

BENGALURU CITY UNIVERSITY

REGULATIONS AND SYLLABUS FOR B.Sc. Biotechnology

CHOICE BASED CREDIT SYSTEM (SEMESTER SCHEME)

2020-2021



B.Sc. CBCS SEMESTER SCHEME BIOTECHNOLOGY

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SCHEME OF INSTRUCTIONS AND CREDITS

Paper No.	Title of Paper	Type of Paper	Hours/ Week	Duration of Examination	IA Marks	Exam Marks	Total Marks	Credits
				I Semester				I
BTP- 101	Biotechnology – I	Theory	4	3	30	70	100	4
	Cell biology, Genetics & Biochemistry	Practical	3	3	15	35	50	2
		Total Marks a	nd Credits fo	or I semester			150	6
				Semester				
BTP-201	Biotechnology - II	Theory	4	3	30	70	100	4
	Microbiology	Practical	3	3	15	35	50	2
		Total Marks ar	nd Credits fo	r II semester			150	6
			III	Semester			150	
BTP-301	Biotechnology – III	Theory	4	3	30	70	100	Λ
	Molecular biology	Practical	3	3	15	35	50	2
	T	otal Marks an	d Credits for	r III semester			150	6
			IV	Semester			150	
BTP-401	Biotechnology – IV	Theory	4	3	30	70	100	1
	Genetic Engineering	Practical	3	3	15	35	50	
	Т	otal Marks an	d Credits for	IV semester			150	6
			V	Semester			130	
BTP-501	Biotechnology – V	Theory	3	3	30	70	100	4
	Environmental Biotechnology & Immunotechnology	Practical	3	3	15	35	50	2
BTP-502	Biotechnology – VI	Theory	3	3	30	70	100	4
	Plant & Animal Biotechnology	Practical	3	3	15	35	50	2
	T	otal Marks an	nd Credits fo	r V semester			300	12
			VI	Semester	·* · · · ·			
BTP-601	Biotechnology –VII	Theory	3	3	30	70	100	4
	Industrial Biotechnology	Practical	3	3	15	35	50	2
BTP-602	Biotechnology – VIII	Theory	3	3	30	70	100	4
	Bioinformatics, Bio entrepreneurship & Research	Practical	3	3	15	35	50	2
Self.	T	otal Marks and	d Credits for	VI semester	1.000		300	12

CHAIRMAN Department of Microbiology & Biotechnology Bangalore University, JB Campus, Bangalore - 560 056.

Bengaluru City University

B Sc Biotechnology (CBCS) Syllabus 2020 - 21

B Sc I Semester – Biotechnology Paper I: Cell Biology, Genetics and Biochemistry

B Sc II Semester – Biotechnology Paper II: Microbiology

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B Sc III Semester – Biotechnology Paper III: Molecular Biology

B Sc IV Semester – Biotechnology Paper IV: Genetic Engineering

B Sc V Semester – Biotechnology Paper V: Environmental Biotechnology and Immunotechnology

Biotechnology Paper VI: Plant and Animal Biotechnology

B Sc VI Semester – Biotechnology Paper VII: Industrial Biotechnology

Biotechnology Paper VIII: Bioinformatics, Bio entrepreneurship and research

Semester V

Paper V: ENVIRONMENTAL BIOTECHNOLOGY AND IMMUNOTECHNOLOGY

Theory: 45 hours

Unit 1: Environmental biotechnology

1.1 Renewable and Non-renewable sources of Energy:

Conventional fuels and their environmental impact -firewood, plant and coal. Modern fuels and their environmental impact. Methanogenic bacteria in production of biogas. Microbial hydrogen production, conversion of sugars to alcohol and gasohol. 6 hr

1.2 Biofertilizers and biopesticides:

Brief account of nitrogen cycle. Role of symbiotic and non- symbiotic nitrogen fixing bacteria in enrichment of soil (*Rhizobium* and *Azatobacter*). Algal and fungal biofertilizers (VAM and Trichoderma). Vermi composting. 5 hr

1.3 Bioremediation

Biodegradation of lignin and cellulose. Treatment of municipal wastes and industrial effluents.

