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. III Year

Microbiology

Programme / Class: Bachelor of Science	**Year:** Third	**Semester:** Fifth
Subject: Microbiology		
Course Code: B080501T	**Course Title:** Medical Microbiology	

Course outcomes:	**Bloom's taxonomy**
• **CO1-** The historical development of medical microbiology	K1, K3
• **CO2-** The importance of microorganisms in life.	K2, K3
• **CO3-** The microorganisms associated with various infectious diseases.	K5, K4
• **CO4-** The treatment strategies followed for the infectious diseases.	K3,K4
• **CO5-** Antibiotic resistance	K5, K4
• **CO6-** Processes of sample collection and processing	K3,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	**History of Medical Microbiology** Contribution of pioneers in the field of Medical Microbiology, Normal Microflora of human body: skin, mouth, alimentary canal and gintourinary tract	7
II	**Bacterial diseases** Diseases caused by certain bacterial pathogens *Staphylococcus aureus, Streptococcus pneumoniae, Mycobacterium tuberculosis, Salmonella typhi, Vibrio cholera*	8
III	**Viral diseases** Diseases caused by certain viruses Human Immunodeficiency Virus, Hepatitis Virus, Influenza virus, Herpes virus	8
IV	**Parasitic diseases** Diseases caused by protozoa *Giardia* sp., *Plasmodium* sp., *Leshmania* sp., and *Entamoeba* sp.	7
V	**Pathogenic fungal disease I** Dermatophytes- *Trichophyton, Microsporum* Filamentous fungi causing subcutaneous infection by Mucor, *Rhizopus* and *Aspergillus*	8

VI	**Pathogenic fungal disease II** Systemic mycoses caused by Blastomyces, Histoplasma and Yeast like fungi: *Candida* and *Cryptococci*	8
VII	**Antibiotics and Chemotherapeutics** Historical development of chemotherapeutic and antibiotic substances, Major antimicrobial agents, Mode of action of chemotherapeutic and antibiotic substances.	8
VIII	**Antibiotic resistance, Sample collection and processing** Drug resistance, Mechanism of antibiotic resistance, Antibiotic susceptibility assay. Collection and transport of appropriate clinical sample specimen for clinical diagnostics	6

Suggested Readings:

1. Annadurai, A. A textbook of Immunology and Immunotechnology. S. Chnd
2. Ananthanarayanan R and Panicker C K. Textbook of Microbiology. Orient Longman.
3. Baveja, CP. Text book of Microbiology. Arya publications.
4. Ken S.Rosenthal, Patrick R.Murray, and Michael A.Pfaller. Medical Microbiology 7th Edition, Elsevier
5. Karen C.Carroll, Geo.Brooks, Stephen Morse, and Janet Butel.Jawetz, Melinck, &Adelberg's Medical Microbiology, Lang
6. Suggestive digital platforms web links-
   https://www.futurelearn.com/courses/basic-concepts-in-microbiology-and-clinical-pharmacology-of-antimicrobials
   https://vlab.amrita.edu/?sub=3&rch=73
   https://www.mooc-list.co/tags/pathology
   https://online.creighton.ed/program/medical-microbioogy-and-immunology-ms

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 "Molecular Biology and Microbial Genetics" in IV 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

Suggested equivalent online courses:
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Further Suggestions:
None

Programme / Class: Bachelor of Science	**Year:** Third	**Semester:** Fifth
Subject: Microbiology		
Course Code: B080502T	**Course Title:** Immunology	

Course outcomes:	Bloom's taxonomy
• **CO1-** The historical development of immunology	K1, K4
• **CO2-** The components of immune system, Immune responses, features of antigen and antibody,hypersensitivity responses	K2, K5
• **CO3-** Applications of antibody in diagnosis and therapy, and antigen-antibody reactions.	K3,K4

Credits: 4	**Core:** Compulsory
Max. Marks: 25+75	**Min. Passing Marks:** as per rule

