

**RAJEEV GANDHI GOVT. POST GRADUATE COLLEGE,
AMBIKAPUR, SURGUJA (CG), INDIA**



**Learning Outcomes based Curriculum Framework
FOR
UNDERGRADUATE PROGRAMME**

B.Sc. (Zoology)

**SEMESTER SYSTEM
SESSION 2023-2024**

Rajiv Gandhi Govt P.G. College Ambikapur

DEPARTMENT OF ZOOLOGY

B Sc Under graduate

Zoology Program Outcomes, Program Specific Outcomes and Course Outcomes

Zoology Program Outcomes:

Program out Come-

PO-1. After studying this program, student will be more equipped to learn and know about different biological system. Drawing upon this knowledge.

PO-2.They will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life.

PO-3.Student will be able to explain how organisms function at the level of the gene, genome, cell, tissue and organ-system.

Course out Come-B.Sc.-Ist Semester

Cell Biology and Non-Chordata

- CO-1.To understand the structural organization and function of Intracellular Organelles.
- CO-2.To study the structure, Composition and functions of DNA and RNA.
- CO-3.Students will understand the structures, Positions and functions of Plasma membrane, Endoplasmic reticulum, Mitochondria and Golgi complex.
- CO-4.Students will acquire knowledge about Chromosomes and cell divisions.
- CO-5.They will also know about cancer cell.
- CO-6.Studets will understand the elementary idea about Immunity.
- CO-7. Students will have learning about the basic taxonomy and systematic and classification of Protozoa, Porifera , Coelenterata.
- CO-8.To study the Sexual and asexual reproduction in unicellular Paramecium.
- CO-9.Students will acquire knowledge of structure and life cycle of Sycon and Obelia.
- CO-10.Students will have learning about the basic taxonomy and systematic and classification of Platyhelminthes, Nematelminthes, Annelida and Arthropoda up to Order.
- CO-11.Students will understand the life cycle and pathogenesis of Parasite Fasciola and Ascaris.
- CO-12.They will also know about Pheretima and Palaemon.
- CO-13. Students will have learning about the basic taxonomy , systematics and classification of Phylum Mollusca and Echinodermata up to Order.
- CO-14.They will learn details of external feature, digestive system, respiratory system and reproductive system in Pila.
- CO-15.To study the various system of Starfish.

B.Sc. (Zoology)		SEMESTER I	
COURSE TITLE: Cell Biology and Non-Chordata			
Paper Code: ZOO 101		Course Code UD 4	
Credit -6		Hours-90hrs	
Theory-6	Practical-0	Theory-90	Practical-45/2
Marks			
Theory-75		Practical-50/2	
Scheme of Marks: (i)Objective type questions (ii) Very Short Question (iii)Short Questions (iv) long type questions			
Unit I 18 hrs	1.The cell (Prokaryotic and Eukaryotic) 2.Organization of Cell: Extra-nuclear and nuclear (Plasma membrane, Mitochondria, Endoplasmic reticulum, Golgi body, Ribosome and Lysosome) 3.Nucleus, Chromosomes, DNA and RNA		
Unit II 18hrs	1.Cell division (Mitosis and Meiosis) 2.An elementary idea of Cancer cells and Cell transformation. 3.An elementary idea of Immunity: Innate& Acquired Immunity, Lymphoid organs, Cell of Immune System, Antigen, Antibody and their interactions		
Unit III 18 hrs	1.General characters and classification of phylum Protozoa, Porifera and Coelenterata up to order 2.Protozoa:Type study-Paramecium 3.Porifera: Type study- Sycon 4.Coelenterata: Type study- Obelia		
Unit IV 18hrs	1.General characters and classification of phylum Platyhelminthes, Nematelminthes, Annelida and Arthropoda up to order 2.Platyhelminthes and Nematelminthes: Type Study- Fasciola, Ascaris 3.Annelida: Type study-Pheretima 4.Arthropoda: Type study-Palaemone		
Unit V 18 hrs	1.General Characters and classification of Phylum Mollusca and Echinodermata up to order. 2.Mollusca: Type study-Pila 3.Echinodermata-Type study-Asterias(starfish)		

REFERENCES:

- Mordern Zoology-Dr. H. N. Baijal
- Unified Zoology-Dr.V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr.R.T.Mehta
- R.P. Unified Zoology Dr. S.M. Saxena
- Zoology for Degree Students-I-Dr. V. K. Agrawal

Course out Come-B.Sc.-II Semester

Chordata and Embryology

CO-1.To study the classification, structural peculiarities of Hemichordata , protochordata and their evolutionary Importance.

