Course syllabus for
Single Major and Single Minor
B.Sc. in Microbiology Syllabus
(Semester IV)
(FYUGP Regulation 2024-25)
University of North Bengal

B.Sc. Syllabus in Microbiology according to the Course syllabus for Single Major and Single Minor together with allied courses (FYUGP 2024)

University of North Bengal

Format of question papers for semester end examination

1. **For 60 Marks (Theory papers)**

Sl. No	Question to be answered	Out of	Marks of each question	Total Marks
1.	06	08	01	1X6=6
2.	05	07	06	6X5=30
3.	02	04	12	12X2=24
			Total	60

2. **For 20 Marks (Practical Papers)**

Sl. No	Question to be answered	Marks of each question	Question type	Total Marks
1.	01	08	Practical	8X1=8
2.	01	05	Practical	5X1=5
3.	01	05	Viva	5X1=5
4.	01	02	Lab records	2X1=2
All questions are compulsory			Total	20

MAJOR

Paper: 7 MAJOR Paper Code: MICRMAJ407

MOLECULAR BIOLOGY

(Paper Type: Theory)
Semester –IV
Lecture Hours : 45 h Marks: 60 Credits: 3

Unit 1 Structures of DNA and RNA / Genetic Material **No. of Hours: 5**

Types of genetic material, denaturation and renaturation, cot curves. DNA topology – linking number, topoisomerases; Organization of DNA Prokaryotes,Viruses, Eukaryotes.RNA Structure, Organelle DNA -- mitochondria and chloroplast DNA.

Unit 2 Replication of DNA (Prokaryotes and Eukaryotes) **No. of Hours: 10**

Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication Mechanism of DNA replication: Enzymes and proteins involved in DNA replication – DNApolymerases, DNA ligase, primase, telomerase – for replication of linear ends Various models of DNA replication including rolling circle, D- loop (mitochondrial), Θ (theta) mode of replication and other accessory protein.

Unit 3 Transcription in Prokaryotes and Eukaryotes **No. of Hours: 6**

Transcription: Definition, difference from replication, promoter - concept and strength of promoter RNA Polymerase and the transcription unitTranscription in Eukaryotes: RNA polymerases, general Transcription factors

Unit 4 Post-Transcriptional Processing **No. of Hours: 4**

Split genes, concept of introns and exons, RNA splicing, spliceosome machinery**,** concept of alternative splicing, Polyadenylation and capping, Processing of rRNA

Unit 5 Translation (Prokaryotes and Eukaryotes) **No. of Hours: 10**

Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation,elongation and termination of polypeptides in both prokaryotes and eukaryotes, Fidelity of translation,Inhibitors of protein synthesis in prokaryotes and eukaryote

Unit 6 Regulation of gene Expression in Prokaryotes and Eukaryotes No. of Hours: 10

Principles of transcriptional regulation, regulation at initiation with examples from *lac* operon, Sporulation: *Bacillus,* Changes in Chromatin Structure -DNA methylation and Histone Acetylation mechanisms

Paper: 7 MAJOR Paper Code: MICRMAJ407

MOLECULAR BIOLOGY

(Paper Type: Practical)
Semester –IV
Lecture Hours : 30 h Marks: 20 Credits: 1

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of salmon sperm / calf thymus DNA using UV spectrophotometer (A260 measurement)
5. Estimation of RNA using colorimeter (orcinol reagent) or UV spectrophotometer (A260 measurement)
6. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
7. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).

SUGGESTED READINGS

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco
3. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia

4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons.Inc.
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
6. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
7. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

Paper: 8 MAJOR Paper Code: MICRMAJ408

CELL BIOLOGY

(Paper Type: Theory)
Semester –IV
Lecture Hours : 45 h Marks: 60 Credits: 3

Unit 1: Structure and organization of Cell **No. of Hours: 12**

Cell Organization – Eukaryotic (Plant and animal cells) and prokaryotic, Plasma membrane: Structure and transport of small molecules; Cell Wall: Eukaryotic cell wall; Mitochondria, chloroplasts and peroxisomes; Cytoskeleton: Structure and organization of actin filaments, association of actin filaments with plasma membrane, cell surface protrusions, intermediate filaments, microtubules

Unit 2: Nucleus **No. of Hours: 4**

Nuclear envelope, nuclear pore complex and nuclear lamina Chromatin – Molecular organization Nucleolus

Unit 3: Protein Sorting and Transport **No. of Hours: 12**

Ribosomes, Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing and quality control in ER, smooth ER and lipid synthesis, export of proteins and lipids Golgi Apparatus – Organization, protein glycosylation, protein sorting and export from Golgi Apparatus Lysosomes

