

UNIVERSITY OF MUMBAI
No.UG / 248 of 2007

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and Syllabi relating to the B.Sc. degree course vide this office Circular No.UG/153 of 1997, dated 14th May, 1997 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Ad-hoc Board of Studies in Life Sciences at its meeting held on 3rd April, 2007 has been accepted by the Academic Council at its meeting held on 13th April, 2007 vide Item No.4.19 and that in accordance therewith, the syllabus in the subject of Life Sciences at the S.Y.B.Sc. examination has been revised as per Appendix and that the same will be brought into force with effect from the academic year 2007-2008.

MUMBAI-400 032

30th May 2007

for I/c. REGISTRAR

To,

The Principals of the affiliated colleges in ~~Arts~~ Science

A.C./4.19/13.04.2007

No.UG/ 248 - A of 2007, MUMBAI-400 032

30th May, 2007

Copy forwarded with compliments for information to :-

- 1) The Dean, Faculty of Science
- 2) The Chairman, Ad-hoc Board of Studies in Life Sciences

for I/c. REGISTRAR

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the P.A. to the Pro-Vice-Chancellor, and the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Officer on Special Duty and Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that no separate Action Taken Report will be sent in this connection. the Assistant Registrar Constituent Colleges Unit (2 copies), BUCT (1 copy), the Deputy Account, Unit V (1 copy), the In-charge Director, Centralize Computing Facility (1 copy), the Receptionist (1 copy), the Telephone Operator (1 copy), the Secretary MUASA (1 copy), the Superintendent, Post-Graduate Section (2 copies), the Superintendent, Thesis Section (2 copies)

UNIVERSITY OF MUMBAI



**REVISED SYLLABUS
IN THE SUBJECT OF
LIFE SCIENCE**

**FOR PAPERS I, II AND III
AT THE
S.Y.B.SC. EXAMINATION**

(With effect from the academic year 2007-2008)

①

**Syllabus of Second Year B.Sc.
Mumbai University
(To be introduced from the academic year 2007-08)**

Paper I: Life Sciences-Physiological Approach: Organism as a Regulatory Unit
Paper II: Life Sciences-Biochemical Approach: Regulation and Integration of Processes in the cell
Paper III: Life Sciences -Population Approach: Population & Communities as Regulatory Units

Note: 1. Three short (4 hours) or one long (more than 8 hour) field excursion for studies on habitat with documentation of field observations and submission of field report during an academic year shall be mandatory.

2. Field work of not less than 8 hours duration is equivalent to one period per week for a batch.

3. For theory papers, units 1, 2 & 5 shall be completed in the first term and 3, 4 and 6 in the second term

4. With regard to Practical Papers I, II and III, practical 1 to 8 shall be completed in the first term and the remaining shall be completed in the second term.

[Homeostasis or physiological constancy is a dynamic unifying theme. Feedback mechanisms work to maintain physiological processes within the narrow range that is compatible with life. All organisms have, to some extent, control & compensatory mechanisms to regulate their internal state in spite of a variable environment. Two great communication systems are found in living organisms, linking receptors and effectors together. These systems are the chemical communication system, which includes hormones and the nervous system. Because communication systems are involved in virtually all homeostatic control, we will first examine their principles of operation. Once we see how neurons and humoral communication function, we can appreciate how they regulate circulation, respiration, excretion and other vital activities.]

Unit 1:

(16)

I. General Introduction, Central Regulation & Coordination of Homeostasis

A. General introduction to homeostasis:

(2)

- (i) Review of cellular, tissue, organ and systems level of organization.
- (ii) Positive and negative feedback mechanisms & homeostasis

B. Central Regulation and Co-ordination of Homeostasis

1) Hormonal Regulation in animals:

(10)

- i) Classical endocrine system (including paracrine secretion) and Neuroendocrine (especially Invertebrate) systems-Molting in arthropods. (2)
- ii) Mechanism of Hormone action – Specificity, hormone binding, membrane bound receptor & an introduction to signal transduction, cytosolic receptor. (one steroid and one protein hormone as example) (2)
- iii) General overview of Vertebrate endocrine glands and their role in homeostasis: (6)
 - Hypothalamo-hypophyseal axis; Parathyroid – eg. bone metabolism;
 - Adrenal- eg. sodium, potassium, protein balance; stress; Thyroid- eg. metabolic alterations; Pancreas- eg. glucose metabolism (details to be covered under digestion); Hypothalamus – eg. food intake, body heat; thirst; sleep; wakefulness; energy; Pineal gland- eg. day and night rhythm (to be covered under Biorhythm); Thymus – eg. immune system (details to be covered under Body Defence, below); Ovary, testis & uterus (details to be covered under reproduction, below)

- (3)
- 2) Plant hormones and their role in homeostasis – Gibberilic acid, Auxins,
(4) Ethylene, Cytokinin and Abscissic acid (structure and function)

Unit 2

14

II. Regulation by means of Nervous System

(14)

Nervous System: A perspective – Vertebrate Central and Peripheral; Autonomic nervous system and its role in homeostasis; concept of Plexus (2)
Evolution of Nervous system: Organisms without Nervous system; in radial animals; vertebrate brain (2)
Sensory System: Classification of sense organs; adaptation (2)
Muscle (types, structure, mechanism of contraction; mention other effectors like, glands, electric organ and light emission in fire-flies (3)
Behavior and behavioral adaptation: Reflexes, instinct and Learning (Habituation) (2)
Biorythm: circadian- sleep-wake cycle ; in plants with at least one example (2)
A brief summary of Neuro-endocrine coordination- eg. coping with stress (1)

Unit 3

15

III. Transport/Circulation & Respiratory system and Gas Exchange

A. Regulation of Transport & Circulation

(8)

- i) Circulatory system in animals; Transport system in plants (Xylem, Phloem, control of fluids in plants - an introduction (2)
- ii) Ions and molecules across membranes (1)
- iii) In plants: Electro-osmosis, pinocytosis, root pressure, guttation and bleeding, Kinetics of active / food transport (2)
- iv) In animals: Extra cellular fluid, cardiovascular systems, Neurogenic, myogenic heart
Properties of heart muscle – Cardiac cycle, ECG, Cardiac output, regulation of blood pressure and blood flow; clotting of blood; Autonomic control of heart. (3)

B. Respiratory System & Gas Exchange

(1)

- i) Physical principles of gas exchange; Survey of gas exchange mechanisms (2)
- ii) Respiration in plants (1)
- iii) Aquatic respiration (e.g. Mosquito larvae and fish gill) (1)
- iv) Respiratory mechanisms and their regulation (e.g. Invertebrates - earthworm (cutaneous), crab (gill), scorpion (Book lungs), Vertebrates – Frog (Cutaneous, Buccal & Pulmonary) (2)
- v) Respiratory Pigments; Regulation of O_2 and CO_2 balance (1).

Unit 4

IV. Digestive System / Nutritional Homeostasis & Excretory System/Osmotic Homeostasis

15

A. Digestive system/ Nutritional Homeostasis:

(8)

- i) Autotrophs and Heterotrophs – e.g. Plants, Nitrobacter / alga and amoeba, Mineral nutrients in plants; Macro, Micro, deficiencies and toxic elements (2).
- ii) Survey of Digestive systems: Intracellular and Extra cellular digestion in animals: Intracellular (e.g. Amoeba / Paramecium); Extra cellular: any one plant, symbiotic in ruminant stomach (See also Practical I). (1)
- iii) Hormonal control of digestion in humans: Gastrin, Cholesystokinin, Secretin; Factors controlling blood glucose levels in humans- Hypoglycemia (Glucagon and Epinephrine in Glycogenolysis; Glucocorticoids & Insulin/Growth hormone in Gluconeogenesis); Hyperglycemia: (Insulin in Glycogenesis, cellular oxidation & Lipogenesis: Metabolism & Temperature regulation (Metabolic rate & body size; Homeotherms, Poikilotherms) (5)

B. Excretory system/Osmotic Homeostasis

(7)

- i) Phylogenetic review of organs and processes – Contractile vacuole, flame cells, nephridium, malpighian tubules, kidney and skin in man (see Laboratory Practicals). (1)
- ii) In plants – Water and salt regulation under normal and stressed conditions. (2)
- iii) In animals – Concept of osmoregulation and processes associated with osmoregulation (Ultra filtration, Selective reabsorption, Secretion; Acid- base regulation) (2)
- iv) Nitrogenous excretory products (Ammonotelism, Ureotelism, Uricotelism) (1)
- v) Homeostasis under stress – eg. Diabetes insipidus (1)

Unit 5

17

V. Reproductive system, Development / Homeostatic Mechanisms for the continuation of life

A. Alternation of Generations:

(7)

- i) Asexual & Sexual; parthenogenesis (as in daphnia); Spore formation as in Dictyostelium (1)

- ii) Sex determination in plants – e.g. Maize. (1)
- iii) Aromatase and production of oestrogen, sex reversal (2)
- iv) Temperature dependant sex determination in reptiles. (1)
- v) Mechanism of mammalian primary sex determination – Testis determining gene factor, Ovary determining (1).
- vi) Secondary sex determination (1)

B. Endocrine control of Reproduction in humans

- i) Menstrual Cycle : Ovary- Phases of ovarian development, phases of menstrual cycle - development of endometrium, physiological interruption of cycle during pregnancy and lactation, during use of contraceptive pill, termination of cycle - menopause (7)

C. Gametogenesis and early development: in plants: kinds of ovules, fertilization, development of an embryo (angiosperm), in animals: types of eggs, fertilization, cleavage patterns, blastula, gastrula (Frog) (To be dealt with also in the laboratory. (3)

See the Practical Syllabus)

Unit 6

VI. Body Defense and Recovery Mechanisms/ Homeostasis against infection / predatory attack (13)

- i) In prokaryotes: Chemotaxis, toxin (only one example each) (1)
 ii) In plants: 1. biomolecules: secondary metabolites, surface protectants, enzymes, (3)
movements: Vital movements - Locomotion / Curvative movements, Hydration (Nastic, Tropic, Thermo, Thigmo, Seismonastic) and Hygroscopic movements
 iii) In animals: 1. Immunity: Innate and adaptive immunity: Innate -In Invertebrates and in Vertebrates inflammation cell types (Hemocytes / mono (5)
 and polymorphonuclear & phagocytosis; Adaptive - primary and secondary lymphoid organs (no structural details), T and B cells (functions only), antigens and antibodies (definitions only) 2. Behavior & Behavior Modification:
 iv) Movement (See also Unit II): Towards food and away from adverse environment; Learned response & Memory. (2)
 iv) Tissue damage & repair: Wound healing & regeneration (Brief introduction only) (2)

Units 1, 2 and 5 to be completed in the First term &
 Units 3, 4 and 6 in the Second Term

References:

1. aiz,P.,Plant Physiology , 2nd or later edition. Sinauer Assoc. Inc. Pub.
2. adlee,E., Endocrinology,, 5th edition 2005 or the latest, Pearson Edu.
3. ithers,S.,Comparative animal physiology, Saunders College Pub.
4. nit Schmidt-Nielson, Animal Physiology - 5 th edition (1998) or the latest
5. alisbury & Ross, Plant physiology , Latest edition
6. ilbert ,W.,Embryology- Construction of the organism -1997 or later edition, Sinauer Assoc. Inc. Pub
7. Taylor, Green & Stout, Biological Science, 3rd edition. 2004 or the latest, Ed. Soper. Cambridge University Press
8. Herried, Clyde (Latest Edition), Macmillan, New York;
9. Bhojwani & Bhainagar, Plant embryology, 4 th edition (2003) or the latest, Vikas Pub. house
10. RGS Bidwell , Plant physiology , Macmillan pubn. 3rd edition or the latest
11. P.S.Gill, Plant physiology
12. Buchannan and Jones, Biochemistry and molecular biology of plants (2000) I K International Ltd.
13. Scott Gilbert, Developmental Biology, 8th edition. 2006 or the latest, Sunderland Pub
14. Herried, C. Mac millan, Latest edition.
15. Kimball, Latest Edition or Free Online Edition
16. Campbell & Reese, Biology, Sixth(2002) or the latest Ed.
17. Solomon, Berg & Martin, Biology, Seventh(2005) or the latest Edition

[This paper deals with topics related to Basic Biochemical Processes in cells and tissues and the regulation and integration of these processes.]

Unit 1

- | | |
|---|------|
| I. Water, pH, Buffers. | 15 |
| II. Enzymes | (4) |
| 1. Classification | (11) |
| 2. Kinetics | |
| 3. Effect of pH and Temperature | |
| 4. Inhibitors | |
| 5. Enzyme extraction, purification and Specific activity
(Mention Techniques : Dialysis, Gel-filtration, Ion-exchange,
Affinity chromatography and Spectrophotometry) | |

Unit 2

III. Survey of Metabolism

A. Carbohydrates :

- | | |
|---|------|
| a. | (10) |
| 1. Glycolysis – process and metabolic regulation | |
| 2. Citric Acid Cycle – | |
| a) Process and regulation. | |
| b) Importance as a central amphibolic pathway
unifying all primary biological processes. | |
| b. | (5) |
| 1. Gluconeogenesis | |
| 2. Pentose phosphate pathway | |
| 3. Short account of polysaccharide synthesis | |

Unit 3

IV. Survey of Metabolism

B. Amino Acids :

- | | |
|--|-----|
| a. | (9) |
| 1. Deamination & ammonia disposal by Urea cycle. | (6) |
| 2. Decarboxylation & integration into Krebs' cycle | |
| b. | (3) |
| 1. Transamination | |
| 2. Glutamate synthesis | |

C. Lipids :

- a.
 1. Lipolysis (6)
 2. Role of Carnitine in mitochondrial permeability
 3. Beta- Oxidation of fatty acids
 4. Ketone bodies

15

Unit 4

- b.
 1. Fatty acid biosynthesis
 2. Cholesterol biosynthesis (3)

V. Bioenergetics :

A. Electron Transport System

- i. Localization and
- ii. Sequence of electron transporters (2)

B. Oxidative Phosphorylation

- i. Mitchell's Chemiosmotic Hypothesis (4)
- ii. ATP synthesis
- iii. Control of respiration, uncoupling and metabolic poisons

VII Photosynthesis

- i. Photophosphorylation, Hill reaction (6)
- ii. C3 and C4 cycles
- iii. Photorespiration

14

Unit 5

VIII. Nucleic acids :

1. Chemistry of nucleic acids. Absorption spectra and melting curves & a brief outline of biosynthesis of purines and pyrimidines.

(5)

2. DNA replication with details of enzymes involved (4)
3. Transcription (a) in Prokaryotes and (b) In Eukaryotes (4)
- mRNA processing to familiarize with intron/exon splicing
4. Reverse transcription. (1)

Unit 6

16

IX. Gene Regulation & Protein biosynthesis :

1. Translation : Genetic code; Translation system, post translational modification. (12)
2. Regulation of gene expression: (6)
- (a) Operon model (Lac, Trp).

(b) Brief concept of Alternate splicing & RNAi

VI Overview of metabolism : Integration of carbohydrate, protein, lipid and nucleic acid metabolism .

(4)

[Units 1, 2 & 5 shall be completed in the 1ST Term & Units 3, 4 & 6 shall be in the 2ND Term]

References:

1. Lehninger Principles of Biochemistry by D.L Nelson and M.M. Cox, 4th edition, W. H Freeman Publishers, New York. (2005)
2. Biochemistry by J.M. Berg, J L Tymencko and L. Stryer 5th edition, W H Freeman and co., New York. (2002)
3. Fundamentals of Biochemistry by D. Voet , J. G. Voet and C.W. Pratt 1st ed, John Wiley & Co., New York (1999)
4. Kimball, Latest edition or Free Online Edition.

Paper III

Life Sciences - Population Approach: Population & Communities as Regulatory Units
(Total No. of Lectures = 90)

"Nothing in Biology Makes Sense, Except in the Light of Evolution" - T. Dobzhansky

Quantitation is an important aspect in modern biology. A clear understanding of how to handle measurements of biological variation in nature as well as in different experimental setups is therefore obligatory for a biology student. Unit 1 and 2 include basic application of statistics in Biology. Further, elementary bio-informatics has been introduced for students to acquire the basics of that field to deal with "in silico" data in future.

The units 3&4 are introduction to the processes and consequences of Evolution and its modern syntheses with focus of integrating genetics, population and the environment.

Population dynamics of human beings are not only dependent on biological forces but also social forces. The health status of people and diseases prevalent in an area often are reflections of both. Units 5 & 6 that form Studies on Human Population & Epidemiology introduce students to these concepts and discuss some epidemiologically important diseases].

Unit 1.

15

1. Biostatistics

15

- a. Sample versus Population: Sampling – different methods – importance of "sample size" (2)
- b. Measures of Central Tendency - Mean, Median and Mode (1)
- c. Measures of Location - 'Z' score, percentile (2)
- d. Measures of variation - range, variance, standard deviation, Interquartile range, coefficient of variance (2)
- e. Probability Distribution, Binomial, Poisson with biological examples, no mathematical derivations, Normal distribution, skewed distribution, probability calculations from 'Z' scores with biological examples only (6)
- f. Standard Deviation & Standard error; significance test for large sample (2)

: h. Significance tests for small samples: (i) Paired and unpaired T test from laboratory data. (see Practical syllabus)

(ii) Chi square test from laboratory data (see practical syllabus) (4)

i) ANOVA - Analysis of Variance with biological examples only (2)

j) Concept of Correlation: Linear Regression & correlation from laboratory data (see Practical syllabus) (2)

II. Bioinformatics

(4)

1. Introduction to Bioinformatics: Concept of information network: Internet, IP address, TCP/IP, FTP, HTTP, HTML and URLs; Virtual libraries (Concept of database and their use in Biology); The European Molecular Biology Network- EMBnet, The National Centre for Biotechnology Information - NCBI, Pub Med (2)
2. DNA sequence data analysis: annotation for putative genes; translation of codes to into amino acid letter codes (2)

III. EVOLUTION:

a. History and development of evolutionary thought:

(6)

- i) The world was ready - Georges Currier's Catastrophe Theory & Origin of Paleontology; Lamarck (2)
- ii) Darwin Develops Theory: HMS Beagle; Geology & Fossils influence Darwin's thinking; Bio-geography; Natural selection as a process results in adaptation to the Environment; **Evidences:** Fossil record, Bio-geography, Comparative Anatomy, Comparative Biochemistry; Cytochrome Diversity (4)

b. Process of Evolution:

(11)

- i) Genetic Equilibrium & Disequilibrium in populations: Hardy Weinberg's law and factors influencing the law; Shift in frequency of genes within populations. (4)
- ii) Causes of Variations: Genes Mutate; Gene Flows Bring New Genes; Genetic Drift- Founder effect & Bottle - Neck effect (2)

iii) Directed Changes in Populations: Natural selection: Against Lethal alleles; non-lethal recessive selection favouring heterozygotes; Laboratory studies with examples of *Drosophila*, antibiotic resistant bacteria, pesticide resistant organisms, industrial melanism, maintenance of heterozygotes as in sickle celled anemia in malaria endemic regions; Selectionists versus Neutralists (5)

Unit 4

13

iv) Adaptation & Types of Selection: Directional selection; Stabilizing Selection; Disruptive Selection (2)

v) Speciation: Mechanism of Speciation : Reproductive Isolating Mechanisms; Adaptive Radiation, Sympatry and Allopatry. (2)

c. Consequences of Evolution & Assessment of Biological Relationships: (6)

vi) Phylogenetic Trees- i) Traditional; Cladistics & parsimony principle, Cladogram (4)

ii) Evolutionary significance of Biodiversity: Food chains and Food web with examples from Laboratory/Field study / (see the Practical syllabus) (2)

d. Studying Evolutionary Lineages: Evolutionary History of Horse -a case study (3)

Unit 5

16

1. Human population studies: (6)

a) Trends in human evolution: Darwinian & Social Evolution (2)

b) Population dynamics: Growth rate and Population pyramid and variants; Indian scenario (2)

c) Population and distribution of resources: geographically, urban-rural. (2)

2 Public Health status & strategies in India (10)

a) Malnutrition: Calorific malnutrition; Protein malnutrition; Avitaminosis (3)

b) Infectious Diseases: Host-parasite relationship (to be discussed with respect to epidemiology, aetiology, pathology (only target tissues), diagnosis, therapy, preventive measures; discovery of the concept of hygiene & vaccines : i. Vector Borne - Malaria, Dengue (4)

ii) Viral Hepatitis B, (3)

Unit 6

Infectious Diseases (Contd.) (iii) Bacterial- Tuberculosis, Leprosy, Typhoid, Cholera (10)

(iv) Helminths Filariasis (2)

(v) Fungal Ringworm, Atlatoxin poisoning (2)

Units 1, 2, and 5 are to be completed in the first term and Units 3, 4 and 6 in the second term]

References

1. Strickberger, Evolution, 1994 or later edition CBS Publishers and Distributors

2. Strickberger, Genetics 3rd Ed. (2004) or latest Prentice Hall Pvt Ltd.

3. Dixon & Dodson, Evolution, 2nd Ed. or the latest Edition, D. Van Nostrand Co.

4. Greenwood, Richard and Peutherer, Medical Microbiology: a guide to microbial infections, 14th Ed or the latest

5. Davis, Delbecq E., Ginsberg, Microbiology, Lippincott Company, Philadelphia, 1990

6. Ananthanarayanan and Panniker, Textbook of Microbiology, 5th Edition, (1996), Orient Longman, Hyderabad

7. Talaro and Talaro, Foundations in Microbiology, 4th Ed McGraw Hill (2002)

8. Biology - Hernied, Clyde, Macnullan, New York (Latest Edition)

9. Biology - Kimbal (latest Edition) / Online Free Edition

1
SYBSC LIFE SCIENCES
University of Mumbai
Practical Paper I

[As the "Expected Learning Outcome" is a good way of defining the extent of details of an experiment necessary at a certain level, this is incorporated in each case:

- I - Instrumentation knowledge,
- C - Concept understanding,
- T - Technical skill,
- R - Relevance to daily life]

1. Good Laboratory Practices & Temporary Mounting of spiracle/trachea from cockroach or any convenient animal from cockroach. [I]
2. Temporary mount preparation of septal nephridia of earth worm (Annelid) /Malpighian Tubule (of any insect) and study of urinary tubule using permanent histology preparation of vertebrate kidney [T,C]
3. Study of Axes of Bilateral animals & Dissection : Digestive system of cockroach (Arthropod) Concept of dorsal - ventral & anterior- posterior axes; segmentation of body; digestive system and comparison with the digestive system of Earthworm (Annelid) [T,C,R]
4. Heart and aortic arches of shark or any other convenient vertebrate; compare with the heart of an invertebrate eg. Annelid/arthropod from diagram [T,C]
5. Paramecium: Studies on mode of feeding using stained yeast (Actual viewing of intracellular digestion) [T,C,I,R]
6. Study of in vivo and vitro pollen germination [I,T,C]
7. Extraction and estimation of plant alkaloid using suitable plant [T,C, R]
8. Preparation of temporary slide to show excretory product in plant [T,C,R]
9. Endocrine gland observation in mouse/rat/Fish (location only, in dissected preserved specimen) [C,R]
10. Study of histology of endocrine gland using permanent slides only [C, R]
11. Estrus cycle in rat and observation of PAP smear slide [T,C,R]
12. Microtomy: Paraffin block preparation (Demonstration only), sectioning (Demonstration only) and staining of slides for histological studies [I,T,C,R]
13. Fish brain, Chick brain, Goat brain (external morphology only) [C]
14. Frog embryology-Egg, Sperm, Stages of Embryo: Blastula & Gastrula (study of permanent slides only) [C]
15. Observation of leaf gall or any other suitable sample/slide on plant diseases [C,R]
16. Giemsa staining of Hemocyte /Coelomocytes of Invertebrates eg., Drosophila larva, Caterpillar, Earthworm to study morphological features and to compare with Human blood cells (from pictures).

{First 8 Practicals shall be completed in the 1st term and the rest in the second}

Practical Paper II

[As the "Expected Learning Outcome" is a good way of defining the extent of details of an experiment necessary at a certain level, this is incorporated in each case:

- I = Instrumentation knowledge,
- C = Concept understanding,
- T = Technical skill
- R = Relevance to daily life]

1. Good Laboratory Practices & pH meter – (i) principle & instrumentation and (ii) determination of pH (titration of Acids/Bases/Buffers/ 'chameleon balls'). I, C, T
2. Protein precipitation by pH manipulation (Casein from Milk/ Curds)
3. Study of Enzyme activity, K_m - Urease (from Jack beans)/Lipase/Protease(from detergents) I, C, T
4. Histochemical localization of Enzymes (Acid Phosphatase) C, T
5. Colorimetric Protein Estimation by Biuret Method and calculation of specific activity of Enzyme (Enzyme extract / Casein from previous experiments.). I, C, T
6. Colorimetric Cholesterol Estimation / total Lipid Estimation from egg. C, T R
7. Solvent Extraction of Lipids. C, T, R
8. RNA/Ribose Sugars. C, T
9. Chromatography of Sugars – Circular/Ascending Paper C, T
10. Titrmetric Estimation of Ascorbic acid (Vit C). C, T, R
11. Column Chromatography of Proteins / Pigments. I, C, T
12. Thin Layer Chromatography for separation of Plant Pigments. (Slide technique) C, T, R
13. Protein separation by PAGE (Demonstration) I, T, C (Separation techniques for charged materials based on electrophoretic mobility; Drawing of electrical circuit)
14. Colorimetric estimation of Inorganic Phosphates by Stannous chloride method. C, T, R

[First 8 Practicals to be completed in the 1st term; the rest in the second]

SYBSC LIFE SCIENCES
University of Mumbai
Practical Paper III

[As the "expected Learning Outcome" is a good way of defining the extent of details of an experiment necessary at a certain level, this is incorporated in each case:

I - Instrumentation knowledge,
C - Concept understanding,
T - Technical skill
R - Relevance to daily life]

- 1) Good Lab Practices- A Review & Gram staining technique using skin / mouth swabs (T, C, R)
- 2) Demonstration of capsule staining using a suitable microorganism (T, C)
- 3) Biostatistical methods: Significance test & Correlation using convenient data generated in the Class Lab. For example, any of the following data: ABO blood Group of students of the class/ Finger prints/Growth rings of tree bark/Whorls of snail shell/ Survey of Genetically inherited features of human population (PTC test) or any other relevant data like number of seeds germinated/ pulse rate of Human before and after exercise (climbing stairs) or Heart beat of Daphnia before and after treating with drugs/neurotransmitters/chemicals. (T,C,R)
- 4) Bioinformatics : Annotation of Nucleotide sequence; translation of putative gene sequence into single letter amino acid codes; BLAST search demonstration [T,C,R,I]
- 5) Collection of mosquito stages: Adult (Male/Female)/egg/larvae/ pupa from the field & Observation of permanent slides to study the Life cycle of *Culex* and *Anopheles* mosquitoes. (R,C,T)
- 6) Study of tuberculosis and leprosy tissues (permanent slides/pictures only) (R,C)
- 7) Temporary slide preparation of giant chromosomes from salivary gland/malpighian tubule/hind gut of larvae of *Chironomus* / *Drosophila* or any other convenient model system & Chromosome puff from pictures or preparation (I,C,T)
- 8) Preparation of culture media & culturing experimental model systems: Bacteria/Fungus/*Drosophila* & Isolation of *E.coli* / *Yeast* or any fungus by streak plate method /isolation of *Drosophila* larva by suspending the medium in concentrated sugar solution (T, R, C)
- 9) Biochemical test for *E.coli* (IMViC test) (T, R)
- 10) Estimation of bactericidal/bacteriostatic activity of Antibiotic or other natural products using for example, *Staphylococcus aureus* by paper disc method. (T,C,R)
- 11) Study of normal and abnormal Karyotypes using Idiograms (C)
- 12) Widal's test (qualitative) / VDRL (qualitative) (C, R)
- 13) Temporary mounting of hakers of house fly or any other dipterans and its evolutionary significance (T,C,R)
- 14) Homologous and Analogous organs [C Identification only]
- 15) Field Study /Learning of Food Chain or other plant-animal interaction with any convenient plant in the neighborhood / Identifying and Reporting 5 trees (any other plants) and five birds /moths& Butterflies (or any other animals) from the neighborhood [T,R,C]

[First 8 Practicals to be completed in the 1st Term; the rest in the second]

-XOX-