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 Immunology** History of immunology, Physical and physiological barriers, Innate and Acquired immunity, Organs and Cells of Immune system.	7
II	**Complement System** Complement System Proteins, Complement System Activation by Classical, Alternate and Lectin Pathway	8
III	**Immunity** Humoral and Cell Mediated Immunity, Active And Passive Immunity	8
IV	**Antigen & Immunogens** Antigen Characteristics, Types of Antigens, Adjuvants, Immunogenicity and Antigenicity, Cytokines,	7
V	**Immunoglobulins and MHC and their role** Classes of immunoglobulin, structure and function, Major Histocompatibility Complex: Types, Antigen Presentation through MHC class I and class II molecules	9
VI	**Hypersensitivity** Types of Hypersensitivity, Mechanism of hypersensitivities with examples	5
VII	**Immune Response** Antibody dependent Cell mediated Cytotoxicity, Phagocytosis, Inflammation and Inflammatory response mechanism.	6

VIII	**Applications of Immunoglobulins** Applications of antibody in diagnosis and therapy; *In vitro* serological test methods: Antigen-Antibody Reactions: Agglutination and immunodiffusion; ELISA and RIA.	10

Suggested Readings:

1. Kindt, Goldsby and Osborne. Kuby's Immunology. WH Freeman& Company,
2. Roitt I,Brostoff, J and Male D.Immunology, 6th edition, 2001, Mosby, London.
3. Ramesh SR, Immunology. Mc Graw Hill Publications.
4. Madhavee LP, A Textbook of Immunology, S Chand Publisher.
5. Reddy R, Textbook of Immunology, 3rd edition, AITBS Publisher.
6. Digital links
    - https://www.mcgill.ca/microimm/undergraduate-programs/courses
    - https://oline.creighton.edu/program/medical-microbiology-and-immunology-ms

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 **Molecular Biology and Microbial Genetics** in IV 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

Suggested equivalent online courses:
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Further Suggestions:
None

Programme / Class: Bachelors of Science	**Year:** Third	**Semester:** Fifth
Subject: Microbiology		
Course Code: B080503P	**Course Title:** Experiments in Medical Microbiology & Immunology	

Course outcomes:	**Bloom's taxonomy**
• **CO1-** The preparation of culture media, microorganisms associated with human body, characterization ofmicroorganisms associated with disease.	K1, K2
• **CO2-** Antigen- antibody interaction	K2, K3
• **CO3-** Learning of the application of antibodies for diagnostic purposes, antibiotic sensitivity test and resistancetransfer.	K4, K5

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	Preparation of chocolate agar, and other media required for medically important microorganisms	6
2	Isolation and characterization of skin normal microflora	6
3	Isolation of bacteria from teeth crevices	6
4	Demonstration of α and β haemolysis on blood agar medium.	8
5	Demonstration of serological tests: blood groups, Rh factor determination, pregnancy test, Widal, VDRL, ELISA	12
6	Demonstration of pathogenic fungi in mycoses lesion	8
7	Antibiotic sensitivity test and MIC determination	6
8	Demonstration of antibiotic resistance transfer from resistant to sensitive microorganism	8

Suggested Readings:

1. Hudson L, and Hay FC, Practical Immunology, 3rd edition, Wiley.
2. Noel R. Rose, Herman Friedman, John L. Fahey., Manual of Clinical Laboratory Immunology, 3rd edition, ASM. Ed.3; 1986.
3. Talwar GP and Gupta SK, A Handbook of Practical and Clinical Immunology, Vol.I-II; CBS Publishers and Distributors. Delhi
4. Aneja KR, Experiments in Microbiology, Plant Pathology and Biotechnology, Ist edition, New Age International Publisher
5. Randhawa VS, Practicals and Viva in Medical Microbiology, Harcourt India Pvt. Ltd.
6. Digital Links

- http://www.vlab.co.in
- http://www.vlab.iitb.ac.in
- http://www.onlinelabs.in
- http://www.vlab.amrita.edu
- http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques

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 "Molecular Biology and Microbial Genetics" in IV Semester of Diploma course in Microbial Technology.