CO-2.Students will be able to analyse the Comparative knowledge to Petromyzon and Myxine.

CO-3. Students will be able to understand the principles of taxonomy , systematics and classification of Chordata.

CO -4. Students will be able to gain a comprehensive knowledge of Poisonous and non poisonous snakes.

CO -5. Students will understand about snake venom and poison apparatus.

CO-6. Students will be able to analyze the process of metamorphosis of amphibians.

CO-7.Students will be able to gain a comprehensive knowledge about Migration, Flight adaptation and Perching mechanism in Bird .

CO-8.Students will be able to evaluation of Prototheria, Metatheria , Eutheria and their affinities.

CO-9.Students will understand adaptation of aquatic Mammals.

CO-10. Understand the concepts of embryology.

CO-11.Students gains comprehensive knowledge about gametogenesis , cleavage mechanisms, gastrulation ,parthenogenesis and role of hormones in metamorphosis and regeneration.

CO-12.Students will understands the concepts of Embryonic induction and Differentiation.

CO-13.To understands the formation of three germinal layers in Frog.

CO-14.Students will be able to analysis the concept of regeneration.

B.Sc. (Zoology)		SEMESTER II	
COURSE TITLE: Chordata and Embryology			
Paper Code-ZOO 102		Course Code -UD4	
Credit -6		Hours-90hrs	
Theory-6	Practical-3	Theory-90	Practical-45/2
Marks			
Theory-75		Practical-50/2	
Scheme of Marks: (i)Objective type questions(ii) Very Short Question (iii)Short Questions (iv) long type questions			
Unit I 18 hrs	1. Classification of Hemichordata 2. Hemichordata-Type study-Balanoglossus 3. Classification of Chordates upto orders. 4. Protochordata-Type study-Amphioxus. 5. A comparative account of Petromyzon and Myxine.		
Unit II 18hrs	1. Fishes-Skin & Scales, migration in fishes, Parental care in fish. 2. Amphibia-Parental care and Neoteny. 3. Reptilia-Poisonous & Non-poisonous Snakes,Poison apparatus, snake venom and Extinct Reptiles.		
Unit III 18 hrs	1. Birds-Flight Adaptation, Migration, and Perching mechanism, Discuss-Birds are glorified reptiles. 2. Mammals-Comparative account of Prototheria, Metatheria, Eutheria and Affinities. 3. Aquatic Mammals and their adaptations.		
Unit IV 18hrs	1. Fertilization 2. Gametogenesis, Structure of gamete and Types of eggs. 3. Cleavage 4. Development of Frog up to formation of three germ layers. 5. Parthenogenesis		
Unit V 18 hrs	1. Embryonic induction, Differentiation and Regeneration. 2. Development of Chick (a) Up to formation of three germ layers. (b) Extra-embryonic membranes. 3. Placenta in mammals.		

REFERENCES:

- Modern Zoology-Dr. H. N. Baijal
- Unified Zoology-Dr. V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr. R. T. Mehta
- R. P. Unified Zoology Dr. S. M. Saxena
- Zoology for Degree Students-I-Dr. V. K. Agrawal

Zoology
B.Sc.II Semester
Practical

The practical work will, in general be based on the syllabus prescribed in theory and the candidates will be required to show knowledge of the following:-

- Dissection of Earthworm, Cockroach, Palaemon and Pila.
- Minor dissection-appendages of Prawn & hastate plate, mouth parts of insects, radulla of Pila. (Alternative methods: By Clay/Thermacol/drawing/ Model etc.)
- Adaptive characters of Aquatic, terrestrial, arial and desert animals.
- Museum specimem invertebrate
- Slides-Invertebrates, frog embryology, Chick embryology and cytology.

