



# UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)  
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section

Email: [academicsectionju14@gmail.com](mailto:academicsectionju14@gmail.com)

## NOTIFICATION (23/April/Adp./13)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies in the subject of **Biotechnology** for Semester IIIrd and IVth of **Four Year Under Graduate Programme (FYUGP)** under the **Choice Based Credit System** as per NEP-2020 (as given in the annexure) for the examinations to be held in the years as per the details given below:

Subject	Semester	For the examinations to be held in the year
Biotechnology	Semester-III Semester-IV	December 2023, 2024 and 2025 May 2024, 2025 and 2026

The Syllabi of the courses is also available on the University website: [www.jammuuniversity.ac.in](http://www.jammuuniversity.ac.in).

Sd/-

DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/1674-1699

Dated: 04/5/23

Copy for information and necessary action to:

1. Dean Faculty of Science
2. HOD/Convener, Board of Studies Biotechnology
3. Sr. P.A. to the Controller of Examinations
4. All members of the Board of Studies
5. C.A. to the Controller of Examinations
6. Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG. Exam. Non.Prof)
- ✓ 8. Incharge University Website for necessary action please

*Sumitashamo*  
Deputy Registrar (Academic) 4/5/23

*ACAS*  
3/5

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3/5/23

**UNIVERSITY OF JAMMU**

**SYLLABI AND COURSE OF STUDY IN  
BIOTECHNOLOGY**

**For the Examination to be held in Year 2023, 2024, 2025,  
2026**

**BIOTECHNOLOGY COURSE**

**UG SEMESTER III & IV  
UNDER NEP-2020**

**UNIVERSITY OF JAMMU**  
**SYLLABI AND COURSES OF STUDY IN BIOTECHNOLOGY**  
**For the examination to be held in 2023, 2024 and 2025**  
**UG SEMESTER-III**  
**UNDER NEP-2020**

S. No	Course type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory		Practical/Tutorial		
1.	Major	UMJBTT-301	General Microbiology	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment: 10 marks	Exam: 15 Marks	100
2.	Major	UMJBTT-302	Cell Biology and Genetics	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment: 10 marks	Exam: 15 Marks	100
3.	Minor	UMIBTT-303	Basic Microbiology	4 (3+1)	Mid Semester: 15 Marks	End Semester Exam: 60 Marks	Assessment: 10 marks	Exam: 15 Marks	100
4.	Multidisciplinary	UMDBTT-304	Biotechnology for Human Welfare	3+0	Mid Semester: 15 Marks	End Semester Exam: 60 Marks	NA	NA	75
5.	SEC	USEBTT-305	Basic Molecular Diagnostics	2 (1+1)	Mid Semester: 5 Marks	End Semester Exam: 20 Marks	Assessment: 10 marks	Exam: 15 Marks	50

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**University of Jammu**  
**Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020**  
**Semester – III**  
**(Examination to be held in December 2023, 2024, 2025)**  
**MAJOR COURSE**

**Course Code: UMJBTT-301**  
**Course Title: General Microbiology**  
**Credits: 4 (3Theory+1Practical)**  
**Total No. of Lectures: Theory: 45 hours**  
**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

**Objectives and Expected Learning Outcomes**

The course provides an introduction to the fundamentals of microbiology concepts such as history and development; microscopy; classification of microbes like bacteria, viruses, fungus, algae. After successfully completing this course, the students will be able to understand the microbial structures; life cycle and their patho-mechanisms. Course will also provide the information about the application of microbes for improving human health.

**Unit 1: Bacteriology**

Prokaryotic classification and diversity; structure & function of prokaryotic cell membrane, flagella, pili and capsule; bacterial reproduction; transformation, transduction and conjugation; bacterial growth and kinetics; factors affecting bacterial growth, control of bacterial growth.  
Archeae: diversity, structure and function; halophiles, methanophiles and hyperthermophiles.

**Unit 2: Mycology**

Introduction to mycology; fungi: distribution, morphology, cell structure, reproduction and life cycle; fungal classification, lower fungi and higher fungi; economic importance of fungi.  
Lichens: distribution, morphology, cell structure and life cycle; economic importance of lichens.

**Unit 3: Phycology**

Introduction to phycology; algae: distribution, cellular and subcellular structure, classification; algal nutrition; algal reproduction and life cycle; algal ecology; algal biotechnology; economic importance of algae in agriculture, environment, industry, medicine and food.

**Unit 4: Virology**

Viruses: discovery, nomenclature and classification, morphology and structure, capsid, envelop, viral genome; viral multiplication and transmission. Distinctive properties and cultivation of viruses, viroids and prions. Viruses infecting bacteria, plant and animals.

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**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

**Practicals:**

1. Preparation of different types of microbial culture media
2. To study the growth curve of given microbe
3. Isolation and identification of microbe from different spoiled foods
4. Isolation of amylase producing bacteria from soil
5. To demonstrate conjugation and transduction using student teaching kits
6. Simple biochemical tests of bacteria
7. Antibiotic sensitivity tests
8. Methylene blue reductase test for accessing the quality of milk.
9. Screening of microbial culture for the ability to produce extracellular enzymes
10. Identification of different algae from pond water and other water bodies
11. To visit nearby research Institution/University to get acquainted with advanced techniques in related subject

**NOTE FOR PAPER SETTING**

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Mid Term Assessment test	50%	1 ½ Hours	15
External Theory End Semester	100%	3 Hours	60
Internal Practical	-	-	10 (Based on Daily Performance only)
External Practical	-	-	15

**A) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours**

**B) External End Semester Examination: (60 Marks) Time Allotted 3 Hours**

- a) External End Semester Theory Examination will have two sections (A & B).
- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions.

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**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

**Reference Book:**

1. Microbiology- Prescott, L.M., Harley, J.P. and Klein, D.A., McGraw Hill, USA, 12th edition (2022).
2. Principle of Virology- Flint, J.V.R., Racaniello, G.F., Rall, T., Hatzioannou, A.M. and Skalka, ASM press (2020).
3. Brock Biology of Microorganisms- Madigan, M.T., Martinko, J.M. and Parker, J., Pearson Benjamin Cummings Publishing, San Francisco, 16<sup>th</sup> edition (2020).
4. Microbiology- Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 7<sup>th</sup> edition (2019).
5. Microbiology: An introduction- Tortora, G.J., Funke, B.R. and Case, C.L., Pearson Education Inc., 14<sup>th</sup> edition (2019).
6. Fundamentals of Microbiology- Pommerville, J.C., Jones & Bartlett Learning, 12<sup>th</sup> edition (2021).
7. Microbiology- Tortora, G.J., Funke, B.R. and Case, C.L., Pearson Education India, 11<sup>th</sup> edition (2016).
8. Virology- Saravanan, P., M.J.P. Publication (2007).
9. An Introduction to Modern Virology- Dimmock, N.J., Easton, A.J. and Leppard, K.N., Blackwell publications, 5<sup>th</sup> edition (2007).
10. Principle of Microbiology- Sumbali, G. and Mahotra, R., Tata Mc Graw Hill (2009).
11. Introductory Mycology- Alexopoulos, C.J., Mims, C.W. and Meredith, M.B. Blackwell Wiley, 4<sup>th</sup> edition (2017).
12. Phycology- Lee, R.E., Cambridge University Press, 5th edition (2018).

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**Semester – III**  
**(Examination to be held in December 2023, 2024, 2025)**  
**MAJOR COURSE**

**Course Code: UMJBTT-302**  
**Course Title: Cell Biology and Genetics**  
**Credits: 4 (3Theory+1Practical)**  
**Total No. of Lectures: Theory: 45 hours**  
**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

**Objectives and Expected Learning Outcomes**

This course focuses on understanding the concept of cellular transport, biogenesis of cellular organelles and cell energetics, communication mechanisms of cells, its division and cell death. The course also provides fundamental understanding of genetics that contribute to heredity and variation among organisms and variations related to mutations and transposable elements

**Unit 1: Cellular organisation and transport**

Plasma membrane, modification of plasma membrane and intracellular junctions; nuclear pore complex, membrane transport, solute transport by simple diffusion, facilitated diffusion and active transport. Biogenesis of cellular organelles: mitochondria, chloroplast, endoplasmic reticulum, golgi complex. Protein structure, folding, and regulation, protein sorting and vesicular transport. Bioenergetics: laws of thermodynamics, Gibbs free energy, relationship between equilibrium constant and change in free energy, feasibility of chemical reactions, importance of coupled reactions.

**Unit 2: Cell cycle and cell communication**

Cell division: mitosis and meiosis, phases of cell division; cell cycle, regulation of cell cycle, cell cycle checkpoints, significance of cell cycle. Cell senescence and programmed cell death. General principles of cellular signalling. Cytoskeleton and cell adhesion: microtubules, intermediate filaments, actin filaments, extracellular matrix.

**Unit 3: Post Mendelian genetics, linkage & crossing over**

Post Mendelian concept of heredity, partial or incomplete dominance, co-dominance, penetrance and expressivity, epistasis. Multiple allelism: blood groups in Humans-ABO and Rh. Chromosomal theory of linkage, kinds of linkage, linkage groups; crossing over, types of crossing over, mechanism of crossing over and its importance, cytological detection of crossing over.

**Unit 4: Mutations and Transposable elements**

Mutations and their types, mutagens, mutation at the molecular level, applications of mutations; chromosomal variations: general account of structural and numerical aberrations; chromosomal evolution in wheat and cotton. An overview of transposable elements and their significance: Ac/Ds elements in maize, P elements in Drosophila and IS elements in bacteria.

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**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

**Practical**

1. To measure the length and breadth of the given cell sample by using micrometer.
2. To study the mitosis and the cell cycle in onion root-tip cells
3. To study the polytene chromosomes from salivary gland of *Drosophila*.
4. Identification, maintenance and culturing of *Drosophila* stock.
5. Experiments on epistatic interactions including test cross and back cross.
6. Determination of linkage and cross-over analysis
7. Demonstration of partial or incomplete dominance, co-dominance in flowers/plants.
8. Experiments to understand the basic concept of the ABO blood group type.
9. Effect of UV radiations on *E. coli* for different time periods.
10. To visit nearby research Institution/University to get acquainted with advanced techniques in related subject

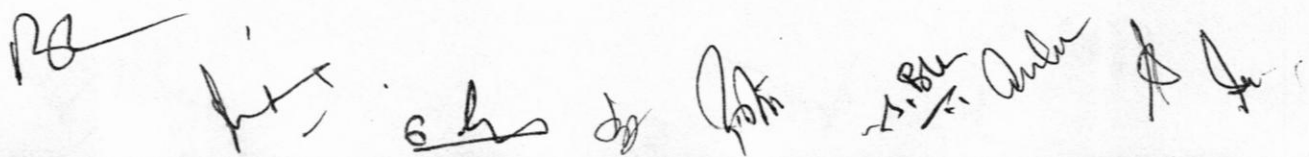
**NOTE FOR PAPER SETTING**

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External Theory End Semester	100%	3 Hours	60
Internal Practical	-	-	10 (Based on Daily Performance only)
External Practical	-	-	15

**A) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours**

**B) External End Semester Examination: (60 Marks) Time Allotted 3 Hours**

- a) External End Semester Theory Examination will have two sections (A & B).
- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions





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**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

**References Books:**

1. Cell and Molecular Biology: Concepts and Experiments- Karp, G., John Wiley & Sons. Inc, 8<sup>th</sup> edition (2021).
2. The World of the Cell- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G.P, Pearson Benjamin Cummings Publishing, San Francisco, 8<sup>th</sup> edition (2021).
3. The Cell: A Molecular Approach- Cooper, G.M. and Hausman, R.E, Sinauer Associates Inc. and ASM Press, 8<sup>th</sup> edition (2019).
4. Genetics: Analysis and Principles- Brooker, R.J., McGraw Hill Education, 6<sup>th</sup> edition (2019).
5. Genes XI- Lewin, B., Jones and Bartlett Publishers, 11<sup>th</sup> edition (2021).
6. Genetics: Analysis and Principles- Brooker, R.J., McGraw Hill Education, 6<sup>th</sup> edition (2019).
7. Principles of Genetics- Snustad, P.D. and Simmons, M.J., John Wiley & Sons, Inc., 7<sup>th</sup> edition (2019).
8. Lewin's Genes XII- Goldstein, E.S., Krebbs, J.E., Kilpatrick, S.T., Jones and Bartlett Publishers, Inc., 12<sup>th</sup> edition (2020).
9. Genetics-Strickberger, M.W., Macmillain Publishers, New York, 5<sup>th</sup> edition (2013).
10. Principles of Gene Manipulations- Old, R.W. and Primrose, S.B., Black Well Scientific Publications, 7<sup>th</sup> edition (2011).

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**University of Jammu**  
**Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020**  
**Semester – III**  
**(Examination to be held in December 2023, 2024, 2025)**  
**MINOR COURSE**

**Course Code: UMIBTT-303**  
**Course Title: Basic Microbiology**  
**Credits: 4 (3Theory+1Practical)**  
**Total No. of Lectures: Theory: 45 hours**  
**Practical: 30 hours**  
**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

**Objectives and Expected Learning Outcomes**

The course provides an introduction to the fundamentals of microbiology concepts such as history and development; microscopy; classification of microbes like bacteria, viruses, fungus, algae. After successfully completing this course, the students will be able to understand the microbial structures; life cycle and their patho-mechanisms. This will also provide the information about the application of microbes for improving human health.

**Unit 1: Bacteriology**

Prokaryotic classification and diversity; structure & function of prokaryotic cell membrane, flagella, pili and capsule; bacterial reproduction; transformation, transduction and conjugation; bacterial growth and kinetics; factors affecting bacterial growth, control of bacterial growth.  
Archeae: diversity, structure and function; halophiles, methanophiles and hyperthermophiles.

**Unit 2: Mycology**

Introduction to mycology; fungi: distribution, morphology, cell structure, reproduction and life cycle; fungal classification, lower fungi and higher fungi; economic importance of fungi.  
Lichens: distribution, morphology, cell structure and life cycle; economic importance of lichens.

**Unit 3: Phycology**

Introduction to phycology; algae: distribution, cellular and subcellular structure, classification; algal nutrition; algal reproduction and life cycle; algal ecology; algal biotechnology; economic importance of algae in agriculture, environment, industry, medicine and food.

**Unit 4: Virology**

Viruses: discovery, nomenclature and classification, morphology and structure, capsid, envelop, viral genome; viral multiplication and transmission. Distinctive properties and cultivation of viruses, viroids and prions. Viruses infecting bacteria, plant and animals.



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**Practicals:**

1. Preparation of different types of microbial culture media
2. To study the growth curve of given microbe
3. Isolation and identification of microbe from different spoiled foods
4. Isolation of amylase producing bacteria from soil
5. To demonstrate conjugation and transduction using student teaching kits
6. Simple biochemical tests of bacteria
7. Antibiotic sensitivity tests
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9. Screening of microbial culture for the ability to produce extracellular enzymes
10. Identification of different algae from pond water and other water bodies
11. To visit nearby research Institution/University to get acquainted with advanced techniques in related subject

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**A) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours**

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- a) External End Semester Theory Examination will have two sections (A & B).
- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions



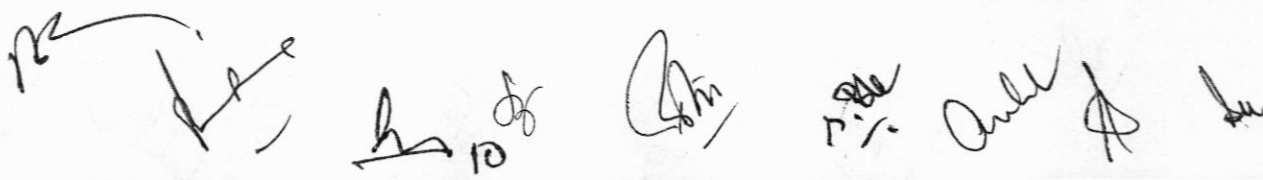
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**Maximum Marks: 100**  
**Theory: 75**  
**Practical: 25**  
**Duration of Examination: 3 hours**

- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

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1. Microbiology- Prescott, L.M., Harley, J.P. and Klein, D.A., McGraw Hill, USA, 12<sup>th</sup> edition (2022).
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**MULTIDISCIPLINARY COURSE**

**Course Code: UMDBTT-304**  
**Course Title: Biotechnology for Human Welfare**  
**Credits: 3**  
**Total No. of Lectures: 45 hours**  
**Maximum Marks: 75**  
**Theory: 75**  
**Duration of Examination: 3 hours**

**Objectives and Expected Learning Outcomes:** The course provides an introduction to biotechnology and the application of biotechnology for human welfare including Agriculture, industry, environment and human health care. After successfully completing this course, the students will be able to understand the scope and application of biotechnology in various areas.

**Unit 1: Introduction to Biotechnology**

Definition & scope of Biotechnology, conventional biotechnology, modern Biotechnology, main subfields of Biotechnology: Medical (red) Biotechnology, Agricultural (green) Biotechnology, Industrial (white) Biotechnology, Marine (blue) Biotechnology, Food Biotechnology, and Environmental Biotechnology. Introduction to microbes: beneficial microbes, harmful microbes. Principles of Genetic Engineering & Bioprocess Technology.

**Unit 2: Biotechnology in Agriculture & Environmental management**

Introduction to Genetically Modified (GM) crops, safety and challenges for their acceptance, need for GM crops, Golden Rice, Bt Cotton, FlavrSavr Tomato. Biodegradation of potential pollutants, recycling of wastes and other waste treatment technologies. Controlling environmental pollution through bioremediation; biomonitoring, biotreatment and biodegradation of solid, liquid and gaseous wastes.

**Unit 3: Industrial Applications of Biotechnology**

Basic principles of Fermentation Technology- historical perspective, overview of fermentation in making of bread, curd, yogurt, cheese, beer, wine, etc.; basic design of fermenters; overview of industrial production of alcoholic beverages, antibiotics & enzymes, bioplastics and biofuels.

**Unit 4: Biotechnology in Human healthcare**

Introduction to Animal Biotechnology, transgenic animals and ethical issues associated with it; application of Animal Biotechnology in development of disease resistance, better milk and meat yielding animals, fisheries and poultry improvement. Introduction to Human Genome Project. Molecular diagnostics tools like PCR and DNA fingerprinting; an overview of vaccines.

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**Reference Books:**

1. Gene Cloning and DNA Analysis: An Introduction- Brown, T.A., Wiley Blackwell, 8<sup>th</sup> edition (2020).
2. Principles of Gene Manipulations and Genomics- Primrose, S.B and Twyman, R., Black Well Scientific Publications, 8th edition (2016).
3. Biotechnology: A textbook of Industrial Microbiology- Crueger, W. and Crueger, A., Panima Publishing Co. New Delhi, 3<sup>rd</sup> edition (2017).
4. Environmental Biotechnology Concepts and Applications- Hans-Joachim, J. and Winter, J., Wiley Blackwell, 1<sup>st</sup> edition (2004).
5. Elements of Biotechnology- Gupta, P.K., Rastogi and Co., Merrut, India, 2<sup>nd</sup> edition (2010).
6. Introduction to Plant Biotechnology- Chawla, H.S., C.R.C. Press, 3<sup>rd</sup> edition (2020).
7. Text Book of Biotechnology- Das, H.K., Wiley India Pvt. Limited, 5<sup>th</sup> edition (2017).

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University of Jammu  
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Semester – III  
(Examination to be held in December 2022, 2023, 2024)  
Skill Enhancement Course

Course Code: USEBTT-305  
Course Title: Basic Molecular Diagnostics  
Credits: 2 (Theory: 25 Marks + Practicals: 25 Marks)  
Total No. of Lectures: Theory: 25 hours  
Practical: 30 hours  
Maximum Marks: 50  
Theory: 25  
Practical: 25  
Duration of Examination: 2.5 hours

**Objectives and Expected Learning Outcomes:**

To provide practical knowledge on various molecular techniques used in the field of diagnostics. Upon completion of the course the participants should be able to define basic terminology and describe concepts in molecular diagnostics, perform molecular techniques including nucleic acid extraction, conventional, real-time polymerase chain reaction and understand the concept of nucleic acid sequencing and various immune-assays.

**Unit 1: Nucleic acid based diagnostics**

Developing standard operating protocols (SOP) for a molecular diagnostic laboratory; basic methods of documentation and other protocols for molecular diagnostic facility. Nucleic acid-based diagnostics for infectious diseases and non-infectious diseases: Polymerase Chain Reaction (PCR), quantitative Polymerase Chain Reaction (qPCR), isothermal amplification, nucleic acid hybridization, Fluorescence *In Situ* Hybridization (FISH), micro-arrays, DNA Sequencing.

**Unit 2: Protein based diagnostics**

Protein based diagnostics, antibody technology, antigen-antibody interaction, western blotting; immunoassays and their applications: RIA (Radioimmunoassay), ELISA (Enzyme Linked Immunosorbent Assay), chemiluminescent immunoassays; FACS (Fluorescence Activated Cell Sorting) and ChIP (Chromatin Immunoprecipitation) – to study protein gene interaction.

**Unit 3: Practicals**

1. Collection of clinical samples
2. DNA extraction and its preservation
3. RNA extraction and preservation
4. To study, use and maintenance of a thermocycler machine
5. To design and validate primers for Polymerase Chain Reaction (PCR)
6. To prepare master mixture for Polymerase Chain Reaction (PCR)
7. To set up and perform *in silico* Polymerase Chain Reaction (PCR)
8. To demonstrate quantitative Polymerase Chain Reaction (qPCR)
9. Demonstration of antigen-antibody interaction assays
10. To demonstrate Enzyme-Linked Immunosorbent Assay (ELISA)
11. To visit nearby research Institution/University to get acquainted with advanced techniques in related subject

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