4 hr

Unit 2: Immunology

2.1 Introduction

Cells and organs of immune system, blood cell components, Primary and secondary lymphoid organs and their functions. Immunity-innate and acquired, Active and passive, Humoral and cell mediated immunity. 6 hr

2.2 Antigens and their types, epitopes, haptens and factors that influence antigenicity, Antibodies-structure, types, properties and functions. Monoclonal antibody production. 4 hr

2.3 Antigen- antibody reactions - Precipitation, haeme agglutination, ABO blood typing and Rh typing. Immuno-electrophoresis- RIA, ELISA, SRID, ODD, RIEP and immunofluorescent techniques.5 hr

Unit 3. Complement system, Hypersensitivity and vaccines.

3.1 Complement system- components, MHC types, properties and functions. Hypersensitivity and its types. 5 hr

3.2 Organ transplantation- types, graft rejection, immune suppressors and auto immune diseases (Rheumatoid arthritis and multiple sclerosis). 5 hr

3.3 Vaccines and immunization - passive and active immunization. Types of vaccines - inactive, attenuated and recombinant vaccines (DNA and peptide). Interferons – general account. 5 hr

Semester V Practical V: Environmental Biotechnology and Immunotechnology

5

15 units of 3 hours each

1.	Estimation of BOD of water sample.	2 units	
2.	Estimation of Total hardness of water samples.	1 unit	
3.	Temporary preparation of VAM and <i>Rhizobium</i> from roots.	1 unit	
4.	Bacterial examination water by MPN method.	3 units	
5.	Human Blood typing.	1 unit	
6.	WIDAL and VDRL tests.	2 units	
7.	Differential counting of WBC.	1 unit	
8.	Separation of Immunoglobulin from serum.	2 units	
9.	Preparation of biofertilizer formulation (Rhizobium) and study of effect on seed		
	germination.	2 units	

Paper VI: PLANT AND ANIMAL BIOTECHNOLOGY

45 hours

UNIT 1: Plant biotechnology

- 1.1 Introduction to Plant biotechnology and In-vitro methods in Plant tissue culture.
 Aseptic techniques, nutrient media, use of Plant growth regulators- auxins, cytokinin and gibberellins.
- 1.2 Micropropagation of elite species: selection of explant, sterilization and inoculation and culture maintenance, transferring to shooting and rooting media and hardening in green house. Cell suspension culture for invitro production of secondary metabolites safranin and capsaicin. 5 hr
- 1.3 Organ culture -Ovary, ovule, anther, embryo and endosperm (triploid plant). Somatic embryogenesis- technique and applications. Soma clonal variations and their significance. 5 hr

UNIT2: Animal biotechnology

2.1 Introduction to Animal biotechnology. culture media- natural (plasma clot, biological fluids, tissue extracts, embryo extracts). Importance of serum in media. Chemically defined media and examples. Growth factors-EGF, FGF, PDGF, IL-1, IL-2, NGF and erythropoietin. 5 hr

2.2 Primary explantation techniques- slide or coverslip culture, carrel flask culture, roller test tube culture. Primary cell culture - Isolation and disaggregation of tissue- mechanical and enzymatic methods, Culture of cells-monolayer, suspension and immobilized cell systems.
 6 hr

2.3 Organ or embryo culture - plasma clot, raft, agar gel, grid methods, whole embryo culture and its applications. Secondary culture- transformed cell lines and continuous cell lines. 4 hr

UNIT 3: Applications of plant and animal biotechnology

3.1 Protoplast culture: Protoplast isolation- mechanical and enzymatic methods, Culturing and regeneration of protoplasts. Protoplast fusion methods, Selection of somatic hybrids and cybrids. Cryopreservation of plant cultures.

3.2 Edible vaccines from plants- muskmelon. Synthetic seed preparation and their applications.
 Applications of micropropagation in forestry. Invitro fertilization – nuclear transfer, ES methods.
 Cloning of Dolly.

