



ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)

Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,

(Recognised Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE)

Detail Syllabus of

B.Sc. II Year

or

Diploma in Microbial Technology



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Programme/Class: Diploma	Year: Second	Semester: Third
Subject: MICROBIOLOGY		
Course Code: B080301T	Course Title: Basic Biochemistry and Microbial Physiology	
Course Outcomes:		Bloom's Taxonomy
• CO1- Will have understanding of the basic principles of thermodynamics applied to biological systems		K1, K3
• CO2- Will be conversant with the structures of carbohydrates, lipids, proteins and nucleic acids		K2, K4
• CO3- Will comprehend the basic concepts of enzyme biochemistry including enzyme kinetics, and will become aware of different variants of enzymes found in living cells.		K3, K5
• CO4- Will be acquainted with the diverse physiological groups of bacteria/archaea and microbial transportsystems.		K3, K6
• CO5- Will have an in-depth knowledge of patterns of bacterial growth, bacterial growth curve, calculation of generation time and specific growth rate, and effect of the environment on growth.		K2, K4
• CO6- Will apprehend how biochemical pathways are used by bacteria for energy generation and conservation during growth on glucose under aerobic and anaerobic conditions		K3, K5
• CO7- Will be familiar with the physiology of nitrogen fixation and assimilation of inorganic nitrogen by bacteria and understand how interactions between microbes and the environment affect cellular physiology.		K4, K6
Credits: 4		Core: Compulsory
Max. Marks: 25+75		Min. Passing marks: as per rules
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:4-0-0		
Unit	Topics	Total No. of Lectures/ Hours (60)
I	Overview of thermodynamics and bioenergetic Basics of thermodynamics- First and second laws, concept of enthalpy, entropy, free energy change, standard free energy change, equilibrium constant and spontaneous reactions and coupled reactions	6
II	Water & Carbohydrates Structure and properties of water, Handerson Hasselbalch equation, Ionic product of water, pH and buffers. Structure & classification of carbohydrates, carbohydrates metabolism: glycolysis, fermentation, Pentose phosphate pathway (PPP), Entner Doudoroff pathway, Krebs Cycle, Electron transport chain (ETC)- Chemiosmotic hypothesis, oxidative phosphorylation and ATP generation, Gluconeogenesis	12



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III	Proteins Structure & Classification- Protein structure: primary, secondary- peptide unit salient features, α helix, β sheet, β turn, tertiary and quaternary-human hemoglobin as an example. Forces involved in protein folding	6
IV	Lipids & Nucleic acids Structure and classification of lipids. Metabolism of lipids- Alpha and beta oxidation of lipids; Nucleic acids Structures, Double helical structure of DNA. Types of DNA: A, B, Z. Physic-chemical properties of DNA. RNA types- rRNA, mRNA, tRNA.	6
V	Enzymology concepts: Concepts of holozymes, apoenzyme, cofactors, prosthetic group, coenzyme, metal cofactors; Classification of enzymes; Active site and activation energy; Lock and key hypothesis, induced fit hypothesis; enzyme kinetics; Allosteric enzymes-cooperativity; Enzyme inhibition: competitive and noncompetitive	6
VI	Microbial nutrient uptake and transport: Microbial classification based on nutrient and energy source; Nutrient uptake mechanisms-passive and facilitated diffusion; Primary and secondary active transport; Concept of uniport, symport, antiport, group translocation; Iron uptake	8
VII	Microbial growth and effect of environmental factors on growth Bacterial growth curve and kinetics-Generation time and specific growth rate; Diauxic growth and synchronous growth; Batch, Fed batch and continuous cultures; Chemostat and turbidostat	8
VIII	Stress physiology and Nitrogen metabolism Effect of oxygen, pH, osmotic pressure, heat shock on bacteria; Microbial adaptation to Environment-Temperature, pH, Oxygen, Pressure, Salt, Water activity; Extremophiles application in industry; Dissimilatory nitrate reduction, Nitrogen fixation	8



