St. Xavier's College – Autonomous Mumbai

Syllabus
For 2nd Semester Courses in
LIFE SCIENCE
(June 2013 onwards)

Contents:

LIFE SCIENCE

F.Y.B.Sc. **Course No. S.LSC.2.01**

Title: Cell Biology

Learning Objectives:

On completion of the course, the student must be able to:

1. Differentiate between prokaryotes and eukaryotes.
2. Students will understand the structures and basic components eukaryotic cells, with respect to membranes and organelles.
3. Describe the function and the composition of the plasma membrane.
4. Understand how the endoplasmic reticulum and Golgi apparatus interact with one another and know with which other organelles they are associated.
5. Understand the structure and function of the mitochondria and chloroplast.
6. Understand the basis and significance of mitosis and meiosis

Number of lectures: 45

UNIT I **(15 lectures)**

1. Cell as a unit of life**:** Prokaryotes, Eukaryotes (plant, yeast, animal cell) (1)
2. Cell membrane**:** (4)
    a. Membrane Structure and Function
    b. Chemical composition of membranes
    c. Membrane lipids; Membrane proteins
    d. Functions of membranes: Transport, Cell-cell interactions, Receptors (eg; insulin receptor with link to diabetes)
    e. Membrane Model: Fluid Mosaic Model (Freeze fracture technique)
3. Membrane transport: (5)
    a. Active Transport:
        i. Uniport, Symport, Antiport
        ii. Primary, Secondary
    b. Passive Transport:
        i. Simple diffusion
        ii. Facilitated diffusion (Carrier proteins, Channels)
        iii. Osmosis (one example of each type of transport)
    c. Membrane transport associated disease : cystic fibrosis
    d. Bulk transport: endocytosis and exocytosis
4. Membrane junctions (4)
    a. Classification of junctions:
        i. Occluding: Tight
        ii. Anchoring: Desmosomes
        iii. Channel- forming: Gap, Plasmodesmata
        iv. Signal- Relaying: Chemical synapse
5. Cell wall: (1)
    a. Structure and function of Plant Cell Wall: Primary and secondary wall.

UNIT II **(15 lectures)**

1. Ribosomes: (2)
    a. Structure and function of Prokaryotic and Eukaryotic ribosomes

2. Endoplasmic Reticulum: (4)
    a. RER: structure and role in protein synthesis and glycosylation of proteins Eg. Glycophoprin
    b. SER: structure and function
3. Golgi: (3)
    a. Structure, Origin and Relationship with the ER
    b. Role in storage and secretion of glycoproteins
4. Lysosomes And Peroxisomes: (2)
    a. Lysosomes : Lysosome cycle, Functions , Tay Sachs disease
    b. Peroxisomes : Structure and Function, Zellweger syndrome
5. Mitochondria: (2)
    a. Structure and function
    b. Mitochondria associated disease: LHON and MELAS
6. Plastids: (2)
    a. Types of plastids
    b. Structure and function of chloroplast

UNIT III **(15 lectures)**

1. Cytoskeletal Elements: (6)
    a. Microfilaments:
        i. Structure and function in plant & animal cells (sarcomere structure)
        ii. Microfilament associated disease: DMD
        iii. Microtubules: Structure and role in mitotic spindle & cilia/flagella
        iv. Intermediate filaments: Structure and function
2. Cell cycle and cell division
    a. Cell cycle (G0, G1, G2, M phases) (2)
    b. Mitosis and Meiosis and their significance (3)
3. Nucleus: (4)
    a. Structure of an interphase nucleus: nuclear membrane, nucleolus, nucleosome.
    b. Heterochromatin & Euchromatin
    c. Specialized chromosomes: polytene and lampbrush chromosomes

Practicals S.LSC.2.01 PR

1. Microscopy- Light and EM, and their resolution with respect to organelle structure , Cell junctions: EM pictures
2. Cytoplasmic Streaming in Hydrilla
3. Detection of barr body from buccal smear.
4. Study of Mitosis in onion root tip.
5. Study of eukaryotic cell morphology: onion peel and buccal smear staining
6. Determination of the viability of a given cell sample.
7. Detection of mitochondria and Starch granules in plant cell lysate.

References

1. Molecular Biology of the Cell,5th Ed.(2008) , B.A.Alberts, A. Johnson ., J. Lewis, M. R. K. Roberts, P.Walters, Garland Science Publication
2. Cell and Molecular Biology-concepts and experiments-4th Ed. G.Karp, (2005), John Wiley and Sons Inc.

3. The World of Cell, 5th Ed.(2003), W.M. Becker, L.J. Kleinsmith, J. Hardin, Pearson Education (Singapore)
4. The Cell-A molecular approach, $th Ed.(2007), G.M.Cooper, R.E. Hausman, ASM Press Washington, D.C.
5. Molecular Cell Biology – 6th Ed. (2008) H.Lodish, A. Berk, C.A. Kaiser, M. Krieger, M.P.Scott, A. Bretscher, H. Ploegh, P. Mortsudira, W.H. Freeman and Company, N.Y.
6. Cell Biology (1992) Smith and Wood, Chapman and Hall

LIFE SCIENCE

F.Y.B.Sc. **Course No. S.LSC.2.02**

Title: Fundamentals of Microbiology

Learning Objectives:

On completion of the course, the student must be able to:

1. This course provides a working knowledge of microbes and its special techniques. Students will learn the structure and function of prokaryotic and eukaryotic micoorganisms, as well as viruses.
2. Describe both the nutritional and environmental conditions required for growth by microorganisms
3. Construct bacterial growth curves and explain the specfic phases that occur during bacterial growth.
4. Discuss the physical and chemical mechanisms for controlling microbial populations both in vivo and in vitro.

Number of lectures: 45

UNIT I **(15 lectures)**

1. Introduction to Microbiology (3)
   a. History of microbiology: early Microscope, Spontaneous Generation & Germ Theory
   b. Impact of Microorganisms in industry, agriculture, biotechnology and health.
2. Microbial diversity and Molecular Taxonomy: (3)
   a. Prokaryotes, eukaryotes and archaeabacteria
   b. Bacterial phylogeny (based on ribosomal DNA)
3. Prokaryotic cell: Cell shape, size and arrangement (6)
   a. bacterial cell wall: Gram positive and gram negative,
   b. capsule, flagella, endospores, nucleoid, plasmid
4. Archaebacteria: Classification, Structure of cell wall and cell membrane, one example of each of: Psychrophiles, Halophiles, Thermophiles and Sulfur bacteria. (3)

UNIT II **(15 lectures)**

1. Viruses, Viroids and Prions (6)
   a. Virus structure: capsid morphology, genetic material (DNA and RNA viruses),viral envelope, classification of viruses: general features, bacterial (T4), plant (TMV) and animal viruses (Retrovirus)
   b. Life cycle: T4 and lambda phage.
   c. Viroids
   d. Prions e.g., scrapie
2. Fungi (4)
   a. Classification
   b. Growth and reproduction: sexual & asexual eg; yeast & neurospora.
3. Algae (2)
   a. Classification
   b. Structural Organization
   c. Life cycle of *Chlamydomonas*
   d. Role of Algae in nature

4. Protozoa (3)
   a. Classification
   b. Morphological Diversity
   c. Life cycle: Parasitic eg; *Entamoeba*, Non-parasitic eg; *Paramoecium*

UNIT III **(15 lectures)**

1. Microbial Nutrition: (6)
   a. Common nutrient requirements: C, H, O_2, N, P, S
   b. Nutritional types
   c. Culture media: simple, complex, differential media, selective media (One eg each)
   d. Anaerobic growth media and methods: thioglycollate medium
   e. Laboratory culture of microorganisms: Concept of pure culture and 'consortium'
   f. Preservation of cultures
2. Microbial growth: (5)
   a. Cell growth and Binary fission
   b. Exponential growth: The growth curve, Generation time
   c. Batch and Continuous culture
   d. Factors influencing microbial growth: oxygen, temp., pH, salt
   e. Measurements of Growth
3. Control of Microbial Growth (4)
   a. Physical agents: heat sterilization, radiation sterilization, filter sterilization
   b. Chemical agents
   c. Antimicrobial agents: Antibiotics (penicillin)

Practicals S.LSC.2.02 PR

1. Sterile techniques
2. Monochrome staining (curd/mouth swab/ skin swab/soil)
3. Gram staining
4. Cell Wall staining
5. Streak plating of soil sample suspension.
6. Preparation of media for yeast growth and streak plating.
7. Study of fungi from stale food and permanent slides of fungi.
8. Determination of MIC of NaCl on microbial cultures

Group Projects:

1. Testing the efficacy of mouth wash.
2. Study of bacteria from canteen food.
3. Effect of turmeric, aloe vera, garlic as an antibacterial agent/ disinfectants

References

1. Brock Biology of Microorganisms (12th Edition); Madigan, Martinko, Dunlap & Clark
2. Alcamo's Fundamentals of Microbiology (8th Edition); Jeffrey C. Pommerville
3. Microbiology-an introduction (6th Edition); Tortora, Gerard J.
4. Microbiology (7th Edition) – Prescott, Harley and Klein
5. Principles of Microbiology (2nd edition) – Ronald Atlas
6. Microbiology (7th edition) – Prescot, Harley, Kline

Template of Theory Question paper
Courses S.LSC. 2.01 & 2.02

CIA I – 20 marks, 45 mins.
Unit I: Objectives/Short questions, not more than 2-3 marks each

CIA II – 20 marks, 45 mins.
Unit II: Objectives/Short questions, not more than 2-3 marks each

End Semester exam – 60 marks, 2 hours
Question 1: Unit I: maximum marks per sub-question - 6 marks
20 marks to be answered out of 28-30 marks
Question 2: Unit II: maximum marks per sub-question - 6 marks
20 marks to be answered out of 28-30 marks
Question 3: Unit III: maximum marks per sub-question - 6 marks
20 marks to be answered out of 28-30 marks

Mark-distribution pattern for Practical
CIA & End Semester Practical Examination

CIA per course

Q1. Any one / two practicals	15 marks
Q2. Journal	05 marks

End semester Practical Examination

Any two / three practicals	30 marks