3.3 Stem cells-characteristic features, types, culture and applications. Transgenic animals and their significance. Transgenic cattle and transgenic mice.5 hr

Practical VI: Plant and Animal Biotechnology

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15 Units of 3 hours each

1.	Lay out plan for Plant and Animal biotech laboratories.	1 unit
2.	Surface sterilization of plant explants.	1 unit
3.	Plant tissue culture media preparation-MS medium.	2 units
4.	Inoculation of explants on media for callus culture- leaf disc and shoot tip.	2 units
5.	Preparation of synthetic seeds.	1 unit
6.	Cell_viability test- trypan blue method.	1 unit
7.	Preparation of Hank's basal salt solution.	1 unit
8.	Isolation of liver parenchyma cells form goat liver.	1 unit
9.	Protoplast isolation by mechanical method.	1 unit
10.	Isolation of leucocytes (PMN leucocytes) from human blood sample.	2 units
11.	Visit to Plant biotech industry and writing a report.	2 41113
	(Report in the practical record itself.)	2 units

B.Sc. VI Semester

Biotechnology Paper VII: Industrial Biotechnology

Theory: 45 Hours

Unit 1: Introduction to industrial Biotechnology

1.1 Introduction and scope of industrial fermentation. Basic principles of fermentation technology. Isolation and screening of industrially useful microorganisms, strain improvement by mutant selection and recombinant DNA method and maintenance of strain. 5 hr

- 1.2 Fermentation types Batch and continuous fermentation. Solid state and submerged fermentation. Single stage and multistage fermentation. Media for fermentationnatural and synthetic media.
- 1.3 Types and design of fermenters or bioreactors- Stirred tank, bubble column, air-lift, tower and tray fermenters. Process of aeration, agitation, temperature regulation and foam control.

Unit 2: Process development and Downstream process

2.1 Scale-up process – shake flask culture to pilot plant.

2.2 Sterilization of fermenter, media and air: heat sterilization, radiation and filtra methods (sintered glass filter and membrane filter).	ation 4 hr
2.3 Inoculum preparation.	1 hr
2.4 Downstream process – separation of cells and spent media- filtration and centrifuga Disintegration of cells. Extraction, concentration and purification of product.	tion. 6 hr

2 hr

2 hr

2.5 Product quality assurance and packaging.

Unit 3: Industrial production of microbial products

- 3.1 Production of alcohol- ethanol and alcoholic beverages Wine and Beer. 3 hr
- 3.2 Production of organic acid-citric acid, antibiotic-penicillin G, amino acids- glutamic acid (MSG), Vitamins- Vitamin B12, microbial polysaccharide- Xanthan gum, SCPproduction of SCP from bacteria.

3.3 Production of industrially used bacterial and fungal amylases and proteases. Uses of enzymes in detergents, leather industry, food and beverage industry and pharmaceutical industry.

Practical VII: Industrial biotechnology

15 units of 3 hours each

Estimation of lactic acid from milk.	2 units
Culturing of Aspergillus, Yeast and Agaricus.	3 units
Production and estimation of citric acid from Aspergillus	2 unite
Preparation of wine from granes	
Estimation of alcohol by specific and its multiple	2 units
inverse biling to a control by specific gravity method.	1 unit
invertase) from yeast culture and estimation.	2 units
√isit or tour to biotech industries and submission of report on the same in Pra	actical
examination for 5 Marks.	3 units
	Estimation of lactic acid from milk. Culturing of Aspergillus, Yeast and Agaricus. Production and estimation of citric acid from Aspergillus. Preparation of wine from grapes. Estimation of alcohol by specific gravity method. mmobilization of enzyme (invertase) from yeast culture and estimation. /isit or tour to biotech industries and submission of report on the same in Pra examination for 5 Marks.

B.Sc. VI Semester

Biotechnology Paper VIII: Bioinformatics, Bio entrepreneurship and bioresearch

Theory: 45 Hours

Unit 1: Bioinformatics

1.1 Introduction to bioinformatics. Knowledge base in biology. IT in biology. Skills required to become a successful bioinformatician. Basics of computers- hardware and software, system software, application software, operating systems and software related to bioinformatics. Applications of bioinformatics.

1.2 Data bases: Database structure and management of data base. File formats, annotated sequence databases, genome and organism specific data bases. Retrieval of biological data. Accessing databases – PubMed, Nucleic acid sequence databank-NCBI and EMBL, Protein sequence databank- NBRF-PIR, SWISSPROT, Structural databases-protein databank-PDB.6 hr

1.3 Tools of biological data retrieval -RASMOL, FASTA, BLAST, PubMed. Sequence alignment, scoring matrices, multiple sequence alignment. Brief account of 3D structure prediction and docking studies. Concept of Genomics – structural and functional, Transcriptomics, metabolomics and Proteomics. 5 hr