Suggested Continuous Evaluation Methods:
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Suggested equivalent online courses:
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Further Suggestions:

Programme/Class: Bachelor of Science	**Year:** Third	**Semester:** Sixth
Subject: Microbiology		
Course Code: B08060IT	**Course Title:** Food Microbiology	

Course outcomes:	**Bloom's taxonomy**
• **CO1-** Upon completion the students will learn about the role of Microorganism in food Microbiology.	K1, K3
• **CO2-** Learn the symptoms of deteriorated food.	K4, K5
• **CO3-** Assimilate knowledge about Microbial Examination of food.	K2,K3
• **CO4-** Learn about food preservation techniques.	K3, K5
• **CO5-** Will get sufficient knowledge regarding analysis of milk.	K2,K4
• **CO6-** Will be able to monitor food quality.	K1, K4

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	**Introduction to food & nutrition**. History, Development and Scope of food microbiology; Concept of food and nutrients; Physiochemical properties of food; Importance and types of microorganisms in food (bacteria, mold and yeast); Food as a substrate for microorganism- Intrinsic and extrinsic factors that affect growth and survival of microbes in food, natural flora and source of contamination of foods in general.	8
II	**Microbial spoilage of various foods** Principal; Spoilage of vegetables, fruits, meats, eggs, milk and butter, bread, canned foods.	6
III	**Microbial examination of food** DMC, viable count, examination of faecal Streptococci. Food quality monitoring, Biosensors and Immunoassays.	6
IV	**Food Preservation** Basic Principles, Methods (heating, freezing, dehydration, chemical preservatives, radiation). Modern technologies in food preservation, Packaging material.	8
V	**Fermented foods:** Fermented dairy products (cheese, butter, yoghurt), Kefir; Other Fermented foods- Soya sauce, Saurkraut, Dosa, Tempeh; Probiotics: health benefits, types of microorganisms used, probiotic foods available in market.	8

VI	**Food borne diseases (Causative agents, foods involved, symptoms and preventive measures)** Food intoxication- Staphylococcus aureus, Clostridium botulinum and	8
	Mycotoxins; Food infections- E.coli, Salmonellosis, Bacillus cereus, Sheigellosis, Listeria.	
VII	**Microorganisms and milk** Physical and chemical properties of milk; Milk as a substrate for microorganisms; Microbiological analysis of milk – Rapid Platform test, standard plate count, MBRTtest, alkaline phosphatase enzyme test, DMC; Method of preservation of milk and milk product, pasteurization sterilization and dehydration.	8
VIII	**Food sanitization and control** HACCP, Indices of food sanitary quality and sanitisers; Microbiological quality standard of food.	8

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, New Delhi
7. Andrew Proctor (2011) Alternatives to conventional food processing. RSC Publisher
8. Arun K. Bhunia & Bibek Ray, Fundamental Food Microbiology, 5th Ed., CRC Press

Suggestive digital platforms web links –

- Doyle. Michael P, Gonzalez-francisco Diez, Food Microbiology : Fundamentals and frontiers, 5th edition, Hill Colin, available on Wiley online Library.
- http://www.vlab.co.in
- http://www.vlab.amrita.edu
- http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques

This course can be opted as an elective by the students of following subjects: Open for all
But special for B.Sc. Math, B.Sc. Statistic, B.Sc. Nutrition, B.Sc. Biotech, B.Sc. Forestry & B.Sc. Agriculture, B.Sc. Biology

Course prerequisites: To study this course, a student must have had the subject **Medical Microbiology** & **Immunology** in V Semester of Degree in Bachelor of Science.

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

Suggested equivalent online courses:

Further Suggestions:
None

Programme/Class: Bachelor of Science	**Year:** Third	**Semester:** Sixth
Subject: Microbiology		
Course Code: B080602T	**Course Title:** Industrial Microbiology	

Course outcomes :	**Bloom's taxonomy**
• **CO1-** Develop understanding about IPR in industry	K1, K3
• **CO2-** Understand role of microorganism in industry	K2, K4
• **CO3-** Know about Processing & selection of best microbial strains for the industry	K2,K6
• **CO4-** Gain fundamental knowledge of fermentation process	K3, K5
• **CO5-** Gain knowledge about production of various pharmaceutical products or industrially important product	K4, K5

Credits: 4	**Core:** Compulsory
Max. Marks: 25+75	**Min. Passing Marks:** as per rule

