



UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE UNIVERSITY)

Baba Salub Ambedkar Road, Jammu-180006 (J&K)

NOTIFICATION

(19/Sept./Adp/42)

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 revised Syllabi and Courses of Study in the subject of **Biotechnology** for the following semesters under the **Choice Based Credit System** at the Undergraduate level (as given in the Annexure) for the examinations to be held in the years indicated against each semester as under:-

Subject	Semester	For the examinations to be held in the year	Course Code	%of change
Biotechnology	Semester-I	Dec. 2019, 2020 and 2021	UBTTC 101	17%
			UBTPC 102	15%
	Semester-II	May 2020, 2021 and 2022	UBTTC 201	70%
			UBTPC 202	30%
	Semester-III	Dec. 2020, 2021 and 2022	UBTTC 301	40%
			UBTPC 302	50%
			UBTTS 303 UBTPS 304	65%
	Semester-IV	May 2021, 2022 and 2023	UBTTC 401	No Change
			UBTPC 402	No Change
			UBTTS 403 UBTPS 404	100%

The alternative question papers are required to be set as per the University regulation given as under:-

- I. If the change in the syllabi and courses of study is less than 25%, no alternative question paper will be set
- II. If the change is 25% and above but below 50%, alternative Question paper be set for one year
- III. If the change is 50% and above or whole scheme is changed, alternative Question paper be set for two years.

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

Sd/-

DEAN ACADEMIC AFFAIRS

No. F.Acd/II/19/ 5742 - 5756
Dated: 26-9-2019

Copy to:

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

Section Officer (Academic)

26/9/19

Fresh and Modified Scheme of Courses in B.Sc Biotechnology at Undergraduate level under (Choice Based Credit System)

Semester	Course No.	Title	Credits	Nature of Course	% change (Theory/ Practical)
I	UBTTC101	Biochemistry and Cell Biology	4	CORE	17%
	UBTPC102	Biochemistry and Cell Biology	2	CORE (Practical)	15%
II	UBTTC201	Microbiology and Genetics	4	CORE	70%
	UBTPC202	Microbiology and Genetics	2	CORE (Practical)	30%
III	UBTTC301	Molecular Biology and Bioinformatics	4	CORE	40%
	UBTPC302	Molecular Biology and Bioinformatics	2	CORE (Practical)	50%
	UBTTS303	Bioprocess Technology and Environmental Biotechnology	2	Skill Enhancement	65%
	UBTPS304		2	Skill Enhancement (Practical)	
IV	UBTTC401	Genetic Engineering and Plant Biotechnology	4	CORE	No change
	UBTPC402	Genetic Engineering and Plant Biotechnology	2	CORE (Practical)	No change
	UBTTS403	Medical Biotechnology	2	Skill Enhancement	100%
	UBTPS404		2	Skill Enhancement (Practical)	

B.Sc. Biotechnology
SEMESTER I
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2019 Dec.,2020 and Dec.,2021
CORE COURSE

Title: Biochemistry and Cell Biology
Credits: 4

Course Code: UB TTC101
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2 & ½ hours

Unit I: Water and its properties

Water and its properties; physico-chemical properties of water; Dissociation and Association constants, pH and buffer, Henderson- Hasselbalch equation and its significance, hydrophobicity and hydrophilicity; Dielectric constant.

Unit II: Basic Biochemistry

Carbohydrates: classification, structure and functions; Carbohydrate metabolism- glycolysis, TCA cycle, Electron transport chain; Biological oxidation: electron transfer and oxidative phosphorylation. Lipid and fats, classification of lipids and fatty acids, saturated and unsaturated fatty acids.

Unit II: Proteins

Amino acids: structure and nomenclature; Structural organization of proteins- primary, secondary: alpha- helix, beta-pleated sheet structures, tertiary and quaternary structure of proteins; Protein classification: fibrous and globular proteins and functions; Vitamins and hormones; types of vitamins and their deficiency symptoms, steroid and peptide hormones.

Unit IV: Cell and its Functions

Cell theory, Structure of pro-and eukaryotic cells; Molecular organization and functions of cell membranes; Cell organelles: Nucleus, Mitochondria, Chloroplast and endoplasmic reticulum; Cytoskeleton

Unit V: Cell cycle, cell death and cell renewal

Cell cycle: checkpoints, regulation; Cancer, causes, types, Diagnosis and therapy; Programmed cell death; Stem cells, Types: Embryonic stem cell, induced pluripotent stem cells.

References:

1. Nelson D.L. & Cox M. (2017). Lehninger Principles of Biochemistry. W.H. Freeman, New York. 7th ed.
2. Berg J.M., Tymoczko J.L. & Stryer L. (2011). Biochemistry. W.H. Freeman & Company, New York. 7th ed.
3. Voet, D. and Voet, J.G. (2011) Biochemistry. John Wiley and Sons inc. USA. 4th ed.
4. Murray R.K., Granner, D.K., Mayers, P.A. and Rodwell, V.W. (2003) Harper's Biochemistry, Appleton, Lange Publishers, CT. 6th ed.
5. Karp G. (2013) Cell Biology. John Wiley Inc. New York. 7th ed.
6. Lodish H., Berk A., Kaiser C.A. (2007). Molecular Cell Biology. W. H. Freeman. 6th ed
7. Alberts, B., Bray, J.L., Roberts, K, and Watson, J.D. (2008). Molecular biology of the Cell. Garland Publishing House, New York, 2nd ed.

B.Sc. Biotechnology
SEMESTER I
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2019 Dec.,2020 and Dec.,2021
CORE COURSE

Title: Biochemistry and Cell Biology
Credits: 4

Course Code: UBTTTC101
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2& ½ hours

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	1 hour	20% (20 marks)
External End Semester University examination	Up to 100% (after 90 days)	2½ hours	80% (80 marks)
Total			100

Note for paper setters

External End Semester Examination (Total marks: 80)

Time duration: 2hrs 30 min

The question paper will have 3 sections.

Section I: Five (5) short answer questions representing all units i.e. at least one from each unit (without detailed explanation having 70-80 words) of 3 marks each = 15 marks (**All compulsory**)

Section II: Five (5) medium answer questions (with explanation having 250-300 words) of 7 marks each = 35 marks (**All compulsory**)

Section III: Five (5) long answer questions (with detailed explanation/ of 500-600 words) covering all the units. The candidate will be required to answer only **two** questions of 15 marks each = 30 marks.

Internal Assessment (Total Marks:20)

Time duration:1hr

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 10 marks. It will have eight short answer questions, selecting at least three from each of the two/three units/50% of the syllabus covered. A candidate has to attempt **any five** questions of two marks each.

Part B: Total weightage to this part shall be 10 marks. It will have two long answer questions, selecting at least each one from first two / three units/50% of the syllabus covered. A candidate has to attempt **any one** question of 10 marks.

B.Sc. Biotechnology
SEMESTER I
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2019, Dec.,2020 and Dec.,2021

**Title: Laboratory Course based on
Biochemistry and Cell Biology**

**Course Code: UBTPC102
Total Marks: 50**

Credits: 2

**Internal Examination: 25 marks
End Semester Examination: 25 marks Practicals**

01. Preparation of physiological buffers.
02. Working of spectrophotometer.
03. Demonstration of Beer Lamberts Law
04. Determination of pKa value.
05. Qualitative test for detection of glucose in solution.
06. Quantitative estimation of glucose in the solution.
07. Qualitative test for detection of protein in solution.
08. Quantitative estimation of proteins in the solution.
09. Paper chromatography, TLC.
10. Determination of λ_{max} of the given compound.
11. To make temporary slides.
12. To make permanent slides.
13. To study different types of plant cells and animal cells.
14. To study mitosis and meiosis.

References:

1. Plumer, D. (2017). An Introduction to Practical Biochemistry. McGraw Hill Education. 3rd ed.
2. DBT Life Sciences Protocol Manual January, 2018
<https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>
3. Mahajan. N, Gupta. P. (2019) Experimental Biochemistry and Cell Biology. Vinesh Publisher.

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance)
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks

B.Sc. Biotechnology
SEMESTER II
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year May,2020, May,2021 and May,2022
CORE COURSE

Title: Microbiology and Genetics

Credits: 4

Course Code: UBTTC201

Total marks: 100

Internal Examination: 20 marks

End Semester Examination: 80 marks

Duration: 2 & ½ hours

Unit I: Techniques in Microbiology

History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner, scope of Microbiology; Methods and control of sterilization; Principles and applications of microscopy (Bright field, Dark field, Phase contrast, Fluorescence and Electron microscopy); Staining techniques; Microbiological media, composition and types; Growth curve; Pure culture techniques, culture collection and maintenance of cultures.

Unit II: Basic Microbiology

Prokaryotic cell structure and function; Cell wall of Gram +ve and Gram -ve cells; Flagella and motility; Bacterial Reproduction; Transformation, Transduction and Conjugation; Eukarya: Overview of Algae, Fungi, Slimemolds and protozoa; Basics of Microbial taxonomy; Viruses: Discovery, classification and structure.

Unit III: Basic Genetics & Mendel's Laws

Introduction: Historical developments in the field of genetics; Organisms suitable for genetic experimentation and their genetic significance; Mendel's experiments ó Factors contributing to success of Mendel's experiments, Law of segregation ó Monohybrid ratio, Law of Independent assortment ó Dihybrids, Trihybrids.

Unit-IV: Post Mendelian Genetics

Deviation from Mendel's Laws - Partial or incomplete dominance, co-dominance, Penetrance and expressivity, Pleiotropism, Epistatic gene interaction, Modified dihybrid ratios; Multiple Alleles: ABO blood groups & Rh factor.

Unit-V: Mutations and Transposable elements

Mutations: Molecular basis, Ames test for mutagenic agents; Variations in chromosomes structure - deletion, duplication, inversion and translocation (Reciprocal and Robertsonian); chromosomal aberrations in human beings; Abnormalities ó Aneuploidy and Euploidy; Overview of transposable elements in bacteria and plants.

References:

1. Prescott, L.M., Harley, J.P. and Klein, D.A. (2017). Microbiology. McGraw Hill, USA. 10th ed.
2. Pelczar, M.J.J., Chan, E.C.S. and Kreig, N.R (2005). Microbiology. Tata McGraw Hill, New Delhi.
3. Tortora G.J., Funke B.R. and Case C.L. (2016). Microbiology. Pearson Education India. 11th ed.
4. Klug W. S. and Cummings M. (2015). Concepts of Genetics. Pearson Education India, 11th ed.
2. Pierce B. A. (2016). Genetics-A conceptual Approach. WH Freeman. 6th ed
3. Hartl D. L. and Jones E.W. (2000) Genetics- Analysis of Genes and Genomes. Jones & Bartlett Pub. 5th ed
4. Griffith A. F.(2011). An Introduction to Genetic Analysis. WH Freeman, 10th ed.
5. Snustad D. P. and Simmons M. (2011). Principles of Genetics. J. John Wiley & Sons. 6th ed.
7. Russell (2016). iGenetics: A molecular Approach. Pearson Press.

B.Sc. Biotechnology
SEMESTER II
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year May,2020, May,2021 and May,2022
CORE COURSE

Title: Microbiology and Genetics
Credits: 4

Course Code: UBTTC201
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2& ½ hours

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	1 hour	20% (20 marks)
External End Semester University examination	Up to 100% (after 90 days)	2½ hours	80% (80 marks)
Total			100

Note for paper setters

External End Semester Examination (Total marks: 80)

Time duration: 2hrs 30 min

The question paper will have 3 sections.

Section I: Five (5) short answer questions representing all units i.e. at least one from each unit (without detailed explanation having 70-80 words) of 3 marks each = 15 marks (**All compulsory**)

Section II: Five (5) medium answer questions (with explanation having 250-300 words) of 7 marks each = 35 marks (**All compulsory**)

Section III: Five (5) long answer questions (with detailed explanation/ of 500-600 words) covering all the units. The candidate will be required to answer only **two** questions of 15 marks each = 30 marks.

Internal Assessment (Total Marks:20)

Time duration:1hr

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 10 marks. It will have eight short answer questions, selecting at least three from each of the two/three units/50% of the syllabus covered. A candidate has to attempt **any five** questions of two marks each.

Part B: Total weightage to this part shall be 10 marks. It will have two long answer questions, selecting at least each one from first two / three units/50% of the syllabus covered. A candidate has to attempt **any one** question of 10 marks.

B.Sc. Biotechnology
SEMESTER II

(Under CBCS at Undergraduate Level)

Syllabi for the examinations to be held in the years May,2020, May,2021 and May,2022

Title: Laboratory Course based on Microbiology and Genetics

CourseCode: UBTPC202

Credits: 2

Total marks: 50

Internal Examination: 25 marks

End Semester Examination: 25 marks

Practicals:

01. To study different components, use and care of the compound Bright Field Microscope.
02. Culture characteristics of different microorganisms.
03. Different sterilization techniques.
04. Preparation of media for cultivation of bacteria.
05. Isolation of microorganisms from soil, air and water. Colony purification.
06. Enumeration of microorganisms; total vs viable count.
07. Study morphology of molds and yeast by methylene blue staining.
08. Bacterial staining: simple staining, Negative staining and Gram ϕ staining.
09. Biochemical activities of microorganisms.
10. Antibiotic sensitivity of microbes.
11. Induction of random mutagenesis in micro-organisms.
12. Blood grouping
13. To study polyploidy in onion root tips after treatment with colchicine.

References:

1. Cappuccino J.G. & Welsh C.T. (2014). Microbiology: A Laboratory Manual. Pearson Education India. 10th ed
 2. Aneja K.R. (2014). Laboratory Manual of Microbiology and Biotechnology. Medtech Publisher. 1st ed.
 3. DBT Life Sciences Protocol Manual January, 2018
- <https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance)
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks

B.Sc. Biotechnology
SEMESTER III
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2020, Dec.,2021 and Dec.,2022
CORE COURSE

Title: Molecular Biology and Bioinformatics
Credits: 4

Course Code: UBTTTC301
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2& ½ hours

Objective: The course is designed to give students a sound and basic exposure to Molecular biology and bioinformatics. This course offers a very robust and forward looking program in Biotechnology.

Unit I: DNA Structure and Replication

DNA and RNA as a genetic material; Bonding in macromolecules, Weak bonds and structure determination of macromolecules i.e. nucleic acids and proteins. Structural aspects ó Components of DNA and RNA; Salient features of A, B & Z form of DNA; General features of DNA replication and basic rules of replication; Semiconservative mode of DNA replication: experimental basis.

Unit II: Transcription

Central dogma; Organization of gene: concept of promoter, enhancers, silencer; Transcription factors, RNA polymerase; RNA: salient features and types (mRNA, tRNA, rRNA, siRNA, miRNA); Ribozymes; Transcription in prokaryotes, Initiation, elongation and termination; Operon concept, inducible and repressible operons.

Unit III: Translation

Genetic code: salient features; start codon, stop codon, wobble hypothesis, degeneracy of codon, codon bias; concept of reading frame; Translation: structure and function of ribosomes; Protein synthesis in prokaryotes initiation, elongation and termination.

UNIT IV: Introduction to Bioinformatics

Bioinformatics: History and scope; Sources of biological data (Sequencing, Microarray, Proteomics); Basic Concepts of Sequence Alignment- Local and global alignment, Pair wise and multiple sequence alignments, BLAST, ClustalW; Similarity and homology of sequences, orthologs and paralogs.

UNIT V: Biological databases and Applications of Bioinformatics

Nucleic acid databases (GenBank, DDBJ, EMBL, NDB & Ensembl); Gene expression databases (EBI Expression atlas, The Human Protein Atlas); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Gene Ontology(GO) analysis; Phylogenetic analysis; Basic concepts of Drug discovery methods.

B.Sc. Biotechnology
SEMESTER III
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2020, Dec.,2021 and Dec.,2022
CORE COURSE

Title: Molecular Biology and Bioinformatics
Credits: 4

Course Code: UBTTC301
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2& ½ hours

References:

1. Krebs J.E., Kilpatrick S.T. & Goldstein E.S.(2013). Lewin's Genes XI. Jones & Bartlett Learning. 11th Edition
2. Watson G.D, Baker T.A. & others (2017). Molecular biology of the gene. Pearson. 7th ed
3. Karp G. (2007) Cell & Molecular Biology: Concepts and Experiments. John Wiley Inc. New York. 5th ed.
4. Lodish H., Berk A., Kaiser C.A. (2007). Molecular Cell Biology. W. H. Freeman. 6th ed
5. Burton E (2008). Molecular Biology: gene to protein. Jones & Bartlett.
6. Clark & Pazdernik (2009).Biotechnology: applying the genetic revolution. Academic Press.
7. Hartwell (2004). Genetics from genes to genomes. Macgraw-Hill
8. Attwood, T. K and parry-Smith, D. J. (2006). Introduction to Bioinformatics. Pearson Education, Singapore.
9. Introduction to Bioinformatics by Aurther M Lesk

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	1 hour	20% (20 marks)
External End Semester University examination	Up to 100% (after 90 days)	2½ hours	80% (80 marks)
Total			100

Note for paper setters:

External End Semester Examination (Total marks: 80)

Time duration: 2hrs 30 min

The question paper will have 3 sections.

Section I: Five (5) short answer questions representing all units i.e. at least one from each unit (without detailed explanation having 70-80 words) of 3 marks each = 15 marks (**All compulsory**)

Section II: Five (5) medium answer questions (with explanation having 250-300 words) of 7 marks each = 35 marks (**All compulsory**)

Section III: Five (5) long answer questions (with detailed explanation/ of 500-600 words) covering all the units. The candidate will be required to answer only **two** questions of 15 marks each = 30 marks.

Internal Assessment (Total Marks:20)

Time duration:1hr

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 10 marks. It will have eight short answer questions, selecting at least three from each of the two/three units/50% of the syllabus covered. A candidate has to attempt **any five** questions of two marks each.

Part B: Total weightage to this part shall be 10 marks. It will have two long answer questions, selecting at least each one from first two / three units/50% of the syllabus covered. A candidate has to attempt **any one** question of 10 marks.

**B.Sc. Biotechnology
SEMESTER III**

(Under CBCS at Undergraduate Level)

Syllabi for the examinations to be held in the years Dec.,2020, Dec.,2021 and Dec.,2022

**Title: Laboratory course based on
Molecular Biology and Bioinformatics
Credits: 2**

**Course code: UBTPC302
Total Marks: 50 marks
Internal Examination: 25 marks
End Semester Examination: 25 marks**

Practicals:

1. Isolation of DNA from living cell.
2. Quantification of DNA by Spectro photometer.
3. Characterization of DNA by agarose gel electrophoresis of DNA.
4. Estimation of purity of DNA by spectrophotometry.
5. Quantification of DNA using agarose gel by normalization.
6. Database homology with query sequences using BLAST analysis.
7. Pairwise comparison of sequences.
8. Multiple sequence analysis and phylogenetic analysis using CLUSTAL W.
9. To check the expression of particular human gene in a tissue/cell line using Protein Atlas.
10. GO analysis (for e.g. using DAVID & PANTHER)

References:

1. Sambrook J. & Green M.R. (2012). Molecular Cloning: A Laboratory Manual. CSHL Press. 4th ed
2. DBT Life Sciences Protocol Manual January, 2018
<https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>
3. Web resource for Bioinformatics:
<https://www.nihlibrary.nih.gov/services/bioinformatics-support/online-bioinformatics-tutorials>

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance)
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks

B.Sc. Biotechnology
SEMESTER III
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year Dec.,2020, Dec.,2021 and Dec.,2022
(Skill Enhancement Course)

Title: Bioprocess Technology and Environmental Biotechnology
Credits: 2

Course code: UBTTTS303
Total Marks: 50 marks
Internal Examination: 10 marks
End Semester Examination: 40 marks
Duration of Examinations: 2 ½ hours

Unit I: Concept of Fermentation and Bioprocess technology

- i. Bioprocess Technology, Types of bioprocesses- batch, continuous, fed batch, Microbial growth kinetics
- ii. Design and formulation of Media for industrial bioprocesses
- iii. Sterilization of media and air.
- iv. Bioreactor and its types.
- v. Bioprocess monitoring and control, automated control vs manual control of bioprocesses

Unit II: Downstream processing, Bioprocess based products and Effluent treatment

- i. Typical steps for bioprocess-based product synthesis, upstream processing
- ii. Downstream processing: Criteria for downstream processing
- iii. Typical steps involved in Downstream processing
- iv. Commercial production of Organic acids, antibiotic and solvents: Bioethanol, butanol, citric acid, acetic acid, penicillin
- v. Effluent treatment strategies, physical, chemical and biological methods, the bioreactors used for treatment of wastes, and disposal of wastes

UNIT-III: Environment: Basic Concepts and Issues and Bioremediation

- i. Environment: Basic concepts and issues
- ii. Environmental pollution: Types and causes
- iii. Global environmental problems: Their impact and biotechnological approaches for management. Ozone depletion, Ultra Violet radiations, Green-house effect, acid rain and Soil erosion
- iv. Bioremediation: principle and process. Bioremediation of contaminated soils and waste land, Spilled Hydrocarbons, Microorganisms in Bioremediation, Myco-remediation and Phytoremediation.
- v. Biopesticides, Biofuel, Biopolymers and Bioplastics, Biomining.

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	45 min	20% (10 marks)
External End Semester University examination	Up to 100% (after 90 days)	2 hours	80% (40 marks)
Total			50

B.Sc. Biotechnology
SEMESTER III
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year Dec.,2020, Dec.,2021 and Dec.,2022
(Skill Enhancement Course)

Title: Bioprocess Technology and Environmental Biotechnology
Credits: 2

Course code: UBTTTS303
Total Marks: 50 marks
Internal Examination: 10 marks
End Semester Examination: 40 marks
Duration of Examinations: 2 ½ hours

Note for paper setters

External End Semester Examination (Total marks: 40)

Time duration: 2hrs

The question paper will have 3 sections.

Section I: Three (3) short answer questions representing all units (without detailed explanation having 70-80 words) of 3 marks each = 9 marks (**All compulsory**)

Section II: Three (3) medium answer questions (with explanation having 250-300 words) of 7 marks each = 21 marks (**All compulsory**)

Section III: Two (2) long answer questions (with detailed explanation/ of 400-500 words) covering all the units. The candidate will be required to answer only **one** questions of 10 marks each = 10 marks.

Internal Assessment (Total Marks:10)

Time duration: 45 min

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 5 marks. It will have eight short answer questions, selecting at least each one from first two /50% of the syllabus covered. A candidate has to attempt **any five** questions of **one** mark each.

Part B: Total weightage to this part shall be 5 marks. It will have two long answer questions, selecting at least each one from first two/50% of the syllabus covered. A candidate has to attempt **any one** question of **five** marks.

B.Sc. Biotechnology
SEMESTER III
 (Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years Dec.,2020, Dec.,2021 and Dec.,2022
(Skill Enhancement Course)

**Title: Laboratory course based on Bioprocess Technology
 & Environmental Biotechnology**
Credits: 2

Course code: UBTPS304
Total Marks: 50 marks
Internal Examination: 25 marks
End Semester Examination: 25 marks

Practicals:

01. Collection, Processing and Storage of Effluent Samples
02. Determination of Chemical Oxygen Demand in Waste Water Samples
03. Determination of Dissolved Oxygen in Waste Water Samples
04. Determination of Total Dissolved Solids in Waste Water Sample
05. Analysis of Total Hardness of Waste Water Sample
06. Analysis of Temporary Hardness of Waste Water Sample
07. Analysis of Waste Water/Sludge for Heavy Metals
08. Microbial degradation of organic pollutants
09. Selection of bacteria with degrading traits against organic pollutants
10. Isolation and Characterization of Bacteria from Crude Petroleum Oil / Contaminated Soil
11. Bacterial growth curve.
12. Calculation of thermal death point (TDP) of a microbial sample.
13. Production and analysis of ethanol.
14. Production and analysis of amylase.
15. Production and analysis of lactic acid.
16. Isolation of industrially important microorganism from natural resource.

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance)
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years May,2021, May,2022 and May, 2023
CORE COURSE

**Title: Genetic Engineering and
Plant Biotechnology**
Credits: 4

Course Code: UBTTTC401
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2& ½ hours

Unit I: Plant tissue culture

Plant tissue culture: Micropropagation, stages of propagation, advantages and applications; Culture media (Whiteø and Murashige and Skoogø); Plant growth regulators (Auxins, Cytokinins and Gibberlins) and their use in plant tissue culture; Callus: Initiation and maintenance, types of callus; suspension cultures; batch cultures and continuous cultures.

Unit II: Applications of Plant tissue culture

Somatic embryogenesis and its application; Haploid production using anther, pollen and ovule culture, embryo rescue; Protoplast isolation and fusion and their applications, Cybrids; Production of secondary metabolites.

Unit III: Recombinant DNA technology

Isolation and purification of nucleic acid (genomic/plasmid DNA and RNA); Quantification and storage of nucleic acids, Enzymes in genetic engineering : Exo & Endo nucleases, Restriction nucleases, DNA polymerase I, II and III, Klenow fragment, helicases, topoisomerases, Reverse Transcriptase, Taq polymerase, Enzymes in modification- Methylases and phosphatases and their mechanism of action; RNase and their mechanism of action; Enzymes in modification- Polynucleotide kinase, Ligases; Vectors and their types; Construction of genomic and cDNA library

Unit IV: Major techniques in Molecular Biology

Methods of nucleic acid detection; Polymerase chain reaction (PCR) and its applications; Variations in PCR and their applications; Methods of nucleic acid hybridization; Restriction mapping; DNA sequencing: Maxam and Gilbertø degradation method, Sangerø chain termination method and Pyrosequencing; DNA fingerprinting; Molecular markers: RFLP, RAPD, AFLP, SSR and SNPs and their applications.

Unit V: Application of Genetic engineering

Gene transfer in plants using Agrobacterium tumefaciens; Vector less gene transfer methods; selectable markers and scorable markers; Chloroplast transformation; Major genes transferred through genetic engineering; Advantages and application of Genetic engineering in production of transgenic plants with resistance against herbicides and insects; Golden Rice and Bt cotton.

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years May, 2021, May, 2022 and May, 2023
CORE COURSE

**Title: Genetic Engineering and
Plant Biotechnology**

Credits: 4

Course Code: UBTTTC401
Total marks: 100
Internal Examination: 20 marks
End Semester Examination: 80 marks
Duration: 2 & ½ hours

References:

1. Brown T. A. (2016). Gene Cloning and DNA Analysis: An Introduction. Wiley Blackwell. 7th ed.
2. Primrose S.B. (2005). Principles of Gene Manipulation And Genomics. Wiley India. 7th ed.
3. Bhojwani, S.S and Razdan, M.K. (2010). Plant Tissue Culture: Theory and Practice Elsevier Science.
4. Fu, T-J., Singh, G. and Curitis, W.R., eds (1999). Plant Cell and Tissue Culture for the Production of Food Ingredients, Kluwer Academic/ Plenum Press.
5. Gupta, P.K. (2010). Elements of Biotechnology (3rd edition), Rastogi and Co., Merrut, India.
6. Chawla, H. S. (2009). Introduction to Plant Biotechnology. 3rd edition C RC Press.
7. Das, H.K. (2010). Text Book of Biotechnology. 4th edition, Wiley India Pvt. Limited
8. Gupta, P.K. (2011). Plant Biotechnology, Rastogi Publishers, Meerut, India.
9. Hammound, J., McGarvey, P. and Yusibov, V., eds (2000). Plant Biotechnology; Springer Verlag.

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	1 hour	20% (20 marks)
External End Semester University examination	Up to 100% (after 90 days)	2½ hours	80% (80 marks)
Total			100

Note for paper setters

External End Semester Examination (Total marks: 80)

Time duration: 2hrs 30 min

The question paper will have 3 sections.

Section I: Five (5) short answer questions representing all units i.e. at least one from each unit (without detailed explanation having 70-80 words) of 3 marks each = 15 marks (**All compulsory**)

Section II: Five (5) medium answer questions (with explanation having 250-300 words) of 7 marks each = 35 marks (**All compulsory**)

Section III: Five (5) long answer questions (with detailed explanation/ of 500-600 words) covering all the units. The candidate will be required to answer only **two** questions of 15 marks each = 30 marks.

Internal Assessment (Total Marks:20)

Time duration:1hr

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 10 marks. It will have eight short answer questions, selecting at least three from each of the two/three units/50% of the syllabus covered. A candidate has to attempt **any five** questions of two marks each.

Part B: Total weightage to this part shall be 10 marks. It will have two long answer questions, selecting at least each one from first two / three units/50% of the syllabus covered. A candidate has to attempt **any one** question of 10 marks.

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years May,2021, May,2022 and May,2023

**Title: Laboratory course based on
Genetic Engineering and Plant Biotechnology
Credits: 2**

**Course code: UBTPC402
Total Marks: 50 marks
Internal Examination: 25 marks
End Semester Examination: 25 marks**

Practicals:

01. Sterilization techniques for glassware/ plasticware. Operational use of autoclave and laminar air flow.
02. Media preparation; making of cotton plugs, plugging and sealing of culture vessels.
03. To prepare different explants for culturing.
04. To demonstrate various steps of explant inoculation.
05. Genomic DNA isolation from plants.
06. Restriction digestion of DNA.
07. Demonstration of steps of Southern blotting.
08. Demonstration of PCR amplification.
09. Demonstration of cloning.

References:

1. Sambrook J. & Green M.R. (2012). Molecular Cloning: A Laboratory Manual. CSHL Press. 4th ed
2. DBT Life Sciences Protocol Manual January, 2018
<https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance))
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year May,2021, May,2022 and May, 2023
(Skill Enhancement Course)

Title: Medical Biotechnology

Credits: 2

Course code: UBTTS403
Total Marks: 50 marks
Internal Examination: 10 marks
End Semester Examination: 40 marks
Duration of Examinations: 2 ½ hours

UNIT 1: Molecular Diagnostics

PCR to detect infectious diseases, Monoclonal antibodies, Nucleic acid therapeutic agents-Antisense RNA, Ribozyme, interfering RNA, Susceptibility tests: Tests for bactericidal activity. Applications of RFLP, Protein Therapeutics-Pharmaceuticals

UNIT 2: Vaccines and Gene Therapy

Live, attenuated, killed, subunit, Recombinant and DNA vaccines; Gene Therapy-Types of gene therapy, Augmentation Gene therapy, Targeted gene therapy, Ethical issues.

UNIT 3: Advances in Medical Biotechnologies

DNA fingerprinting and forensic analysis, Drug designing, Stem cell technology, Tissue Engineering, Pharmacogenomics, Nanobiotechnology.

References:

1. Jogdand S N. Medical Biotechnology 2nd Edition Himalaya publishers 2008
2. Niemeyer C.M. and Mirkin C.A, Introduction to Nanobiotechnology, Wiley VCH publishers 2003

Scheme of examination:

The students shall be evaluated during the conduct of the course in the semester as follows:

Examination (Theory)	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Assessment test	Up to 50% (after 45 days)	45 min	20% (10 marks)
External End Semester University examination	Up to 100% (after 90 days)	2 hours	80% (40 marks)
Total			50

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the year May,2021, May,2022 and May, 2023
(Skill Enhancement Course)

Title: Medical Biotechnology

Credits: 2

Course code: UBTTS403
Total Marks: 50 marks
Internal Examination: 10 marks
End Semester Examination: 40 marks
Duration of Examinations: 2 ½ hours

Note for paper setters

External End Semester Examination (Total marks: 40)

Time duration: 2hrs

The question paper will have 3 sections.

Section I: Three (3) short answer questions representing all units (without detailed explanation having 70-80 words) of 3 marks each = 9 marks (**All compulsory**)

Section II: Three (3) medium answer questions (with explanation having 250-300 words) of 7 marks each = 21 marks (**All compulsory**)

Section III: Two (2) long answer questions (with detailed explanation/ of 400-500 words) covering all the units. The candidate will be required to answer only **one** questions of 10 marks each = 10 marks.

Internal Assessment (Total Marks:10)

Time duration: 45 min

The internal assessment under CBCS shall comprise of two parts

Part A: Total weightage to this part shall be 5 marks. It will have eight short answer questions, selecting at least each one from first two /50% of the syllabus covered. A candidate has to attempt **any five** questions of **one** mark each.

Part B: Total weightage to this part shall be 5 marks. It will have two long answer questions, selecting at least each one from first two/50% of the syllabus covered. A candidate has to attempt **any one** question of **five** marks.

B.Sc. Biotechnology
SEMESTER IV
(Under CBCS at Undergraduate Level)
Syllabi for the examinations to be held in the years May.,2020, May.,2021 and May.,2022
(Skill Enhancement Course)

Title: Laboratory course based on Medical Biotechnology

Course code: UBTPS404

Credits: 2

Total Marks: 50 marks

Internal Examination: 25 marks

End Semester Examination: 25 marks

Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.

Practicals:

01. Perform/demonstrate RFLP and its analysis
02. Kirby-Bauer method (disc-diffusion method) to study antibiotic sensitivity of a bacterial culture
03. A kit-based detection of a microbial infection (Widal test)
04. Study of Electron micrographs (any four).
05. Perform any one immuno diagnostic test (Typhoid, Malaria, Dengue)
06. Use of ELISA for disease diagnosis.
07. PCR-based diagnosis.
08. Biochemical analyses for diabetes (blood glucose fasting and PP) and cardiovascular disease (serum cholesterol)

Scheme of Examination:

Examination (Practical)	Syllabus to be covered in the examination	% Weightage(marks)
Daily evaluation of practical records / Viva voce / attendance etc.		50% (25 Marks including 5 for attendance, 5 for Viva-voce and 15 marks (5 for Test + 10 marks daily performance)
Final Practical Performance + Viva voce (External Examination)	100%	50% (25 Marks including 20 for external paper and 5 marks for Viva voce)
Total		50 marks