Unit 4: Cell Signalling **No. of Hours: 5**

Signalling molecules and their receptors Function of cell surface receptors Pathways of intra-cellular receptors – Cyclic AMP pathway

Unit 5 Cell Cycle, Cell Death and Cell Renewal **No. of Hours: 12**

Eukaryotic cell cycle and its regulation, Mitosis and Meiosis, Development of cancer, causes and types, Programmed cell death

Paper: 8 MAJOR Paper Code: MICRMAJ408

CELL BIOLOGY

(Paper Type: Practical)
Semester –IV
Lecture Hours : 30 h Marks: 20 Credits: 1

1. Perform microscopy with a representative plant and animal cell.
2. Study of the structure of cell organelles through electron micrographs
3. Cytochemical staining of DNA – Feulgen
4. Study of polyploidy in Onion root tip by colchicine treatment.
5. Identification and study of cancer cells by photomicrographs.
6. Study of different stages of Mitosis.
7. Study of different stages of Meiosis.
8. Staining of mitochondria by Janus Green stain.

SUGGESTED READING :

1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's World of the Cell.8th edition. Pearson.

2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons.Inc.

3. De Robertis, EDP and De Robertis EMF.(2006). Cell and Molecular Biology.8th edition. Lipincott Williams and Wilkins, Philadelphia.

4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition.ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA

MINOR

Paper: 4 (MINOR) Paper Code: MICRMIN404
CELL AND MOLECULAR BIOLOGY
(Paper Type: Theory)
Semester –IV
Lecture Hours: 45h Marks: 60 Credits: 3

Unit 1: Structure and organization of Cell **No. of Hours: 9**

Cell Organization – Eukaryotic (Plant and animal cells) and prokaryotic, Plasma membrane: Structure and transport of small molecules; Cell Wall: Eukaryotic cell wall; Mitochondria; Cytoskeleton: Structure and organization of actin filaments, intermediate filaments, microtubules.

Unit 2: Nucleus **No. of Hours: 4**

Nuclear envelope, nuclear pore complex and nuclear lamina Chromatin – Molecular organization Nucleolus

Unit 3: Cell Signalling **No. of Hours: 5**

Signalling molecules and their receptors Function of cell surface receptors Pathways of intra-cellular receptors – GPCR

Unit 4: Cell Cycle, Cell Death and Cell Renewal **No. of Hours: 6**

Eukaryotic cell cycle , Mitosis and Meiosis, Apoptosis.

Unit 5 : Structures of nucleic acid **No. of Hours: 2**

Types of genetic material, double helical structure of DNA, general structure of different RNA

Unit 6 :Replication of DNA (Prokaryotes) **No. of Hours: 6**

Bidirectional and unidirectional replication, semi- conservative, Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase Various models of DNA replication including rolling circle, Θ (theta) mode of replication and other accessory protein.

Unit 7: Transcription in Prokaryotes **No. of Hours: 3**

Transcription: Definition, promoter, RNA Polymerase and phases of transcription. Polyadenylation and capping,

Unit 8: Translation (Prokaryotes) **No. of Hours: 5**

Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation,elongation and termination of polypeptides in prokaryotes.

Unit 9: Regulation of gene Expression in Prokaryotes **No. of Hours: 5**

Principles of transcriptional regulation, regulation at initiation with examples from *lac* operon,

Paper: 4 (MINOR) Paper Code: MICRMIN404

CELL AND MOLECULAR BIOLOGY

(Paper Type: Practical)
Semester –IV
Lecture Hours: 30h Marks: 20 Credits: 1

1. Study of different types of DNA and RNA using micrographs and model / schematic representations

2. Study of semi-conservative replication of DNA through micrographs / schematic representations

3. Isolation of genomic DNA from *E. coli* and its estimation using UV spectrophotometer (A260 measurement)

4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.

5. Perform microscopy with a representative plant and animal cell.

6. Study of the structure of cell organelles through electron micrographs

7. Cytochemical staining of DNA – Feulgen

8. Study of polyploidy in Onion root tip by colchicine treatment.

9. Study of different stages of Mitosis.

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Course syllabus for
Three Discipline specific multidisciplinary Course
B.Sc. in Microbiology Syllabus
(Semester IV)
(FYUGP Regulation 2024-25)
University of North Bengal

B.Sc. Syllabus in Microbiology according to the Course syllabus for Three Discipline specific multidisciplinary Course 2024-25,

University of North Bengal

DISIPLINE SPECIFIC COURSE
(DSC) Subject A/B

Paper: 4 (DSC) Paper Code: MICRDSC404

CELL AND MOLECULAR BIOLOGY

(Paper Type: Theory)
Semester –IV
Lecture Hours: 45h Marks: 60 Credits: 3

Unit 1: Structure and organization of Cell **No. of Hours: 9**

Cell Organization – Eukaryotic (Plant and animal cells) and prokaryotic, Plasma membrane: Structure and transport of small molecules; Cell Wall: Eukaryotic cell wall; Mitochondria; Cytoskeleton: Structure and organization of actin filaments, intermediate filaments, microtubules.

Unit 2: Nucleus **No. of Hours: 4**

Nuclear envelope, nuclear pore complex and nuclear lamina Chromatin – Molecular organization Nucleolus

Unit 3: Cell Signalling **No. of Hours: 5**

Signalling molecules and their receptors Function of cell surface receptors Pathways of intra-cellular receptors – GPCR

Unit 4 Cell Cycle, Cell Death and Cell Renewal **No. of Hours: 6**

Eukaryotic cell cycle , Mitosis and Meiosis, Apoptosis.

Unit 5 Structures of nucleic acid **No. of Hours: 2**

Types of genetic material, double helical structure of DNA, general structure of different RNA

Unit 6 Replication of DNA (Prokaryotes) **No. of Hours: 6**

Bidirectional and unidirectional replication, semi- conservative, Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase Various models of DNA replication including rolling circle, Θ (theta) mode of replication and other accessory protein.

Unit 7 Transcription in Prokaryotes **No. of Hours: 3**

Transcription: Definition, promoter, RNA Polymerase and phases of transcription. Polyadenylation and capping,

Unit 8 Translation (Prokaryotes) **No. of Hours: 5**

Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation,elongation and termination of polypeptides in prokaryotes.

Unit 9 Regulation of gene Expression in Prokaryotes **No. of Hours: 5**

Principles of transcriptional regulation, regulation at initiation with examples from *lac* operon,

Paper: 4 (DSC) Paper Code: MICRDSC404

CELL AND MOLECULAR BIOLOGY

(Paper Type: Practical)

Semester –IV

Lecture Hours: 30h Marks: 20 Credits: 1

1. Study of different types of DNA and RNA using micrographs and model / schematic representations

2. Study of semi-conservative replication of DNA through micrographs / schematic representations

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4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.

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MINOR

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(Paper Type: Theory)
Semester –IV
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Paper: 4 (MINOR) Paper Code: MICRMIN404

CELL AND MOLECULAR BIOLOGY

(Paper Type: Practical)
Semester –IV
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13. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons.Inc.
14. De Robertis, EDP and De Robertis EMF.(2006). Cell and Molecular Biology.8th edition. Lipincott Williams and Wilkins, Philadelphia.
15. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition.ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA

Inter Disciplinary (IDC) Course

Life Science Group 2
Paper: 3 (IDC) Paper Code: ….
DAIRY MICROBIOLOGY
(Paper type: Theory)
(Semester: IV)
Lecture Hours: 30 h Marks: 40 Credits:2

Unit 1: **No. of Hours: 3h**
Milk as balanced diet, constituent of milk, antimicrobial constituents of milk, milk spoilage.

Unit 2: **No. of Hours: 7h**
Dairy starter cultures, fermented dairy products (production and role and type of microorganisms): yogurt, acidophilus milk, cheese Probiotics: definition, Health benefits, types of microorganisms used.

Unit 3: **No. of Hours: 5h**
Types of microorganisms present in milk: acid producing, gas producing and pathogenic (*Bacillus cereus, Clostridium botulinum)* microorganism

Unit 4: **No. of Hours: 5h**
Sources of contamination of milk and their control: Exterior of the animal, interior of the udder, utensils, water, milker, flies and insects, soil and manure, milking barn, cattle shed and surroundings.

Unit 5: **No. of Hours: 5h**
Microbiological examination of milk: Direct microscopic count, Standard plate count, Methylene blue reduction test, Resazurin reduction test. Coliforms and their types, and Coliform test.

Unit 6: **No. of Hours: 5h**
Pasteurization and its type, Cleaning and sanitization of dairy equipment: Methods of cleaning and sanitization: Cleaning in place (CIP)

Life Science Group 2
Paper: 3 (IDC) Paper Code: …
DAIRY MICROBIOLOGY
(Paper type: Tutorial)
(Semester: IV)
Lecture Hours: 15 h Marks: 20 Credits:1

Evaluation of the students will be done as suggested in the FYUGP, NBU regulation 2024-25.

SUGGESTED READINGS

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology.1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992). Food Microbiology.3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA.(2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.