



## UNIVERSITY OF JAMMU

### NOTIFICATION (18/Feb./Adp/91)

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** for the Vth and VIth 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:-

<b>Subject</b>	<b>Semester</b>	<b>For the examinations to be held in the year</b>
<b>Biotechnology</b>	Semester-V	December 2018, 2019 and 2020
	Semester-VI	May 2019, 2020 and 2021

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

Sd/-  
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/18/16703-16725  
Dated: 15-2-2018

Copy for information and necessary action to:

1. Special Secretary to the Vice Chancellor, University of Jammu for the kind information of the Worthy Vice-Chancellor please
2. Sr. P.A. to the Dean Academic Affairs/ Dean Research Studies
3. Sr. P.A. to the Registrar/Controller of Examinations
4. Dean, Faculty of Science
5. HOD/Convener, Board of Studies in Biotechnology
6. All members of the Board of Studies
7. C.A to the Controller of Examinations
8. I/c Director, Computer Centre, University of Jammu
9. Asst. Registrar (Conf. /Exams. UG/ Inf./Pub.)
10. Incharge, University Website for necessary action please.
11. S.O (Confidential)

*[Signature]*  
Assistant Registrar(Academic)

*[Signature]*  
14/2/18  
*[Signature]*  
14/2/18

# **B.Sc Biotechnology**

## **SEMESTER-V**

**(Discipline Specific Elective Course)**

**Under (CBCS) at Undergraduate Level**

**(For the examinations to be held in the years Dec.2018, Dec.2019 and Dec. 2020)**

**Course Title: Animal Biotechnology**

**Course Code: UBTTE501**

**Duration of Examinations : 2 ½ hrs**

**Credit :4**

**Internal Examination : 20 marks**

**Max. Marks : 100      External**

**Examination : 80 marks**

**Objectives :** Animal Biotechnology is about understanding the use of science and engineering to modify living organisms. This course has developed to introduce students towards advancement in biotechnology research that can be used for benefit of animal and human health. To understand how animal cells can be cultured in lab and how cells can be further manipulated to produce valuable products for medical, industrial and agricultural use.

### **Unit-I: Introduction to Cell Culture**

History and concept of cell culture development; surroundings and stimulating natural conditions for animal cells, metabolic capabilities of animal cells. Laboratory organization and equipment's used for animal cell culture; Aseptic conditions and sterilization and aseptic conditions.

### **Unit-II: Biology of Cultured Cell**

Biology and characterization of cultured cells: Cell morphology, cell adhesion, cell proliferation, cell differentiation, energy metabolism. Medium for cell culture, different types of cell culture media, serum and serum free media.

### **Unit-III: Basic Techniques**

Basic cell culture: Source of tissue, Dispersion and disruption of tissues; Different tissue culture techniques including primary and secondary cultures; Monolayer and Suspension cultures; cryopreservation. Measurement of growth and viability and cytotoxicity of cell in culture, Growth kinetics of cells in culture.

### **Unit-IV: Types of Cell Culture**

Cell line, cell strain, continuous cell lines; Transformed cell lines; development, characterization and maintenance of cell lines, common cell culture contaminants; Organ, Organotypic and Histotypic culture; three dimension culture; Stem cell culture and its applications.

## **Unit-V: Applications**

Hybridomas and cell transformation: The basis of hybridoma technology, Storage of hybridoma cells, Monoclonal antibodies and their commercial production and their use for mankind. Production of useful products in transgenic animals, regulatory proteins, blood products, vaccines and hormones.

### **Books recommended**

1. Satyanarayana, U. (2008). Biotechnology. Books and Allied (P) Ltd, (Kolkatta) India.
2. Freshney, Ian R. (2016). Culture of Animal Cells 3<sup>rd</sup> Edition. Wiley- Liss.
3. Singh BD. (2014). "Text book of Biotechnology." Kalyani publishers Ludhiana .
4. Butler (2008). Animal Cell Culture & Technology, 2e (PB).
5. Singh B, Gautam and SK. Textbook of Animal Biotechnology Paperback – Import, (2013)
6. Ranga MM. Animal Biotechnology (3rd Edition). (2007)

### **Note for paper setters**

**External End Semester Examination (Total marks: 80) Time duration: 2 hrs 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: 1 hr.**

**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- V**  
**(Discipline Specific Elective Course)**  
**Under (CBCS) at Undergraduate Level**

**Syllabi for the examinations to be held in the years Dec. 2018, Dec. 2019 and Dec. 2020**

**Course Title: Virology**

**Course code: UBTTE502**

**Duration of Examinations : 2 ½ hrs**

**Internal Examination : 10 marks**

**External Examination : 40 marks**

**Credits: 2**

**Max. Marks: 50**

**Objective:** This course falls under the category of Discipline specific elective course. This course will enable the students to have the understanding on the basics of the Virology. This course will also help in developing broad understanding of molecular virological strategies, mechanisms and their relationship to current paradigms in virus pathogenesis. Study of antiviral activities along with their application and relevance in current research, diagnoses and treatment will remain the main learning objectives of this course.

**Unit-1: Introduction to Basic Virology**

History and principles of virology, virus taxonomy, Virus structure and morphology, DNA and RNA viruses, Viruses Prions and Viroids, Mechanisms of Viral Entry and Spread of Infection.

**UNIT-II: Introduction to Replication Strategies**

Virus Replication: RNA viruses: General strategies, replication of plus stranded RNA virus (polio), negative strand RNA viruses (influenza), Replication of double stranded RNA virus (rota), and retroviruses (HIV and HTLV). DNA viruses: Replication of double stranded DNA viruses (SV40, pox), single stranded DNA virus (AAV)

**UNIT-III: Antivirals and Viral Vaccines**

Viral Vaccines: Conventional vaccines-killed and attenuated, Modern vaccines-recombinant proteins, subunits, DNA vaccines. Vaccine delivery and adjuvants. Antivirals: Interferons, mechanisms of action. Antiretrovirals: mechanism of action and drug resistance. Modern approaches of virus control: Anti-sense RNA, siRNA, ribozymes.

## **Note for paper setters**

**External End Semester Examination (Total marks: 40) Time duration: 2 hrs**

**The question paper will have 3 sections.**

**Section I: Three (3) short answer questions representing all units, i.e one from each unit (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 having 400-500 words) covering all the units. The candidate will be required to answer only one question of 10 marks.**

**Internal Assessment (Total Marks: 10) Time duration: 45 minutes**

**The internal assessment under CBCS shall comprise of two parts**

**Part A: Total weightage to this part shall be 5 marks.** It will have five short answer questions from 33% of the syllabus covered comprising of one unit.

**Part B: Total weightage to this part shall be 5 marks.** It will have two long answer questions from 33% of the course covered i.e. one unit. A candidate has to attempt any one question of 5 marks.

## **Books Recommended :**

1. Fields Virology Vol 1 and 2. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman, and S.E. Straus, eds.), 3rd Edition. Lippincott-Raven, Philadelphia, PA.
2. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses.
3. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka. Latest edition / Pub. Date: December 2003 Publisher: American Society Microbiology--- Chapters 3-13.
4. DNA Virus Replication. Alan J. Cann. Latest edition / Pub. Date: March 2000. Publisher: Oxford University Press.
5. Principles of Molecular Virology. Alan Cann J. Cann. Latest edition / Pub. Date: June 2005. Publisher: Elsevier Science & Technology Books.

**B.Sc BIOTECHNOLOGY**  
**SEMESTER-V**  
**(Skill Enhancement Course)**  
**Under (CBCS) at Undergraduate Level**

(For the examinations to be held in the years Dec. 2018, Dec.2019 and Dec.2020)

**Course Title: Bioinformatics**

**Course code: UBTT503**

**Duration of Examinations: 2 ½ hrs**

**Credits: 4**

**Internal Examination : 20 marks**

**Max. Marks: 100**

**External Examination : 80 marks**

**Objective:** The course is being offered as Skill Enhancement course. The course will illustrate the power of computing in modern biology and will help in finding hidden messages in biomolecules without ever needing to put on a lab coat. It will help in answering different biological questions by simply applying algorithms or software tools.

**Unit-I: Introduction to Computers and internet**

Computer and its major components. Generation of computers: first generation, second generation, Third generation, fourth generation computers. Number system: Decimal and binary number system. Computer coding of words. Internet and its history, IP address: types of address classes, domain names. Uniform resource locator (URL), communication protocols: TCP/IP. Types of networking: local area networks (LAN), MAN, WAN, Search engines, WWW search strategies, understanding MS-Word and MS-Excel.

**Unit-II: Introduction to Bioinformatics**

Basic Bioinformatics and its relation with molecular biology. History, application and scope of bioinformatics, Examples of related tools (FASTA, BLAST), databases (GENBANK, Pubmed, PDB ) and software (RASMOL,Ligand Explorer). Data generation; Generation of large scale molecular biology data through Genome and Protein sequencing,

**Unit-III : Biological Databases and its Types**

Introduction to data types and source. Classification and Presentation of Data. Quality of data, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL), Protein databases (Primary, Composite and Secondary); Specialized databases (TIGR and ACeDB).

**Unit-IV: Sequence Analysis**

Basic concepts of sequence similarity, identity and homology, definitions of homologs, orthologs, paralogs. Introduction to Sequence alignments: Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm). Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM series. Use of pairwise alignments and Multiple

sequence alignment for analysis of Nucleic acid and protein sequences and interpretation of results.

### **Note for paper setters**

**External End Semester Examination (Total marks: 80) Time duration: 2 hrs 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: 1 hr.**

**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.

### **Books Recommended:**

1. Attwood, T. K and parry-Smith, D. J. (2006). Introduction to Bioinformatics. p. 240, Pearson Education, Singapore.
2. Introduction to Bioinformatics by Aurther M lesk
3. Developing Bioinformatics Computer Skills By: Cynthia Gibas, Per Jambeck
4. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
5. Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine), by SorinDraghici
6. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
7. Current topics in computational molecular biology, Tao, Jiang, Ying Xu, Michael Q.Zang
8. Gura, T. (2000). Bones, molecules.....or both? Nature 406: 230-233
9. Simonson, A. B et al. (2005). Decoding the genomic tree of life. PNAS 102: 6608-6613

**B.Sc. BIOTECHNOLOGY**  
**SEMESTER-VI**  
**(Discipline Specific Elective Course)**  
**Under (CBCS) at Undergraduate Level**

**(Syllabus for the examinations to be held on May,2019, May,2020 and May,2021)**

**Course Title: Environmental Biotechnology**

**Course Code : UBTTE601**

**Duration of Examinations : 2 ½ hrs**

**Credits: 4**

**Internal Examination : 20 marks**

**Max. Marks: 100**

**External Examination : 80 marks**

**Objective:** The objective of this course is to familiarize the students with various problems concerning environment and their possible solutions employing the biotechnological approaches.

**UNIT-I: Environment: Basic Concepts and Issues**

- 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

**UNIT-II: Environmental Biotechnology-I**

- i. Types of pollution, causes and control
- ii. Eutrophication: types and control
- iii. Waste water treatment-physical, chemical and biological treatment processes

**UNIT-III: Environmental Biotechnology-II**

- i. Microbiology of waste water treatments: Aerobic process: Activated sludge, Oxidation ponds and ditches, Trickling filter, Towers, Rotating discs and drums
- ii. Anaerobic processes: Anaerobic digestion, anaerobic filters
- ii. Energy resources: conventional and renewable energy resources.

**UNIT-IV: Environmental Biotechnology-III**

- i. Solid waste and Soil pollution management, Treatment and disposal of Solid waste.
- ii. Aerobic (composting and vermiculture)
- iii. Anaerobic treatment of solid waste and biogas generation.



## **UNIT-V: Bioremediation and Biodegradation**

- i. Bioremediation :principle and process. Bioremediation of contaminated soils and waste land, Spilled Hydrocarbons.
- ii. Biodegradation of Organic pollutants, Pesticides and Xenobiotics.
- iii. Biopesticides, Biopollution, Biopolymers and Bioplastics, Biomining.

### **Books Recommended**

1. Tchobanoglous, G., Franklin, B. and Stensel, H. D.(1991)Wastewater Engineering ó Treatment, Disposal and Reuse, Tata McGraw Hill, New Delhi
2. M.Moo-Young (2007) Comprehensive Biotechnology, Pergamon Press, Oxford
3. De, A. K. (2003) Environmental Chemistry Wiley Eastern Ltd., New Delhi
4. Allsopp, D. and Seal, K. J. (2004) Introduction to Biodeterioration, ELBS/Edward Arnold,
5. Ahmed, N., Qureshi, F. M. and Khan, O. Y. (2001) Industrial and Environmental Biotechnology. Horizon.
6. Kumar, A. (2004) Environmental Biotechnology. Daya publishing house.
7. Goel P.K. and Pathade G.R. (2004) Biotechnological applications in Environment and Agriculture. ABD Publishers.
8. Goel, P.K. (2003) Advances in industrial waste water treatment. ABD Publishers.
9. Cutter, S. L. (2003) Environmental risks and Hazards. Prentice Hall.
10. Ignacimuthu, S. (2003) Environmental Science. Phoenix Publishing house.
11. Pathade, G. R. and Goel, P.K. (2003) Biotechnology in Environmental Management. ABD Publications.

**B.Sc Biotechnology**  
**SEMESTER-VI**  
**(Skill Enhancement Course)**  
**Under (CBCS) at Undergraduate Level**

**(Syllabus for the examinations to be held on May,2019, May, 2020 and May, 2021)**

**Course Title : Instrumentation and Analytical Techniques**

**Course Code : UBTTTS603**

**Duration of Examination : 2 ½ hrs**

**Internal Examination : 20 marks**

**External Examination : 80 marks**

**Credits : 4**

**Max. Marks : 100**

**Objective:** The course is designed to give students exposure to various techniques and instruments used in molecular biology, enzymology, microbiology, biochemistry etc. The course is targeted to make students aware of the principles behind working of various instruments.

**Unit-I: Microscopy**

Microscopy: Principle and types; Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy; Electron microscopy: TEM and SEM; various types of stains, Staining- Direct staining, indirect staining, Negative staining, Differential staining.

**Unit-II: Chromatography**

Chromatography principle and Chromatographic terms, Types of chromatography: Adsorption chromatography, Paper chromatography, thin layer chromatography, column chromatography, ion exchange chromatography, Gel filtration, Affinity and Gas chromatography techniques, Liquid chromatography and HPLC.

**Unit-III: Electrophoresis**

Electrophoresis- General Principles and types; Horizontal and vertical gel electrophoresis; Agarose gel electrophoresis and Poly-acrylamide gel electrophoresis; native PAGE, SDS PAGE, zymogram, isoelectric focusing, 2-D gel electrophoresis, Pulse field gel electrophoresis and immuno-electrophoresis.

**Unit-IV: Centrifugation and Fermentation**

Centrifugation techniques: Basic principles, Sedimentation coefficient, Different types of centrifuges; density gradient, Analytical and preparative ultracentrifugation methods, Salting out,

Fermenter design: Sparger, agitator, baffle; operating characteristics of fermenters; Computer control of fermentation process.

### **Unit-V: Molecular Biology Techniques**

Calorimetry, spectrophotometry (UV, visible and IR); Radioisotope techniques- Basic concept, GM and scintillation counter, autoradiography, RIA, Applications in biological science; Polymerase chain reaction; DNA sequencing: Sanger's method, Maxam Gilbert method, Pyrosequencing

#### **Books Recommended:**

1. Primrose, S.B. (1994). Molecular Biotechnology, 2<sup>nd</sup> edition, Blackwell Scientific Publishers.Oxford.
2. Berger, S.L and Kimmel, A.R (1996). Methods in Enzymology, Guide to Molecular Cloning Techniques, vol. 152, Academic Press Inc., San Diego.
3. Sambrook, J. Fritsch, E.F. and Maniatis, T. (2001). Molecular Cloning. A Laboratory Manual 2<sup>nd</sup> ed., Cold Spring Harbor Laboratory Press.
4. Kuby, J. (2007), Immunology. 6<sup>th</sup> Edition. W.H. Freeman and company, New York.
5. Satyanarayana, U. (2005). Biotechnology. Books and Allied (P) Ltd, (Kolkatta) India
6. Nicholas, P, Stevans, L. Fundamental of Enzymology (1999). Oxford University Press, New York.
7. Tripathi, G. (1999). Enzyme Biotechnology. Technoscience Publications, Jaipur, India.
8. Palmer T. The Chemical Nature of Enzyme Catalysis, Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Horwood Publishing Limited, Coll House, Westergate, England, 2001.
9. Stanbury, P. F., Whitaker, A., Hall, S. J., Principles of Fermentation Technology, Butterworth-Heinemann, UK 1995.
10. Creuger W and Crueger A (1991) Biotechnology: Text Book of industrial microbiology and Biotechnology. Sinauer Associatesw Inc. Sunderland , MA.
11. Molecular cloning: A laboratory manual, 3 volumes by Green & sambrook. 4<sup>th</sup> edition, cold spring. Harbor laboratory press, 2012.
12. Gene cloning & DNA analysis : An introduction by T.A.Brown, 6<sup>th</sup> edition , wiley-Blackwell,2010.
13. Recombinant DNA principles & methodologies edited by James.J.Greene & venigalla.B.Rao, CRC press, 2009.
14. Essentials of molecular biology by David Freifelder & George.M.Malacinski ; 2<sup>nd</sup> edition, panama publishing corporation.reprinted 1996.

**Note for paper setters**

**External End Semester Examination (Total marks: 80) Time duration: 2 hrs 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: 1 hr.**

**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- VI**

**(For the examinations to be held in the years May, 2019, May, 2020 and May,2021)**

**Title : Environmental Biotechnology (Practicals)**

**Course No.: UBTPE602**

**Duration of Examination:- 3 Hrs**

**Credits : 2**

**Maximum Marks : 50**

**External Examination : 25**

**Internal Assessment : 25**

**Practicals**

1. Collection, Processing and Storage of Effluent Samples
2. Determination of Chemical Oxygen Demand in Waste Water Samples
3. Determination of Dissolved Oxygen in Waste Water Samples
4. Determination of Total Dissolved Solids in Waste Water Sample
5. Analysis of Total Hardness of Waste Water Sample
6. Analysis of Temporary Hardness of Waste Water Sample
7. Analysis of Waste Water/Sludge for Heavy Metals
8. Microbial degradation of organic pollutants
9. Selection of bacteria with degrading traits against organic pollutants
10. Isolation and Characterization of Bacteria from Crude Petroleum Oil / Contaminated Soil

**Note for distribution of 50 Marks in Practical Examination: (50% internal and 50% external)**

**I. Internal Assessment (25 marks)**

- |  |   |          |
|--|---|----------|
| 1. Attendance                                      | : | 5 Marks  |
| 2. Practical Test:                                 |   | 5 Marks  |
| 3. Daily performance based on practical work done: |   | 10 Marks |
| 4. Viva-voce                                       |   | 5 Marks  |

**II. External Assessment (25 marks)**

- |                                   |  |          |
|-----------------------------------|--|----------|
| 1. External practical examination |  | 20 Marks |
| 2. Viva-voce                      |  | 5 Marks  |