



UNIVERSITY OF JAMMU

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

Academic Section

Email: academicsectionju14@gmail.com

NOTIFICATION (22/Sept./Adp/26)

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 Ist and IInd for Four Year Under Graduate Programme** 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 examination to be held in the years
Biotechnology	Semester-I	December 2022, 2023 and 2024
	Semester-II	May 2023, 2024 and 2025

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

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/22/5750-5771

Dated: 19-9-2022

Copy for information and necessary action to:

1. Special Secretary to the Vice-Chancellor, University of Jammu for information of Hon'ble Vice-Chancellor
2. Dean, Faculty of Science
3. HOD/Convener, Board of Studies in Biotechnology
4. Sr. P.A. to the Controller of Examinations
5. All members of the Board of Studies
6. Confidential Assistant to the Controller of Examinations
7. I/C Director, Computer Centre, University of Jammu
8. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG/ Exam Eval Non-Prof/CDC)
9. Incharge, University Website for Uploading of the notification.

Sumitasharma
Deputy Registrar (Academic) 18/9/22

[Signature]
18/9/22

UNIVERSITY OF JAMMU

**SYLLABI AND COURSE OF STUDY IN
BIOTECHNOLOGY**

**For the Examination to be held in Year 2022,
2023, 2024 & 2025**

BIOTECHNOLOGY COURSE

**UG SEMESTER I & II
UNDER NEP-2020**

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
					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
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-104	Bioinstrumentation and Analytical techniques	2 (40 marks theory +1 marks practicals)	Mid Semester: 10 Marks	End Semester Exam: 30 Marks	NA	Exam: 10 Marks	50

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2022, 2023, 2024)
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 2022, 2023, 2024)
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 2022, 2023, 2024)
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 & Bartlett Publishers USA, latest edition.
6. Genetics ó 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. Krebs, 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, 13th edition (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 2022, 2023, 2024)
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)

Historical overview and laws of Inheritance; Understanding Mendel's principles and deviations; Gene interactions and their outcome; Linkage and crossing over

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 2022, 2023, 2024)
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 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 Gramø 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 2022, 2023, 2024)
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).
3. Cell Biology- D.E. Robertis & De Robertis, 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 & Bartlett Publishers USA, latest edition.
6. Genetics ó Monroe W Strickberger, Macmillain Publishers, New York, latest edition.
7. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications, 8th edition (2016).
8. Lewinø Genes XII - Elliott S. Goldstein, Jocelyn E. Krebs, 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, 13th edition (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 2022, 2023, 2024)
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 2022, 2023, 2024)
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 2022, 2023, 2024)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-104

Course Title: Bioinstrumentation and Analytical Techniques

Credits: 2 (40 marks theory+ 10 marks practicals)

Total No. of Lectures: Theory: 25 hours

Practical: 30 hours

Maximum Marks: 50

Theory: 40

Practical: 10

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.

NOTE FOR PAPER SETTING

Total marks of the USEBTT-101 are 50, 20% marks shall be reserved for internal assessment (10 Marks). 80% of the marks (40 marks) shall be reserved for external examination to be conducted by the University/College.

Internal Assessment Test (10 Marks) Time Allotted 1 Hour

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – I
(Examination to be held in December 2022, 2023, 2024)
SKILL ENHANCEMENT COURSE

Course Code: USEBTT-104

Course Title: Bioinstrumentation and Analytical Techniques

Credits: 2 (40 marks theory+ 10 marks practicals)

Total No. of Lectures: Theory: 25 hours

Practical: 30 hours

Maximum Marks: 50

Theory: 40

Practical: 10

Duration of Examination: 2.5 hours

External End Semester Examination 40 Marks (Time Allotted 2½ Hours)

1. External theory exam shall be of 30 marks and consists of 2 sections.
 - a. Section A shall be of 10 marks and comprise of 4 short answer type questions of 2½ marks each, from Unit I and II (All compulsory).
 - b. Section B shall be of 20 marks and will comprise of four long type questions of 10 marks each, two from Unit I and two from Unit II. A candidate has to attempt one from each unit.
2. External Practical Exam shall be of 10 marks to be conducted by the college/ University with practical exercise of 5 marks and Viva voce of 5 marks.

Note: During the submission of marks to University of Jammu final pattern will be 10 (internal) and 40 (external).

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 2023, 2024, 2025
UG SEMESTER-II
UNDER NEP-2020

S. No	Course type	Course No.	Course Title	Credits	Marks				Total Marks
					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-204	Methods in Microbiology and Biochemistry	2 (40 marks theory +1 marks practicals)	Mid Semester: 10 Marks	End Semester Exam: 30 Marks	NA	Exam: 10 Marks	50

University of Jammu
Syllabi of Biotechnology for FYUP under CBCS as per NEP-2020
Semester – II
(Examination to be held in May 2023, 2024, 2025)
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 2023, 2024, 2025)
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 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 2023, 2024, 2025)
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 Verlag (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 2023, 2024, 2025)
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.

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

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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).
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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.

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Semester – II
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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 II: 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.

UnitIII: 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 IV: 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

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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, Meerut, 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 Verlag (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).

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Semester – II
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SKILL ENHANCEMENT COURSE

Course Code: USEBTT-204

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: 50

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 perform 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 ó 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

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SKILL ENHANCEMENT COURSE

Course Code: USEBTT-204

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: 50

Theory: 40

Practical: 10

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

Total marks of the USEBTT-201 are 50. 20% marks shall be reserved for internal assessment (10 Marks). 80% of the marks (40 marks) shall be reserved for external examination to be conducted by the University/College.

Internal Assessment Test (10 Marks) Time Allotted 1 Hour.

External End Semester Examination 40 Marks (Time Allotted 2½ Hours)

1. External theory exam shall be of 30 marks and consists of 2 sections.
 - a. Section A shall be of 10 marks and comprise of 4 short answer type questions of 2½ marks each, from Unit I and II (All compulsory).
 - b. Section B shall be of 20 marks and will comprise of four long type questions of 10 marks each, two from Unit I and two from Unit II. A candidate has to attempt one from each unit.
2. External Practical Exam shall be of 10 marks to be conducted by the college with practical exercise of 5 marks and Viva voce of 5 marks.

Note: During the submission of marks to University of Jammu final pattern will be 10 (internal) and 40 (external).

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Practical: 30 hours

Maximum Marks: 50

Theory: 40

Practical: 10

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).