॥ अंतरं पेटवू ज्ञानज्योत ॥

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for T. Y. B.Sc.

ZOOLOGY

With effect from June,2004

Instruction

Two tutorials and two seminars shall be conducted per paper, excluding the regular teaching schedules

NORTH MAHARASHTRA UNIVERSITY
JALGAON

Syllabus For T.Y.B.Sc.

ZOOLOGY

With Effect From June, 2004

STRUCTURE

PAPER – I	:	ANATOMY OF NON CHORDATES-III AND CHORDATES-III
PAPER – II	:	CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY
PAPER – III	:	MAMMALIAN HISTOLOGY AND PHYSIOLOGY
PAPER – IV	:	BIOCHEMISTRY AND MICROTECHNIQUE
PAPER – V	:	PARASITOLOGY AND MOLECULAR BIOLOGY
PAPER – VI	:	SECTION : I – BIOINFORMATICS OR PATHOLOGY OR PUBLIC HEALTH AND HYGIENE AND SECTION : II – BIOTECHNOLOGY
PAPER – VII	:	PRACTICAL – I : ANATOMY OF NON CHORDATES-III AND CHORDATES-III, BIOCHEMISTRY AND MICROTECHNIQUE
	:	PRACTICAL – II : CELL BIOLOGY, DEVELOPMENTAL BIOLOGY, PARASITOLOGY AND MOLECULAR BIOLOGY
	:	PRACTICAL – III : MAMMALIAN HISTOLOGY, MAMMALIAN PHYSIOLOGY, BIOINFORMATICS, PATHOLOGY, PUBLIC HEALTH AND HYGINE AND BIOTECHNOLOGY

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS FOR T. Y. B. Sc. ZOOLOGY

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PAPER - I : ANATOMY OF NON CHORDATES- III AND CHORDATES-III

SECTION - I : NON CHORDATES-III

1. Systematic postion, habit and habitat, external mprphology, internal organisation, functional anotomy and life cycle of
   - 1) Paramoecium (08 periods)
   - 2) Leech (14 periods)
   - 3) Starfish (14 periods)
2. Study of structural and functional organisation of the following groups with reference to the prescribed topics :
   - 1) Coelenterata : Polymorphism in Siphonophora, Coral reefs (07 periods)
   - 2) Arthropoda : Appendages in Crustacea (Lobster or Prawn) (04 periods)
   - 3) Mollusca : Pearl formation, Shell in Mollusca. (05 periods)

SECTION -II : CHORDATES-III

1. Study of Calotes with reference to the following :
   - 1) Systematic postion, habit and habitat
   - 2) External characters : Shape, morphology and scales.
   - 3) Functional anatomy :
     a) Digestive system b) Respiratory system, c) Circulatory system d) Excretory system e) Nervous system f) Reproductive system and breeding habits g) Eye, ear and hyoid apparatus. (16 periods)
2. Study of the following groups with reference to prescribed topics :
   - 1) Urochordates :
     a) A sexual reproduction in Doliolum and Pyrosoma
     b) Ascidian larvae and retrogressive metamorphosis in Urochordates. (04 Periods)
   - 2) Cyclostomata : General, primitive and specialized characters and Amocoetous larva. (3 periods)
3. Pisces : a) Account of Dipnoi
   b) Fins : Paired, Unpaired and Caudal fins
   c) Accessary respiratory organs in Saccobranchus, Clarias, Anabas and Amphipneus (7 periods)
4. Amphibia : Neoteny and Pedogenesis (1 period)
5. Reptiles : Temporal vacuities. (2 periods)
6. Aves : a) Modification of beaks and feet with reference to habits and habitat.
   b) Migration in birds : Definition, causes, routes. (5 periods)

7. Mammals : Specilised characters of following orders with atleast one example.
   a) Marsupials b) Cetacea c) Chrioptera (3 periods)
8. Study of comparative anatomy with reference to the following topics
   1. Integument : Comparative histology of integument of Scoliodon . Frog. Calotes Pigeon and Rat.
   2. Heart : Structure of heart of Scoliodon. Frog. Calotes, Pigeon and Rat.
   3. Aortic arches : Evolution of aortic arches.
   4. Kidneys : Evolution of archinephros, pronephros, mesonephros. metanephros and their ducts.
   5. Brain : Morphological variations in the region of brain of Scoliodon, Frog, Calotes, Pigeon and Rat. (11 periods)

PAPER - II : CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY
SECTION II : CELL BIOLOGY

1. Introduction to Cell Biology :
   1. Definition and scope.
   2. General orgaisation of prokaryotic and eukaryotic cells with reference to size, shapes and structure with examples.
   3. Comparision of prokaryotic and eukaryotic cells. (5 periods)
2. Plasma membrane :
   1. Structure of Plasma membrane
   2. Models of Plasma membrane
      a) Unit membrane model
      b) Danielli -Davson model
      c) Fluid mosaic model
   3. Cell Junctions, membrane modifications, microvilli, desmosomes
   4. Functions: Active transport, pinocytosis, phagocytosis and secretion (8 periods)
3. Mitochondria
   1. Origin, occurence and morphology
   2. Ultra structure and functions
   3. Mitochondria as symbionts. (4 periods)
4. Endoplasmic Reticulum
   1. Origin, occurence, morphology and ultra structure.
   2. Types : Smooth and rough
   3. Functions (4 periods)
5. Golgi Complex :
   1. Orgin, occurence, morphology and ultra structure.
   2. Functions (4 periods)
6. Lysosomes :
   1. Orgin, occurence, morphology, polymorphism and ultra structure.
   2. Functions (4 periods)
7. Ribosomes :
   1. Types, occurence, morphology and ultra structure.
   2. Functions . (3.periods)
8. Nucleus :
   1. Position, number, shape, size and ultrastructure.
   2. Nuclear membrane. Pore complex, nucleoplasm, and nucleolus.
   3. Functions
   4. Chromosome number : Haploidy. Diploidy. Polyploidy.
   5. Classification of chromosomes . acrocentric, metacentric. submetacentric, telocentric
   6. Gaint chromosomes : Lampbrush and Polytene : causes. structure and functions. (10 periods)

9. Cell cycle and cell division :
   1. Cell cycle : a) G1, Go, S, G2 and M phases
      b) Control of cell cycle
   2. Mitosis : Process and significance
   3. Meiosis : Process and Significance
   4. Comparison between mitosis and meiosis (7 periods)

10. Cellular ageing and cell death :
   1. Concept of ageing, intracellular changes, extra cellular changes.
   2. Cell death - Apoptosis
      a) Definition, Process, significance, examples.
      b) Necrosis : Definition and examples.
      c) Necrobiosis : Definition and examples. (3 periods)

SECTION II : DEVELOPMENTAL BIOLOGY

1. Definition and scope of Developmenttal Biology (2 periods)
2. Concept of Developmental Biology, growth, differentiation, de-differentiation, regeneration, induction, organiser, totipotency, fate map (presumptive areas.) (4 periods)

3 Gametogenesis :
   1. Spermatogenesis including spermeogenesis.
   2. Oogenesis
   3. Difference between spermatogenesis and oogenesis.
   4. Significance of gametogenesis. (4 periods)

4. Structure of Gametes :
   1. Sperm : Ultrastructure, mention variations with reference to insect, frog and human sperms.
   2. Ovum : General Structure, egg membrane : Primary, secondary and tertiary.
   3. Types of eggs : Classifications based on the amount of yolk and distribution of yolk. (7 periods)

5. Fertilization :
   1. Definition and types (external, internal)
   2. Monospermy polyspermy - physiological and pathological.
   3. Process of fertilization
      a) Attraction and recognition of sperm, Androgamones, gynogamones, fertilizin and antifertilizin
      b) Penetration mechanism and activation, acrosome reaction, cortical reaction, fertilization membrane.
      c) Amphimixis
   4. Significance of fertilization. (7 periods)

6. Parthenogenesis
   Definition, types a) Natural arrhenotoky and thelytoky b) Artificial
   Significance of parthenogenesis, (2 periods)

7. Cleavage
   1. Definition, characteristics and significance.
   2. Planes of cleavage
   3. Types : a) Holoblastic- equal and unequal b) Meroblastic - discoidal and superficial c) Determinate and indeterminate cleavage (regulative and mosaic)
   4. Patterns with examples - Radial, spiral, bilateral and asymmetrical. (5 periods)

8. Blastulation :
   Definition and types. (2 periods)

9. Gastrulation
   1. Definition and concept
   2. Basic cell movements (morphogenetic movements) in gastrulation : Epiboly.

emboly, convergence, involution, divergence, invagination, ingression, delamination, concrescene, infiltration, constriction and elongation with reference to Amphioxus and frog. (4 periods)

10. Chick embryology :
    1. Structure of Hen's egg (freshly laid), egg membranes.
    2. Fertilization, cleavage and blastulation.
    3. Gastrulation : Formation of primitive endoderm.
    4. Development of Primitive streak.
    5. Head process, somites, regression of primitive streak.
    6. Development of brain upto 72 hours.
    7. Development of heart and main blood vessels upto 72 hours.
    8. Development of digestive system upto 72 hours.
    9. Development of extra-embryonic membranes.
    10. Significance / use of chick embryo in development biology. (12 periods)
11. Placenta
    1. Definition and significance
    2. Types of placenta in mammals
        a) With reference to morphological pecularities (i) Deciduate placenta ii) Indeciduate placenta.
        b) With reference to the foetal and maternal tissues involved
        i) Diffuse ii) Cotyledonary iii) Zonary iv) Discoidal
        c) With reference to histological pecularities i) Epitheliochorial ii) Syndesmochorial iii) Endotheliochorial iv) Haemochorial v) Haemoendothelial. (4 periods)

PAPER - III MAMMALIAN HISTOLOGY AND PHYSIOLOGY

SECTION I : MAMMALIAN HISTOLOGY.

1. Study of the following tissues : (8 periods)
    a) Epithelial - Simple, stratified, its types.
    b) Connective - Proper, Areolar, Adipose, Ligament, Tendon, Cartilage.
    c) Muscle - Striated - ultra structure, smooth, cardiac.
    d) Nervous - Types of neurons, medullated nerve fibre.
2. Digestive system : (14 periods)
    Histology of tooth, tongue, salivary gland, Alimentary tract - oesophagus, stomach, duedenum, ileum, colon, Associated glands- Liver, Pancreas.
3. Respiratory system : (3 periods)
    Histology of trachea and lung.
4. Circulatory system : (5 periods)
    Histology of blood and blood vessels.
5. Histology of skin : (3 periods)
    Epidermis, dermis and glands.
    (Epidermal derivatives not expected)
6. Histology of Kidney : (6 periods)
    V. S. of kidney, Structure of nephron (Urineferous tubule) collecting duct, blood supply, J. G. Complex.
7. Reproductive system : (9 periods)
    a) Histology of testis - V.S. of testis: T.S. of testis - seminiferous tubules and interstitial cells.
    b) Histology of ovary - V.S. of ovary, structure of Graafian follicle, Corpus Luteum, corpus albicans.
    c) Histological structure of uterus, placenta.
8. Histology of pituitary gland (4 periods)
    Adenohypophysis, Neurohypophysis.

SECTION II : MAMMALIAN PHYSIOLOGY

1. Nutrition and Physiology of digestion : (6 periods)
   Definition of nutrition, balanced diet and its significance, chemical digestion - oral, Gastric and intestinal, Absorption and Assimilation.
2. Respiration : (6 periods)
   Definition, mechanism of ventilation, respiratory pigments - Haemoglobin, myoglobin. Transport of gases - oxygen, carbondioxide, chloride shift, oxygen dissociation curve.
3. Circulation : (6 periods)
   Cardiac cycle : Systole, diastole, blood volume, stroke volume, blood pressure-Hypertention, Hypotention, Pace maker and its role, E.C.G.
   Coagulation of blood - mechanism and various factors.
4. Muscle Physiology : (6 periods)
   Sliding filament theory of muscle contraction (Molecular basis), Myoneural junction, Muscle stimulation - simple muscle twitch, summation tetanus, muscle fatigue. Physical and chemical changes during muscle contraction.
5. Nervous Physiology : (6 periods)
   Terminology : Stimulation, impulse, conduction, response. EEG, MRI, CT Scan.
   Origin and conduction of nerve impulses
   Neurotransmitters - definition, properties and types - serotonin, acetyl choline, sympathin, dopamine.
   Synapse : Ultra structure and transmission.
6. Sense organs : (6 periods)
   a) Physiology of vision - Visual pathway and stimulation of photoreceptors - rods, cones
   b) Physiology of hearing : Auditory pathway and stimulation of organ of corti.
7. Excretion : (3 periods)
   Physiology of urine formation by counter current multiplier theory - ultrafiltration, selective reabsorption, tubular secretion.
8. Reproduction : (8 periods)
   a) Male sex hormones and their physiological roles.
   b) Female sex hormones and their physiological roles.
   c) Reproductive cycles : Oestrous cycle with hormonal control, Menstrual cycle with hormonal control.
9. Pituitary as master endocrine gland, its interrelation with thyroid, adrenal glands and Gonads, Feed back mechanism-Positive and negative. (5 periods)

PAPER IV BIOCHEMISTRY AND MICROTECHNIQUE
SECTION I : BIOCHEMISTRY

1 Principles and uses of techniques in analytical biochemistry : Calorimetry, Spectrophotometry, Centrifugation, Paper Chromatography. (5 periods)
2 P^H and Buffers
   Concept of P^H and PK. P^H values of body fluids, significance. Ionization of acids and bases. Derivation of Henderson-Hassel Balch equation. Buffers : Definition, Concept, measurement of P^H, P^H meter. (4 periods)
3. Molecular Interactions :
   Definition, formation and examples of the following chemical bonds : covalent and non-covalent bonds, peptide bonds, disulphide bonds, hydrogen bonds, electrostatic bonds, Van der Waals forces, glycosidic bonds, Phospodiester bonds. (3 periods)
4. Carbohydrates :
   1. Classification
   2. Stereoisomerism, geometrical isomerism, optical isomerism and optical activity.
   3. Monosaccherides : Structure of glucose.
   4. Monosaccharides : Properties, mutarotation, oxidation-reduction reactions, glycoside formation, ester formation, osazone formation.
   5. Disaccharides : Maltose, lactose, Sucrose.
   6. Polysaccharides : Starch, glycogen, cellulose and chitin. (Structural formulae not expected)
   7. Biological importance of monosaccharides, disaccharides and polysaccharides. (6 periods)
5 Lipids :
   1. Classification
   2. Falty acids : Saturated and unsaturated, essential and non-essential, prostaglandins, acylglycerols and waxes.
   3. Occurrence and Significance of :
      a) Phospholipids : Lecthin, Cephalin
      b) Spingolipids
      c) Glycolopids
      d) Steriods
      e) Terepenoids
      f) Lipoproteins (7 periods)
6. Proteins :
   1. Amino acids : Classification, structure of amino acids, essential and non-essential amino acids, non-protein amino acids.
   2 Properties of amino acids : Physical properties, reactions of amino group carboxyl group and R-groups.
   3. Structure of Proteins : Primary, secondary, tertiary and quarternary with examples.

4. Fibrous proteins : Keratin, silk and collagens.
5. Globular proteins : (a) Antibodies (IgG) (b) Hormones : Insulin (8 periods)

7. Enzymes :
   1. Classification (outline)
   2. Properties of enzymes, lock and key model, induced fit model.
   3. Factors affecting enzymatic activity . Substrate concentration, enzyme concentration, PH, temperature, inhibitors and activators.
   4. Isozymes : Definition. Lactate dehydrogenase, Significance. (6 periods)

8 Nucleic Acids :
   1. Purines, Pyramidines, ribose, deoryribose.
   2. Nucleosides and nucleotides.
   3. Nucleotides as co-enzymes (NAD, NADH, FAD, FMN etc.)
   4. RNA- Structure and functions, RNA as a catalyst.
   5. DNA- Structure, B, A and Z-DNA; Functions of DNA. (8 periods)

9. Vitamins (Structural formulae not expected)
   1. Fat soluble : A, D, E, K
   2. Water soluble : B1, B2, B6, B12, C
   3. Sources, daily requirements
   4. Principal role in Metabolism.
   5. Deficiency diseases. (5 periods)

SECTION B : MICROTECHNIQUE

This course be taught with reference to theory and practical

1 Introduction : Definition. Scope and applications (1 period)

2. Collection of material Narcotization, decapitation.

Fixation

a) Definition
b) Improtance of fixation
c) Theory of fixation
d) Qualities of a good fixative
e) Types of fixatives : Coagulant and non coagulant. Fixatives : Primary and Compound fixatives.
f) Composition and physico-chemical reactions of following fixatives with tissues and tissue contents.
   i) Ethanol ii) Formaline iii) Acetic Acid iv) Bouin's fluid (Aqueous and alcoholic) v) Zenker's fluid vi) Carnoy's fluid
g) Specific fixatives for the following
   i) Embryo ii) Fixative for whole mounts (6 periods)

3 Washing : i) Theory ii) Significance of washing (2 periods)

4. Dehydration : i) Definition ii) Dehydrating agents - Methanol, Ethanol, acetone iii) Significance and use of dehydrating agents. (3 periods)

5. Clearing : i) Definition and importance
   ii) Clearing agents, their merits and demerits
   a) Xylene b) Toluene c) Benzene d) Chloroform e) Cedar wood oil (4 periods)

6 Embedding : i) Cold and hot infiltration
   ii) Paraffin . a) Selection of paraffin wax according to need ii) Melting and handling of paraffin, paraffin ovens and their types.
   iii) Embedding containers : a) paper trays b) Metal L s c) Glass dishes/lids
   iv) Embedding procedure and embedding faults.
   v) Orientation of the tissue in the block so as to obtain transverse and sagittal sections. (8 periods)
   vi) Storage of blocks .

7. Trimming and mounting of trimmed block on microtome peg. (2 periods)

8. Section Cutting :
   i) Microtome-Rotary-use and precautions for handling.
   ii) Cryostat for frozen sections.
   iii) Microtome knives - types and sharpening.
   iv) Razor blade holder

v) Defects and their possible causes and remedies during section cutting.
(6 periods

9. Affixing and processing of sections :
   i) Mayer's fixative ii) Slide warmers (Hot plate) iii) Procedure of affixation, common precautions and difficulties. iv) Serial sections, orientation and utilization of space on slide and their storage. (6 periods)
10. Staining :
   i) Types of stains - acidic, basic, amphoteric, neutral and vital.
   ii) Theory of staining
   iii) Stains- preparation of Haematoxyline solution.
      a) Mayer's acidified haematoxyline
      b) Ehrlich's acid haematoxyline
      c) Delafield's haematoxyline
   iv) Mordants - Definition, importance and common mordants.
   v) Staining methods- a) Haemetoxyline- eosin method
   vi) Specific staining reactions - a) Feulgen reaction b) PAS reaction
   vii) Processing of paraffin section during staining.
   viii) Vital staining - Use and importance with suitable examples. (8 periods)
11. Clearing and Mounting : i) Mounting media ii) Canada balsam iii) DPX(1 period)
12. Clearing, labelling and preservation of permanent slides. (2 periods)
13. Measurements and sketches of microscopic objects.
   a) Micrometer scale - calibration at different magnifications and measurement of cell diameter.
   b) Camera lucida - i) principle and working ii) Measurement from camera lucida sketches. (4 periods)

PAPER - V PARASITOLOGY AND MOLECULAR BIOLOGY

SECTION I : PARASITOLOGY

1. Introduction, Definition and scope of parasitology. (1 period)
2. Types of parasites - (5 periods)
   1 Ectoparasites
   2 Endoparasites Gut parasites, haemoparasites, tissue parasites and lymph parasites.
   3 Facultative and obligatory parasites.
3. Types of Hosts : (3 periods)
   Definitive, intermediate, paratenic, reservoir, vector
4. Study of the following parasites with reference to classification, geographical distribution, morphology, life cycle, transmission, pathogenicity, treatment and prophylaxis.
   1. Phylum Protozoa : a) Entamoeba histolytica b) Plasmodium vivax
   2 Phylum Platyhelminthes : a) Fasciola hepatica b) Taenia solium
   3 Phylum Nemathelminthes : a) Ascaris lumbricoides
   4. Phylum Arthropoda : a) Mite ; Sarcoptes scabei (22 periods)
5. 1) Adaptation for infectiousness 2) Adaptation for establishment
   3) Adaptation for transmission (6 periods)
6. Host specificity . (2 periods)
   Definition, structural and physiological basis.
7. Effects of parasites on hosts: (4 periods)
   1. Mechanical, lytic, nutritional, obstructive.
   2. Biological effects of Sacculina on crab.
8. Immunology and hyperinfection (6 periods)
   Infection, disease, self-cure and advancement in immunology.
9. Definition with examples : (3 periods)
   1) Zoonosis 2) Hyperparasitism 3) Pseudoparasitism 4) Parasite mix
   5) Inflammation 6) Neoplasia 7) Metaplasia 8) Hyperplasia 9) Hypertrophy.

SECTION II : MOLECULAR BIOLOGY

1. Introduction to molecular biology (1 period)
2. DNA as the genetic material. (7 periods)

Bacterial transformation and transduction. Evidences to prove that DNA is the genetic material (Avery's experiment). Plasmids. cosmids. Griffith's experiment for transformation. Zinder and Lederberg's experiment for transduction including the life cycle of bacteriophage.

3. DNA structure (revision) (2 periods)
4. Central dogma of molecular biology.
   1. DNA replication : Prokaryotic and Eukaryotic DNA replication. (5 periods)
   2. Transcription : Transcription in prokaryotes and eukaryotes, types of RNA, RNA processing (7 periods)
   3. Translation :
      a) Genetic code : Properties of genetic code (1 period)
      b) Structure of tRNA and its role as an adaptor, Wobble hypothesis (1 period)
      c) Protein synthesis : Ribosomes, Polysomes, amino acid, activation, polypeptide chain initiation, peptide bond formation, chain elongation, termination and post-translational modifications. (6 periods)
5. Concept of Operon (2 periods)

Regulation of gene action - lac operon.

6. Mutation : (6 periods)

Gene mutation and mutagenic agents, radiation, dyes and chemicals, alkylating agents and their effect on DNA. Transversons and transition. DNA repair process : Photorepair, Dark excision.

7. RNA as the genetic material : (5 periods)

RNA viruses, RNA tumour viruses, Rous sacroma virus, HIV-life cycles, reverse transcription. Hepatitis-B virus-mode of transmission, life cycle, pathogenecity and control. Oncogenes.

8. Introduction to polymerase chain reaction (PCR), Southern, Northern and Western blotting techniques, ELISA technique, DNA finger printing, polyacrylamide gel electrophoresis (PAGE), Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), Agarose gel electrophoresis. (9 periods)

PAPER VI

SECTION I - BIOINFORMATICS OR PATHOLOGY OR PUBLIC HEALTH AND HYGIENE

BIOINFORMATICS

1. Introduction :
   1. Introduction to bioinformatics.
   2. History and generations of computers.
   3. Block diagram and function of each block of computer system.
   4. Types of computers (Micro. Mini. Laptop, Mainframe, super)
   5. Definitions : Software. Hardware. Complier and Interpreter.

   (10 periods, 10 Marks)
2. Concepts of Memory :
   1. Memory cell, types of memory- RAM and ROM
   2. Storage devices - Floppy disc, Hard disc, Compact disc, magnetic disc and Magnetic tape. (6 periods)
3. Input output devices :
   1. Keyboard, Mouse, Printers. Plotters and Scanner. (6 periods)
4. Operating System :
   1. Need, Definition and function of operating system.
   2. Types of operating system - DOS and WIndow 2000.
   3. MS Office - Word, Excel and Powerpoint. (14 periods)
5. Fundamentals of Internet :
   1. History, Search engines, WWW. Web Browser.
   2. Use of internet to biologists.
   3. Creation of E-mail ID (8 periods)
6. Genome information :
   1. Functional genomics, biomolecular structure - protein and DNA.
   2. Data bases of DNA information. (8 periods)

Note : Every college should have minimum 5 computers with Internet facility and Internet should be tought on computer with interactive basis.

PATHOLOGY

1. Introduction to pathology : (2 periods)
   Definition, aim, scope and basic branches.
2. Diseases : Definition and causes. (8 periods)
   1. Abnormal heriditory factors
   2. Abnormal environmental factors.
      a) Inanimate - Physical, Chemical
      b) Animate - Pathogens- Bacterial, Viral, parasitic
   3. Nutritional deficiency
   4. Errors of metabolism
   5. Carcinogens.
3. Microbial diseases : (10 periods)
   Signs and symptoms, pathogenesis and protection.
   Baterial : Cholera, Typhoid, Tuberculosis, Leprosy, Syphillis.
   Viral : Polio myletis, meningitis, AIDS, hepatitis.
   Fungal : Candidiasis, Ring-worm infection (Teania corposis)
4. Clinical Pathology : (12 periods)
   1) Urine examination 2) Cerebrospinal fluid 3) Liver function test
   4) Renal function test 5) Glucose tolerence test (GTT) 6) Widal test
   7) ELISA 8) Western blot 9) Lipid profile, HDL, LDL 10) Pap-smear
   11) TBI, TBM, TBC
5. Necrosis : Definition, causes, changes, types. (2 periods)
6. Gangrene : Causes and types (2 periods)
7. Haematology : Blood groups (ABO+ Rh), Anaemia, Leucaemia-introduction. (3 periods)
8. Circulatory disturbance : (4 periods)
   a) Thrombosis : Definition and types
   b) Embolism : Definition and types.
   c) Shock : Definition and Types.
9. Retrogressive Changes : (4 periods)
   Cloudy swelling, fatty degeneration, amyloid degeneration, glycogen infiltration, hyaline and mucoid degeneration.
10. Disorders of Pigmentation : (3 periods)
    Melanosis, lipochromes, haemoglobin derivatics.
11. Principles and importance of the following techniques/ (2 periods)
    1) C. T. Scanning 2) MRI technique 3) Ultra sonography 4) ECG
    5) X-ray technology 6) EEG

PUBLIC HEALTH AND HYGIENE

1. Health : Definition, factors affecting health, inborn and environmental, personal and and community health World Health Organization and Services (3 periods)
   (Annonyms, blood banks, leprosy hospitals etc.)
2. Food : 1. Classification, necessity, Food preservation methods, deficiency diseases, vegetarian and non-vegetarian food.
   2. Beverages and Condiments.
   3. Adulterations and its effects- Effect of alcohol, tobacco and drugs.
   (08 periods)
3. Houses and Buildings : Residential, lodging, hospitals, Animal shades, hotels, tea shops, parlours etc. (3 periods)
4. Air and Ventilation : Composition of air, air pollution. Purification, ventilation systems (natural and artificial) (4 periods)
5. Water and Water supplies : Sources and Properties of water, Pollution and Purification, Filters of various types, examinations of water samples, uses of water, diseases spread by water and water supplies. (6 periods)
6. Soil : Composition properties, diseases spread by soil and soil pollution. (2 periods)
7. Sanitation : The disposal of human (especially from home, hospitals, hotels etc.) and animal waste, refuse and sewage. (3 periods)
8. Diseases : 1. Communicable diseases, their causatives organisms, signs, symptoms, modes of transmission, prevention and control.
   a) Excremental - Typhoid, Cholera and dysentries.
   b) Air borne - Common cold, Influneza, chickenpox, measals, tuberculosis.
   c) Arthropod borne - Malaria, filariasis, dengue, encephalitis, guinea worm diseases, plague.
   d) Contact infections - Venerial diseases, skin diseases, AIDS.
   e) Alimentary Infections - Helminths and bacterial
   2. Non Communicable diseases- Heart diseases, Diabetes, etc. (9 periods)
9. Pets : General information about pets, cats, dogs. (1 period)
10. Pests : 1. Definition, household pests, housefly, cockroach, silverfish, ants and rats.
    2. External parasites - Mosquito, Bed bug, mites and fleas, tick.
    3. Internal Parasites - Round worms and hook worms, Tapeworm.
    (4 periods)
11. Social and Industrial Hygiene : Accidents, emergencies in home and industry, occupational diseases, prevention, provisions for disabled-mental hygiene. (4 periods)
12. Radiation risks : (2 periods)
13. Vital Statistics : A general idea about the vital statistics and its importance. (3 periods)

Total 52 periods

PAPER VI
SECTION II : BIOTECHNOLOGY

1 Biotechnology :

Definition. Introduction. Scope and Importance. (2 periods)

2. Animal cell and Tissue culture :

1 Culture Media and procedures : Scope of animal cell and tissue culture, advantages and disadvantages of tissue culture, media for cells and tissues, culture procedures, applications of tissue culture. (5 periods)

2. Primary Culture, cell lines and cloning :

Disaggregation (mechanical and enzymatic) of tissues and primary culture, cultured cells and evolution of cell lines, Maintenance of cultures-cell lines, cloning of cell lines, large scale cell culture in biotechnology, Somatic cell fusion. (6 periods)

3. Tissue and organ culture :

Primary explantation techniques- Tissue culture (Slide, test tube and flask culture) organ culture, whole embryo culture, tissue engineering (artificial skin and artificial cartilage) (4 periods)

3. Genetic Engineering :

Introduction recombinant DNA technique Identification and isolation of desired gene, purified DNA and restriction enzymes, restriction analysis, vectors, probing, cloning and gene expression, cell-cell fusion, insertion of recombinant DNA, Production of human insulin, production of growth hormone, production of interferons and vaccines. (12 periods)

4. Transfection Methods and Transgenic Animals :

Gene transfer or transfection, targeted gene transfer, transgenic animals (Mice, sheep, pigs, chick, rabbits, goats, cows, fish) (3 periods)

5. Immunotechnology :

1. Immune system, Antibodies, Interferons and vaccines :

Natural immunity and acquired immunity, immune responses (B-cells and T-cells), Structure of immunoglobulins, genetics and molecular biology of the production of antibodies or interferons, vaccine development and immunization. (5 periods)

2. Hybridoma and Monoclonal Antibodies :

Hybridoma technology and the production of monoclonal and polyclonal antibodies, antibody engineering using genetic manipulation, alternatives to hybridoma technology, production of human and humanised antibodies, uses of monoclonal antibodies (diagnosis, imaging, therapy, vaccines, enzymes etc.) (6 periods)

6. Industrial Biotechnology :

Introduction, enzymes technology, biological sources of enzymes, commercial production of enzyme and its packaging, enzymes-immobilization and their uses in industry. (3 periods)

7. Biotechnology in Medcine :

Animal and human health care (vaccines, coma diagnosis and cure of diseases including gene therapy and transplantation of bone narrow/ artificial skin), genetic counselling, forensic medcine. (3 periods)

8. Biotechnology and Environment :

Pollution control : Cleaner technologies, reducing environmental impact of industrial effluents, toxic site reclamation, reducing environmental impact of chemical herbicides and fertilizers, biosensors to detect environmental pollutants. (3 periods)

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PAPER-VII

PRACTICAL I : ANATOMY OF NON - CHORDATES II & CHORDATES III , BIOCHEMISTRY AND MICROTECH... PRACTICALS

I I Paramoecium
(a) External Morphology
(b) Binary Fission
(c) Conjugation

2. Leech
(a) External Characters
(b) Dissection of leech so as to expose
1) Digestive System
2) Reproductive System
3) Nervous System
(c) Mountings
Jaws, salivary glands, Botryoidol tissue of leech.

3. Star Fish
(a) External Characters
(b) Dissection of starfish so as to expose
i) Digestive System
ii) Water Vascular system
(c) Mountings :- Tube feet and Gonads (To show gametes)

II Study of the following animal with reference to morphological pe... economic importance if any

1) Protozoa	:-	Arcella, Euglena, Vorticella an...
2) Porifera	:-	Euplectella, Hyuonema Bot...
3) Coelenterata	:-	Obelia, Physalia, Pennatula, Corals and Beroe.
4) Platyhelminthes	:-	Planria, Polystomum, Taenia...
5) *Nematoda*	:-	*Trichinella, Ancyclostoma, A...*
6) *Annelida*	:-	*Chaetopterus, Pheretima and Po...*
7) *Arthropoda*	:-	*Balanus, Lobster, Termite, Butterfly, Spider , Centipede and Ap...*
8) Echinodermata	:-	Sea urchin, Sea cucumber , Brittle star, Sea lily .

III Calotes
1) External Characters
2) Dissection
a) Digestive System
b) Arterial System
c) Venous System

...Reproductive System
...Brain
...Meninges
...Pecten
...Scales
...Hyoid apparatus.
...following animals with reference to morphological peculiarities and ...mportance if any

...chordates	-	Doliolum, Salpa, Pyarosoma and simple ascidian.
...thostomes	-	Petromyzon, Myxine.
...	-	Sawfish, Exocoetus, Electric ray, Anabas, Clarias, Pomfret, Bombay duct, Hammer Headed Shark, Suckerfish.
...ibia	-	Ichthyophis, Salamander, Hyla, Rhacophorus, Proteus.
...ata	-	Turtle, Chameleon, Crocodile. Cobra, Ratsnake, Varanus.
...	-	Duck, Kite, Parrot, Woodpecker, King fisher (Only beaks and feet).
...ata	-	Loris, Kangaroo, Scaly ant eater, Whale, Bat, Squirrel.

...e study :
...parative Histology of skin - Scoliodon. Frog, Pigeon and Rat.
...parative study of Heart -Scoliodon, Frog, Pigeon and Rat.
...parative study of Brian - Scoliodon, Frog, Pigeon and Rat
...Study tour visit - to a Costal area, Sanctury, Zoo, National park, ...Research Laboratories of Biological importance.
...should be included in the Journal as a separate Practical.

BIOCHEMISTRY PRATICALS

...Experiments
1. Identication of Carbohydrates (mixture not expected)
(a) Thymol test (b) Iodine test (c)Phosphoric acid test (d) Benedict's test
(e) Cupric acetate test (f)Phenyl hydrazine reaction
2. Isolation of Casein from milk.
3. Isolation of DNA from liver.
4. Isolation of RNA from liver.
5. Factors affecting enzymatic reactions to demonstrate effects of temperature, P^H (acid, alkali), alcohol, inhibitors and activators.
6. Chemical tests for amino acids.
7. Detection of amino acids by circular or ascending paper Chromato graphy.
8. Estimation of protein by Lowry's method.

Minor Experiments

1. Study of analytical instruments , balances. incubators. P^H meter. Ca... Spectrophotometer and Centrifuge.
2. Isolation of starch from patato.
3. Isolation of haemoglobin
4. Isolation of thrombin
5. Isolation of fibrinogen.
6. Preparation of buffer solutions of given molarity and P^H value.
7. Preparation of solutions of given percentage, molarity and normality us... appropriate glassware.

Note. 1) Any five majar experiments must be conducted.
2) Minor experiment No.1 - Study of analytical instruments is compulsory. An... other four minor experiments must be also condicted (Total : Five minor experiments)

MICROTECHNIQUE PRACTICLAS.

1. Preparation of Permamemt whole mounts of different kinds - 5 slides.
2. Preparation of Permamemt slides of histological sections from different organs - 5 slides.
3. Staining by Feulgen reaction.
4. Staining by PAS reaction.
5. Vital staining - Staining of mitochondria by Janus green.
6. Calibration of micrometer scale and measurement of cell diameter from the given permanant slide
7. Sketching by camera lucida and measurement of cell diameter from the sketches.

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PAPER VIII

...AL II : CELL BIOLOGY, DEVELOPMENTAL BIOLOGY, PARASITOLOGY AND MOLECULAR BIOLOGY

CELL BIOLOGY

1. ...of mitosis in onion root tips by squash preparation.
2. Study of meiosis from grasshopper testes / Tradiscantia buds by squash preparation.
3. Preparation of salivary gland chromosome from Chironomus larva or Drosophila larva.
4. Observation of living Amoeba / paramoecium / Euglena for locomotory movements.
5. Study of mitochondria in suitable material using Janus Green B. Stain.
6. Study of cell death in Chick embryo
7. Study of cell organelles from xerox materials or from microphotographs.

DEVELOPMENTAL BIOLOGY PRACTICALS

1. Study of male gamates of Amphioxus, Frog, bird and mammal.
2. Study of female gamates of Amphioxus frog, bird and mammal.
3. Study of blastulae of Amphioxus, frog and bird.
4. Study of gastrulae of Amphioxus, frog and bird.
5. Mounting / temporary preparation of Chick embryos.
6. Study of whole mounts of chick embryos : Primitive streak (13 to 16 hours), Head process (18 hours), Head fold (24 hours), different stages of development - 33, 48 and 72 hours of incubation.
7. Study of chick embryo sections to observe brain and heart in 48 hours and 72 hours cross sections.
8. Study of different types of placentae with suitable histological slides or xerox materials.

PARASITOLOGY PRACTICALS

1. Study of mouthparts of vectors Anopheles, Housefly.
2. Study of Structure and life cycle stages of protozoan parasites. (Entamoeba, Plasmodium)
3. Study of structural modifications of parasites Fasciola . Taenia , Bedbug (sanax)
4. Study of parasites with refernce to habit, habitat, life history and pathogenicity Fasciola . Taenia . Ascaris .
5. Study of endoparasites (Rectal parasites) from Cockroach / Frog or any suitable animal.
6. Mounting of helminth parasites from suitable animal
7. Life cycle of Anopheles mosquito by culture method

MOLECULAR BIOLOGY PRACTICALS

Major Experiments

1. Preparation of DNA paper model and study of the structure of DNA.
2. Estimation of DNA by Diphenylamine reagent.
3. Estimation of RNA by Orcinol reagent.
4. Mounting of Salivry gland chromosomes from Chironomus or Drosophila larvae.

Minor Experiments

1. Study of human karyotype from chromosome spread photograph.
2. Methyl green - Pyronin staining for DNA and RNA in tissue sections or Protozoan cells.

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PAPER IX

PRACTICAL III : MAMMALIAN HISTOLOGY, MAMMALIAN PHYSIOLOGY, BIOINFORMATICS, PATHOLOGY, PUBLIC HEALTH AND HYEGINE AND BIOTECHNOLOGY.

MAMMALIAN HISTOLOGY PRACTICALS

Temporary stained preparation of following tissues of Rat.
a) Striated muscle fibre b) Medullaed nerve fibre c) Squamous epithelium
d) Areolar connective tissue e) Hyaline cartilage
Study of histological microslides of the following.
1) V. S. of skin 2) V. S. of tooth 3) T. S. of tongue 4) T. S. of oesophagus
5) T. S. of stomach 6) T. S. of duodenum 7) T. S. of ileum 8) T. S. of rectum
9) C. S. of Salivary gland 10) C. S. of Pancreas 11) T. S. of trachea
12) C. S. of lung 13) T. S. of artery 14) T. S. of vein 15) Blood smear
16) V. S. of kidney 17) C. S. of kidney 18) C. S. of testis 19) C. S. of ovary
20) T. S. of placenta 21) V. S. of pituitary.

MAMMALIAN PHYSIOLOGY PRACTICALS

Major Experiments

Digestion of starch by Salivary amylase.
Calculation of respiratory quotient (R.Q.) in rat.
Differential Count of W.B.C.
Estimation of haemoglobin
Total Count of R.B.C.
Total Count of W.B.C.
Study of Simple muscle twitch by kymograph method.
Detection of abnormal urine Constituents.
Study of heart beats by kymographic method (a) Effect of temperature
(b) Effect of drugs.

Minor Experiments

Preparation of haemin Crystals.
Estimation of haemoglobin
Measurement of blood pressure.
Determination of normal urine constituents.
Study of oestrus cycle by vaginal smear technique.
Digestion through intestine.
Titrable acidity of Urine.

Any five major experiments and five minor experiments must be conducted.

BIOINFORMATICS PRACTICALS

Demonstration of booting
Demonstration of Dos commands (atleast 6)
Creation of an application (letter) using M S Word.

4. Creation of a picture using 'Paint' toolbar.
5. Preparation of a mark statement using Excel.
6. Preparation of a table using some biological information / data.
7. Creation of various graphs (Pie, Pie chart, histograms) using Excel.
8. Introduction to internet surfing and E-mail.
9. Preparation of a presentation on Power Point.
10. Compulsory visit to Bioinformatics Center.

PATHOLOGY PRACTICALS

1. Normal and Abnormal constituents of urine.
2. Estimation of haemoglobin.
3. Differntial count of W.B.Cs.
4. Semen analysis : Normal and abnormal count from Rat testis.
5. E.S.R. and P.C.V.
6. Widal test
7. Study of pathogenic agents with the help of microscopic slides. (any four)
   a) Malarial parasite (P.vivax, P. falciperium)
   b) Trypanosoma
   c) Vibrio cholerae
   d) Salmonella typhii
   e) Mycobacterium tuberculosis
   f) Pneumococci
8. Study of inflammed tissues / Pathological lesions using charts or slides.
   a) Lung - Lobar pneumonia
   b) Intestine - typhoid
   c) Lymph - node tuberculosis
   d) Lung - tuberculosis.
   e) Carcinoma of any tissue.
   f) Neutrophilia.
   g) Fibrosis.
9. Specimens using charts or slides. (any two)
   a) Ovarian Cysts.
   b) Thyroid goitre.
   c) Liver abscess.
10. Study of Nematode parasites with the help of slides / specimens

PUBLIC HEALTH AND HYGIENE PRACTICAL

1. Detection of adulterents in food and oils. (Chilli powder, Tea powder, Turmeric, Honey, Mustard, Rava, Edible oils and Fats)
2. Study of Animal Vectors.
   I) Vectors :- Mosquitoes, Tick, Housefly, Head louse, Bed bug, Rat, flea.
3. Study of Pathological slides :

   i) Salmonella typhi
   ii) Vibrio cholerae
   iii) Mycobacterium tuberculae
   iv) Wuchereria bancrofti
   v) Mycobacterium lepriae
   vi) E. coli.
   vii) Trypanosoma
   viii) Trichinella spiralis.
   ix) Dengue virus
   x) HIV
   xi) Carcinoma/Sarcoma/Leukemia
4. Compulsory visit to a) Water purification plant.
   b) Health centre.
   c) Sewage disposal plant
   d) Vital statistical centre.
5. Calculation of Biological oxygen demand from sewage water / Industrial effluent
6. Demonstration of Guppy fish.

BIOTECHNOLOGY PRACTICALS

1. Demonstration of ethanol production by fermentation.
2. Preparation of Cheese.
3. Study of biogas plant from suitable models or actual functioning of the plant.
4. Isolation and purification of micro- organism on nutrient agar by dilution plate method.
5. Isolation and purification of micro- organism on nutrient agar by streak plate method.
6. Isolation and estimation of chromosomal DNA from rat liver or micro-organisms.
7. Determination of blood groups by antigen - antibody reactions.
8. Separation of serum proteins by polyacrylamide gel electrophoresis.
9. Estimation of salivary amylase activity.
10. Submission of report of visit to diary or tannary or pharmaceutical industry.

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Note: 2 Theory and One Seminar Per Course Per Year

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