



St. Xavier's College (Autonomous) Mumbai

Syllabus For 2nd Semester Courses in **LIFE SCIENCE** (June 2018 onwards)

Contents:

Syllabus (theory and practicals) for Courses:

| | |
|----------|------------------------------|
| SLSC0201 | Cell Biology |
| SLSC0202 | Fundamentals of Microbiology |
| SLSC02PR | Practicals |

Template for theory and practical question paper

Evaluation and Assessment Grid

Percent revision:

2015-16: No revision

2016-17: No revision

2017-18: No revision

2018-19: 40-50% revision to practicals

2019-20: No revision

LIFE SCIENCE

F.Y.B.Sc.

Course No. SLSC0201

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 (2)
 - 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

References

1. *Molecular Biology of the Cell* (2008) 5th Edition, Alberts, B.A., Johnson, A., Lewis, J., Roberts, M.R.K., Walters, P. Garland Science Publication
2. *Cell and Molecular Biology-concepts and experiments* (2005) 4th Edition, Karp, G. John Wiley and Sons Inc.
3. *The World of Cell* (2003) 5th Edition, Becker, W.M., Kleinsmith, L.J., Hardin, J. Pearson Education (Singapore)
4. *The Cell-A molecular approach* (2007) 4th Edition, Cooper, G.M., Hausman, R.E. ASM Press Washington, D.C.
5. *Molecular Cell Biology* (2008) 6th Edition, Lodish, H., Berk, A., Kaiser, A.C. Krieger, M., Scott, M.P., Bretscher, A., Ploegh, A., Mortsudira, P. 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. SLSC0202

Title: Fundamentals of Microbiology

Learning Objectives:

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

1. Explain the distinguishing characteristics, structure and function of prokaryotic and eukaryotic microorganisms, 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 specific phases that occur during bacterial growth.
4. Discuss the physical and chemical methods 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 archaeobacteria
 - 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. Archaeobacteria: 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, O₂, 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)

References

1. *Brock Biology of Microorganisms* (2007) 12th Edition, Madigan, M.M., Martinko, J.M., Dunlap, P.V., & Clark, D.P. Pearson
2. *Alcamo's Fundamentals of Microbiology* (2006) 8th Edition, Pommerville, J.C. Jones and Bartlett Learning
3. *Microbiology-an introduction* (1997) 6th Edition, Tortora, G. J., Berdell, F.R., & Case, C.L. Benjamin-Cummings Pub. Co.
4. *Prescott, Harley and Klein's Microbiology* (2008) 7th Edition, Willey, J.M., Sherwood L., Woolverton C.J. McGraw-Hill
5. *Principles of Microbiology* (1997) 2nd edition, Atlas, R. McGraw-Hill

Practical: SLSC02PR

1. Microscopy
 - a. Know your microscope and wet mount of Hydrilla
 - b. Iodine mount of onion cells
 - c. Methylene blue staining and observation of cheek epithelial cells
 - d. Cytoplasmic streaming in Hydrilla
 - e. Observation of different stages of mitosis in onion root tip
 - f. Observation of fungi and algae
2. General microbiology lab instructions, biosafety and sterilization techniques
3. Monochrome staining (curd/mouth swab/ skin swab/ soil)
4. Gram staining
5. Cell wall staining
6. Preparation of microbial media
 - a. Nutrient broth
 - b. Nutrient agar plates
 - c. Nutrient agar slants and butts
7. Aseptic techniques
8. Isolation of microorganisms by streak plate technique
9. Determination of MIC of NaCl for microbial cultures

Template of Theory Question paper

Courses: SLSC201 & 202

CIA I – 20 marks, 45 mins.

Unit I: Objectives/Short questions, not more than 2-3 marks each

CIA II – 20 marks

Unit II: Test (*45 mins*) /Survey /Assignment /Presentation /Poster /Essay /Review

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

Course: SLSC02PR

End semester Practical Examination

Experiments

Identification

Journal

Total marks: 100

70 marks

20 marks

10 marks

DEPARTMENT OF LIFE SCIENCES AND BIOCHEMISTRY

| F.Y.B.Sc. Life Science Exam Grid Semester 2 | | | | | |
|----------------------------------------------------|--------------|----------------------------------|----------------------|-----------------------------|--------------|
| Course | Exam | Knowledge and Information | Understanding | Application/Analysis | Total |
| 0201 | CIA I | 8 | 8 | 4 | 20 |
| | CIA II | 8 | 8 | 4 | 20 |
| | End semester | 18 | 18 | 24 | 60 |
| Course | Exam | Knowledge and Information | Understanding | Application/Analysis | Total |
| 0202 | CIA I | 10 | 7 | 3 | 20 |
| | CIA I | 10 | 7 | 3 | 20 |
| | End semester | 25 | 20 | 15 | 60 |