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Suggested Readings:

1. Moat A.G., Foster J.W. and Spector M.P. 2002. *Microbial Physiology*, 4th edition. A Johan Wiley and sons inc., publication.
2. Kim B.H. and Gadd G.M. 2008. *Bacterial physiology and metabolism*. Cambridge University Press, Cambridge.
3. Gilbert H.F. 2000. *Basic concepts in biochemistry: A student's survival guide*. Second Edition. Mc-Graw-Hill Companies, health professions Division, New York.
4. Madigan M.T., Martinko J.M., Stahl D.A. and Calrk D.P. 2012. *Brock Biology of Microorganisms*. 13th ed. Pearson Education Inc.
5. Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer. 2015. *Biochemistry* 8th edition. W. H. Freeman.
6. Suggestive digital platforms web links-
 - <https://lipidnanostructuresgroup.weebly.com>
 - <https://www.labster.com/microbiology-virtual-labs>
 - <https://www.microbiologybook.org>
 - <https://www.cpe.rutgers.edu/courses/current/lf0401wa.html>
 - <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microscopy>
 - <https://www.futurelearn.com/courses/introduction-to-microbiology>

This course can be opted as an elective by the students of following subjects: Open for all

Course prerequisites: To study this course, a student must have had the subject "Agriculture and Environmental Microbiology" in II Semester of certificate course in Microbial Technology

Suggested Continuous Evaluation Methods

House Examination/Test: 10 marks

Written Assignment/Presentation/Project/Research Orientation/Term papers/Seminar: 10 Marks

Class performance/Participate: 5 Marks

Further Suggestions: None



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Programme/Class: Diploma	Year: Second	Semester: Third
Subject: MICROBIOLOGY		
Course Code: B080302P	Course Title: Experiments in Basic Biochemistry and Microbial Physiology	
Course Outcomes:		Bloom's taxonomy
• CO1- Understand the structures of carbohydrates and their main properties, as well as conduct chemical tests to detect their presence in samples.		K1, K3
• CO2- Would have acquired practical knowledge of biochemical techniques for proteins and will be familiar with the use of a spectrophotometer.		K4, K5
• CO3- Understand the fundamental principles of enzyme biochemistry, including enzyme kinetics, at the end of the course.		K2, K6
• CO4- Will have a thorough understanding of bacterial growth patterns, bacterial growth curves, generation time and basic growth rate calculations, and the impact of the environment on growth.		K3, K5
• CO5- Will learn about the fermentation process in microbes.		K1, K3
Credits: 2		Core: Compulsory
Max. Marks: 25+75		Min. Passing marks: as per rules
Total No. of Lectures-Tutorials-Practical(in hours per week): L-T-P:0-0-2		
S. No.	Objectives	Total No. of Lectures/ Hours (60)
1	Use and calibration of pH meter and preparation of buffers. Preparation of stock and working solutions. Handling of pipettes and micropipettes and checking their accuracy.	4
2	Qualitative tests Carbohydrates: Molisch's Test, Fehling's Test, Benedict's Test, Iodine Test) Amino acids and Proteins: Ninhydrin test, Biuret test, Lowry's assay. Lipids: Solubility Test, Translucent Spot Test, Emulsification Test.	20
3	Quantitative estimation of carbohydrate by anthrone method. Quantitative estimation of proteins by Lowry's method Determination of the acid value of a fat	10
4	Amylase production, H ₂ S production, Urease production test, IMViC test	10
5	Effect of temperature and pH on growth of E. coli, Effect of carbon and nitrogen on microbial growth.	8
6	Demonstration of carbohydrate fermentation, indole production, catalase test, oxidase test.	8
Suggested readings: 1. Daniel M. Bollag, Stuart J. Edelstein, Protein Methods, Volume 1, 1991, Wiley. 2. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2000, Narosa. 3. Sambrook J and Russell DW., Molecular Cloning: A Laboratory Manual. 4th Edition, 2004, Cold Spring Harbour Laboratory press. 4. Maloy SR, Cronan JE and Friefelder D, Microbial Genetics 2nd EDITION., 2004, Jones and Barlett Publishers 5. Larry Snyder. Molecular Genetics of Bacteria: 3rd (third) Edition. 6. Digital links • http://www.mooc.list.com/tag/molecular-biology • http://www.mooc.list.com/course/microbiology.sayloro		