Scheme of Practical Exam

1. Major Dissection	10 Marks
2. Minor Dissection	05 Marks
3. Comments on Excercise based on Adaptation	04 Marks
4. Cytological Preparation	05 Marks
5. Spots-8(Slides-4,Specimens-4)	16 Marks
6. Sessional	10 Marks

Course out Come-B.Sc.-III Semester
Anatomy and Physiology
(Comparative Anatomy of various organ systems of Vertebrates)

- CO-1. Students will have understood the structure of different Integument and its derivatives.
- CO-2. They will also understand the Comparative anatomy of various organ systems of vertebrates.
- CO-3. Understands about structure composition of Scales, hair and feathers.
- CO-4. Student will understand the various type of Endoskeleton.
- CO-5. Course provides students comprehensive understanding about Circulatory system and Urinogenital system.
- CO-6. students gain evolutionary knowledge about Heart and Aortic arches.
- CO-7 . Course provides students comprehensive understanding about neurobiology, neurophysiology, molecular neurobiology.
- CO-8. Comparative animal physiology is a comprehensive subject that gives in depth knowledge of various physiological processes Ear and Eye.
- CO-9. Describing structural and functional knowledge of gonad and ducts.
- CO-10. After going through this course on Animal Physiology (Vertebrates)', the students have a good Understanding of how vertebrate animals work.
- CO-11. The students will be able to explore an original query of blood Coagulation.
- CO-12. Students will be able to understand the Cardiac cycle of heart.
- CO-13. After successfully completing this course, the students will be able to Understand Synaptic transmission to Nerve impulse.
- CO -14. Students gain knowledge of physiology of Muscle contraction.
- CO-15. After successfully completing this course, the students will be able to understand regulation of processes of Excretion.

B.Sc. (Zoology)		SEMESTER III	
COURSE TITLE: Anatomy and Physiology (Comparative Anatomy of various organ systems of Vertebrates)			
Paper Code ZOO 103		Course Code UD 4	
Credit -6		Hours-90hrs	
Theory-6	Practical-3	Theory-90	Practical-45/2
Marks			
Theory-75		Practical-50/2	
Scheme of Marks: (i)Objective type questions(ii) Very Short Question (iii)Short Questions (iv) long type questions			
Unit I 18 hrs	1. Integument and its derivatives: structure of scales, hair and feathers. 2. Alimentary canal and digestive glands in vertebrates 3. Respiratory organs: Gills and lung, air-sac in birds.		
Unit II 18hrs	1.Endoskeleton(a) Axial Skeleton-Skull and Vertebrae,(b) Appendicular Skeleton, Limbs and girdles. 2. Circulatory system: Evolution of heart and aortic arches. 3.Urinogenital system: Kidney and excretory ducts.		
Unit III 18 hrs	1.Nervous system: General plan of brain and spinal cord. 2.Ear and Eye structure and function 3.Gonads and genital ducts.		
Unit IV 18hrs	1.Digestion and absorption of dietary components. 2.Physiology of heart, cardiac cycle and ECG 3. Blood Coagulation. 4. Respiration: mechanism and control of breathing		
Unit V 18 hrs	1.Excretion:Physiology of excretion, osmoregulation, 2.Physiology of muscle contraction 3.Physiology of nerve impulse, Synaptic transmission		

- REFERENCES: Mordern Zoology-Dr. H. N. Baijal
- Unified Zoology-Dr.V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr.R.T.Mehta
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Course out Come-B.Sc.-IV Semester

Vertebrate Endocrinology, Reproductive biology, Behavior, Evolution and Applied Zoology

CO-1.They will learn detail of endocrinology with classification of hormones, their biosynthesis.

CO-2. Learn basic principles of Hormone.

CO-3.Understand the basic organization of the Endocrine disorder of Pituitary, Thyroid and Pancreas.

CO -4. Students of this class will be able to understand the importance of hormones in the Gametogenesis.

CO -5. After successfully completing this course, the students will be able to understand to Mechanism of parturition.

CO-6. Gain knowledge about the Reproductive cycle in vertebrates.

CO -7. Description of Variation .

CO-8.Understanding the current Evidences of organic evolution.

CO-9.Conceptualization and theories of organic evolution .

CO-10. After successfully completing this course, the students will be able to demonstrate knowledge of key concepts in animal behavior.

CO-11.Learn a wide range of theoretical and practical techniques used to study animal behavior.

CO-12.Thinking ability , flexibly and apply knowledge to new behavior problem.

CO -13. Understands concepts of fisheries, fishing tools and site selection .

CO -14. Students will be able to biological and chemical pest control.

CO -15. Gives knowledge of silk worm rearing and Mulberry cultivation .

B.Sc. (Zoology)		SEMESTER IV	
COURSE TITLE: Vertebrate Endocrinology, Reproductive Biology Behavior, Evolution and Applied Zoology			
Paper Code ZOO 104		Course Code UD 4	
Credit -6		Hours-90hrs	
Theory-6	Practical-0	Theory-90	Practical-0
Marks			
Theory-75		Practical-0	
Scheme of Marks: (i)Objective type questions(ii) Very Short Question (iii)Short Questions (iv) long type questions			
Unit I 18 hrs	1.Structure and function of Endocrine glands. 2.Hormone receptor 3.Biosynthesis and secretion of thyroid, adrenal, ovarian and testicular hormones 4.Endocrine disorder of pituitary, thyroid, adrenal and pancreas		
Unit II 18hrs	1.Reproductive cycle in vertebrates 2.Menstruation, lactation and pregnancy 3.Mechanism of parturition 4.Hormonal regulation of gametogenesis		
Unit III 18 hrs	1.Evidences of organic evolution 2.Theories of organic evolution 3.Variation, Mutation, Isolation and Natural selection 4.Evolution of Horse		
Unit IV 18hrs	Introduction to Ethology: Branches and concept of ethology 2. Patterns of Behaviour, Taxes, Reflexes, Drives and Stereotyped behaviour. 3.Reproductive behavioural patterns. 4.Drugs and behavior, Hormones and Behaviour		
Unit V 18 rs	1.Prawn Culture 2. Sericulture 3.Apiculture 4.Pisciculture 5.Poultry keeping 6.Elements of Pest Control:Chemical & Biological Control		

- REFERENCES: Mordern Zoology-Dr. H. N. Baijal
- Unified Zoology-Dr.V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr.R.T.Mehta
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Zoology

B.Sc.IV Semester

Practical

The Practical work in general shall be based on the syllabus prescribed and the students will be required to show the knowledge of the following :

- Study of the representative examples of the different chordates (Classified characters)
- Dissection of various systems of scoliodon-Afferent and Efferent branchial cranial nerves, internal ear.

Alternative methods: By clay/ Thermacol/ Drawing/Model etc.)

- Simple microscopic technique through unstained or stained permanent mount.
- Study of prepared slides histological, as per theory papers.
- Study of limb girdles and vertebrae of Frog, Varanus, Fowl and Rabbit.
- Identification of species and individual of honey bee.
- Life cycle of honey bee and silkworm.
- Exercise based on Evolution and Animal behavior.

Scheme of Practical Exam

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|---|----|
| • Major dissection (Cranial nerves/efferent branchial vessel) | 10 |
| • Exercise based on evolution | 05 |
| • Exercise based on applied zoology | 05 |
| • Exercise based on animal behaviour | 04 |
| • Spotting-8 (slides-4, bones-2, specimen-2) | 16 |
| • Viva | 05 |
| • Sessional marks. | 05 |

Course out Come-B.Sc.-V Semester

Ecology, Environmental Biology: Toxicology, Microbiology and Medical Zoology

CO-1.Students will understand the various features and aspects of population ecology, community ecology and ecosystem ecology.

CO-2.They will acquire knowledge about environmental biology in details.

CO-3.To studies the various pollution and their harmful effect.

CO-4.Student will be learning the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forest and wild life.

CO-5. After successfully completing this course, the students will be able to Understands concepts of energy flow in ecosystem .

CO-6.Understands laws of limiting factor of environment.

CO-7. The study of this paper students gain knowledge in the basic concept of Toxicology.

CO-8. Imparts knowledge regarding the various Heavy metal toxicity .

CO-9. It provides opportunities for student's research projects, internships in assessing the effects of poisonous animal.

CO-10.They will also know the various tools and techniques related to industrial microbiology.

CO-11. Understanding of Industrial microbiology and production of penicillin .

CO-12. Student's gains knowledge about microbiology of milk and milk production.

CO-13.They also will acquire knowledge about some parasites for their life cycle, pathology, diagnosis, symptoms and treatment.

CO-14.They will also have knowledge about the basics of parasite, host interaction etc.

CO-15. To study about pathogenic protozoan's and helminthes and their vector and treatment

B.Sc. (Zoology)		SEMESTER V	
COURSE TITLE: Ecology, Environmental Biology: Toxicology, Microbiology and Medical Zoology			
Paper Code ZOO 105		Course Code UD 4	
Credit -6		Hours-90hrs	
Theory-6	Practical-0	Theory-90	Practical-0
Marks			
Theory-75		Practical-50/2	
Scheme of Marks: (i)Objective type questions(ii) Very Short Question (iii)Short Questions (iv) long type question			
Unit I 18 hrs	(Ecology) <ul style="list-style-type: none"> • Aims and scopes of ecology • Major ecosystems of the world-Brief introduction • Population-Characteristics and regulation of densities • Communitis and ecosystem • Bio-geo chemical cycles • Air &water Pollution • Ecological Succession 		
Unit II 18hrs	(Environmental Biology) <ul style="list-style-type: none"> • Laws of limiting factor • Food chain in fresh water ecosystem • Energy flow in ecosystem –Trophic levels • Conservation of natural resources • Environmental impact assessment 		
Unit III 18 hrs	(Toxicology) <ul style="list-style-type: none"> • Definition and classification of Toxicants • Basic Concept of toxicology • Principle of systematic toxicology • Heavy metal Toxicity(Arsenic, Murcury, Lead, Cadmium) • Animal poisons-snake venom, scorpion & bee poisoning • Food poisoning 		
Unit IV 18hrs	(Microbiology) <ul style="list-style-type: none"> • General and applied microbiology • Microbiology of domestic water and sewage • Microbiology of milk & milk products • Industrial microbiology: fermentation process, production of penicillin, alcoholic breverages, bioleaching 		
Unit V 18 hrs	(Medical Zoology) <ul style="list-style-type: none"> • Brief introduction to pathogenic microorganisms, Ricketssia, Spirochaetes, AIDS and Typhoid • Brief account of life history & pathogenicity of the following pathogens with reference to man: prophylaxis & treatment • Pathogenic protozoan's-Entamoeba, Trypanosome & Plasmodium • Pathogenic helminthes-Schistosoma • Nematode pathogenic parasites of man • Vector insects 		

REFERENCES:

- Genetics P.S.Verma and V.K.Agarwal
- Mordern Zoology-Dr. H. N. Bajjal
- Unified Zoology-Dr.V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr.R.T.Mehta

Course out Come-B.Sc.VI Semester

Genetics, Cell Physiology, Biochemistry, Biotechnology and Biotechniques

CO-1.Students will learn the fundamental genetics like linkage and linkage map.

CO-2. Understanding the chromosome anomalies and associated diseases.

CO-3. Knowledge about gene and chromosomal mutation.

CO-4.To studies the mechanism of active transport and its role in mitochondria and Endoplasmic reticulum.

CO-5. Under standing of general idea about pH and buffer .

CO-6.To understands about the amino acid and peptides and its structure and biological function.

CO-7.Students will understand the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids.

CO-8.Students will understand the metabolism of carbohydrates, lipids and protein in detail.

CO-9.They will also understand the nature, mechanism of protein and their metabolism.

CO-10.Student will acquire knowledge about recombinant DNA and gene therapy.

CO-11.To understands the scope and importance of tissue culture, hybridoma, transgenic animals and gene library.

CO -12. Students gain knowledge about various tools & techniques used in gene cloning.

CO-13.Students will acquire knowledge some instrumentation such as light microscope, compound, phase contrast and electron microscopes.

CO -14. Students gain knowledge about various tools & techniques used in biological systems and gives them insight about their use in research.

CO-15.To study principles and Acquired skills the separation methods of centrifugation, chromatography and electrophoresis.

B.Sc. (Zoology)		SEMESTER VI	
COURSE TITLE: Genetics, Cell Physiology, Biochemistry, Biotechnology and Biotechniques			
Paper Code ZOO 106		Course Course UD 4	
Credit -6		Hours-90hrs	
Theory-6	Practical-0	Theory-90	Practical-45
Marks			
Theory-75		Practical-50	
Scheme of Marks:			
(i)Objective type questions(ii) Very Short Question (iii)Short Questions (iv) long type questions			
Unit I 18 hrs	(Genetics) <ul style="list-style-type: none"> • Linkage & Linkage maps, Sex Determination and Sex linkage • Gene interaction-Incomplete dominance & Codominance, Supplementary gene, Complementary gene, Epistasis, Lethal gene, Pleiotropic gene and multiple alleles. • Mutation: Gene and chromosomal mutation • Human genetics: Chromosomal alteration: Down, Edward, Patau, Turner and Klinefelter Syndrome Single gene disorders: Alkaptonuria, Phenylketonuria, Sickle cell anemia, albinism and colour blindness. 		
Unit II 18hrs	(Cell Physiology) <ul style="list-style-type: none"> • General idea about pH & buffer • Transport across membrane: Diffusion and Osmosis • Active transport in mitochondria & endoplasmic reticulum • Enzymes-classification and Action 		
Unit III 18 hrs	(Biochemistry) <ul style="list-style-type: none"> • Amino acids & peptides-Basic structure & biological function • Carbohydrates & its metabolism-Glycogenesis; Gluconeogenesis; Glycolysis; Glycogenolysis; Cori-cycle • Lipid metabolism-Oxidation of glycerol; Oxidation of fatty acids • Protein Catabolism-Deamination, transamination, transmethylation 		
Unit IV 18hrs	(Biotechnology) <ul style="list-style-type: none"> • Application of Biotechnology • Recombinant DNA & Gene cloning • Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Transgenic Animals and Gene library) 		
Unit V 18 hrs	(Biotechnique) <ol style="list-style-type: none"> 1.Principle & techniques about the following <ol style="list-style-type: none"> (i) pH meter (ii) Colorimeter (iii) Microscopy-Light microscopes: Compound, Phase contrast & Electron microscopes (iv) Centrifuge (v) Separation of biomolecules by chromatography & electrophoresis 		

REFERENCES:

- Genetics P.S.Verma and V.K.Agarwal
- Mordern Zoology-Dr. H. N. Baijal
- Unified Zoology-Dr.V. K. Tiwari
- Navboth Unified Zoology-Dr. Preeti Khare and Dr.R.T.Mehta
- R.P. Unified Zoology Dr. S.M. Saxena

B.Sc.VI SEMESTER

Zoology

Practical

The practical work in general shall be based on syllabus prescribed in theory.

The candidates will be required to show knowledge of the following:

- Estimation of population density, percentage frequency, relative density.
- Analysis of producers and consumers in grassland.
- Detection of gram-negative and gram-positive bacteria.
- Blood group detection(A,B,AB,O)
- R.B.C.and W.B.C.count
- Blood coagulation time
- Preparation of hematin crystals from blood of rat.
- Observation of Drosophila, wild and mutant.
- Chromatography-Paper or gel.
- Colorimetric estimation of Protein.
- Mitosis in onion root tip.
- Biochemical detection of Carbohydrate, Protein and Lipid.
- Study of permanent slides of parasites, based on theory paper.
- Working principles of pH meter, colorimeter, centrifuge and microscope.

Scheme of marks distribution

Time:3:30 hrs

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|--|----|
| • Hematological Experiment | 08 |
| • Ecological Experiment: Grassland Ecosystem/Population Density/Frequency/relative density | 06 |
| • Bacterial staining | 05 |
| • Biochemical experiment | 06 |
| • Practical based on Instrumentation(Chromatography/pH meter/microscope/centrifuge. | 05 |
| • Spotting (5 spots) | 10 |
| • Viva | 05 |
| • Sessional | 05 |

