UNIVERSITY OF JAMMU

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

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(25/Oct./Adp./ 117)

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 Study in the subject of **Biotechnology** of Semesters I, II and III **Four Year Under Graduate Programme** under as per **NEP-2020 (as given in the annexure)** for the Regular Candidates for the examinations to be held in the years as per the details given below:

Subject	Semester	Existing Course Code	New Course Code	For the examinations to be held in the year	%age Change
Biotechnology	Semester-I	UMJBTT-101	UMJBTT-101	Dec. 2026, 2027 and 2028	No Change
		UMIBTT -102	UMIBTT -102	Dec. 2026, 2027 and 2028	No Change
		UMDBTT -103	UMDBTT -103	Dec. 2026, 2027 and 2028	No Change
		USEBTT -104	USEBTT -111	Dec. 2026, 2027 and 2028	100%
	Semester-II	UMJBTT-201	UMJBTT-201	May 2027, 2028 and 2029	No Change
		UMIBTT -202	UMIBTT -202	May 2027, 2028 and 2029	No Change
		UMDBTT 2103	UMDBTT 203	May 2027, 2028 and 2029	No Change
		USEBTT -204	USEBTT -211	May 2027, 2028 and 2029	100%
	Semester-III	UMJBTT-301	UMJBTT-301	Dec. 2027, 2028 and 2029	No Change
		UMJBTT-302	UMJBTT-302	Dec. 2027, 2028 and 2029	No Change
		UMIBTT -303	UMIBTT -303	Dec. 2027, 2028 and 2029	No Change
		UMDBTT -304	UMDBTT 304	Dec. 2027, 2028 and 2029	No Change
		USEBTT -305	USEBTT -311	Dec. 2027, 2028 and 2029	100%

The Syllabi of the courses is available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/25/ 11190-205
Dated: 13/10/25

Copy for information and necessary action to:

1. Dean, Faculty of **Life-Science**
2. Convener, Board of Studies in **Biotechnology**
3. All members of the Board of Studies
4. Sr. P.A.to the Controller of Examinations
5. Director, CITES&M, University of Jammu for directing the concerned to upload the notification on University Website.
6. C.A. to the Controller of Examinations
7. Director, Computer Centre, University of Jammu.
8. Joint Registrar/Deputy Registrar/Asst. Registrar (Confidential/Exam UG/Exam. Non Prof.)

Abuca 10/10/25
Joint Registrar (Academic)

9/10/25 9/10/25

UNIVERSITY OF JAMMU

SYLLABI AND COURSE OF B.Sc. BIOTECHNOLOGY
For the Examination to be held in Year 2025, 2026, 2027, 2028, 2029 & 2030

UNIVERSITY OF JAMMU

SYLLABI AND COURSE OF STUDY IN BIOTECHNOLOGY
For the Examination to be held in Year 2025, 2026, 2027, 2028, 2029 & 2030

UNIVERSITY OF JAMMU

SYLLABI AND COURSE OF STUDY IN BIOTECHNOLOGY

BIOTECHNOLOGY COURSE

B.Sc BIOTECHNOLOGY				
Semester	**Types of Courses**	**Course code**	**Title**	**Credits**
Sem-Ist	Major	UMJBTT-101	**Fundamentals of Biotechnology -I**	4 (3+1)
	Minor	UMIBTT-102	**Introduction to Biotechnology -I**	4 (3+1)
	Multi-disciplinary	UMDBTT-103	**Biotechnology for Human Welfare**	3+0
	Skill Enhancement	USEBTT-111	**Bioinstrumentation and Analytical techniques**	3 (1+2)
Sem- 2nd	Major	UMJBTT-201	**Fundamental of Biotechnology -II**	4 (3+1)
	Minor	UMIBTT-202	**Introduction to Biotechnology -II**	4 (3+1)
	Multi-disciplinary	UMDBTT-203	**Application of Biotechnology in Agriculture**	3+0
	Skill Enhancement	USEBTT-211	**Methods in Microbiology and Biochemistry**	3 (1+2)
Sem- 3rd	Major	UMJBTT-301	**General Microbiology**	4 (3+1)
	Major	UMJBTT-302	**Cell Biology and Genetics**	4 (3+1)
	Minor	UMIBTT-303	**Basic Microbiology**	4 (3+1)
	Multidisciplinary	UMDBTT-304	**Biotechnology for human welfare**	3+0
	Skill Enhancement Course	USEBTT-311	**Basic Diagnostic techniques**	3 (1+2)
Sem- 4th	Major	UMJBTT-401	**Molecular Biology**	4 (3+1)
	Major	UMJBTT-402	**Enzymology**	4 (3+1)
	Major	UMJBTT-406	**Immunology**	4 (3+1)
	Major	UMJBTT-404	**Biochemistry and Metabolism**	4 (3+1)
	Minor	UMIBTT-405	**Introduction to Molecular**	4 (3+1)

			Biology	
				20 credits
Sem- 5th	Major	UMJBTT-501	**Animal Biotechnology**	4 (3+1)
	Major	UMJBTT-502	**Genetic Engineering**	4 (3+1)
	Major	UMJBTT-503	**IPRs, Bioethics and Entrepreneurship in Biotechnology**	4 (3+1)
	Major	UMJBTT-504	**Medical Biotechnology**	2 (2+0)
	Minor	UMIBTT-505	**Introduction to Genetic Engineering**	4 (3+1)
	Summer internship	USEBTI-506	**Summer internship**	2
				20 credits
Sem- 6th	Major	UMJBTT-601	**Genomics and Proteomics**	4 (3+1)
	Major	UMJBTT-602	**Plant Biotechnology**	4 (3+1)
	Major	UMJBTT-603	**Bioprocess Engineering**	4 (3+1)
	Major	UMJBTT-604	**Applied and Advanced Microbiology**	4 (3+1)
	Minor	UMIBTT-605	**Introduction to Genomics and Proteomics**	4 (3+1)
				20 credits
Sem- 7th	Major	UMJBTT-701	**Nanobiotechnology**	4 (3+1)
	Major	UMJBTT-702	**Environmental Biotechnology**	4 (3+1)
	Major	UMJBTT-703	**Food Biotechnology**	4 (3+1)
	Major	UMJBTT-706	**Biostatistics and Bioinformatics**	4 (3+1)
	Minor	UMIBTT-705	**Introduction to Nanobiotechnology**	4 (3+1)
				20 credits
Sem- 8th Honours	Major	UMJBTT-801	**Industrial Biotechnology**	4 (3+1)
	Major	UMJBTT-802	**Structural Biology**	4 (3+1)
	Major	UMJBTT-803	**Advances in Biotechnology**	4 (3+1)
	Major	UMJBTT-804	**Vaccine and drug designing**	4 (3+1)
	Minor	UMIBTT-805	**Introduction to vaccine and drug designing**	4 (3+1)
				20 credits
			OR	
Sem- 8th Research	Major	UMJBTT-806	**Research Methodology**	4 (3+1)
	Minor	UMIBTT-807	**Introduction to Research Methodology**	4 (3+1)
	Research project	USEBTP-808	**Research project**	12
				20 credits

UNIVERSITY OF JAMMU
SYLLABI AND COURSES OF STUDY IN BIOTECHNOLOGY
For the examination to be held in December 2022, 2023, 2024
UG SEMESTER-I
UNDER NEP-2020

S. No	Course type	Course No.	Course Title	Credits	Marks				Total Marks	Percentage syllabus change
					Theory		Practical/Tutorial			
1.	Major	**UMJBTT-101**	Fundamentals of Biotechnology -I	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment 10 marks	Exam: 15 Marks	100	-- No change.
2.	Minor	**UMIBTT-102**	Introduction to Biotechnology -I	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment 10 marks	Exam: 15 Marks	100	--
3.	Multi-disciplinary	**UMDBTT-103**	Biotechnology for Human Welfare	3+0	Mid Semester: 15 Marks	End Semester Exam: 60 Marks	NA	NA	75	--
4.	Skill Enhancement	**USEBTT-111**	Bioinstrumentation and Analytical techniques	25 marks theory +50 marks practicals)	Mid Semester: Marks	End Semester Exam: Marks	Assessement	Exam:	75	100% change

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MAJOR COURSE

Course Code: UMJBTT-101
Course Title: Fundamentals of Biotechnology-I
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 Biotechnology with the major focus to cell biology, genetics, biomolecules, microbiology and molecular biology. After successfully completing this course, the students will be able to understand the basic concepts in cell biology, genetics, molecular biology and microbiology; understand the structure and biological significance of biomolecules.

Unit 1: Cell Biology and Genetics
Cell theory, Cell as basic unit of life (Viral, bacterial, fungal, plant and animal cells), Ultra structure of prokaryotic and eukaryotic cells (Cell wall, cell membrane, Golgi Complexes, Endoplasmic Reticulum, Peroxisome, Lysosomes etc), Semi- autonomous Organelles (Mitochondria & Chloroplast: Endosymbiotic theory), Nucleus: Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin
Historical overview; Understanding Mendel's principles, symbols and terminologies, laws of dominance, segregation and independent assortment; Gene interactions and their outcome

Unit 2: Introduction to Biomolecules
Carbohydrates: Definition, functions and classification of carbohydrates. Oligosaccharides, Polysaccharides-components and functions. Amino acids: Structures and Classifications Proteins: Physical properties: salting in and salting out, peptide bond, Organization of protein structure into primary, secondary, tertiary and quaternary structures. Lipids: Introduction, classification, properties of Fatty acids, Saturated and unsaturated fatty acids, Essential fatty acids, Triacylglycerol, simple and mixed Triacylglycerol. Nucleotides: Introduction, purine and pyrimidine bases, General composition of nucleic acids, nucleosides, nucleotides.

Unit 3: Microbiology
History and development of Microbiology; Microscopy: Principle and applications of different types of microscopes; Prokaryotes: diversity and taxonomy, cell structure and function; Methods in microbiology (sterilization, culturing methods, staining techniques); Microbiological media, composition and types; Applications of Microbiology.

Unit 4: Molecular Biology
DNA and RNA as a genetic material, DNA and RNA Structure and components, Central Dogma of Molecular Biology, General features of DNA replication and basic rules of replication. Basic concept of transcription and translation in prokaryotes and eukaryotes.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MAJOR COURSE

Course Code: UMJBTT-101
Course Title: Fundamentals of Biotechnology-I
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

Practical

1. Study, use and maintenance compound microscope
2. To study different types of plant cells and animal cells.
3. Qualitative test for detection of carbohydrates in the solution.
4. Qualitative test for detection of lipids in the solution.
5. Qualitative test for detection of proteins in the solution.
6. Preparation of culture media, isolation of microorganisms from soil, air and water.
7. Colony purification, bacterial staining: simple staining, negative staining and Gram's staining
8. Problems based on monohybrid, dihybrid, trihybrid crosses
9. Problems based on chi square test.
10. Isolation of genomic DNA from living cell and quantification of DNA by Spectrophotometer.

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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)

MAJOR COURSE

Course Code: UMJBTT-101
Course Title: Fundamentals of Biotechnology-I
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

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 books

1. Cell and Molecular Biology Concepts and Experiments- G. Karp, John Wiley & Sons, Inc., 8th edition (2015).
2. Fundamentals of Biochemistry- Jain and Jain; S. Chand., 7th edition (2016).
3. Cell Biology- D.E. Robertis& De Roberis, Blaze publishers & Distributors Pvt. Ltd., 8th edition (2017).
4. The Cell: A Molecular Approach- Cooper, G.M. and Hausman, R.E., Oxford University Press, Washington, D.C.; Sinauer Associates, MA., 8th edition (2019).
5. Basic Genetics- Daniel L. Hartl, Jones &Barlett Publishers USA, latest edition.
6. Genetics – Monroe W Strickberger, Macmillain Publishers, New York, latest edition.
7. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications, 8th edition (2016).
8. Lewin's Genes XII - Elliott S. Goldstein, Jocelyn E. Krebbs, and Stephen T. Kilpatrick, Jones and Bartlett Publishers, Inc., 12th edition (2018).
9. Microbiology- Prescott, L.M., Harley, J.P. and Klein, D.A. McGraw Hill, USA, 12th edition (2022).
10. Microbiology-Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R. Tata McGraw Hill, New Delhi (2005).
11. Microbiology: An Introduction-Tortora G.J, Funke B.R. and Case C.L., Wever and Bair. Pearson Education India, 13thedition (2021).
12. Lehninger's Principles of Biochemistry- Nelson and Cox, W. H., Freeman and company, New York, 8th edition (2021).
13. Biochemistry- Voet D and Voet JG , John Wiley & Sons, New York, 6th edition (2004).
    Biochemistry- Berg JM, Tymoczko, JL, and Stryer L. WH Freeman & Co., New York,9th edition (2019).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MINOR COURSE

Course Code: UMIBTT-102
Course Title: Introduction to Biotechnology -I
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 Biotechnology with the major focus to cell biology, genetics, biomolecules, microbiology and molecular biology. After successfully completing this course, the students will be able to understand the basic concepts in cell biology, genetics, molecular biology and microbiology; understand the structure and biological significance of biomolecules.

Unit 1: Cell Biology and Genetics
Cell theory, Cell as basic unit of life (Viral, bacterial, fungal, plant and animal cells), Ultra structure of prokaryotic and eukaryotic cells (Cell wall, cell membrane, Golgi Complexes, Endoplasmic Reticulum, Peroxisome, Lysosomes etc), Semi- autonomous Organelles (Mitochondria & Chloroplast: Endosymbiotic theory), Nucleus: Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin
Historical overview; Understanding Mendel's principles, symbols and terminologies, Laws of dominance, segregation and independent assortment; Gene interactions and their outcome

Unit 2: Introduction to Biomolecules
Carbohydrates: Definition, functions and classification of carbohydrates. Oligosaccharides, Polysaccharides-components and functions. Amino acids: Structures and Classifications Proteins: Physical properties: salting in and salting out, peptide bond, Organization of protein structure into primary, secondary, tertiary and quaternary structures. Lipids: Introduction, classification, properties of Fatty acids, Saturated and unsaturated fatty acids, Essential fatty acids, Triacylglycerol, simple and mixed Triacylglycerol. Nucleotides: Introduction, purine and pyrimidine bases, General composition of nucleic acids, nucleosides, nucleotides.

Unit 3: Microbiology
History and development of Microbiology; Microscopy: Principle and applications of different types of microscopes; Prokaryotes: diversity and taxonomy, cell structure and function; Methods in microbiology (sterilization, culturing methods, staining techniques); Microbiological media, composition and types; Applications of Microbiology.

Unit 4: Molecular Biology
DNA and RNA as a genetic material, DNA and RNA Structure and components, Central Dogma of Molecular Biology, General features of DNA replication and basic rules of replication. Basic concept of transcription and translation in prokaryotes and eukaryotes.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)

MINOR COURSE

Course Code: UMIBTT-102
Course Title: Introduction to Biotechnology -I
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

Practical

1. Study, use and maintenance compound microscope
2. To study different types of plant cells and animal cells.
3. Qualitative test for detection of carbohyderates in the solution.
4. Qualitative test for detection of lipids in the solution.
5. Qualitative test for detection of proteins in the solution.
6. Preparation of culture media, isolation of microorganisms from soil, air and water.
7. Colony purification, bacterial staining: simple staining, Negative staining and Gram's staining
8. Experiments on monohybrid, dihybrid, trihybrid cross
9. Experiments on chi square test.
10. Isolation of genomic DNA from living cell and quantification of DNA by Spectrophotometer.

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 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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MINOR COURSE

Course Code: UMIBTT-102
Course Title: Introduction to Biotechnology -I
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

Reference books:

1. Cell and Molecular Biology: Concepts and Experiments- G. Karp, John Wiley & Sons, Inc., 8th edition (2015).
2. Fundamentals of Biochemistry- Jain and Jain; S. Chand, 7th edition (2016).

Cell Biology- D.E. Robertis& De Roberis, Blaze publishers & Distributors Pvt. Ltd., 8th edition (2017).

3. The Cell: A Molecular Approach- Cooper, G.M. and Hausman, R.E., Oxford University Press, Washington, D.C.; Sinauer Associates, MA., 8th edition (2019).

Basic Genetics- Daniel L. Hartl, Jones &Barlett Publishers USA, latest edition.

4. Genetics – Monroe W Strickberger, Macmillain Publishers, New York, latest edition.
5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications, 8th edition (2016).
6. Lewin's Genes XII - Elliott S. Goldstein, Jocelyn E. Krebbs, and Stephen T. Kilpatrick, Jones and Bartlett Publishers, Inc., 12th edition (2018).
7. Microbiology- Prescott, L.M., Harley, J.P. and Klein, D.A. McGraw Hill, USA, 12th edition (2022).
8. Microbiology- Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R., Tata McGraw Hill, New Delhi (2005).
9. Microbiology: An Introduction- Tortora, G.J., Funke, B.R. and Case C.L., Wever and Bair. Pearson Education India, 13th edition (2021).
10. Lehninger's Principles of Biochemistry- Nelson and Cox, W. H., Freeman and company, New York, 8th edition (2021).
11. Biochemistry- Voet D and Voet JG , John Wiley & Sons, New York, 6th edition (2004). Biochemistry- Berg JM, Tymoczko, JL, and Stryer L. WH Freeman & Co., New York, 9th edition (2019).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MULTIDISCIPLINARY COURSE

Course Code: UMDBTT-103
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; Introduction to DNA, RNA, Proteins and the Central Dogma; Microbes and their Culturing; Principles of Genetic engineering & Bioprocess technology.

Unit 2: Applications of Biotechnology- Agriculture and Industry
Need for Genetically Modified (GM) crops, Golden rice, Bt Cotton & FlavrSavr Tomato;
Overview of industrial production of alcoholic beverages, antibiotics & enzymes, Bio-fertilizers and bio-pesticides, Bioplastics and Biofuels.

Unit 3: Biotechnology in Environment
Biodegradation of potential pollutants, recycling of wastes and other waste treatment technologies. Controlling environmental pollution through bioremediation, biomonitoring, biotreatment and biodegradation of all solid, liquid and gaseous wastes.

Unit 4: Biotechnology in Human healthcare
Human Genome Project, Gene therapy, Molecular Diagnostics tools - PCR, DNA fingerprinting, an overview of vaccines, Recombinant insulin

NOTE FOR PAPER SETTING

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Internal Theory Assessment	50%	1½ Hours	15
External Theory End Semester	100%	3 Hours	60

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

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
MULTIDISCIPLINARY COURSE

Course Code: UMDBTT-103
Course Title: Biotechnology for Human Welfare
Credits: 3
Total No. of Lectures: 45 hours
Maximum Marks: 75
Theory: 75
Duration of Examination: 3 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.
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 Books:

1. Gene Cloning and DNA Analysis: An Introduction- Brown T. A., Wiley Blackwell, 8th edition (2020).
2. Principles of Gene Manipulation and Genomics- Primrose S.B., Wiley India,7th edition (2014).
3. Biotechnology: A textbook of Industrial Microbiology- Crueger W and Crueger A., Panima Publishing Co. New Delhi, 3rd edition (2017).
4. Environmental Biotechnology Concepts and Applications- Hans-Joachim J. and Winter, J. (2004)
5. Elements of Biotechnology- Gupta, P.K.,Rastogi and Co., Merrut, India, 2nd edition (2010).
6. Introduction to Plant Biotechnology- Chawla, H. S.; C RC Press, 3rd edition (2020).
7. Text Book of Biotechnology- Das, H.K., Wiley India Pvt. Limited, 5th edition (2017).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-111
Course Title: Bioinstrumentation and Analytical Techniques
Credits: 3 (25 marks theory + 50 marks practicals)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25 marks
Practical: 50 marks
Duration of Examination: 2.5 hours

Objectives and Expected Learning Outcomes: The course provides the basic principles and functioning of various bioinstruments and analytic techniques used in biotechnology labs. After successfully completing this course, the students will be able to handle various bioinstruments and perform analytical techniques like chromatography, mass spectrometry and spectroscopy.

Unit 1: Basic analytical techniques-I
Principle and functioning of micropipetts; Preparation of buffers and reagents; Principle, working and functions of electronic balance, Autoclave, Biosafety hood, Microscope, Centrifuge, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Thermocycler, Real time PCR, Gel documentation system.

Unit 2: Basic analytical techniques-II
Basic concepts in chromatography; Types of Chromatography (Paper chromatography, Thin-layer chromatography Column chromatography, Ion- exchange chromatography, Gas chromatography and HPLC), Mass spectrometry, Spectroscopy (UV-Vis).

Unit 3: Practical
1. Handling and operation of Microscope
2. To prepare the buffer at required pH.
3. To perform PCR.
4. Electrophoresis of DNA.
5. Demonstration and operation of Gel documentation system.
6. Spectrophotometer/colorimeter (Beer-Lambert's law).
7. Spectroscopic estimation of DNA (UV).
8. Demonstration on operation of Centrifugation.
9. To separate and study plant pigments by paper chromatography.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2025, 2026 & 2027)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-111
Course Title: Bioinstrumentation and Analytical Techniques
Credits: 3 (25 marks theory + 50 marks practicals)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25 marks
Practical: 50 marks
Duration of Examination: 2.5 hours

NOTE FOR PAPER SETTING

Note for paper setting for mid term examination part -1:
The question paper will of 25 marks. There will be two sections in the question paper with pattern as follow:
Section A shall comprise of 4 short answer type questions of (2.5 Marks each) covering all three units with at least one question from each unit. The students have to attempt all 4 questions from section A.
Section B shall be comprise of a total of 6 questions with two questions selected from each unit. Each question shall be of 5 marks. The students have to attempt three questions selecting only one question from each unit.

Evaluation of skills: Final examination part 2:
The evaluation of skill will be internal. The examination of skill shall be of 50 marks. The evaluation of skill will be done internally through the board of three members (including the trainer of the course).

Reference books

1. Methods in biotechnology- Hong, S. B., Rashid, M. B., & Santiago-Vázquez, L. Z. John, Wiley & Sons, 1st edition (2016).
2. Wilson and Walker's principles and techniques of biochemistry and molecular biology- Wilson, K., Hofmann, A., Walker, J. M., &Clokie, S., Cambridge University Press, 8th edition (2018).
3. Analytical techniques in biochemistry and molecular biology- Katoch, R., Springer Science & Business Media (2011).
4. Basic Methods in Microscopy: Protocols and Concepts from Cells: A Laboratory Manual- Goldman, R. D., & Spector, D. L., Eds Cold Spring Harbor Laboratory Press, 1st edition (2006).
5. Fundamentals of bioanalytical techniques and instrumentation- Ghosal, S., &Avasthi, A. S., Phi Learning Pvt. Ltd, 2nd edition (2018).

UNIVERSITY OF JAMMU
SYLLABI AND COURSES OF STUDY IN BIOTECHNOLOGY
For the examination to be held in May 2026, 2027 & 2028
UG SEMESTER-II
UNDER NEP-2020

S. No	Course type	Course No.	Course Title	Credits	Marks				Total Marks	Percentage syllabus change
					Theory		Practical/Tutorial			
1.	Major	**UMJBTT-201**	Fundamental of Biotechnology -II	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment 10 marks	Exam: 15 Marks	100	--
2.	Minor	**UMIBTT-202**	Introduction to Biotechnology -II	4 (3+1)	Mid Semester: 15 Marks	End exam: 60 marks	Assessment 10 marks	Exam: 15 Marks	100	--
3.	Multi-disciplinary	**UMDBTT-203**	Application of Biotechnology in Agriculture	3+0	Mid Semester: 15 Marks	End Semester Exam: 60 Marks	NA	NA	75	--
4.	Skill Enhancement	**USEBTT-211**	Methods in Microbiology and Biochemistry	3 (25 marks theory +50 marks practicals)	Mid Semester: Marks	End Semester Exam: Marks	Assessment	Exam:	75	100%

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
MAJOR COURSE

Course Code: UMJBTT-201
Course Title: Fundamentals of Biotechnology-II
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 Biotechnology with the major focus to recombinant DNA technology, Immunology, Enzyme and Bioprocess technology; plant and animal biotechnology. After successfully completing this course, the students will be able to understand the basic concepts in rDNA technology and Bioprocess technology and also understand the process of immune system and mechanism of enzyme action.

Unit 1: Recombinant DNA technology
Concept of recombinant DNA technology and its enzymes in gene cloning; Method of gene cloning and tools and techniques involved, Applications of recombinant DNA technology in medicine, agriculture, veterinary sciences and protein engineering.

Unit 2: Immunology
Brief history and overview of immune system, Innate and Adaptive immunity, Active and Passive immunity, cells and Hematopoiesis, organs of immune system, Concept of Antigen and Antibody, Immunoglobulin and their types, monoclonal antibody generation, MHC complex, Antigen-antibody interactions and assays used for detection (RIA and ELISA).

Unit 3: Enzyme and Bioprocess Technology
Introduction to Enzymes, Nomenclature and classification of Enzymes, brief introduction to active site. Cofactors, coenzyme, prosthetic groups, holoenzyme and apoenzyme, Active site hypothesis (lock-and-key, induced fit, strain or transition-state stabilization); Enzyme activity units, Factors affecting enzyme activity (Enzyme concentration, substrate concentration, pH, temperature and reaction time). Introduction to Bioprocess Technology, Types of bioprocesses- batch, continuous, fed batch, Microbial growth kinetics Design and formulation of Media for industrial bioprocesses, Sterilization of media and air, Bioreactor and its types.

Unit 4: Plant and Animal Biotechnology
In vitro culture: approaches & methodologies - preparation steps for tissue culture; surface sterilization of plant material; basic procedure for aseptic tissue transfer; incubation of culture; media composition & Growth hormones; micro-culture of plants.

Animal tissue culture, history, requirements for animal cell culture, aseptic conditions, types of media, Primary and secondary culture, subculture, cryopreservation.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)

MAJOR COURSE

Course Code: UMJBTT-201
Course Title: Fundamentals of Biotechnology-II
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

Practicals

1. PCR Amplification of gene of interest
2. Cloning of gene of interest in plasmid
3. Understanding the concept and maintenance of aseptic conditions for animal cell culture lab
4. Preparation of the media
5. Demonstration of various sterilization techniques used in laboratory.
6. Preparation of culture media for tissue culture, bacteria and fungi.
7. Demonstration of various steps of micropropagation
8. Effect of reaction time on the activity of enzyme.
9. Effect of substrate concentration on enzyme activity,
10. Calculation of kinetic parameters such as K_m, V_{max}.
11. Effect of temperature and pH on the activity of enzyme, and pH and thermostabilityanaslysis
12. To perform ABO blood typing
13. To perform differential leukocyte count

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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
MAJOR COURSE

Course Code: UMJBTT-201
Course Title: Fundamentals of Biotechnology-II
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

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 Books

1. Understanding Enzymes- Trevor, P., Prentice Hall/Ellis, Harwood, England, 4th edition (2018).
2. Fundamentals of Enzymology- Nicholas, C. Price and Lewis Stevens, Oxford University Press, 3rd edition (2009).
3. Principles of Fermentation Technology- Stanbury, P.F., Whitaker, A., & Hall, S.J. India: Elsevier Science Ltd, 3rd edition (2016).
4. Bioprocess Engineering: Basic concepts- Shuler, M. L., &Kargi, K. India: Prentice Hall, 3rd edition (2017).
5. Introduction to Plant Biotechnology- Chawla, H. S., C RC Press, 3rd edition (2020).
6. Text Book of Biotechnology- Das, H.K., Wiley India Pvt. Limited, 5th edition (2017).
7. Plant Biotechnology- Hammound, J., McGarvey, P. and Yusibov, V., Springer Verag (2012).
8. Plant Biotechnology- Gupta, P.K.,Rastogi Publishers, Meerut, India, 2nd edition (2016).
9. Plant Biotechnology and Genetics- Steward CN. Techniques and Applications, Wiley and Sons, 2nd edition (2016).
10. Principles of Gene manipulation- Old, R.N. and Primose, S.B.., Blackwell Publishing, 7thedition (2006).
11. Goldsby, R. A., Kindt, T.J. and Osborne,B.A.Kuby Immunology. W.H. Freeman and company, New York, 7th edition, (2013).
12. Roitt,I., Brostoff, J. and Male,D. Immunology. Hartcourt Brace and Company, Asia Pvt.Ltd.latest edition.

University of Jammu

Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
MINOR COURSE

Course Code: UMIBTT-202
Course Title: Introduction of Biotechnology-II
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 Biotechnology with the major focus to recombinant DNA technology, Immunology, Enzyme and Bioprocess technology; plant and animal biotechnology. After successfully completing this course, the students will be able to understand the basic concepts in rDNA technology and Bioprocess technology and also understand the process of immune system and mechanism of enzyme action.

Unit 1: Recombinant DNA technology

Concept of recombinant DNA technology and its enzymes in gene cloning; Method of gene cloning and tools and techniques involved, Applications of recombinant DNA technology in medicine, agriculture, veterinary sciences and protein engineering.

Unit 2: Immunology

Brief history and overview of immune system, Innate and Adaptive immunity, Active and Passive immunity, cells and Hematopoiesis, organs of immune system, Concept of Antigen and Antibody, Immunoglobulin and their types, monoclonal antibody generation, MHC complex, Antigen-antibody interactions and assays used for detection (RIA and ELISA).

Unit 3: Enzyme and Bioprocess Technology

Introduction to Enzymes, Nomenclature and classification of Enzymes, brief introduction to active site. Cofactors, coenzyme, prosthetic groups, holoenzyme and apoenzyme, Active site hypothesis (lock-and-key, induced fit, strain or transition-state stabilization); Enzyme activity units, Factors affecting enzyme activity (Enzyme concentration, substrate concentration, pH, temperature and reaction time). Introduction to Bioprocess Technology, Types of bioprocesses- batch, continuous, fed batch, Microbial growth kinetics Design and formulation of Media for industrial bioprocesses, Sterilization of media and air, Bioreactor and its types.

Unit 4: Plant and Animal Biotechnology

Animal tissue culture, history, requirements for animal cell culture, aseptic conditions, types of media, Primary and secondary culture, subculture, cryopreservation. In vitro culture: approaches & methodologies - preparation steps for tissue culture; surface sterilization of plant material; basic procedure for aseptic tissue transfer; incubation of culture; media composition & Growth hormones; micro-culture of plants.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)

MINOR COURSE

Course Code: UMIBTT-202
Course Title: Introduction of Biotechnology-II
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

Practicals

1. PCR Amplification of gene of interest
2. Cloning of gene of interest in plasmid
3. Understanding the concept and maintenance of aseptic conditions for animal cell culture lab
4. Preparation of the media
5. Demonstration of various sterilization techniques used in laboratory.
6. Preparation of culture media for tissue culture, bacteria and fungi.
7. Demonstration of various steps of micropropagation
8. Effect of reaction time on the activity of enzyme.
9. Effect of substrate concentration on enzyme activity,
10. Calculation of kinetic parameters such as Km, Vmax.
11. Effect of temperature and pH on the activity of enzyme and pH and thermostability analysis
12. To perform ABO blood typing
13. To perform differential leukocyte count

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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)

MINOR COURSE

Course Code: UMIBTT-202
Course Title: Introduction of Biotechnology-II
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

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 Books

1. Understanding Enzymes- Trevor, P., Prentice Hall/Ellis, Harwood, England, 4th edition (2018).
2. Fundamentals of Enzymology- Nicholas, C. Price and Lewis Stevens, Oxford University Press, 3rd edition (2009).
3. Principles of Fermentation Technology- Stanbury, P.F., Whitaker, A., & Hall, S.J. India: Elsevier Science Ltd, 3rd edition (2016).
4. Bioprocess Engineering: Basic concepts- Shuler, M. L., &Kargi, K. India: Prentice Hall, 3rd edition (2017).
5. Introduction to Plant Biotechnology- Chawla, H. S., C RC Press, 3rd edition (2020).
6. Text Book of Biotechnology- Das, H.K., Wiley India Pvt. Limited, 5th edition (2017).
7. Plant Biotechnology- Hammound, J., McGarvey, P. and Yusibov, V., Springer Verag (2012).
8. Plant Biotechnology- Gupta, P.K., Rastogi Publishers, Meerut, India, 2nd edition (2016).
9. Plant Biotechnology and Genetics- Steward CN. Techniques and Applications, Wiley and Sons, 2nd edition (2016).
10. Principles of Gene manipulation- Old, R.N. and Primose, S.B.., Blackwell Publishing, 7thedition (2006).
11. Goldsby, R. A., Kindt, T.J. and Osborne,B.A.Kuby Immunology. W.H. Freeman and company, New York, 7th edition, (2013).
12. Roitt,I., Brostoff, J. and Male,D. Immunology. Hartcourt Brace and Company, Asia Pvt.Ltd. latest edition.

University of Jammu

Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
MULTIDISCIPLINARY COURSE

Course Code: UMDBTT-203
Course Title: Applications of Biotechnology in Agriculture
Credits: 3
Total No. of Lectures: Theory: 45 hours
Maximum Marks: 75
Theory: 75
Duration of Examination: 3 hours

Objectives and Expected Learning Outcomes
Biotechnology has huge is increasingly being used to in different areas of Agriculture for enhancing quality and quantity, disease and stress resistance in crops and livestock. At the end of the course students will able to understand the principals and technical advances behind the in vitro culture of plant cells and methods of producing transgenics; improving the productivity and performance of plants under biotic and abiotic stresses; development of transgenic animals for the production of vaccines, milk, and for poultry and livestock improvement.

Unit 1: Introduction to Agricultural Biotechnology
Conventional breeding and Biotechnology, Use of Biotechnology in different areas of agriculture: Biofertilizers, Biopesticides. Introduction to GM crops, their safety and acceptance; role of Biotechnology in climate change and biodiversity

Unit 2: Introduction to Plant Tissue Culture
History of plant tissue culture, requirements for plant tissue culture lab, Totipotency, micro propagation of economically important crops, Artificial Seeds.

Unit 3: Transgenic Plants and Applications
Basic concept and techniques of genetic transformation, Genetic Engineering for quality improvement; Disease resistance plants: herbicide resistance, disease resistance; transgenic crops and food security; Plants as bio factories for molecular pharming; plantibodies, nutraceuticals, ethical issues associated with transgenic crops.

Unit 4: Transgenic Animals and Applications
Introduction to Animal Biotechnology, Role of Animal Biotechnology in development of disease resistance, better milk and meat yielding animals, fisheries and poultry improvement, vaccines, ethical issues associated with transgenic animals.

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Internal Theory Assessment	50%	1½ Hours	15
External Theory End Semester	100%	3 Hours	60

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
MULTIDISCIPLINARY COURSE

Course Code: UMDBTT-203
Course Title: Applications of Biotechnology in Agriculture
Credits: 3
Total No. of Lectures: Theory: 45 hours
Maximum Marks: 75
Theory: 75
Duration of Examination: 3 hours

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.
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 Books

1. Plant Tissue Culture: Theory and Practice- Bhojwani, S.S and Razdan, M.K., Elsevier Science (2010).
2. Plant Cell and Tissue Culture for the Production of Food Ingredients- Fu, T-J., Singh, G. and Curitis, W.R., Kluwer Academic/ Plenum Press, latest edition.
3. Elements of Biotechnology- Gupta, P.K., Rastogi Publications, Merrut, India, 2nd edition (2019).
4. Introduction to Plant Biotechnology- Chawla, H. S. C RC Press, 3rd edition (2020).
5. Text Book of Biotechnology- Das, H.K.,Wiley India Pvt. Limited, 5th edition (2017).
6. Plant Biotechnology- Hammound, J., McGarvey, P. and Yusibov, V., Springer Verag (2012).
7. Plant Biotechnology- Gupta, P.K. Rastogi Publishers, Meerut, India, 2nd edition (2016).
8. Plant Biotechnology and Genetics- Steward CN., Wiley and Sons, 2nd edition (2016).
9. Principles of Gene manipulation- Old, R.N. and Primose, S.B., Blackwell Publishing,7th edition (2006).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-211
Course Title: Methods in Microbiology and Biochemistry
Credits: 2 (40 marks theory+ 10 marks practical)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 40
Practical: 10
Duration of Examination: 2.5 hours

Objectives and Expected Learning Outcomes: The course provides the basic concept of various methods used in microbiology and biochemistry. After successfully completing this course, the students will be able to performs various microbiological processes like culturing, identification, purification and preservation of microbes. The student will be able to perform various biochemical tests, Blood grouping, sputum analysis etc

Unit 1: Methods in Microbiology
Microscopy: Principle and working of light microscope, compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, confocal microscope and electron Microscopes, Culture media and pure culture techniques: Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media, Serial dilution and plating methods (pour plate, spread plate, streak plate methods).
Control of microbes- Sterilisation, disinfection, antiseptic, tyndallisation, pasteurization: Physical-dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Chemical-phenol and phenolic compounds, (halogen aliphatic alcohol, formaldehyde, ethylene oxide, heavy metals) anionic and cationic detergents. Culture preservation and maintenance: sub-culturing, refrigeration, glycerol preservation, stab cultures, cryopreservation, lyophilization and paraffin method, Stains and staining techniques: Principle of staining, Types of stains-simple staining, negative staining, differential staining, Gram and acid-fast staining, flagellar staining, capsule and endospore staining.

Unit 2: Methods in Biochemistry
Water, Electrolyte and Acid-Base Balance. Distribution of Water in Body, Water turnover and balance. Body Fluids: Biochemistry of Urine, blood and CSF Normal and abnormal constituents and clinical entities in body fluids. Clinical Hematology: Collection of blood - Anticoagulant, preservation, Estimation of blood glucose, Clotting time, bleeding time Blood grouping- ABO system, ABO Grouping, Rh typing, CSF and other body Fluids Cerebrospinal fluid analysis, Semen analysis, sputum examination, pregnancy test – Interpretation.

Unit 3: Practical
1. To study the use and maintenance of compound microscope
2. Preparation of different types of culture media and sterilization
3. Sub-culturing and preservation of cultures

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-211
Course Title: Methods in Microbiology and Biochemistry
Credits: 3 (25 marks theory + 50 marks practical)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25
Practical: 50
Duration of Examination: 2.5 hours

4. Aseptic techniques- Culture transfer from solid to solid, solid to liquid and liquid to liquid: Checking of possible contamination
5. Isolation of microorganisms from soil, air and water.
6. Colony purification, bacterial staining: simple staining, Negative staining and Gram's staining
7. Viable count of bacteria by serial dilution and pour plating.
8. Simple biochemical tests of bacteria
9. Antibiotic sensitivity tests
10. Operation of autoclave, hot air oven, membrane filtration (demonstration only), culture room fumigation using formalin, surface sterilization
11. Preparation of normal and molar solutions, Stock and working solutions
12. Preparation of physiological buffers
13. Qualitative test for detection and quantitative estimation of glucose in the solution.
14. Qualitative test for detection and quantitative estimation of proteins in the solution

NOTE FOR PAPER SETTING

Note for paper setting for midterm examination part -1:
The question paper will of 25 marks. There will be two sections in the question paper with pattern as follow:
Section A shall comprise of 4 short answer type questions of (2.5 Marks each) covering all three units with at least one question from each unit. The students have to attempt all 4 questions from section A.
Section B shall be comprise of a total of 6 questions with two questions selected from each unit. Each question shall be of 5 marks. The students have to attempt three questions selecting only one question from each unit.

Evaluation of skills: Final examination part 2:
The evaluation of skill will be internal. The examination of skill shall be of 50 marks. The evaluation of skill will be done internally through the board of three members (including the trainer of the course).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2026, 2027 & 2028)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-211
Course Title: Methods in Microbiology and Biochemistry
Credits: 3 (25 marks theory + 50 marks practical)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25
Practical: 50
Duration of Examination: 2.5 hours

Reference books

1. Methods in biotechnology- Hong, S. B., Rashid, M. B., & Santiago-Vázquez, L. Z. John, Wiley & Sons, 1st edition (2016).
2. Wilson and Walker's principles and techniques of biochemistry and molecular biology- Wilson, K., Hofmann, A., Walker, J. M., &Clokie, S., Cambridge University Press, 8th edition (2018).
3. Analytical techniques in biochemistry and molecular biology- Katoch, R., Springer Science & Business Media (2011).
4. Biochemical methods- Sadasivam, and Manickam, New age International Publishers, 3rd edition (2018).
5. Basic Methods in Microscopy: Protocols and Concepts from Cells: a Laboratory Manual- Goldman, R. D., & Spector, D. L., Cold Spring Harbor Laboratory Press, 1st edition (2006).
6. Fundamentals of bioanalytical techniques and instrumentation- Ghosal, S., &Avasthi, A. S. Phi Learning Pvt. Ltd, 2nd edition (2018).

UNIVERSITY OF JAMMU
SYLLABI AND COURSES OF STUDY IN BIOTECHNOLOGY
For the examination to be held in 2026, 2027 and 2028
UG SEMESTER-III
UNDER NEP-2020

S. No	Course type	Course No.	Course Title	Credits	Marks				Total Marks	Percentage syllabus change
					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-311**	Basic Molecular Diagnostics	3 (25 marks theory +50 marks practicals)	Mid Semester: Marks	End Semester Exam: Marks	Assessment:	Exam:	75	100%

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)

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

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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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

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., Hatziioannou, 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, 16th edition (2020).
4. Microbiology- Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R., Tata McGraw Hill Education Pvt. Ltd. , New Delhi, 7th edition (2019).
5. Microbiology: An introduction- Tortora, G.J., Funke, B.R and Case, C.L., Pearson Education Inc., 14th edition (2019).
6. Fundamentals of Microbiology- Pommerville, J.C., Jones & Bartlett Learning, 12th edition (2021).
7. Microbiology- Tortora, G.J., Funke, B.R. and Case, C.L., Pearson Education India, 11th 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, 5th 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, 4th edition (2017).
12. Phycology- Lee, R.E., Cambridge University Press, 5th edition (2018).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
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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

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

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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

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, 8th 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, 8th edition (2021).
3. The Cell: A Molecular Approach- Cooper, G.M. and Hausman, R.E, Sinauer Associates Inc. and ASM Press, 8th edition (2019).
4. Genetics: Analysis and Principles- Brooker, R.J., McGraw Hill Education, 6th edition (2019).
5. Genes XI- Lewin, B., Jones and Bartlett Publishers, 11th edition (2021).
6. Genetics: Analysis and Principles- Brooker, R.J., McGrawl Hill Education, 6th edition (2019).
7. Principles of Genetics- Snustad, P.D. and Simmons, M.J., John Wiley & Sons, Inc., 7th edition (2019).
8. Lewin's Genes XII- Goldstein, E.S., Krebbs, J.E., Kilpatrick, S.T., Jones and Bartlett Publishers, Inc., 12th edition (2020).
9. Genetics-Strickberger, M.W., Macmillain Publishers, New York, 5th edition (2013).
10. Principles of Gene Manipulations- Old, R.W. and Primrose, S.B., Black Well Scientific Publications, 7th edition (2011).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)

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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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

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

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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

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 Books:

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., Hatziioannou, 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, 16th edition (2020).
4. Microbiology- Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R., Tata McGraw Hill Education Pvt. Ltd. , New Delhi, 7th edition (2019).
5. Microbiology: An introduction- Tortora, G.J., Funke, B.R and Case, C.L., Pearson Education Inc., 14th edition (2019).
6. Fundamentals of Microbiology- Pommerville, J.C., Jones & Bartlett Learning, 12th edition (2021).
7. Microbiology- Tortora, G.J., Funke, B.R. and Case, C.L., Pearson Education India, 11th 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, 5th 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, 4th edition (2017).
12. Phycology- Lee, R.E., Cambridge University Press, 5th edition (2018).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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.

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
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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

NOTE FOR PAPER SETTING

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Internal Theory Assessment	50%	1½ Hours	15
External Theory End Semester	100%	3 Hours	60

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.
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 Books:

1. Gene Cloning and DNA Analysis: An Introduction- Brown, T.A., Wiley Blackwell, 8th 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, 3rd edition (2017).
4. Environmental Biotechnology Concepts and Applications- Hans-Joachim, J. and Winter, J., Wiley Blackwell, 1st edition (2004).
5. Elements of Biotechnology- Gupta, P.K., Rastogi and Co., Merrut, India, 2nd edition (2010).
6. Introduction to Plant Biotechnology- Chawla, H.S., C.R.C. Press, 3rd edition (2020).
7. Text Book of Biotechnology- Das, H.K., Wiley India Pvt. Limited, 5th edition (2017).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
Skill Enhancement Course

Course Code: USEBTT-311
Course Title: Basic Molecular Diagnostics
Credits: 3 (Theory: 25 Marks + Practicals: 50 Marks)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25
Practical: 50
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 defines basic terminology and describes 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 acidbased 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

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
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Course Code: USEBTT-311
Course Title: Basic Molecular Diagnostics
Credits: 3 (Theory: 25 Marks + Practicals: 50 Marks)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25
Practical: 50
Duration of Examination: 2.5 hours

NOTE FOR PAPER SETTING

Note for paper setting for midterm examination part -1:
The question paper will of 25 marks. There will be two sections in the question paper with pattern as follow:
Section A shall comprise of 4 short answer type questions of (2.5 Marks each) covering all three units with at least one question from each unit. The students have to attempt all 4 questions from section A.
Section B shall be comprise of a total of 6 questions with two questions selected from each unit. Each question shall be of 5 marks. The students have to attempt three questions selecting only one question from each unit.

Evaluation of skills: Final examination part 2:
The evaluation of skill will be internal. The examination of skill shall be of 50 marks. The evaluation of skill will be done internally through the board of three members (including the trainer of the course).

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2026, 2027 & 2028)
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Course Title: Basic Molecular Diagnostics
Credits: 3 (Theory: 25 Marks + Practicals: 50 Marks)
Total No. of Lectures: Theory: 25 hours
Practical: 30 hours
Maximum Marks: 75
Theory: 25
Practical: 50
Duration of Examination: 2.5 hours

Reference Book:

1. Gene Cloning and DNA Analysis: An Introduction- Brown, T. A., Wiley Blackwell, 7th edition (2016).
2. Principles of Gene Manipulations and Genomics- Primrose, S.B and Twyman, R., Black Well Scientific Publications, 8th edition (2016).
3. Elements of Biotechnology- Gupta, P.K., Rastogi and Co., Merrut, India, 3rd edition (2010).
4. RNA and DNA Diagnostics- Erdmann, V.A., Jurga, S. and Barciszewski, J., Springer International Publishing, New York (2015).
5. Molecular Diagnostics- Patrinos, G.P., Danielson, P.B. and Ansorge, W.J., Academic Press Elsevier, 3rd edition (2017).
6. Cellular and Molecular Immunology- Abbas, A., Lichtman, A.H. and Pillai, S., Academic Press Elsevier, 10th edition (2021).
7. Clinical Immunology-Rezaei, M., Academic Press Elsevier (2022).