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- <https://lipidnanostructuresgroup.weely.com>
- <http://www.mooc.list.com/microbial>
- <https://open.umn.edu/opentextbooks/textbooks/biochemistry-free-for-all-ahern>

This course can be opted as an elective by the students of following subjects: Open for all

Course prerequisites: To study this course, a student must have had the subject “Agriculture and Environmental Microbiology” in II Semester of certificate course in Microbial Technology

Suggested Continuous Evaluation Methods

Further Suggestions: None



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FACULTY OF SCIENCE

**KHWAJA MOINUDDIN CHISTI LANGUAGE UNIVERSITY,
LUCKNOW, U.P. (India)**

B.Sc. - Microbiology (2nd Year, Semester-III or IV)

Generic Elective-3 or 4 (GE-3/4)/Minor Elective-3 or 4

Minor Microbiology-3 or 4

Microbial ecology and Bio control by Microorganism

Effective from Session 2022-23



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Programme/Class: Certificate	Year: Second	Semester: Third or Fourth
Subject: Microbiology		
Course Code: B080203T	Course Title: Microbial ecology and Bio control by Microorganism	
Course Outcomes:		Bloom's taxonomy
• CO1- Get acquainted with natural habitats of diverse protection.		K1, K4
• CO2- Understand how microbes interact among themselves and with higher plants and animals with the help of various examples.		K2, K4
• CO3- Become aware of the important role microbes play in bio-geochemical cycling of essential elements occurring within an ecosystem and its significance.		K2, K5
• CO4- Gain in depth knowledge of different types of solid waste, liquid waste and their management.		K3, K5
• CO5- Get familiar with problems of pollution and applications of clear up technologies for the pollutants.		K3, K6
Credits: 4		GE-3 and 4/Minor Elective-3 and 4
Max. Marks: 25+75		Min. Passing marks: as per rules
Total No. of Lectures-Tutorials-Practical(in hours per week): L-T-P: 4-0-0		
Unit	Topics	Total No. of Lectures/ Units & Hours (60)
I	Interaction of Microorganisms Positive and negative interaction- Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Microorganism of rhizosphere, rhizoplane and phylloplane, mycorrhiza (types and its applications).	15
II	Cycling of nutrients (Biogeochemical cycles) – Carbon cycle- Microbial degradation of cellulose, hemicellulase, lignin and chitin; Nitrogen cycle- Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, Phosphorous cycle- Phosphate Immobilisation and solubilisation and Sulphur cycle- Microbes involved in sulphur cycle.	15
III	Biodegradation and Bioremediation Types of bioremediation -microbial bioremediation, phytoremediation, and mycoremediation, Types of reaction in bioremediation, Factors affecting microbial bioremediation-Biotic or biological factors and Abiotic or environmental factors, Biodegradation of hydrocarbons, pesticides and herbicides	15
IV	Sewage/Waste Water Treatment Solid waste management: Source and type of solid waste, method of solid waste disposal (composting and sanitary landfill), Liquid waste management: composition and strength of sewage (BOD & COD), Preliminary treatment, Secondary (oxidation pond, trickling filter, activated sludge process and septic tank) or biological treatment, Waste water treatment of some industry, water recycling	15



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Suggested Readings:

1. Alexander M., Introduction to soil microbiology, Wiley Eastern limited, New Delhi.
2. Alexopoulos C.J. and MIMS C.W., Introductory Mycology, New age international, New Delhi.
3. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi
4. Hurst, C.J., Environmental Microbiology, ASM press, Washington D.C.
5. Mehrotra A.S., Plant Pathology, Tata Mcgraw Hill Publications limited, New Delhi.
6. Pelczar M.J., Chan E.C.S and Kreig N.R., Microbiology, Mcgraw-Hill Book Company, New York.
7. Prescott Lansing M., Harley John P. and Klein Donald A., Microbiology, WCB Mcgraw- Hill, New York.
8. Salle A.J., Fundamental Principles of Bacteriology, Tata Mcgraw-Hill Publishing Company Limited, New Delhi.
9. Stacey R.H. and Evans H.J., Biological Nitrogen Fixation, Chapman and Hall limited, London.
10. Stanier R.Y., Ingraham J.L., General Microbiology, Prentice Hall of India Private Limited, New Delhi.
11. Subbarao N.S., Soil Microroganisms and Plant Growth, Oxford and IBH Publishing Company, New Delhi.

This course can be opted as an elective by the students of following subjects: Open for all The eligibility for this paper is 10+2 with any subject

Suggested Continuous Evaluation Methods: • Seminar/ Presentation on any topic of the above syllabus • Test with multiple choice questions/ short and long answer questions Attendance

Course prerequisites: To study this course, a student must have had the subject ALL in class12th . The eligibility for this paper is 10+2 with any subject

Further Suggestions: It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure

At the End of the whole syllabus any remarks/ suggestions:



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FACULTY OF SCIENCE

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LUCKNOW, U.P. (India)**

B.Sc. - Microbiology (2nd Year, Semester-III)

(SEC-3)/Vocational Course-3

Microbial production of Antibiotics and Organic Acids

Effective from Session 2023-2024



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Programme/Class: Certificate		Year: Second	Semester: Third
Subject: Microbiology			
Course Code: B080303T		Course Title: Microbial production of Antibiotics and Organic Acids	
Course Outcomes:			Bloom's taxonomy
● CO1- Upon completion the students will learn about the role of Microorganism in protection.			K1, K3
● CO2- Assimilate knowledge about Microbial Examination of secondary metabolites.			K4, K5
● CO3- Learn about fermentation techniques.			K2,K6
● CO4- Will get sufficient knowledge regarding analysis of antibiotic and acids.			K3, K5
Credits: 3		SEC-3/Vocational Course-3	
Max. Marks: 40+60		Min. Passing marks: as per rules	
Total No. of Lectures- Tutorials- Practical (in hours per week): L-T-P:3-0-0			
Unit	Topics		Total No. of Lectures/ Unit & Hours (45)
I	Antibiotics (General)- History of antibiotics discovery, Wide range of antibiotics (Broad spectrum and narrow spectrum antibiotics), Microorganism producing antibiotics, Application of antibiotics (Antitumor, food preservative, antibiotics used in animal feed and veterinary medicine, control of plant diseases, tools in molecular biology)		15
II	Production of Antibiotics-Penicillins, Action of penicillins, Organism for penicillin production, Biosynthesis of penicillin, Production process of penicillin, Recovery of penicillin, Recovery of 6- amino penicillanic acid		15
III	Citric Acid- Application of citric acid, Microbial strains for citric acid production, Microbial biosynthesis of citric acid, Factors in the regulation of citric acid production		8
IV	Gluconic acid- Application of gluconic acid, Microbial production of gluconic acid, Production process for gluconic acid, Acetic acid- Microorganism used for production, Production process for acetic acid, Production of vinegar		7
Suggested Readings:			
1. Adams & Moss, Food Microbiology, Published by Royal Society of Chemistry, Cambridge, U.K.			
2. R.S. Mehrotra – Plant Pathology, Tata Mc-Graw Hill			
3. Frazier & Westhoff., Food Microbiology Tata Mc-Graw Hill (2014)			
4. Varnam A.H. & Evans M G – Food borne pathogens. Wolfe Publishing House, London			
5. B.D. Singh (2015) Biotechnology, Kalyani Publisher			
6. Prajapati (2007) Fundamentals of Dairy microbiology, Indian Council of Agricultural Research, NewDelhi			
7. Andrew Proctor (2011) Alternatives to conventional food processing. RSC Publisher			
8. Arun K. Bhunia & Bibek Ray, Fundamental Food Microbiology, 5 th Ed., CRC Press			



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Suggested Continuous Evaluation Methods: • Seminar/ Presentation on any topic of the above syllabus • Test with multiple choice questions/ short and long answer questions Attendance

Course prerequisites: To study this course, a student must have had the subject ALL in class12th . The eligibility for this paper is 10+2 with any subject

Further Suggestions: It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:



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Programme/Class: Diploma		Year: Second	Semester: Fourth
Subject: MICROBIOLOGY			
Course Code: B080401T		Course Title: Molecular Biology and Microbial Genetics	
Course Outcomes:			Bloom's taxonomy
• CO1- Distinguish in prokaryotic cellular structure and functional components of cells, as well as the dissimilarities in genome organization between prokaryotes and eukaryotes.			K2, K3
• CO2- Describe the replication, transmission, and action mechanisms of chromosomal and extrachromosomal genes and sequences.			K4, K5
• CO3- Recognize and distinguish genetic regulatory mechanisms at various levels			K2, K5
• CO4- Gain an understanding of how internal and external signals regulate gene expression, influence microbial diversity, and shape microbial communities and their environments.			K3, K5
• CO5- Describe the processes that lead to mutations and other genetic changes.			K4, K6
Credits: 4		Core: Compulsory	
Max. Marks: 25+75		Min. Passing marks: as per rules	
Total No. of Lectures-Tutorials-Practical(in hours per week): L-T-P:4-0-0			
Unit	Topics		Total No. of Lectures/ Hours (60)
I	Overview of the genome organization – DNA/and RNA as genetic material, DNA double helix structure salient features, types of DNA. RNA Structure. Denaturation and renaturation, cot curves. DNA topology: linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes.		6
II	DNA Replication in Prokaryotes and Eukaryotes- Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication. Mechanism of DNA replication, Replication of chromosome ends.		6
III	Transcription in Prokaryotes and Eukaryotes Concept of transcription unit. General transcription process in prokaryotes and eukaryotes; Post-Transcriptional modification in eukaryotes, Alternative splicing mechanism, RNA interference		8
IV	Translation in prokaryotes and eukaryotes Ribosome structure, tRNA structure and processing, Mechanisms of translation in both prokaryotes and eukaryotes, Genetic code, Wobble hypothesis, Fidelity of translation		8
V	Regulation of gene expression in prokaryotes and eukaryotes Overview of regulation of gene expression, Regulation of gene expression by DNA methylation, histone acetylation and histone methylation mechanisms; Transcription control mechanisms, Inducible Operon System, Repressible Operon System, Translation control mechanisms.		10



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VI	Plasmids in prokaryotes and eukaryotes Plasmid replication and partitioning, host range, plasmid incompatibility, plasmid amplification, regulation of plasmid copy number, curing of plasmids. Types of plasmids.	6
VII	Bacterial gene exchange processes- Mechanisms of Genetic Exchange, Horizontal gene transfer, Transformation; Conjugation; Transduction, Complementation.	8
VIII	Mutations, mutagenesis and repair Types of mutations, Physical and chemical mutagens. Loss and gain of function mutants. Reversion and suppression, Uses of mutations. Ames Test, DNA repair mechanism	8

Suggested Readings:

1. Watson, J. et. Al. 2004. Molecular Biology of the Gene, 5th Edition, CSHL Press, New York.
2. Conn, E., & Stumpf, P. 2009. Outlines of Biochemistry, 5th Ed. Wiley India Pvt. Limited.
3. T A Brown. 2001. Essential Molecular Biology. Oxford University Press, USA
4. Brock, T.D. 1990. The Emergence of Bacterial Genetics, Cold Spring Harbor Lab Press.
5. Ptashne, M. 2002. Genes and Signals, Cold Spring Harbor Laboratory Press.
6. Miller, J.R. 1992. A Short Course in Bacterial Genetics: Lab Manual, Cold Spring Harbor Laboratory Press
7. Suggestive digital platforms web links-
 - <https://www.classcentral.com/tag/microbiology>
 - <http://www.mooc.list.com/tag/molecular-biology>
 - <http://www.mooc.list.com/course/microbiology.sayloro>
 - <https://lipidnanostructuresgroup.weely.com>
 - <http://www.mooc.list.com/microbial>
 - <https://open.umn.edu/opentextbooks/textbooks/biochemistry-free-for-all-ahern>

This course can be opted as an elective by the students of following subjects: Open for all

Course prerequisites: To study this course, a student must have had the subject “Basic Biochemistry and Microbial Physiology” in III Semester of Diploma course in Microbial Technology

Suggested Continuous Evaluation Methods

House Examination/Test: 10 marks

Written Assignment/Presentation/Project/Research Orientation/Term papers/Seminar: 10 marks

Class performance/Participate: 5 Marks

Further Suggestions: None



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Programme/ Class: Diploma		Year: Second	Semester: Fourth
Subject: MICROBIOLOGY			
Course Code: B080402P		Course Title: Experiment in Molecular Biology and Microbial Genetics	
Course Outcomes:			Bloom's taxonomy
• CO1- Understand the fundamentals of molecular biology and genetic research.			K1, K3
• CO2- Use some basic equipment in a molecular biology laboratory.			K4, K5
• CO3- Extract genomic DNA from microbes using molecular biology techniques			K2,K4
• CO4- Measure DNA and verify purity using UV spectrometer and electrophoresis.			K3, K5
• CO5- Understand the basic principle of plasmid isolation and their conformations using electrophoresis.			K1, K3
• CO6- Understand the mutagenic effect of chemical and physical agents and perform test to identify mutagenic effect of chemicals			K3, K6
Credits: 2		Core: Compulsory	
Max. Marks: 25+75		Min. Passing marks: as per rules	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:0-0-2			
S. No.	Objectives		Total No. of Lectures/ Hours (60)
1	Isolation of genomic DNA from <i>E. coli</i> and analysis by agarose gel electrophoresis.		8
2	Estimation of DNA using diphenylamine reagent.		8
3	Resolution of proteins by polyacrylamide gel electrophoresis (SDS-PAGE) and visualization using coomassie dye.		10
4	Replica plating method: Preparation of master and replica plates. Isolation of Histidine auxotrophs		10
5	Isolation of plasmid DNA from <i>E. coli</i> . Study the different conformations of plasmid DNA through agarose gel electrophoresis		8
6	Study of the effect of chemical (nitrous acid) and physical (UV) mutagens on bacterial cells.		8
7	Demonstration of Ames test.		8



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Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
(Recognised Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE))

Suggested readings:

1. Michael Wink, An Introduction to Molecular Biotechnology (2nd), 2012. ISBN: 9783527326372, TX Wiley-Blackwell.
2. Seidman & Moore, Basic Laboratory Methods for Biotechnology: Textbook & Laboratory Reference, 2nd edition. 2009. Prentice Hall. ISBN: 0321570146.
3. Sambrook J and Russell DW., Molecular Cloning: A Laboratory Manual. 4th Edition, 2004, Cold Spring Harbour Laboratory press.
4. Digital links:
 - <https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/ames-test>
 - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846332/>

This course can be opted as an elective by the students of following subjects: Open for all

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Course prerequisites: To study this course, a student must have had the subject “Basic Biochemistry and Microbial Physiology” in III Semester of Diploma course in Microbial Technology.

Suggested Continuous Evaluation Methods

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Further Suggestions: None



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FACULTY OF SCIENCE

**KHWAJA MOINUDDIN CHISTI LANGUAGE UNIVERSITY,
LUCKNOW, U.P. (India)**

B.Sc. - Microbiology (2nd Year, Semester-III or IV)

Generic Elective-3 or 4 (GE-3/4)/Minor Elective-3 or 4

Minor Microbiology-3 or 4

Microbial ecology and Bio control by Microorganism

Effective from Session 2022-23



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
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Programme/Class: Certificate	Year: Second	Semester: Third or Fourth
Subject: Microbiology		
Course Code: B080203T	Course Title: Microbial ecology and Bio control by Microorganism	
Course Outcomes:		Bloom's taxonomy
• CO1- Get acquainted with natural habitats of diverse protection.		K1, K4
• CO2- Understand how microbes interact among themselves and with higher plants and animals with the help of various examples.		K2, K4
• CO3- Become aware of the important role microbes play in biogeochemical cycling of essential elements occurring within an ecosystem and its significance.		K2, K5
• CO4- Gain in depth knowledge of different types of solid waste, liquid waste and their management.		K3, K5
• CO5- Get familiar with problems of pollution and applications of clear up technologies for the pollutants.		K3, K6
Credits: 4		GE-3 and 4/Minor Elective-3 and 4
Max. Marks: 25+75		Min. Passing marks: as per rules
Total No. of Lectures-Tutorials-Practical(in hours per week): L-T-P: 4-0-0		
Unit	Topics	Total No. of Lectures/ Units & Hours (60)
I	Interaction of Microorganisms Positive and negative interaction- Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Microorganism of rhizosphere, rhizoplane and phylloplane, mycorrhiza (types and its applications).	15
II	Cycling of nutrients (Biogeochemical cycles) – Carbon cycle- Microbial degradation of cellulose, hemicellulase, lignin and chitin; Nitrogen cycle- Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, Phosphorous cycle- Phosphate Immobilisation and solubilisation and Sulphur cycle- Microbes involved in sulphur cycle.	15
III	Biodegradation and Bioremediation Types of bioremediation -microbial bioremediation, phytoremediation, and mycoremediation, Types of reaction in bioremediation, Factors affecting microbial bioremediation-Biotic or biological factors and Abiotic or environmental factors, Biodegradation of hydrocarbons, pesticides and herbicides	15
IV	Sewage/Waste Water Treatment Solid waste management: Source and type of solid waste, method of solid waste disposal (composting and sanitary landfill), Liquid waste management: composition and strength of sewage (BOD & COD), Preliminary treatment, Secondary (oxidation pond, trickling filter, activated sludge process and septic tank) or biological treatment, Waste water treatment of some industry, water recycling	15



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Suggested Readings: 1. Alexander M., Introduction to soil microbiology, Wiley Eastern limited, New Delhi. 2. Alexopoulos C.J. and MIMS C.W., Introductory Mycology, New age international, New Delhi. 3. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi 4. Hurst, C.J., Environmental Microbiology, ASM press, Washington D.C. 5. Mehrotra A.S., Plant Pathology, Tata Mcgraw Hill Publications limited, New Delhi. 6. Pelczar M.J., Chan E.C.S and Kreig N.R., Microbiology, Mcgraw-Hill Book Company, New York. 7. Prescott Lansing M., Harley John P. and Klein Donald A., Microbiology, WCB Mcgraw- Hill, New York. 8. Salle A.J., Fundamental Principles of Bacteriology, Tata Mcgraw-Hill Publishing Company Limited, New Delhi. 9. Stacey R.H. and Evans H.J., Biological Nitrogen Fixation, Chapman and Hall limited, London. 10. Stanier R.Y., Ingraham J.L., General Microbiology, Prentice Hall of India Private Limited, New Delhi. 11. Subbarao N.S., Soil Microroganisms and Plant Growth, Oxford and IBH Publishing Company, New Delhi.		
This course can be opted as an elective by the students of following subjects: Open for all The eligibility for this paper is 10+2 with any subject		
Suggested Continuous Evaluation Methods: • Seminar/ Presentation on any topic of the above syllabus • Test with multiple choice questions/ short and long answer questions Attendance		
Course prerequisites: To study this course, a student must have had the subject ALL in class12th . The eligibility for this paper is 10+2 with any subject		
Further Suggestions: It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure		
At the End of the whole syllabus any remarks/ suggestions:		



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FACULTY OF SCIENCE

**KHWAJA MOINUDDIN CHISTI LANGUAGE UNIVERSITY,
LUCKNOW, U.P. (India)**

B.Sc. - Microbiology (2nd Year, Semester-IV)

(SEC-4)/Vocational Course-4

Recombinant DNA Technology

Effective from Session 2023-2024



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
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Programme/Class: Certificate		Year: Second	Semester: Fourth
Subject: Microbiology			
Course Code: B080403T		Course Title: Recombinant DNA Technology	
Course Outcomes:			Bloom's taxonomy
● CO1- To understand the importance of molecular tool.			K1, K4
● CO2- To understand, learn and gain skill of isolation, culturing and maintenance of pure culture.			K2, K4
● CO3- To enable the students to get sufficient knowledge in principles and applications of cloning.			K3,K6
● CO4- After completing this course, students will have working knowledge on cloning.			K4, K5
● CO5- Get employment and entrepreneurship in different applied sectors.			K4, K6
Credits: 3		SEC-4/Vocational Course-4	
Max. Marks: 40+60		Min. Passing marks: as per rules	
Total No. of Lectures-Tutorials-Practical(in hours per week): L-T-P: 3-0-0			
Unit	Topics		Total No. of Lectures/ Unit & Total Hours (45)
I	Brief history of recombinant DNA technology, Molecular tools of genetic engineering- Restriction Endonuclease, Types of endonuclease, Recognition sequences, Cleavage patterns		7
II	DNA ligases-Homopolymer tailing, Linkers and adaptors, Alkaline phosphatase, DNA modifying enzyme- Nucleases (Endonuclease and Exonuclease), Polymerases, Enzyme modifying the end of DNA		14
III	Host cells- Prokaryotic hosts (Escherichia coli and Bacillus subtilis), Eukaryotic hosts (Mammalian cells), Vectors-Characteristics of an ideal vectors, Plasmids, Types of plasmids, Nomenclature of plasmids, pBR322, Bacteriophages, Bacteriophage λ (lambda), Cosmid, Artificial chromosome vectors		14
IV	Method of Gene transfer- Transformation, Conjugation, Electroporation, Liposome-mediated gene transfer, Transduction, Direct transfer of DNA (Microinjection)		10
Suggested Readings:			
1. Aneja, K.R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.			
2. Dubey, R.C. and Maheshwari. D.K. 2012. Practical Microbiology, S.Chand & Company, Pvt. Ltd., NewDelhi.			
3. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.			
4. W.F. Harrigan, Laboratory methods in Microbiology, Publisher – Elsevier			
5. Lynne Mc Landsborough, Food Microbiology Laboratory, CRC Press			
6. Brain McNeil & Harvey (2008), Practical Fermentation Technology, John Wiley & Sons Ltd.			
This course can be opted as an elective by the students of following subjects: Open for all The eligibility for this paper is 10+2 with any subject			



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Suggested Continuous Evaluation Methods: • Seminar/ Presentation on any topic of the above syllabus • Test with multiple choice questions/ short and long answer questions Attendance

Course prerequisites: To study this course, a student must have had the subject ALL in class12th . The eligibility for this paper is 10+2 with any subject

Further Suggestions: It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions: