-	100
BS204	DSC-1B	**Animal Diversity - Vertebrates**	4	4	20	80	25	125
		Lab	1	3				
BS205	DSC-2B	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS206	DSC-3B	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

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Subject: ZOOLOGY

SECOND YEAR

SEMESTER – III

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS301	SEC-1	Fundamentals of Nano Technology (Taught by : Physics)	2	2	10	40	-	50
BS302	SEC-2	Bio Statistics (Taught by : Statistics)	2	2	10	40	-	50
BS303	FL-3 A	English	3	3	15	60	-	75
BS304	SL-3 B	Second Language	3	3	15	60	-	75
BS305	DSC-1C	**Animal Physiology & Animal Behaviour**	4	4	20	80	25	125
		Lab	1	3				
BS306	DSC-2C	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS307	DSC-3C	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – IV

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS401	SEC-3	Fundamentals of Python (Taught by: Computer Science)	2	2	10	40	-	50
BS402	SEC-4	Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)	2	2	10	40	-	50
BS403	FL-4 A	English	3	3	15	60	-	75
BS404	SL-4 B	Second Language	3	3	15	60	-	75
BS405	DSC-1D	**Cell Biology, Genetics & Developmental Biology**	4	4	20	80	25	125
		Lab	1	3				
BS406	DSC-2D	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS407	DSC-3D	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

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Scheme wef A.Y: 2019-20

Subject: ZOOLOGY

THIRD YEAR

SEMESTER – V

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS501	FL-5 A	English	3	3	15	60	-	75
BS502	SL-5 B	Second Language	3	3	15	60	-	75
BS503	G.E.	Water Resources Management (Taught by: Any Science Dept.)	4	4	20	80	-	100
BS504	DSE-1E	Optional - I : Physiological Chemistry & Endocrinology	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS505	DSE-2E	Optional– II : Laboratory Animals Maintenance & Applications	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS506	DSE-3E	**Optional – III : Immunology and Animal Biotechnology**	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – VI

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS601	FL-6 A	English	3	3	15	60	-	75
BS602	SL-6 B	Second Language	3	3	15	60	-	75
BS603	P.W / Optional	Optional: Public Health & Hygiene (Taught by: Zoology / Botany / Biotechnology / Micro Biology)	4	4	20	80	-	100
BS604	DSC-1F	Optional - I : Fisheries	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS605	DSC-2F	Optional– II : Limnology	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS606	DSC-3F	**Optional – III : Ecology, Zoogeograpy & Evolution**	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

F.L : First Language;
S.L : Second Language;
A.E.C.C: Ability Enhancement Compulsory Course;
S.E.C : Skill Enhancement Course;
D.S.C : Discipline Specific Course;
D.S.E : Discipline Specific Effective;
G.E : Generic Elective;
P.W : Project Work;

KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – I

ANIMAL DIVERSITY – INVERTEBRATES

(Core Paper –I)

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

UNIT – I

1.1 Protozoa

1.1.1 General Characters and Classification of Protozoa up to Orders with examples
1.1.2 Type Study –***Elphidium***
1.1.3 Locomotion and Reproduction
1.1.4 Epidemiology of Protozoan diseases – Amoebiasis, Giardiasis, Leishmaniasis, Malaria

1.2 Porifera

1.2.1 General characters and Classification of Porifera up to Orders with examples
1.2.2 Type study - ***Sycon***
1.2.3 Canal system in Sponges
1.2.4 Types of Cells and Spicules in Porifera.

UNIT – II

2.1 Cnidaria

2.1.1General characters and Classification of Cnidaria up to classes with examples
2.1.2 Type study -***Obelia***
2.1.3 Polymorphism in Cnidarians with examples
2.1.4 Corals and Coral Reef formation

2.2 Helminthes

2.2.1 General characters and Classification of **Platyhelminthes** up to classes with examples
2.2.2 Type study -***Schistosoma***
2.2.3 General characters and Classification of **Nemathelminthes** up to classes with examples
2.2.4 Type study –***Dracanculus;*** Parasitic Adaptations in Helminthes

UNIT– III

3.1 Annelida

3.1.1 General characters and Classification of Annelida up to classes with examples
3.1.2 Type study – ***Hirudinaria granulosa***
3.1.3 Evolutionary significance of Coelome and Coelomoducts and Metamerism
3.1.4 Economic Importance of Annelida (Polychaeta, Oligochaeta and Hirudinea)

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3.2Arthropoda

3.2.1 General characters; Classification of Arthropoda upto classes with examples
3.2.2Type study –***Palaemon***(Prawn)
3.2.3Crustacean Larvae; Insect metamorphosis; Useful and Harmful Insects
3.2.4***Peripatus***- Structure and affinities

UNIT – IV

4.1 Mollusca

4.1.1 General characters; Classification of Mollusca upto classes with examples
4.1.2Type study -***Pila*** (Snail)
4.1.3 Pearl formation; Torsion and Detorsion in Gastropods
4.1.4 Molluscs as Bio-indicators, Vectors and Pests; Economic importance

4.2 Echinodermata

4.2.1 General characters and Classification of Echinodermata upto classes with examples
4.2.2 Type study- ***Star Fish***
4.2.3Echinoderm larvae and their evolutionary significance
4.2.4 Autotomy, Regeneration and Symmetry of Echinoderms

Suggested Readings:

1. **L.H. Hyman** '*The Invertebrates' Vol I, II and V.* – M.C. Graw Hill Company Ltd.
2. **Kotpal, R.L. 1988 - 1992** Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. **E.L. Jordan and P.S.** Verma'*Invertebrate Zoology'* S. Chand and Company.
4. **R.D. Barnes** '*Invertebrate Zoology'* by: W.B. Saunders CO., 1986.
5. **Barrington. E.J.W.**, '*Invertebrate structure and Function'* by ELBS.
6. **P.S. Dhami and J.K. Dhami.**Invertebrate Zoology. S. Chand and Co. New Delhi.
7. **Parker, T.J. and Haswell**'*A text book of Zoology'* by, W.A., Mac Millan Co. London.
8. **Barnes, R.D. (1982).***Invertebrate Zoology*, V Edition"

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – I

ANIMAL DIVERSITY - INVERTEBRATES (PRACTICAL)

Instruction: 3 hrs per week
No. of Credits: 1

1. Study of museum slides / specimens/models (Classification of animals up to orders)

i) **Protozoa:***Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoebahistolytica, Plasmodium vivax*

ii) **Porifera**:*Sycon, Spongilla,Euspongia, Sycon*- T.S &L.S, Spicules, Gemmule

iii) **Coelenterata:** *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula*

iv) **Platyhelminthes:***Planaria, Fasciolahepatica, Fasciola*larval forms – Miracidium, Redia, Cercaria, *Echinococcusgranulosus, Taeniasolium, Schistosomahaematobium*

v) **Nemathelminthes:***Ascaris(Male & Female), Drancunculus, Ancylostoma,Wuchereria*

vi) **Annelida:** *Nereis, Aphrodite, Chaetopteurs, Hirudinaria,* Trochophore larva

vii) **Arthropoda:** *Cancer, Palaemon,* Scorpion, *Scolopendra, Sacculina, Limulus, Peripatus,* Larvae -Nauplius, Mysis,Zoea,Mouth parts of male & female *Anopheles* and *Culex,* Mouthparts of Housefly and Butterfly.

viii) **Mollusca:** *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus,* Glochidium larva

ix) **Echinodermata:** *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria,Antedon,* Bipinnaria larva

2. Demonstration of dissection / dissected / virtual dissection:
Prawn: Appendages, Digestive system, Nervous system, Mounting of Statocyst

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

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

5. Computer aided techniques should be adopted as per UGC guide lines.

Suggested manuals:

1. Practical Zoology- Invertebrates by S.S.Lal
2. Practical Zoology – Invertebrates by P.S.Verma
3. Practical Zoology –Invertebrates by K.P.Kurl

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – II

ANIMAL DIVERSITY – VERTEBRATES

(Core Paper – II)

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

UNIT – I

1.1 Hemichordata

1.1.1 General characters and Classification of Hemichordates upto classes with examples
1.1.2*Balanoglossus*- Structure and affinities
1.1.3. Larval Significance (Tornaria)

1.2. Protochordata

1.2.1 General Characters and Classification of Chordates up to orders with examples
1.2.2 Salient features of Urochordata; Retrogressive metamorphosis in Urochordata
1.2.3 Salient features and affinities of Cephalochordata
1.2.4 General Characters of Cyclostomata; Comparison of *Petromyzon*and *Myxine*

UNIT – II

2.1 Pisces

2.1.1 General characters of and Classification of Pisces up to orders with examples
2.1.3*Scoliodon*- Digestive,Respiratory, Circulatory and Nervous system
2.1.4 Types of Scales, Types of Fins
2.1.5 Migration in Fishes

2.2 Amphibia

2.2.1 General characters and Classification of Amphibians up to orders with examples.
2.2.2***Rana tigrina***- Respiratory, Circulatory and Nervous systems
2.2.3 Parental care in Amphibians; Neoteny and Paedogenesis
2.2.4 Metamorphosis in Amphibians and its hormonal control

Unit – III

3.1 Reptilia

3.1.1 General characters and Classification of Reptilia up to orders with examples
3.1.2***Calotes***–Digestive,Respiratory, Circulatory and Nervous systems
3.1.3 Temporal fossa in Reptiles and its evolutionary importance
3.1.4 Distinguished characters of Poisonous and Non-poisonous snakes

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3.2 Aves

3.2.1 General characters and Classification of Aves upto orders with examples.
3.2.2***Columba livia***- Digestive, Respiratory,Circulatory and Nervous systems
3.2.3 Migration in Birds
3.2.4 Flight adaptation in Birds

Unit – IV

4.1 Mammalia

4.1.1 General characters and Classification of Mammalia upto orders with examples
4.1.2***Rabbit***- Digestive, Respiratory,Circulatory and Nervous systems
4.1.3Dentition in Mammals
4.1.4 Aquatic adaptations in Mammals

Suggested Readings:

1. **E.L.Jordan and P.S. Verma**'*Chordate Zoology*' -. S. Chand Publications.

2. **Mohan P.Arora**. '*Chordata – I*, Himalaya Publishing House Pvt.Ltd.

3. **Marshal, Parker and Haswell**'*Text book of Vertebrates*'. ELBS and McMillan, England.

4. **Alfred Sherwood Romer**. Thomas S. Pearson '*The Vertebrate Body*, Sixth edition, CBS CollegePublishing, Saunders College Publishing

5. **George C. Kent, Robert K. Carr**. *Comparative Anatomy of the Vertebrates*, 9th ed. McGrawHill.

6. **Kenneth Kardong***Vertebrates: Comparative Anatomy, Function and Evolution*, 4th ed,'McGraw Hill.

7. **J.W. Young**, *The Life of Vertebrates*, 3rd ed, Oxford University press.

8. **Harvey Pough F, Christine M. Janis, B. Heiser,** *Vertebrate Life,* Pearson, 6th ed, Pearson Education Inc.2002.

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – II

ANIMAL DIVERSITY - VERTEBRATES (PRACTICAL)

Instruction: 3 hrs per week
No. of Credits: 1

I. Study of museum slides / specimens / models (Classification of animals up to orders)

1. **Hemichordata:** *Balanoglossus, Tornmaria larva*
2. **Protochordata:** *Amphioxus, Amphioxus* T.S. through pharynx
3. **Cyclostomata:** *Petromyzon, Myxine, Ammocoetus larva*
4. **Pisces:** *Sphyrna, Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus,* Scales: Placoid, Cycloid, Ctenoid
5. **Amphibia:** *Ichthyophis, Amblystoma, Siren,Hyla, Rachophous,Bufo, Rana,* Axolotal larva
6. **Reptilia :** *Draco, Chemaeleon, Gecko, Uromastix, Vipera russeli, Naja, Bungarus, Enhydrina, Typhlops, Ptyas, Testudo, Trionyx, Crocodilus*
7. **Aves:** Archaeopteryx, *Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo* ,Collection and study of different types of feathers: Quill, Contour, Filoplume, Down
8. **Mammalia:** *Ornithorthynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris,* Hedgehog;
9. **Histology:**T.S. of Liver, Pancreas, Kidney, Stomach, Intestine, Lung, Artery, Vein, Bone T.S, Spinal Cord. T.S.

II. Osteology:
Rabbit – Axial Skeleton (Bones of Skull and Vertebral Column),
Varanus, Pigeon and Rabbit - Appendicular skeleton (Bones of Limbs and Girdles

III. Demonstration of dissection / dissected / virtual dissection: Labeo / Tilapia
1. Digestive system 2. Brain, Weberian Oscicles3. V, VII, IX, X cranial nerves

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

V. 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.

VI. Computer aided techniques should be adopted as per UGC guide lines.

Suggested manuals:

1. **S.S.Lal,** Practical Zoology – Vertebrata
2. **P.S.Verma,** A manual of Practical Zoology– Chordata

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – III

ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR

Theory	**4 Hours/Week**	**4 Credit**	**Internal marks = 20**
Practical	**3 Hours/Week**	**1 Credit**	**External Marks = 80**

UNIT – I

1.1 Digestion

1.1.1 **Enzymes:** Definition, Classification, Inhibition, Regulation
1.1.2 Digestion of Carbohydrates, Proteins, Lipids and Cellulose
1.1.3Absorption and Assimilation of digested food
1.1.4 Role of Gastrointestinal hormones in digestion

1.2 Excretion, Homeostasis and Osmoregulation

1.2.1 Classification of Animals on the basis of excretory products: Ammonotelic, Ureotelic, and Uricotelic; Structure and function of Nephron
1.2.2Urine formation and Counter current mechanism
1.2.3 Concept and Mechanism of Homeostasis
a) Hormone regulation of Blood Glucose levels in Human being
b) Water and Ionic Regulation by Marine and Fresh water Animals
c) Thermo regulation in Human being
1.2.4. Osmoregulation in Marine, Fresh and Brackish water Animals

UNIT – II

2.1 Respiration

2.1.1Definition of Respiration, Respiration mechanism, External, Internal and Cellular Respiration.
2.1.2 Respiratory Pigments; Transport of Oxygen, Oxygen dissociation curves, and Bohr's Effect;
2.1.3 Transport of Carbon dioxide, Chloride shift
2.1.4 Regulation of Respiration; Nervous and Chemical Mechanism

2.2 Circulation

2.2.1 Types of Circulation Open and Closed; Structure of Mammalian Heart
2.2.2 Types of Hearts: Myogenic and Neurogenic
2.2.3 Heart functions - Conduction and Regulation of Heart beat, Regulation of Heart rate; ECG
2.2.4 Tachycardia and Bradycardia; Blood Clotting mechanism

UNIT– III

3.1 Muscle Contraction

3.1.1Types of Muscles
3.1.2 Ultra structure of skeletal muscle fibre
3.1.3 Mechanism and Chemical changes during Muscle Contraction (Sliding filament theory)
3.1.4 Twitch Tetanus summation and Treppe fatigue

3.2 Nerve Impulse

3.2.1 Structure of Neuron
3.2.2 Nerve impulse - Resting potential, Threshold potential and Action potential, Conduction of Nerve impulse
3.2.3 Transmission of Nerve impulse
3.2.4 Synapse and Synaptic transmission; Neurotransmitters-EPSP, IPSP

3.3 Endocrine System

3.3.1 Endocrine glands - Structure, secretions and functions of Pituitary gland
3.3.2 Thyroid, Parathyroid, Adrenal glands and Pancreas
3.3.3 Hormone action and Concept of Secondary messengers
3.3.4 Male and Female Hormones; Hormonal control of Menstrual cycle in human beings

UNIT – IV

4.1 Animal Behaviour

4.1.1 Types of Behaviour- Innate and Acquired; Instinctive and Motivated behaviour
4.1.2 Taxes, Reflexes, Tropisms

4.2 Learning and Memory

4.2.1 **Types of Learning**: Trial and Error Learning, Imprinting, Habituation
4.2.2 **Conditioning:** Classical Conditioning; Instrumental conditioning, Examples of Conditioning, Pavlov's Experiment

4.3 Social Behaviour and Communication

4.3.1 Social behaviour of insects (Dance language of honey bees)Colonial Existence of Bees and Termites; Pheromones

4.4 Biological Rhythms

4.4.1 Biological Clocks, Circadian Rhythms; solar and lunar Rhythms; Circannual Rhythms

Suggested Readings:

1. **Gerard J. Tortora and Sandra Reynolds Garbowski** *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons
2. **Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., JohnE. Hall, Harcourt Asia Ltd.
3. **William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005
4. **Sherwood, Klandrof, Yanc, Animal** *Physiology*, Thompson Brooks/Coole, 2005.
5. **Sherwood, Klandrof, Yanc,** *Human Physiology*, Thompson Brooks/Coole, 2005.
6. **Knut Scmidt-Nielson,** *Animal Physiology***,** 5th edition, Cambridge Low Price Edition.
7. **Roger Eckert and Randal,** *Animal Physiology***,** 4th ed, Freeman Co, New York**.**
8. **Singh. H.R,** Text Book of Animal Physiology and Biochemistry
9. **Nagabhushanam**, Comparative Animal Physiology
10. **Veer Bal Rastogi,** Text Book of Animal Physiology
11. **Dasmann**, "Wild Life Biology"
12. **ReenaMathur,** "Animal Behaviour"
13. **Alocock,** "Animal Behaviour- an Evolutionary Approach

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – III

ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR (PRACTICAL)

Instruction: 3 hrs per week
No. of Credits: 1

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Qualitative tests for identification of ammonia, urea and uric acid (Nitrogenous excretory products)
3. Zonation of gut in Cockroaches
4. Study on effect of pH and Temperature on salivary amylase activity
5. Study of permanent histological sections of mammalian endocrinal glands: Pituitary, Thyroid, Pancreas, Adrenal gland
6. Estimation of Haemoglobin by Sahli's method
7. Estimation of Blood Clotting time
8. Estimation of total protein by Biuret's method
9. Estimation of unit metabolism of fish

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

Suggested manuals:

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). T*extbook 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'sIllustrated Biochemistry*. XXVIII Edition.Lange Medical Books/Mc Graw3Hill.

KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – IV

CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

UNIT – I

1.1 Cell Biology

1.1.1 Ultra structure of Animal cell

1.1.2 Structure (Fluid mosaic model) and Functions of Plasma membrane

1.1.3 Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Ribosomes, Lysosomes, Mitochondria and Nucleus

1.1.4 Chromosomes - Structure, types, Cell Division- Mitosis, Meiosis, Cell Cycle and its regulation.

UNIT – II

2.1 Molecular Biology

2.1.1 DNA (Deoxyribo Nucleic Acid) –Structure-RNA (Ribo Nucleic Acid)-Structure, types, DNA Replication

2.1.2 Protein Synthesis – Transcription, Translation.

2.1.3 Gene Expression - Genetic Code, Operon concept.

2.1.4 Molecular Biology Techniques – Polymerase Chain Reaction (PCR), Electrophoresis.

UNIT – III

3.1 Genetics

3.1.1 Mendel's laws of Inheritance and Non-Mendelian Inheritance , Linkage and Crossing over.

3.1.2 .Sex determination and Sex-linked inheritance.

3.1.3 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation; Aneuploidy and Polyploidy; Gene mutations- Induced versus Spontaneous mutations

3.1.4 Inborn errors of metabolism.

UNIT – IV

4.1 Developmental Biology

4.1.1 Gametogenesis (Spermatogenesis and Oogenesis), Fertilization, Types of eggs, Types of cleavages

4.1.2 Development of Frog upto the formation of primary germ layers

4.1.3 Formation of Foetal membrane in chick embryo and their functions

4.1.4 Types and functions of Placenta in Mammals,Regeneration in Turbellarians and Lizards

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Suggested Readings:

1. **Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell** *'Molecular Cell Biology'* W.H. Free man 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.**Campbell, N. A. and Reece J. B. (2011).** *Biology.* IX Edition, Pearson, Benjamin, Cummings.

9.**James D. Watson, Nancy H. Hopkins** *'Molecular Biology of the Gene'*

10. **Gupta P.K**., 'Genetics'

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – IV

CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY PRACTICAL

Instruction: 3 hrs per week
No. of Credits: 1

I. Cytology

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) Lamp brush and polytene chromosomes

II. Genetics

1. Problems on Genetics - Mendelian inheritance, Linkage and Crossing over, Sex linked inheritance

III. Embryology

1. Study of T.S. of Testis and Ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8, 16 cell stages); Morula, Blastula
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

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

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

- **Computer aided techniques should be adopted as per UGCguide lines.**

Suggested manuals:

1. Manual of laboratory experiments in Cell Biology by **Edward, G.**
2. Freeman and Bracegirdle – An Atlas of Embryology.

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY III Year

SEMESTER – V

IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

UNIT – I

1.1 Basics of Immune system

1.1.1 Cells of the Immune system and the Lymphoid organs (Primary and Secondary)

1.1.2 First line of defences-physical and chemical barriers; second line of defences – inflammation and phagocytosis.

1.1.3 Types of Immunity- Inherent (Active and Passive) and Acquired Immunity (Active and Passive) Humoral and Cell mediated immunity.

1.1.4 Major Histocompatibility complex (MHC)- structure and function of class I and Class II proteins. Significance of MHC in organ transplantation; MHC restriction

UNIT – II

2.1 Antibodies and Antigens and Immune system diseases

2.1.1 Antibodies(Immunoglobulins) – Structure, functions and classification, antibody diversity, Monoclonal antibodies and applications

2.1.2 Antigens structure, antigenic determinants/epitopes, haptens, adjuvants and antigenicity.

2.1.3 Antigen-antibody reactions; Agglutination; Precipitation, Opsonization, Cytotoxicity

2.1.4 Hypersensitivity reactions.
Autoimmunity and Immunodeficiency diseases.

Unit – III

3.1 Animal Biotechnology and Genetically modified organisms

3.1.1 Concept and Scope of Animal Biotechnology

3.1.2 Recombinant DNA Technology and its applications.

3.1.3 Cloning Vectors- Plasmids, Cosmids and shuttle vectors, Cloning methods(Cell, Animal and Gene cloning); Restriction enzymes and Ligases

3.1.4 Transgenesis – Methods of Transgenesis
Production of Transgenic animals- Sheep and Fish

Unit – IV

4.1 Applications of Biotechnology

4.1.1 In vitro fertilization and embryo transfer

4.1.2 Hybridoma technology – concepts and applications

4.1.3 Stem cells- Types and their applications

4.1.4 Recombinant insulin and human growth hormone; Polymerase Chain Reaction (PCR)
Animal Bioreactors- Concepts and Applications.

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Suggested Readings:

1. Text Book of Immunology – Ivan Riott
2. Text Book of Immunology – C.V.Rao
3. Text Book of Immunology – Nandinin Shetty
4. Text Book of Immunology – Kubey
5. Culture of Animal Cells – R. Ian Freshney, Wiley Liss
6. Biotechnology – S. Mitra
7. Animal Cell Culture - Practical Approach – Ed. John. RW. Masters, Oxford
8. Biotechnology – B.D.Singh
9. Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNAAnalysis*. II Edition, Academic Press, California, USA.
10. Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.

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B.Sc. ZOOLOGY III Year

SEMESTER – V

IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY PRACTICAL

Instruction: 3 hrs per week
No. of Credits: 1

I. Immunology

1. Identification of Blood grouping (Demonstration of Agglutination) using kit.
2. Demonstration of Precipitation (VDRL/RPR) using kit.
3. Histological study of Lymphoid organs -Spleen, Thymus, Lymph node, Bone marrow (through prepared slides).
4. Enumeration of Total RBC from a given blood sample.
5. Enumeration of Total WBC from a given blood sample.
6. Enumeration of Differential count of WBC from a given blood sample.

II. Animal Biotechnology

1. Study the following techniques through Photographs / Virtual Lab

a) Identification of Vectors
b) Identification of Transgenic animals
c) DNA sequencing (Sanger's method)
d) DNA finger printing
e) Southern blotting
f) Western blotting

2. PCR (demonstration) on site or of site demonstration.

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

Suggested manuals:

1. A Hand Book of Practical Immunology – **Ivan Riott**
2. Animal Biotechnology – **P.K. Gupta.**
3. Immunology, VI Edition. W.H. Freeman and Company **Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006).**
4. Immunology, VII Edition, Mosby, Elsevier Publication **David, M., Jonathan, B., David, R. B. and Ivan R. (2006).**
5. Cellular and Molecular Immunology. V Edition. Saunders Publication, **Abbas, K. Abul and Lechtman H. Andrew (2003.)**

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KAKATIYA UNIVERSITY

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B.Sc. ZOOLOGY III Year

SEMESTER – VI

ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

UNIT – I

1.1 Ecology- I

1.1.1 Ecosystem Structure and Functions; Types of Ecosystems – Aquatic and Terrestrial
1.1.2 Bio-geo chemical nutrient cycles - Nitrogen, Carbon, Phosphorus and Water
1.1.3 Energy flow in ecosystem
1.1.4 Food chain, food web and ecological pyramids
1.1.5 Animal Associations-Mutualism; Commensalism;Parasitism; Competition, Predation

UNIT – II

2.1 Ecology – II

2.1.1 Concept of Species, Population dynamics and Growth curves
2.1.2 Community Structure and dynamics and Ecological Succession
2.1.3 Ecological Adaptations
2.1.4 Environmental Pollution- Sources, Effect and Control measures of Air, Water, Soiland Noise Pollution
2.1.5 Wildlife conservation - National Parks and Sanctuaries of India, Endangered species; Biodiversity and Hotspots of Biodiversity in India.

UNIT – III

3.1 Zoogeography

3.1.1 Zoogeographical regions
3.1.2 Climatic and faunal peculiarities of Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions
3.1.3 Wallace line, Discontinuous distribution
3.1.4 Continental Drift

Unit – IV

4.1. Evolution

4.1.1 Theories of Evolution – Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Modern synthetic theory, Evidences of Evolution.
4.1.2 Forces of Evolution–Natural Selection, Genetic drift, Gene flow, Genetic load, Organic variations,Hardy Weinberg Equilibrium.
4.1.3. Isolation –Premating and post mating isolating mechanisms.
4.1.4 Speciation: Methods of Speciation - Allopatric and Sympatric; Causes and Role of Extinction in Evolution.

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Suggested Readings:

1. Ecology – Himalaya Publising company – M.P Arora
2. Environmental Biology – P.D. Sharma
3. Environmental Ecology – P.R. Trivedi and Gurdeep Raj
4. Indian Wildlife Threats and Prervation – Buddhadev Sharma and Te Kumar
5. Ecology-Principles and Application II Edn. Cambridge Univ Press, London, Champan. JL and Re.iss MJ.
6. Environmental Studies, TATA McGraw Hill Com. New Delhi, Benny Joseph.
7. Fundamentals of Ecology Third Edn., Nataraj Publishers, Dehradun, Eugene.P. Odum.
8. Ecology and Animal Distribution, Veea Bala Rastogi.
9. Text Book of Ecology and Environment, P.K. Gupta.
10. Ecology and Wildlife Biology, Bhatnagar and Bansal.
11. Evolution 3rd Edn. Blackwell Publishing, Ridley, M (2004).
12. Evolutionary Biology, Addison –Wesley; Minkoff,E(1983).
13. *Evolution*. Cold Spring, Harbour Laboratory Press Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).
14. *Evolution*. IV Edition. Jones and Bartlett Publishers; Hall, B. K. and Hallgrimsson, B. (2008).
15. *Evolution*, 2nd Edn, Oxford and IBH Publishing Co., New Delhi, Jan M. Savage.

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B.Sc. ZOOLOGY III Year
SEMESTER – VI

ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION PRACTICAL

Instruction: 3 hrs per week
No. of Credits: 1

Ecology

1. Determination of pH of Soil and Water.
2. Estimation of Salinity (Chlorides) of water in given samples.
3. Estimation of Carbonates and Bicarbonates in the given water samples.
4. Estimation of dissolved Oxygen of Pond water, sewage, effluents.
5. Identification of Zooplankton from different water bodies.
6. Study of Pond Ecosystem / Local polluted site – Report submission.

Zoogeography

1. Study of at least 3 endangered or threatened wild animals of India through photographs/specimens/models
2. Field visit to Zoo Park to study the management, behavior and enumeration of wild animals.
3. Identification of Zoogeographical realms from the Map and identify specific fauna of respective regions.

Evolution

1. Museum Study of fossil animals: **Peripatus; Coelacanth fish, Dipnoi fishes; Sphenodon; Archaeopteryx.**
2. Study of homology and analogy from suitable specimens and pictures
3. Problems on Hardy-Weinberg Law
4. Macroevolution using Darwin finches (pictures)

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

Suggested manuals:

1. Ecology Student Lab Manual, Biology Labs – Robert Desharnais, JeffreyBell.
2. Ecology Lab manual – Darrell S Vodopich.

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Final Examination: Question Papers Pattern

B.A./B.Sc. (ZOOLOGY)

Theory Question Paper Pattern

WEF Academic Year: 2020-2021

Time: 3 hours] [Max. Marks: 80

Section - A

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

Q1. (a)		
	[OR]	From Unit-I
Q1. (b)		
Q2. (a)		
	[OR]	From Unit-II
Q2. (b)		
Q3. (a)		
	[OR]	From Unit-III
Q3. (b)		
Q4. (a)		
	[OR]	From Unit-IV
Q4. (b)		

Section – B

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

Q5	From Unit-I
Q6	
Q7	
Q8	From Unit-II
Q9	
Q10	
Q11	From Unit-III
Q12	
Q13	
Q14	From Unit-IV
Q15	
Q16	

B.A./B.Sc. (ZOOLOGY)

Practical Question Paper Pattern

WEF Academic Year: 2020-2021

Time: 2 hours] [Max. Marks: 25

1 Major Experiment (10 M)

2 Minor Experiment (5 M)

3 Record (5 M)

4 Viva (5 M)

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Internal Examinations:

1. Two Internal exams are to be conducted and best of two internal marks is considered.
2. First internal exam is to be conducted after completion of Unit-I & II.
3. Second internal exam is to be conducted after completion of Unit-III & IV.
4. Internal Examination duration: 1 hr 30 min
5. Internal Theory QP consists of 20 marks.
6. 10 Short questions are to be given (5Q from each of 2 Completed units); 10Q are to be answered (10Q X 2m = 20m).

Final Exam for Other Papers

1. Each SEC QP consists of 50 marks.
   (10Q are given. 5Q from each unit, 5Q are to be answered, 5Q X 10 m = 50m)
   (Duration:2hrs)
2. GE QP consists of 100 marks. QP model is same as Core paper.
3. Project consists of 100 marks with 4 Credits. 80 Marks will be allotted for Project Evaluation and 20 marks for viva-voce.

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