College of Basic Science and Humanities, OUAT, Bhubaneswar-3

Syllabus for +3, 2nd Year Science

MICROBIOLOGY (core course), SEMESTER –III

Microbial Physiology and Metabolism (THEORY)

Course code- MBC (T) - 2305

Lesson plan

Unit	Topic	Lecture
1	**Microbial Growth and Effect of Environment on Microbial Growth** Definitions of growth, techniques in measurement of microbial growth Batch culture, Continuous culture, diauxic growth curve Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic) Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe),barophilic	 **02** **03** **04** **03**
2	**Nutrient uptake and Transport** Passive and facilitated diffusion Primary and secondary active transport, concept of uniport,symport and antiport . Group translocation, ion uptake.	 **02** **04** **02**
3	**Chemoheterotrophic and Phototrophic Metabolism** Concept of aerobic respiration, anaerobic respiration. Fermentation Sugar degradation pathways i.e. EMP, ED Pentose phosphate pathway, TCA cycle, Electron transport chain: components of respiratory chain. Anaerobic respiration with special reference to dissimilatory nitrate reduction. Fermentation - Alcohol fermentation; Lactate fermentation (homofermentative and heterofermentative pathways. Photosynthesis with reference to photosynthesis in cyanobacteria.	 **02** **02** **04** **02** **04** **02**
4	**Nitrogen Metabolism** Biological nitrogen fixation with special reference to *Rhizobium*, *nif*-gene expression and nitrogenase activity. Ammonification, Nitrification, Assimilatory nitrate reduction, denitrification.	 **03** **05**

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MICROBIOLOGY (core course), SEMESTER –III
Microbial Physiology and Metabolism (THEORY)
Course code- MBC (T) - 2305

Course breakup

Lecture schedule

LECTURE NO.	TOPICS TO BE COVERED
1	Definitions of growth,
2	Techniques in measurement of microbial growth
3	Batch culture,
4	Continuous culture,
5	Diauxic growth curve
6	Microbial growth in response to environment -Temperature (psychrophiles, mesophiles,
7	Thermophiles, extremophiles, thermodurics, psychrotrophs),
8	pH (acidophiles, alkaliphiles),
9	Solute and water activity (halophiles, xerophiles, osmophilic)
10	Oxygen (aerobic, anaerobic, microaerophilic,
11	facultative aerobe, facultative anaerobe)
12	Barophilic
13	Passive and facilitated diffusion
14	Passive and facilitated diffusion
15	Primary and secondary active transport,
16	Concept of uniport,
17	Symport
18	Antiport
19	Group translocation,
20	Ion uptake.
21	Concept of aerobic respiration,
22	Anaerobic respiration.
23	Fermentation Sugar degradation pathways i.e. EMP, ED
24	Pentose phosphate pathway,
25	TCA cycle
26	Electron transport chain:
27	Components of respiratory chain.
28	Anaerobic respiration with special reference to dissimilatory nitrate reduction.
29	Anaerobic respiration with special reference to dissimilatory nitrate reduction.
30	Fermentation - Alcohol fermentation; and

31	Fermentation - Alcohol fermentation
32	Lactate fermentation (homofermentative
33	Heterofermentative pathways.
34	Photosynthesis with reference to photosynthesis in cyanobacteria.
35	Photosynthesis with reference to photosynthesis in cyanobacteria.
36	Biological nitrogen fixation with special reference to *Rhizobium*,.
37	*nif*-gene expression and
38	Nitrogenase activity
39	Ammonification
40	Nitrification
41	Assimilatory nitrate reduction
42	Assimilatory nitrate reduction
43	Denitrification

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Syllabus for +3, 2nd Year Science
MICROBIOLOGY (core course), SEMESTER –III
Cell Biology (THEORY)
Course code- MBC(T) -2306

Lesson plan

Unit	Topic	lecture
1	**Structure and organization of Cell**	
	Cell Organization – Eukaryotic (Plant and animal cells)	01
	Prokaryotic (Bacterial): Structure and function Plasma membrane, Cell Wall, Mitochondria, chloroplasts and peroxisomes Cytoskeleton; Nuclear organization (Eukaryotic and prokaryotic): Nuclear envelope, nuclear pore complex	03 05 02
	Nuclear lamina, Chromatin organization, Nucleolus.	01
2	**Protein sorting and Transport**	
	Ribosome, Endoplasmic Reticulum: Structure, targeting and insertion of proteins in the ER	02
	Protein folding, processing in ER, smooth ER	02
	Lipid synthesis, export of proteins	02
	Lipids Golgi Apparatus – Organization, protein glycosylation,	02
	Protein sorting and export from Golgi Apparatus, Lysosomes	02
3	**Cell signaling**	
	Signaling molecules and their receptors	02
	Function of cell surface receptors	02
	Pathways of intra-cellular receptors – Cyclic AMP pathway	04
	Cyclic GMP and MAP kinase pathway.	02
4	**Cell Cycle, Cell Death and Cell Renewal**	
	Eukaryotic cell cycle and its regulation	02
	Mitosis and Meiosis (Molecular basis)	03
	Development of cancer, causes and types	03
	Programmed cell death	02
	Stem cells: Embryonic stem cell, induced pleuripotent stem cells.	02

College of Basic Science and Humanities, OUAT, Bhubaneswar-3
Syllabus for +3, 2nd Year Science
MICROBIOLOGY (core course), SEMESTER –III
Cell Biology (THEORY)
Course code- MBC(T) -2306

Course breakup

Lecture schedule

LECTURE NO.	TOPICS TO BE COVERED
1	Cell Organization – Eukaryotic (Plant and animal cells)
2	Prokaryotic (Bacterial): Structure and function Plasma membrane
3	Cell Wall, Mitochondria
4	Chloroplasts and peroxisomes
5	Cytoskeleton
6	Cytoskeleton
7	Nuclear organization (Eukaryotic and prokaryotic)
8	Nuclear organization (Eukaryotic and prokaryotic)
9	Nuclear envelope
10	Nuclear pore complex
11	Nuclear lamina, Chromatin organization, Nucleolus.
12	Nuclear lamina, Chromatin organization, Nucleolus.
13	Ribosome, Endoplasmic Reticulum: Structure, targeting and insertion of proteins in the ER
14	Ribosome, Endoplasmic Reticulum: Structure, targeting and insertion of proteins in the ER
15	Protein folding, processing in ER, smooth ER
16	Protein folding, processing in ER, smooth ER
17	Lipid synthesis, export of proteins
18	Lipid synthesis, export of proteins
19	Lipids Golgi Apparatus – Organization, protein glycosylation
20	Lipids Golgi Apparatus – Organization, protein glycosylation
21	Protein sorting and export from Golgi Apparatus
22	Lysosomes
23	Signaling molecules and their receptors

24	Signaling molecules and their receptors
25	Function of cell surface receptors
26	Function of cell surface receptors
27	Pathways of intra-cellular receptors – Cyclic AMP pathway
28	Pathways of intra-cellular receptors – Cyclic AMP pathway
29	Pathways of intra-cellular receptors – Cyclic AMP pathway
30	Pathways of intra-cellular receptors – Cyclic AMP pathway
31	Cyclic GMP and MAP kinase pathway
32	Cyclic GMP and MAP kinase pathway
33	Eukaryotic cell cycle and its regulation
34	Eukaryotic cell cycle and its regulation
35	Mitosis and Meiosis (Molecular basis)
36	Mitosis and Meiosis (Molecular basis)
37	Mitosis and Meiosis (Molecular basis)
38	Development of cancer, causes and types
39	Development of cancer, causes and types
40	Development of cancer, causes and types
41	Programmed cell death
42	Programmed cell death
43	Stem cells: Embryonic stem cell, induced pleuripotent stem cells
44	Stem cells: Embryonic stem cell, induced pleuripotent stem cells

College of Basic Science and Humanities, OUAT, Bhubaneswar-3
Syllabus for +3, 2nd Year Science
MICROBIOLOGY (core course), SEMESTER –III
Molecular Biology (THEORY)
Course code- MBC(T) -2307

LESSON PLAN

Unit	Topic Title	Lecture
1	**Genetic Material (DNA and RNA)**	
	DNA structure and types, Double helical model of DNA.	03
	Evidences of DNA and RNA as genetic material.	02
	Organization of DNA in prokaryotes and eukaryotes.	02
	Extra chromosomal DNA.	01
	Mechanism of DNA replication, various models of DNA replication: rolling circle, Θ (theta) mode of replication.	02
	Mismatch and excision repair, RNA structure and types.	02
2	**Transcriptional and Post-Transcriptional Processing**	
	Transcription: Definition, promoter, RNA Polymerase and the transcription unit.	03
	Transcription: RNA polymerases, general Transcription factors.	02
	Concept of introns and exons.	01
	RNA splicing, Polyadenylation and capping, Processing of rRNA, RNA interference: si RNA, mi RNA and its significance.	04
3	**Translation (Prokaryotes and Eukaryotes)**	
	Mechanism of Translation: Charging of tRNA, aminoacyl tRNA synthetases.	04
	Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes.	04
	Inhibitors of protein synthesis in prokaryotes and eukaryote.	04
4	**Regulation of gene Expression in Prokaryotes and Eukaryotes**	
	Principles of transcriptional regulation.	02
	Regulation at initiation with examples from *lac* and *trp* operons.	04
	Changes in Chromatin Structure-DNA methylation and Histone Acetylation mechanisms.	04

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Syllabus for +3, 2nd Year Science
MICROBIOLOGY (core course), SEMESTER –III
Molecular Biology (THEORY)

Course breakup

Lecturer schedule

Lecture No.	Topics to be covered
1	DNA structure and types
2	DNA structure and types
3	Double helical model of DNA.
4	Evidences of DNA and RNA as genetic material.
5	Evidences of DNA and RNA as genetic material.
6	Organization of DNA in prokaryotes and eukaryotes.
7	Organization of DNA in prokaryotes and eukaryotes.
8	Extra chromosomal DNA.
9	Mechanism of DNA replication
10	Various models of DNA replication: rolling circle, Θ (theta) mode of replication.
11	Mismatch and excision repair
12	RNA structure and types.
13	Principles of transcriptional regulation.
14	Principles of transcriptional regulation.
15	Principles of transcriptional regulation.
16	Regulation at initiation with examples from *lac* and *trp* operons.
17	Regulation at initiation with examples from *lac* and *trp* operons.
18	Regulation at initiation with examples from *lac* and *trp* operons.
19	Changes in Chromatin Structure
20	Changes in Chromatin Structure-DNA methylation
21	Histone Acetylation mechanisms.
22	Histone Acetylation mechanisms.

23	Transcription: Definition, promoter, RNA Polymerase and the transcription unit.
24	Transcription: Definition, promoter, RNA Polymerase and the transcription unit.
25	Transcription: Definition, promoter, RNA Polymerase and the transcription unit.
26	Transcription: RNA polymerases

27	General Transcription factors.
28	Concept of introns and exons.
29	RNA splicing
30	Polyadenylation and capping
31	Processing of rRNA
32	RNA interference: si RNA, mi RNA and its significance.
33	Mechanism of Translation: Charging of tRNA
34	Mechanism of Translation: Charging of tRNA
35	Aminoacyl tRNA synthetases.
36	Aminoacyl tRNA synthetases.
37	Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes.
38	Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes.
39	Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes. Inhibitors of protein synthesis in prokaryotes and eukaryote.
40	Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes.
41	Inhibitors of protein synthesis in prokaryotes and eukaryote.
42	Inhibitors of protein synthesis in prokaryotes and eukaryote.
43	Inhibitors of protein synthesis in prokaryotes and eukaryote.
44	Inhibitors of protein synthesis in prokaryotes and eukaryote.

College of Basic Science and Humanities, OUAT, Bhubaneswar-3
Syllabus for +3, 2nd Year Science
MICROBIOLOGY (Skill Enhancement Course), SEMESTER –III
Biofertilizers and Biopesticides (THEORY)
Course code- MBS -2301

Lesson plan

Unit	Topic	Lectures
1	**Symbiotic Nirogen fixers** Symbiotic N_2 fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants, *Anabaena azollae* - Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.	**02** **01** **02** **03**
2	**Non - Symbiotic Nitrogen Fixers** Free living *Azospirillum* - free isolation, characteristics, mass inoculum production and field application.	**04**

	Azotobacter -free isolation, characteristics, mass inoculum production and field application.	**04**
3	**Phosphate Solubilizers** Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application. Importance of mycorrizal inoculums, types of *mycorrhizae* and associated plants, Mass inoculums, Production of VAM, field applications of *mycorrhizae* and VAM.	**02** **03** **03**
4	**Bioinsecticides** General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, *Bacillus thuringiensis*: production, Field applications, Virus biocontrol, Fungal biocontrol	**03** **03** **02** **02**

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Syllabus for +3, 2nd Year Science
MICROBIOLOGY (core course), SEMESTER –III
Biofertilizers and Biopesticides (THEORY)
Course code- MBS -2301

Course breakup

Lecture schedule

LECTURE NO.	TOPICS TO BE COVERED
1	Symbiotic N_2 fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application
2	*Rhizobium* - Isolation, characteristics, types, inoculum production and field application
3	legume/pulses plants
4	*Anabaena azollae* - Isolation, characterization, mass multiplication
5	*Anabaena azollae* - Isolation, characterization, mass multiplication
6	Role in rice cultivation
7	Crop response,
8	Field application.
9	Free living *Azospirillum* - free isolation
10	*Azospirillum* - chracteristics
11	*Azospirillum* - mass inoculum production

12	*Azospirillum* - field application
13	*Azotobacter* -free isolation
14	*Azotobacter* -characteristics
15	*Azotobacter* - mass inoculum production
16	*Azotobacter* -field application
17	Phosphate solubilizing microbes - Isolation, characterization
18	Phosphate solubilizing microbes -mass inoculum production, field application.
19	Importance of mycorrizal inoculums,
20	Types of *mycorrhizae* and associated plants
21	Mass inoculums,
22	Production of VAM
23	Field applications of *mycorrhizae*
24	Field applications of VAM.
25	General account of microbes used as bioinsecticides
26	General account of microbes used as bioinsecticides
27	Their advantages over synthetic pesticides
28	*Bacillus thuringiensis*: production,
29	*Bacillus thuringiensis*: production,
30	*Bacillus thuringiensis*: Field applications,
31	Virus biocontrol,
32	Virus biocontrol,
33	Fungal biocontrol
34	Fungal biocontrol

College of Basic Science and Humanities, OUAT, Bhubaneswar-3
Syllabus for +3, 2nd Year Science
MICROBIOLOGY (Generic), SEMESTER –III
Applied Microbiology-I (THEORY)
Course code- MBG-(T)-2303

Lesson Plan

Unit	Topic Title	Lectures
I	**Unit I Soil Microbiology** Soil as a habitat for microorganisms; Diversity and distribution of microorganisms in soil; Soil Microflora, bacteria, Fungus and actinomycetes.	 02 02 02
II	**Unit II Microbial Activity in Soil and Plant-microbe interaction** Microbial degradation of cellulose, hemicelluloses, lignin and chitin**;** Microbial Pathogenicity: Virulence factors of pathogens: enzymes, toxins (host specific and non specific);	08 02

	Effects of pathogens on host physiological processes,	02
III	**Unit II Water and Air Microbiology** Aquatic Environment: Microflora of fresh water and marine habitats, BOD and COD; Atmosphere: Aero-microflora and dispersal of microbes; Sampling of air	 03 03 02 02
IV	**Unit IV Microbial application in crop production** Plant growth promoting bacteria; Biofertilizers – Symbiotic (*Rhizobium, Frankia*), Non Symbiotic (*Azospirillum, Azotobacter*, Phosphate solubilizers); Biopesticides, IPM; Weed control.	 02 05 03 02

College of Basic Science and Humanities, OUAT, Bhubaneswar-3

Syllabus for +3, 2nd Year Science
MICROBIOLOGY (Generic), SEMESTER –III
Applied Microbiology-I (THEORY)
Course code-MBG(T)-2303

Course Breakup

Lecture schedule

Lecture No.	Topics to be covered.
1	Soil as a habitat for microorganisms;
2	Soil as a habitat for microorganisms;
3	Diversity and distribution of microorganisms in soil;
4	Diversity and distribution of microorganisms in soil;
5	Soil Microflora, bacteria, Fungus and actinomycetes.
6	Soil Microflora, bacteria, Fungus and actinomycetes.

7	Microbial degradation of cellulose
8	Microbial degradation of cellulose
9	Microbial degradation of hemicelluloses
10	Microbial degradation of hemicelluloses
11	Microbial degradation of lignin
12	Microbial degradation of lignin
13	Microbial degradation of chitin
14	Microbial degradation chitin
15	Microbial Pathogenicity: Virulence factors of pathogens: enzymes, toxins (host specific)
16	Microbial Pathogenicity: Virulence factors of pathogens: enzymes, toxins (host non specific);
17	Effects of pathogens on host physiological processes,
18	Effects of pathogens on host physiological processes,
19	Aquatic Environment: Microflora of fresh water
20	Aquatic Environment: Microflora of fresh water
21	Aquatic Environment: Microflora of marine habitats
22	BOD and COD;
23	BOD and COD;
24	BOD and COD;
25	Atmosphere: Aero-microflora and dispersal of microbes;
26	Atmosphere: Aero-microflora and dispersal of microbes;
27	Sampling of air
28	Sampling of air
29	Plant growth promoting bacteria;
30	Plant growth promoting bacteria;
31	Biofertilizers – Symbiotic (*Rhizobium*)
32	Biofertilizers – Symbiotic (*Frankia*)
33	Biofertilizers Non Symbiotic (*Azospirillum)*
34	Biofertilizers Non Symbiotic (*Azotobacter*);
35	Biofertilizers Non Symbiotic (Phosphate solubilizers);
36	Biopesticides

37	Biopesticides
38	IPM
39	Weed control
40	Weed control