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	History & Multidisciplinary nature of Industrial microbiology. A typical Bio process: Introduction, advantages & limitations. Patents and intellectual property rights.	7
II	Taxonomic diversity of industrially useful bacteria & fungi. Important characteristics of microbes used in Industrial Microbiology, Isolation techniques. Concept & examples of microorganisms classified as Generally Regarded as Safe (GRAS).	8
III	Exploitation of microorganism and their products, Screening, Strain development strategies, Immobilization methods.	8
IV	Fermentation: Media, Raw material, Antifoaming agents, Buffers. Equipments, Fermenter design. Types of fermentation – Single, Batch, Continuous.	7
V	Down-stream processing steps: Detection and assay of the product, Recovery (intercellular and extracellular product). Purification (solvent extraction & chromatography)	9
VI	Production of Alcohol (industrial alcohol, wine, beer, whiskey), Organic acid (Citric acid), Antibiotic (Penicillin)	7

VII	Production of Vitamin (B12), Enzyme (Amylase), Amino acid (Glutamic acid), Hormones (Insulin), Vaccine (Hepatitis B).	6
VIII	Biofuel (Methane), Production of Biofertilizers & Biopesticides, Biotransformation of steroids.	8

Suggested Readings:

1. Industrial Microbiology (2000) by AH Patel, Macmillan Publishers India
2. Biology of Industrial microorganism (1981) by Arnold L. Domain, Bejamin/ cummings Pub. Co.
3. Industrial Microbiology by Prescott & Dunns, AVI Publishing Company Inc.
4. Industrial Microbiology by Casida LE, New age International (P) Ltd.

Suggestive digital platforms web links

- http://foodhaccp.com/foodsafetymicro/onlineindex.html
- http://www.cpe.rutgers.ed/courses/current/If0401wa.html

This course can be opted as an elective by the students of following subjects: Open for all
But special for B.Sc. Math, B.Sc. Statistic, B.Sc. Nutrition, B.Sc. Biotech, B.Sc. Forestry, B.Sc. Biology & B.Sc. Agriculture

Course prerequisites: To study this course, a student must have had the subject "Medical Microbiology & Immunology" in V Semester of Degree in Bachelor of Science.

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

Suggested equivalent online courses:
https://www.classcentral.com/course/swayam-food-microbiology-and-food-safety-17609

Further Suggestions:
None

Programme/ Class: Bachelor of Science	**Year:** Third	**Semester:** Sixth
Subject: Microbiology		
Course Code: B080603P	**Course Title:** Experiments in Food & Industrial Microbiology	

Course outcomes:	**Bloom's Taxonomy**
• **CO1-** Understand the instruments, techniques & Lab discipline	K3 , K5
• **CO2-** Develop skill for identifying microbes used in industry	K2, K6
• **CO3-** Upon completion student will learn about the process of fermentation & design of bioreactors, a majorpart of pharmaceutical industry	K4, K5
• **CO4-** Will learn about the culture of microorganisms used in Food & Industrial microbiology.	K1, 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** **Experiments should be only for demonstration.**	**Total No. of Lectures/ Hours (60)**
1	Study of Bioreactor & its essential parts	4
2	Necessity & procedure of writing SOPs for instruments used in large scale production	6
3	Isolation and microscopic observation of industrially important microorganism	8
4	Isolation and characterization of microorganism used in Dairy industry	8
5	Isolation and characterization of Yeast used in Bakery/distillery/winery	8
6	Isolation & identification of important microorganism of food microbiology	8
7	Bacteriological analysis of food products	8
8	Determination of the quality of milk by MBRT	2
9	Bacterial examination of milk – Alcohol test	4
10	Preservation methods	4

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., New Delhi.

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.
7. Digital links
    - http://www.vlab.co.in
    - http://www.vlab.iitb.ac.in
    - http://www.onlinelabs.in
    - http://www.vlab.amrita.edu
    - http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques
    - http://foodhaccp.com/foodsafetymicro/onlineindex.html
    - http://www.cpe.rutgers.ed/courses/current/If0401wa.html

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 "Medical Microbiology and Immunology" in V Semester of Degree in Bachelor of Science.

Suggested Continuous Evaluation Methods:
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Suggested equivalent online courses:
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Further Suggestions: