

B.Sc Biotechnology

120 hrs

(4 hrs/ week)

II Year B.Sc

## Paper II - Biological Chemistry and Microbiology

## UNIT - I

## Biomolecules

35 hours

- 1.1 Carbohydrates : Importance, classification and properties  
 1.2 Structure, configuration and biochemical importance of monosaccharides (glucose and fructose)  
 1.3 Dissacharides - Structures and biochemical importance of sucrose and trehalose  
 Physiologically important glycosides (streptomycin, cardiac glycosides, ouabain)  
 1.4 Structure and function of homo polysaccharides - starch, inulin, cellulose and glycogen  
 Structure and function of heteropolysaccharides - Hyaluronic acid
- 1.5 **Proteins** : Classification, structure and properties amino acids  
 1.6 Peptide bond - Synthesis and characters  
 1.7 Primary, secondary, tertiary and quaternary structures of proteins
- 1.8 **Lipids** : Fatty acids : Saturated and unsaturated  
 1.9 Triacylglycerols, Spingolipids, Sterols  
 Phospholipids (phosphatidic acid, phosphatidylcholine)
- 1.10 **Enzymes** : Classification and nomenclature of enzymes  
 Kinetics of enzyme catalyzed reactions  
 1.11 Factors influencing enzymatic reactions  
 (a) pH (b) Temperature (c) Substrate concentration (d) Enzyme concentration  
 1.12 Enzyme Inhibition - Competitive and non-competitive

## Unit II

## Intermediary Metabolism

30 hours

- 2.1 Glycolysis  
 2.2 Citric acid cycle  
 2.3 Gluconeogenesis and its significance  
 2.4 Mitochondrial electron transport  
 2.5 Chemiosmotic theory of ATP synthesis  
 2.6  $\beta$ -Oxidation of fatty acid  
 2.7 Deamination, decarboxylation and transamination reactions of amino acids  
 2.8 Catabolism of amino acids - phenyl alanine and tyrosine (Phenylketonuria and albinism)  
 2.9 Photosynthesis - Light reaction and photophosphorylation  
 2.10 Carbon Assimilation

Unit III Fundamentals of Microbiology 25 hours

- 3.1 Outlines of classification of microorganisms
- 3.2 Structure and general characters of Viruses, Bacteria, Fungi and Micro Algae (one example from each group)
- 3.3 Disease causing pathogens and their symptoms (examples: Typhoid, HIV only)
- 3.4 Isolation, identification and preservation of microorganisms (Bacteria)
- 3.5 Identification methods of Fungi and useful Micro Algae
- 3.6 Methods of sterilization
- 3.7 Bacterial reproduction and growth kinetics (Batch and continuous cultures)
- 3.8 Pure cultures and cultural characteristics

UNIT – IV Principles and Applications of Biophysical Techniques 30 hours

- 4.1 Microscopy – Light, Inverted, Fluorescent and Electron microscopy
- 4.2 Colorimetry – Beer – Lambert's Law
- 4.3 UV-VIS Spectrophotometry
- 4.4 Chromatography  
(a) Paper (b) Thin Layer (c) Ion-exchange (d) Gel-filtration
- 4.5 Electrophoresis – Native gels and SDS-PAGE, Agarose
- 4.6 Centrifugation and filtration – Basic Principles
- 4.7 Dialysis and lyophilization
- 4.8 Radio isotopes and their use in biology

Practical Paper - II

90 hrs  
(3 hrs/ week)

Practicals

- Preparation of Normal, Molar and Molal solutions
- Preparation of Buffers (Acidic, Neutral and Alkaline Buffers)
- Qualitative tests of sugars, amino acids and lipids
- Estimations of protein by Biuret method
- Estimation of total sugars by anthron method
- Separation of amino acids by paper chromatography
- Electrophoretic separation of proteins (SDS-PAGE)
- Technique of Micrometry (Stage and ocular)
- Enzyme assay – Catalase or Invertase (or any other enzyme)
- Preparation of routine microbiological media.
- Isolation of common non-pathogenic bacteria
- Staining and identification of bacteria – *E.coli*, *Pseudomonas*, *Bacillus* and *Staphylococcus*

Recommended Books

- Biochemistry - By Dr. U. Satyanarayana, U. Chakrapani
- Biochemistry - By J.L. Jain
- Biochemistry - By Conn and Stumpf
- Biochemistry - By Lehninger
- Textbook of Medical Biochemistry - By S. Ramakrishnan, R. Rajan, and K.G. Prasanna (Orient Longman)
- Biochemistry - By Stryer
- Biochemistry - By Voet and Voet
- Biochemistry (Jaypee) - By Vasudevan
- Biochemistry - By David Rawn
- General Biochemistry - By J.H. Well
- Biochemistry - By K. Trehan
- Biochemical Methods - By S. Sadasivam and A. Manickam
- An introduction to Practical Biochemistry - By T. Plummer
- Experimental Biochemistry - A Student Companion - By V. Deshpande and B. Sasidhar Rao
- Practical Biochemistry - By Upadhyay, Wilson and Wilson, Wilson & Walker
- Biochemistry - Viva Series
- Text Book of Microbiology - By Ananthanarayan and Paniker
- Microbiology - By Cappuccino (Pearson Education)
- Microbiology - By Tortora (Pearson Education)
- Microbiology - B.J. Pelczar, E.S.N. Chan and N.R. Kreig, McGraw Hill Publ.
- General Microbiology - By Stanier, R.Y, J.L. Ingrahm, M.L. Wheelis & P.R. Painter
- General Microbiology - By Powar (Vol. I and Vol. II).
- Practical Microbiology - By Aneja.



New - 2010

P-63



## Bio-chemistry

Biochemistry 9 of 21

### 2<sup>nd</sup> Year Theory - Paper-II: Metabolism and Biochemical Techniques

120 hrs  
(4 hrs/week)

#### Unit-I : Bioenergetics and Biological Oxidations

30 hours

Energy transformations in the living system, Free energy concept. Exergonic and endergonic reactions. High energy compounds. Phosphate group transfer potential. Substrate level phosphorylation.

Biological oxidations: Definition, enzymes involved- oxidases, dehydrogenases and oxygenases. Redox reactions. Redox couplers. Reduction potential ( $\mathcal{E}$ ,  $\mathcal{E}_0$ ,  $\mathcal{E}'_0$ ). Standard reduction potential ( $\mathcal{E}'_0$ ) of some biochemically important half reactions.

Ultra structure of mitochondria. Electron transport chain and carriers involved. Oxidative phosphorylation, theories of oxidative phosphorylation- Mitchell's chemiosmotic theory.  $F_0 F_1$ - ATPase. Inhibitors of respiratory chain and oxidative phosphorylation, uncouplers. Formation of reactive oxygen species and their disposal through enzymatic reactions. Ultra structure of chloroplast, Cyclic and non-cyclic photophosphorylation.

#### Unit- II : Carbohydrate and Lipid Metabolism

30 hours

Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvate- formation of lactate and ethanol, Pasteur effect. Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle,  $C_4$  Pathway.

Catabolism of fatty acids ( $\beta$ - oxidation) with even and odd number of carbon atoms, Ketogenesis, *de novo* synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol.

#### Unit-III : Metabolism of Nitrogen Compounds

30 hours

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine. Inborn errors of aromatic and branched chain amino acid metabolism.

Biosynthesis and regulation of purine and pyrimidine nucleotides, *de novo* and salvage pathways. Catabolism of purines and pyrimidines. Biosynthesis of deoxyribonucleotides- ribonucleotide reductase and thymidylate synthase and their significance. Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome.

Biosynthesis and degradation of heme.

30 hours

**Unit-IV : Biochemical Techniques**

Methods of tissue homogenization: (Potter-Elvehjem, mechanical blender, sonicator and enzymatic).

Principle and applications of centrifugation techniques- differential, density gradient. Ultra-centrifugation- preparative and analytical.

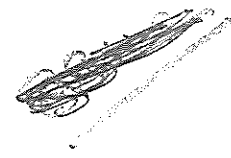
Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ion-exchange and affinity chromatography. Elementary treatment of an enzyme purification.

Electrophoresis- principles and applications of paper, polyacrylamide (native and SDS) and agarose gel electrophoresis.

Colorimetry and Spectrophotometry- Laws of light absorption- Beer-Lambert law. UV and visible absorption spectra, molar extinction coefficient, biochemical applications of spectrophotometer. Principle of fluorimetry.

Tracer techniques: Radio isotopes, units of radio activity, half life,  $\beta$  and  $\gamma$ - emitters, use of radioactive isotopes in biology.

KAKATIYA UNIVERSITY  
B.Sc. II YEAR SYLLABUS  
BOTANY (Theory)



**Part - II: Anatomy, Embryology, Taxonomy and Medicinal Botany**  
(Total Hours of Teaching: 120 @ 4h/Week)

<b>Part - I: ANATOMY</b>	<b>(30 h)</b>
<b>Meristems:</b> Types, histological organization of shoot and root apices and theories.	(4 h)
<b>Tissues and Tissue Systems:</b> Simple, complex and special tissues.	(6h)
<b>Leaf:</b> Ontogeny, diversity of internal structure; Stomata and epidermal outgrowths.	(6 h)
<b>Stem and root anatomy,</b> Vascular cambium – Formation and function. Anomalous Secondary <sup>growth</sup> – general account. <b>Stem</b> – <i>Achyranthes</i> , <i>Boerhavia</i> , <i>Euphorbia</i> , <i>Dracaena</i> ; <b>Root</b> – <i>Beta vulgaris</i>	(8 h)
<b>Wood structure:</b> General account. Study of local timbers – Teak ( <i>Tectona grandis</i> ), Rosewood, ( <i>Dalbergia latifolia</i> ), Red sanders, ( <i>Pterocarpus santalinus</i> ) Nallamaddi, ( <i>Terminalia tomentosa</i> ( <i>T. alata</i> )) <i>Yegisa</i> ( <i>Pterocarpus marsupium</i> ), and Neem ( <i>Azadirachta indica</i> )	(6 h)

<b>Part - II: EMBRYOLOGY</b>	<b>(24 h)</b>
<b>Introduction to Embryology.</b>	
<b>Male structure,</b> Microsporogenesis and development of male gametophyte.	(5 h)
<b>Female structure and types;</b> Megasporogenesis; types and development of female gametophyte.	(6 h)
<b>Pollination</b> – Types; Pollen – pistil interaction. Fertilization.	(4 h)
<b>Endosperm</b> – Development and types. Embryo – development and types: Polyembryony and Apomixis – an outline	(5 h)
<b>Phytology:</b> Pollen morphology, NPC systems, application of Phytology.	(4 h)

<b>Part - III: TAXONOMY</b>	<b>(36 h)</b>
<b>Introduction :</b> Principles of Plant Systematics, Systematics vs Taxonomy, Types of classification : Artificial, Natural and Phylogenetic	(4h)
<b>Systems of classification :</b> Salient features and comparative account of <b>Smith &amp; Hooker</b> and <b>Engler &amp; Prantle</b> .	
<b>An introduction to Angiosperm Phylogeny Group (APG)</b>	(6 h)
<b>Current concepts in Angiosperm Taxonomy :</b> Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy.	(4 h)
<b>International and Taxonomic resources:</b> An introduction to ICBN, <b>Binomial code</b> – a brief account. Herbarium: concept, techniques and applications	(6 h)

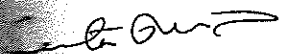
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15. Systematic study and economic importance of plants belonging to the following families: Annonaceae, Capparaceae, Rutaceae, Fabaceae (Faboideae/papilionoideae, Caesalpinoideae, Mimosoideae), Cucurbitaceae, Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae and Poaceae (16 h)

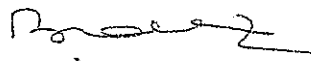
**UNIT- IV: MEDICINAL BOTANY**

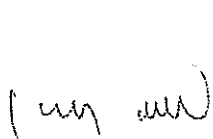

**(30 h)**

16. Ethnomedicine: Scope, interdisciplinary nature, distinction of Ethnomedicine from Folklore medicine. Outlines of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine. Role of AYUSH, NMPB, CIMAP and CDRI (8 h)
17. Plants in primary health care: Common medicinal plants – Tippateega (*Tinospora cordifolia*), tulasi (*Ocimum sanctum*), Pippallu (*piper longum*), Karaka (*Terminalia chebula*), Kalabanda (*Aloe vera*), Turmeric (*Curcuma longa*). (4 h)
18. Traditional medicine vs Modern medicine : Study of select plant examples used in traditional medicine as resource (active principles, structure, usage and pharmacological action) of modern medicine : Aswagandha (*Withania somnifera*), Sarpagandha (*Rauvolfia serpentina*), Nela usiri (*Phyllanthus amarus*), Amla (*Phyllanthus emblica*) and Brahmi (*Bacopa monnieri*). (6 h)
19. Pharmacognosy : Introduction and scope, Adulteration of plant crude drugs and methods of identification – some examples. Indian Pharmacopoeia. (6 h)
20. Plant crude drugs : Types, methods of collection , processing and storage practices, Evaluation of crude drugs. (6 h)





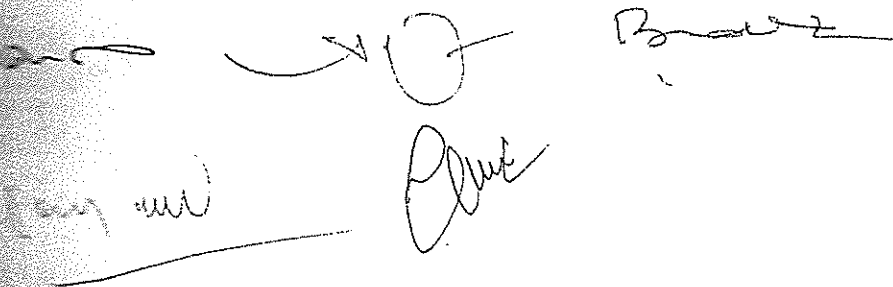




## SUGGESTED READINGS:

- Chatterjaya et. al 2007 . A text book of Palynology, Central , New Delhi.
- Chatterjani, S.S. and S.P. Bhatnagar, 2000. The Embryology of Angiosperms (4<sup>th</sup> Ed.), Vikas Publishing House, Delhi.
- Chatterjani, P.H. and V.H. Heywood. 1963, Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
- Chatterjani, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
- Chatterjani, V.H. 1965. Plant Taxonomy, ELBS, London
- Chatterjani, V.H. and D.M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London
- Chatterjani, S.K. and V.Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahedra Pal Singh , Dehradun.
- Chatterjani, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
- Chatterjani, B.M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.
- Chatterjani, S.G. 2000. Medicinal Plants. Oxford and IBH, New Delhi.
- Chatterjani, R.P. 1986. Pollination biology. Inter India Publishers, New Delhi.
- Chatterjani, C. and Gokeale – Pharmacognosy – Nirali Prakashan, New Delhi.
- Chatterjani, V. 1984. Ayurveda – The Science of Self-healing. Motilal Banarasidass, New Delhi.
- Chatterjani, W.H. and M.P.F. Elwin Lewis. 1976. Medical Botany, Plants Affecting Man's Health. A Wiley Inter Science Publication, John Wiley and Sons, New York.
- Chatterjani, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
- Chatterjani, B.P. 2007. Botany for Degree Students : Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd., New Delhi.
- Chatterjani, R.R. and B.N. Mehrotra. 1993. Compendium of Indian Medicinal Plants. Vol.I & II. CSIR, Publication and Information Directorate, New Delhi.
- Chatterjani, V.V. and I. Balasubramaniyan. 1994. Ayurvedic Drugs and their Plant Sources. Oxford and IBH, New Delhi.
- Chatterjani, C.A. 1989. Plant Taxonomy and Biostatistics (2<sup>nd</sup> Ed.). Edward Arnold, London
- Chatterjani, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.

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CHEMISTRY

New-2010

Chemistry 10 of 28

B.Sc. II Year, Paper - II

120 hrs (4 h / w)

UNIT - I (Inorganic Chemistry - II)

30 h (1h/w)

I. Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states and e.m.f. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu traids in respect of electronic configuration and reactivity of different oxidation states.

9 h

II. Chemistry of f-block elements: Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties, spectral properties and separation of lanthanides by ion exchange and solvent extraction methods. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, position of actinides in the periodic table, comparison with lanthanides in terms of magnetic properties, spectral properties and complex formation.

8 h

III. Theories of bonding in metals: Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

6 h

IV. Metal carbonyls and related compounds - EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni. Metal nitrosyls and metallocenes (only ferrocene).

7 h

UNIT-II (Organic Chemistry - II)

30hrs (1 h / w)

I. Halogen compounds

4 h

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl halides.

Chemical Reactivity, formation of RMgX

Nucleophilic aliphatic substitution reaction- classification into S<sub>N</sub>1 and S<sub>N</sub>2.

Energy profile diagram of S<sub>N</sub>1 and S<sub>N</sub>2 reactions. Stereochemistry of S<sub>N</sub>2 (Walden Inversion) S<sub>N</sub>1 (Racemisation). Explanation of both by taking the example of optically active alkyl halide - 2-bromobutane. Ease of hydrolysis - comparison of alkyl, benzyl, allyl, vinyl and aryl halides

**2. Hydroxy compounds**

6 h

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene.

Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water.

Chemical properties:

a. acidic nature of phenols.

b. formation of alkoxides/phenoxides and their reaction with RX.

c. replacement of OH by X using  $\text{PCl}_5$ ,  $\text{PCl}_3$ ,  $\text{PBr}_3$ ,  $\text{SOCl}_2$  and with  $\text{HX/ZnCl}_2$ .

d. esterification by acids ( mechanism).

e. dehydration of alcohols.

f. oxidation of alcohols by  $\text{CrO}_3$ ,  $\text{KMnO}_4$ .

g. special reaction of phenols: Bromination, Kolb-Schmidt reaction, Riemer-Tiemann reaction, Fries rearrangement, azocoupling.

Identification of alcohols by oxidation with  $\text{KMnO}_4$ , ceric ammonium nitrate, lucas reagent and phenols by reaction with  $\text{FeCl}_3$ .

Polyhydroxy compounds: Pinacol-Pinacolone rearrangement.

**3. Carbonyl compounds**

10 h

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group.

Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids.

Physical properties: absence of hydrogen bonding, keto-enol tautomerism, reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a)  $\text{NaHSO}_3$ , b)  $\text{HCN}$ , c)  $\text{RMgX}$ , d)  $\text{NH}_2\text{OH}$ ,

e)  $\text{PhNHNH}_2$ , f) 2,4 DNP, g) Alcohols-formation of hemiacetal and acetal.

Halogenation using  $\text{PCl}_5$  with mechanism.

Base catalysed reactions: a) Aldol, b) Cannizzaro reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction.

Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones.

Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ .

Analysis of aldehydes and ketones with a) 2,4-DNT test, b) Tollen's test, c) Fehling test, d) Schiff test, e) Haloform test (with equation).

**4. Carboxylic acids and derivatives**

6 h.

Nomenclature, classification and structure of carboxylic acids.

Methods of preparation by a) hydrolysis of nitriles, amides and esters.

b) carbonation of Grignard reagents.

Special methods of preparation of aromatic acids by a) oxidation of side chain.

b) hydrolysis by benzotrichlorides.

c) Kolbe reaction.

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Physical properties: Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids.

Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard- Zelinsky reaction.

Derivatives of carboxylic acids: Reaction of acid chlorides, acid anhydrides, acid amides, esters (mechanism of the hydrolysis of esters by acids and bases).

5. Active methylene compounds 4 h

Acetoacetic esters: preparation by Claisen condensation, keto-enol tautomerism. Acid hydrolysis and ketonic hydrolysis.

Preparation of a) monocarboxylic acids.  
b) dicarboxylic acids.

Reaction with urea

Malonic ester: preparation from acetic acid.

Synthetic applications: Preparation of  
a) monocarboxylic acids (propionic acid and n-butyric acid).  
b) dicarboxylic acids (succinic acid and adipic acid).  
c)  $\alpha,\beta$ -unsaturated carboxylic acids (crotonic acid).

Reaction with urea.

6. Exercises in interconversion 2 h

Unit - III (Physical chemistry - II) 30hrs (1h / w)

1. Phase rule 5 h

Concept of phase, components, degree of freedom. Derivation of Gibbs phase rule. Phase equilibrium of one component - water system. Phase equilibrium of two-component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, desilverisation of lead. Solid solutions- compound with congruent melting point- (Mg-Zn) system, compound with incongruent melting point - NaCl- water system. Freezing mixtures.

2. Dilute solutions 8 h

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties. Van't Hoff factor, degree of dissociation and association.

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### Electrochemistry

17 h

Specific conductance, equivalent conductance, measurement of equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorf's method. Application of conductivity measurements-determination of dissociation constant ( $K_a$ ) of an acid, determination of solubility product of sparingly soluble salt, conductometric titrations. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes. Electrode reactions, Nernst equation, single electrode potential, standard Hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance. Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Applications of EMF measurements, Calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$  and  $K$ ). Determination of pH using quinhydrone electrode, Solubility product of AgCl. Potentiometric titrations.

### Unit IV (General chemistry-II)

30 hrs (1h/w)

#### 1. Molecular symmetry

5h

Concept of symmetry in chemistry-symmetry operations, symmetry elements. Rotational axis of symmetry and types of rotational axes. Planes of symmetry and types of planes. Improper rotational axis of symmetry. Inversion centre. Identity element. The symmetry operations of a molecule form a group. Flow chart for the identification of molecular point group.

#### 2. Theory of quantitative analysis

8 hrs

- Principles of volumetric analysis. Theories of acid-base, redox, complexometric, iodometric and precipitation titrations, choice of indicators for these titrations.
- Principles of gravimetric analysis: precipitation, coagulation, peptization, coprecipitation, post precipitation, digestion, filtration and washing of precipitate, drying and ignition, precipitation from homogenous solutions, requirements of gravimetric analysis.

#### 3. Evaluation of analytical data.

4 h

Theory of errors, idea of significant figures and its importance, accuracy – methods of expressing accuracy, error analysis and minimization of errors, precision – methods of expressing precision, standard deviation and confidence limit.

#### 4. Introductory treatment to:

##### a) Pericyclic Reactions

5 h

Concerted reactions, Molecular orbitals, Symmetry properties HOMO, LUMO, Thermal and photochemical pericyclic reactions. Types of pericyclic reactions – electrocyclic, cycloaddition and sigmatropic reactions – one example each.

## LABORATORY

## Practical F

## I. Titrimet

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- 2) Det
- 3) Det
- 4) Det
- 5) Det
- 6) Det
- 7) Det

## II. Gravim

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- 2) De
- 3) De
- 4) De
- 5) De

## b) Synthetic strategies

4 h

Terminology – Disconnection (dis), Symbol ( $\Rightarrow$ ), synthon, synthetic equivalent (SE), Functional group interconversion (FGI), Linear, Convergent and Combinatorial syntheses, Target molecule (TM). Retrosynthesis of the following molecules

- 1) acetophenone
- 2) cyclohexene
- 3) phenylethylbromide


## c) Asymmetric (Chiral) synthesis

4 h


Definitions-Asymmetric synthesis, enantiomeric excess, diastereomeric excess. stereospecific reaction, definition, example, dehalogenation of 1,2-dibromides by I<sub>2</sub>. stereoselective reaction, definition, example, acid catalysed dehydration of 1-phenylpropanol





7 

B.A. (Comp. Appli) / B.Z. (Comp. Appl) - II YEAR.  
PAPER - II  
OFFICE AUTOMATION



UNIT - I WORD PROCESSING

Word processing programs and their uses, Entering and Editing Text, Formatting, Special features of word processing software, Desk top publishing software converting documents into WWW pages.

(Chapters 13 of Ref1, Chapters 4 to 12 of Ref 2)

UNIT - II SPREADSHEETS:

Spread sheet programs and their uses, Spreadsheet, Interface, Entering data in a worksheet, Edition and Formatting a worksheet, Automating with macro Adding charts, Analysing data in Spreadsheet.

(Chapter 14 of Ref 1, Chapters 13 to 20 of Ref. 2)

UNIT - III

Databases and Database Management System, DBMS, working with a Database, Viewing, Sorting Records, Querying a Database, Enterprise Software.

(Chapters 16 of Ref 1, Chapters 29 to 33 of Ref. 2)

UNIT - IV FORMS AND REPORTS:

Forms, Printing Reports, Forms, Letters and Labels, Relational Databases, Expressions and Macros Graphics in Databases, Linking, Importing and Exporting Records, Protecting and Maintaining Databases

(Chapters 31, 34 to 39 of Ref. 2)

UNIT - V PRODUCTIVITY SOFTWARE:

Presentation programs, Basics, creating a presentation Formatting slides, Special features, Integrating multiple data Sources in a presentation, Presenting slide shows.

Internet Basics, How the internet works, Major featur of Internet, E-mail, Accessing the Internet, Connection a PC to Internet, working on the Internet, WWW

(Chapters 15, 19, 20 of Ref. 1)

TEXT BOOK :

Ref 1: Peter Norton's Introduction to Computers  
(Fourth Edition, TMH)

Ref 2: Working in MS Office  
BY  
Ron , Mansfield (TMH)

REFERENCES :

1. Computers Today by S.K. Basandra (Galgotia)

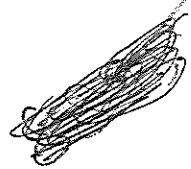


New 2010

P-85

DEPARTMENT OF INFORMATICS, KAKATIYA UNIVERSITY, WARANGAL

B.Sc(Computer Science): II Year: Theory Paper-2



Syllabus

Basics of Object Oriented programming : Object Oriented Programming - Basic concepts of Object Oriented Programming - Benefits of OOP - Applications of OOP.  
Evolution : Java Features - How Java differs from C and C++  
Java and Internet - Java and World Wide Web - Web Browsers - Hardware and Software Requirements - Java Environment.  
Review of Java Language: Simple Java Program - Java Program Structure - Java Tokens- Java Statements - Implementing a Java Program - Java Virtual Machine - Command Line Arguments.  
Constants, Variables and Data types: Constants - Variables - Data types - Declaration of Variables-Giving Values to variables- Scope of Variables-Symbolic Constants-Type Casting.

Chapters : 1,2,3,4 )

Part - 2

Operators and Expressions: Arithmetic Operators - Relational Operators- Logical Operators - Assignment Operators - Increment and Decrement Operators - Conditional Operators - Bitwise Operators - Special Operators - Arithmetic Expressions - Evaluation of Expressions - Precedence of Arithmetic Operators - Operator Precedence and Associativity.

Decision Making and Branching: Decision Making with If statement - Simple If Statement-If else Statement-Nesting If Else Statement- the ElseIf Ladder-The switch Statement - The ?: Operator.

Decision Making and Looping: The while statement - The do statement - The for statement - Jumps in Loops.

Class, Objects and Methods: Defining a Class - Fields Declaration - Methods Declaration - Creating Objects - Accessing class members - Constructors - Methods Overloading - Static Members - Nesting of Methods - Inheritance - Overriding Methods - Final Variables and Methods - Final Classes - Abstract Methods and Classes - Visibility Control.

Chapters : 5,6,7,8 )

Part - 3

Arrays, Strings and Vectors: One-dimensional Arrays-creating an array - Two dimensional Arrays - Strings - Vectors - Wrapper Classes - Enumerated Types.

S. SVN Sarma Chairman, Board of Studies

*(Signature)*

Interfaces: Multiple Inheritance : Defining Interfaces -  
Extending Interfaces - Implementing Interfaces - Accessing  
Interface Variables.

B.Sc(Computer Science): II Year: Theory Paper-2

Packages: Java API Packages - Using system Packages - Naming  
Conventions - Creating Packages - Accessing a Package - Using a  
Package - Adding a Class to a Package - Hiding Classes - Static  
Import.

(CHAPTERS : 9,10,11 )

UNIT - 4

Multithreaded Programming: Creating Threads - Extending the  
Thread Class - Stopping and Blocking a Thread - Life Cycle of a  
Thread - Using Thread Methods - Thread Exceptions - Thread  
Priority - Synchronization.

Managing Errors and Exceptions: Types of Errors - Exceptions -  
Syntax of Exception Handling Code - Multiple Catch Statements -  
Using Finally Statement - Throwing our own Exceptions - Using  
Exceptions for debugging.

Applet Programming: How Applets differ from Applications -  
Preparing to write Applets - Building Applet Code - Applet Life  
Cycle - Creating an executable Applet - Designing a WebPage -  
Applet Tag - Adding Applet to HTML file - Running the Applet -  
More about Applet Tag - Passing parameters to Applets - Aligning  
the display - More about HTML tags - Displaying Numerical Values  
- Getting Input from the user.

(Chapters : 12, 13, 14 )

Unit - 5

Sorting: Bubble Sort - Selection Sort - Insertion Sort - Stacks  
and Queues: Stacks - Queues - Circular Queue - Deques - Priority  
Queue - Parsing Arithmetic Expressions - Linked List: Simple  
Linked List - Finding and Deleting Specified Links - Double Ended  
Lists - Abstract Data types - Sorted Lists - Doubly Linked List:  
- Advanced Sorting : Quick Sort - Binary Trees : Tree Terminology  
- Finding a Node - Inserting a Node - Traversing the Tree -  
Finding Maximum and Minimum values - Deleting a Node - Efficiency  
of Binary Trees - Trees Represented as Arrays - Graphs  
Introduction to Graphs - Searches - Minimum Spanning Tree  
Topological Sorting with Directed Graphs - Connectivity in  
Directed Graphs.

(Chapters : 3,4,5,7 (Only Quick Sort), 8,13)

Prof SVN Sarma Chairman, Board of Studies

J. J. V. N. J.

B.Sc (Computer Science) : II Year: Paper-2

Recommended books :

1. E. Balaguruswamy, Programming with Java, A primer, 3e, TATA McGraw-Hill Company (2008). (Chapters : 1 to 14 )
2. Robert Lafore, Data Structures & Algorithms in Java, Second Edition, Pearson Education (2008)  
Chapters: 3,4,5,7 (Only Quick Sort), 8,13 )

Reference Books :

1. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, Tata McGrawhill (2007).
2. Timothy Budd, Understanding Object Oriented Programming with Java, Pearson Education (2007).
3. Adam Drozdek, Data Structures and Algorithms in Java, Second Edition, Cengage Learning (2008).
4. John R. Hubbard, Anita Hurry, Data Structures with Java, Pearson Education (2008).

Chairman, Board of Studies

( I. V. N. J. W. C. )



Microbiology

II Year B.Sc.

2010

**Paper II: MICROBIAL PHYSIOLOGY AND GENETICS**  
120 hrs (4 hrs/Week)

**UNIT - I : Nutrition, Growth and Enzymes**

30 Hrs

Microbial nutrition - nutritional requirements and uptake of nutrients by cells. Nutritional groups of microorganism - autotrophs, heterotrophs, mixotrophs, methylophs.

Growth media - synthetic, nonsynthetic, selective, enrichment and differential media. Microbial growth - different phases of growth in batch cultures.

Factors influencing microbial growth. Synchronous, continuous, biphasic growth.

Methods for measuring microbial growth - Direct microscopy, viable count estimates, turbidometry, and biomass.

Enzymes - properties and classification, enzyme unit.

Biocatalysis - induced fit, and lock and key model, coenzymes, cofactors, factors affecting catalytic activity of enzymes.

Inhibition of enzyme activity - competitive, noncompetitive, uncompetitive and allosteric.

**UNIT - II Intermediary Metabolism**

30 Hrs

Aerobic respiration - Glycolysis, HMP pathway, ED pathway, TCA cycle, electron transport, oxidative and substrate level phosphorylation. Anaerobic reactions.  $\beta$ -Oxidation of fatty acids.

Glyoxylate cycle. Anaerobic respiration (nitrate, sulphate respiration).

Fermentation - Common microbial fermentations with special reference to alcohol and lactic acid fermentations.

Photosynthetic apparatus in prokaryotes. Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

**UNIT - III Microbial Genetics**

30 Hrs

Fundamentals of genetics - Mendelian laws, alleles, crossing over, and linkage. DNA and RNA as genetic materials.

Structure of DNA - Watson and Crick model. Extra chromosomal genetic elements - Plasmids and transposons.

Replication of DNA - Semi conservative mechanism. Outlines of damage and repair mechanisms.

Mutations - spontaneous and induced, base pair changes, frameshifts, deletions, inversions, tandem duplications, insertions. Variations in physical and chemical mutagens.

Brief account on horizontal gene transfer among bacteria - transformation, transduction and conjugation.

**UNIT - IV Gene Expression and Recombinant DNA Technology**

30 Hr

Concept of gene - Mutation, recombination and cis-acton. One gene - one enzyme hypothesis, one gene - one polypeptide, one gene - one product hypotheses.

Types of RNA and their functions. Outlines of RNA biosynthesis in prokaryotes.

Genetic code. Structure of ribosome and a brief account of protein synthesis.

Types of genes - structural, constitutive, regulatory. Operon concept. Regulation of gene expression in bacteria - lac operon.

Basic principles of genetic engineering - restriction endonucleases.

DNA polymerases and ligases, vectors. Outlines of gene cloning methods.

Genomic and cDNA libraries.

General account on application of genetic engineering in industry, agriculture and medicine.

**REFERENCE BOOKS:**

Caldwell, D.R. (1995). *Microbial Physiology and Metabolism*. W.C. Blackwell Publications, Iowa, USA.

Crueger, W. and Crueger, A. (2000). *Biotechnology: A Text Book of Industrial Microbiology*, Prentice-Hall of India Pvt. Ltd., New Delhi.

Elliot, W.H. and Elliot, D.C. (2001). *Biochemistry and Molecular Biology*, Edilion, Oxford University Press, U.S.A.

- Freifelder, D. (1990). *Microbial Genetics*. Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). *Essentials of Molecular Biology*. Narosa Publishing House, New Delhi.
- Glazer, A.N. and Nikaïdo, H. (1995). *Microbial Biotechnology – Fundamentals of Applied Microbiology*. W.H. Freeman and company, New York.
- Glick, B.P. and Pasternack, J. (1998). *Molecular Biotechnology*. ASM Press, Washington D.C., USA.
- Goltschak, G. (1986). *Bacterial Metabolism*, Springer-Verlag, New-York.
- Kannan, N. (2003). *Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers*. Panima Publishing Co., New Delhi.
- Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). *Principles of Biochemistry*, 2nd Edition, CBS Publishers and Distributors, New Delhi.
- Lewin, B. (2000). *Genes VIII*. Oxford University Press, England
- Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. (1998). *Instant Notes in Molecular Biology*. Viva Books Pvt., Ltd., New Delhi.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). *Microbial Genetics*. Jones and Bartlett Publishers, London.
- Moat, A.G. and Foster, J.W. (1995). *Microbial Physiology*. John-Wiley, New York.
- Nicholl, D.S.T. (2004). *An Introduction to Genetic Engineering*. 2nd Edition. Cambridge University Press, London.
- Old, R.W. and Primrose, S.B. (1994) *Principles of Gene Manipulation*. Blackwell Science Publication, New York.
- Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) *A text Book of Molecular Biotechnology*. Himalaya Publishers, Hyderabad.
- Reddy, S.M. and Reddy, S.R. (2005). *A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology*. Himalaya Publishing House, Mumbai.
- Reddy, S.R. and Reddy, S.M. (2004). *Microbial Physiology*. Scientific Publishers, Jodhpur, India.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). *Principles of Genetics*. 5<sup>th</sup> Edition. McGraw Hill, New York.
- Smith, J.E. (1996). *Biotechnology*. Cambridge University Press.
- Snyder, L. and Champness, W. (1997). *Molecular Genetics of Bacteria*. ASM press, Washington, D.C., USA.
- Strickberger, M.W. (1967). *Genetics*. Oxford & IBH, New Delhi.
- Twynan, R.M. (2003). *Advanced Molecular Biology*. Viva books Pvt. Ltd. New Delhi.
- Verma, P. S. and Agarwal, V.K. (2004). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand & Co. Ltd., New Delhi.
- White D. (1996). *The Physiology and Biochemistry of Prokaryotes*. Oxford University Press, New York

## LAB – II: MICROBIAL PHYSIOLOGY AND GENETICS 00

1. Preparation of media for culturing autotrophic and heterotrophic microorganisms - Algal medium, mineral salts medium, nutrient medium, McConkey agar, and blood agar.
2. Enrichment culturing and isolation of phototrophs chemoautotrophs.
3. Setting and observation of Winogradsky column.
4. Determination of viable count of bacteria.
5. Turbidometric measurement of bacterial growth.
6. Plotting of bacterial growth curve.
7. Factors affecting bacterial growth – pH, temperature, salts.
8. Colorimetric estimation DNA by diphenylamine method.
9. Colorimetric estimation of proteins by Biuret/Lowry method
10. Biochemical test
  - Indole test, Methyl red test, Voges Proskauer test, Citrate test,
  - Carbohydrate fermentation & Gas production, Amylase test, H<sub>2</sub>S production test, Nitrate reduction test, Starch hydrolysis, catalase test
12. Assay of catalase enzyme activity
13. Immobilization of enzyme
14. Problems related to DNA and RNA characteristics, transcription translation.

### REFERENCE BOOKS FOR LAB:

- Dubey, R.C. and Maheswari, D.K. (2002). *Practical Microbiology*. S. Chand & Ltd., New Delhi.
- Jaya Babu (2006). *Practical Manual on Microbial Metabolisms and Gen Microbiology*. Kalyani Publishers, New Delhi.
- Plummer, D.T. (1988). *An Introduction to Practical Biochemistry*. 3rd Edition. Tata Mc GrawHill, New Delhi.
- Reddy, S.M. and Reddy, S.R. (1998). *Microbiology – Practical Manual*, 3rd Edition. Sri Padmavathi Publications, Hyderabad.
- Sashidhara Rao, B. and Deshpande, V. (2007). *Experimental Biochemistry Student Companion*. I.K. International Pvt. Ltd.,
- Bawhney S.K. and Singh, R. (2000) *Introductory Practical Biochemistry*. Nar Publishing House, New Delhi.
- White D. (1996) *The Physiology and Biochemistry of Prokaryotes*. Oxford University Press, New York



II-Year (N) → 2010

B. Sc (ZOOLOGY) II Year (THEORY PAPER – II)  
BIOLOGY OF CHORDATES, EMBRYOLOGY, ECOLOGY AND  
ZOOGEOGRAPHY

120 hrs  
(4 hrs/week)

UNIT – I

1.0. Protochordata to Amphibia

- 1.1. Protochordates: Salient features of Urochordata and Cephalochordata. Structure and life-history of *Herdmania*. Significance of retrogressive metamorphosis 6 hours
- 1.2. General characters of Chordates 1 hour
- 1.3. General characters of Cyclostomes 1 hour
- 1.4. General characters of fishes, classification up to sub-class level with examples 2 hours
- 1.4.1. Type study – *Scoliodon* (Morphology, digestive system, respiratory system, circulatory system, urinogenital system, nervous system and sense organs. 9hrs
- 1.4.2. Types of scales. 1 hour
- 1.5. General characters and classification of Amphibia up to order level. 1 hour
- 1.5.1. Type study – *Rana* (Morphology, digestive system, respiratory system, circulatory system, excretory system, nervous system and reproductive system and sense organs) 9 hours
- 1.5.2. Parental care in amphibia. 1 hour

UNIT – II

2.0. Reptilian to Mammalia

- 2.1. General characters and classification of Reptilia up to order level 3 hours
- 2.1.1. Type study – *Calotes*: (Morphology, digestive system, respiratory system, circulatory system, nervous system and urinogenital system 9 hours
- 2.2. General characters and classifications of Aves up to order level with examples 3 hours
- 2.2.1. Type study – *Pigeon (Columba livia)* (Exoskeleton, respiratory system, circulatory system, excretory system, nervous system and reproductive system). 6 hours
- 2.2.2. Flight adaptations in birds 2 hours
- 2.2.3. Significance of Migration in birds 2 hours
- 2.3. General characters and classification of Mammalia up to order level with examples 3 hours
- 2.3.1. Dentition in Mammals 2 hours

22/7/08

## UNIT – III

### 3.0. Embryology

- |  |         |
|--|---------|
| 3.1. Gametogenesis and Fertilization   | 3 hours |
| 3.2. Types of eggs and cleavages   | 3 hours |
| 3.3. Development of frog up to gastrulation and formation of primary germ layers | 9 hours |
| 3.4. Foetal membranes and their significance                                     | 3 hours |
| 3.5. Placenta: Types and functions   | 4 hours |

## UNIT – IV

### 4.0. Ecology

- |   |          |
|---|----------|
| 4.1. Biogeochemical cycles – Gaseous cycles of Nitrogen and Carbon; Sedimentary cycle – phosphorus.             | 6 hours  |
| 4.2. Definition of Community – Habitat and ecological niche   | 12 hours |
| 4.2.1. Community interactions: Brief account of Competition, predation, mutualism, commensalisms and parasitism |          |
| 4.2.2. Ecological succession  |          |
| 4.3. Population ecology: Density, mortality and natality,   | 12 hours |
| 4.3.1. Growth curves  |          |
| 4.3.2. Population regulation mechanisms – both biotic and abiotic   |          |
| 4.3.3. Zoogeography: Zoogeographical realms. Fauna of Oriental, Ethiopian and Australian regions.               |          |

## PRACTICAL PAPER – II

### CHORDATA, EMBRYOLOGY AND ECOLOGY

Observation of the following slides/specimens/models:

1. Protochordata: *Herdmania*, *Amphioxus*, *Amphioxus* T.S. through pharynx.
2. Cyclostomata: *Petromyzon* and *Myxine*
3. Pisces: *Pristis*, *Torpedo*, *Channa*, *Pleurenectes*, *Hippocampus*, *Exocoetus*, *Echeneis*, *Labeo*, *Catla*, *Clarius*, *Anguilla*. Scales of fishes.
4. Amphibia: *Ichthyophis*, *Amblystoma*, *Siren*, Axolotl larva, *Rana*, *Hyla*, *Alytes*.
5. Reptilia: *Draco*, *Chamaeleon*, *Uromastix*, Russels viper, *Naja*, *Bungerus*, *Echis carinata*
6. Aves: *Picus*, *Psittacula*, *Eudynamis*, *Bubo*, *Alcedo*, *Coracius*, *Archaeopteryx*
7. Mammalia: *Ornithorhynchus*, *Tachyglossus*, *Macropus*, *Erinacius* *Pteropus*, *Funambulus*, *Manis*, *Loris*.

### DISSECTIONS:

1. V, VII, IX and X cranial nerves of Scoliodon
2. Arterial system of Scoliodon
3. Brain of Scoliodon

### OSTEOLOGY:

1. Appendicular skeletons of Varanus, Pigeon and Rabbit

### EMBRYOLOGY:

1. Mounting of sperms (Grasshopper/Rat)
2. Observations of following slides/models  
T.S. of testis and ovary (Rat/Rabbit/Human)
3. Different stages of cleavage (2-cell, 4-cell and 8-cell), Morula
4. Blastula and gastrula of frog.
5. 24 hours, 48 hours and 72 hours of chick embryo

### ECOLOGY:

1. Determination of pH in a given sample
2. Estimation of dissolved oxygen in the given samples at different temperatures.
3. Estimation of salinity (chloride) of water in the given samples.
4. Estimation of hardness of water in terms of Carbonates and bicarbonates in the given samples.