Unit 2: IPR, Bioethics and Bio entrepreneurship

2.1 Biotechnology and IPR. Patents, Trade secrets, copyright, Trade Mark and geographical index. Choice of IPR. Plant genetics resource (PGR), GAAT, TRIPS and examples of IPR in India. 5 hr

2.2 Bioethics – positive and negative effects. Examples- Rice with Vitamin A, no-till agriculture. Biological pest control. Ban on Glyphosate GM plants and environmental concerns. Biodiversity regulations in India. 4 hr

2.3 Bio entrepreneurship – Introduction and scope. Types of bio-industries. Basic requirements and challenges of an entrepreneur. Entrepreneurship development programs of public and private agencies-MSME, DBT, BIRAC and Make in India. Negotiating the road from lab to the market – Strategies and processes of negotiation with financiers, government and regulatory agencies. 6 hr

Unit 3: Importance of research in biology

3.1 Introduction and importance of research in biology. Objectives, motivation and types of research. Significance of research. Major biological research institutes in India – IISc, NCBS, CCMB, ICMR, IBAB, NIV, Serum Institute, JNCASR & IARI. Major biotech companies in India and world and their products. 5 hr

3.2 Research problem identification and formulation. Necessity of a research design, features of a good research design and experimental design. Data preparation, data analysis and data interpretation. 5 hr

3.3 Research Paper and Project writing – Layout of a research paper. Use of encyclopaedias, research guides and handbooks. Publication, Impact factor for Journals and Plagiarism.
 Basic skills of project writing, Importance of documentation.

Practical VIII: Project Work

15 units of 3 hours per week

- The Project work may be carried out individually or in groups of maximum 3 students under guidance of an assigned department faculty in the allotted practical classes.
- The Project work may involve laboratory work, survey or data mining and compilation which may be carried out within or outside the department concurrence from faculty and HOD and detailed Report of the Project shall be submitted.
- Project work Report shall be evaluated by 2 examiners during Practical examination for 25 marks and viva voce on Project for 10 Marks.

REFERENCES BOOKS

CELL BIOLOGY

1.Molecular Biology of Cell - Bruce Alberts et al, Garland publications. 2. Animal Cytology and Evolution – MJD, White Cambidge University Publications. 3. Molecular Cell Biology –Daniel, Scienific American Books. 4. Cell Biology - Jack d Bruke, The William Twilkins Company. 5. Principles of Gene Manipulations – Old & Primrose, Black Well Scientific Publications. 6. Cell Biology – ambrose & Dorouthy M Easty, ELBS Publications. 7. Fundamentals of Cytology – Sharp, McGraw Hill Company. 8. Cytology – Willson & Marrison, Reinform Publications. 9. Molecular Biology – Smith Faber & Faber Publications. 10. Cell Biology & Molecular Biology – EDP Roberties & EMF Roberties, Saunder College. 11. Cell Biology – C.B Powar, Himalaya Publications.

GENETICS

 Basic Genetics – Daniel L. Hartl, Jones &Barlett Publishers USA. 2. Human Genetics and Medicine lark Edward Arnold P London. 3. Genetics – Monroe W Strickberger, Macmillain Publishers, New York. 4. Genes V - Benjamin Lewin, Oxford University Press. 5. Genes I -Benjamin Lewin, Wiley Eastern Ltd., Delhi. 6. Genes II - Benjamin Lewin, Wiley & Sons Publications 7. Genes III- Benjamin Lewin, Wiley & Sons Publications. 8. Principles of Genetics – Winchester Sinnot & Dom. 9. Genetics – Blue print of life by Sandhya Mitra, Tata McGraw Hill Publication. 10. Genetics – Edgar Altenburg Oxford & IBH publications. 11. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications.

MICROBIOLOGY

1. Microbiology-Pelzer, Chan, Krieg Tata McGraw Hill Publications. 2. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications. 3. Fundamentals of Microbiology – Furbisher, Saunders & Toppan Publications. 4. Microbiology –Ronald M.Atals. 5. Introductory Biotechnology-R.B Singh C.B.D. India (1990). 6. Industrial Microbiology-Casual Wiley Eastern Ltd. 7. Fundamentals of Bacteriology – Salley. 8. Fontiers in Microbial technology-P.S. Bison, CBS Publishers. 9. Biotechnology, International Trends of perspectives A. T. Bull, G. HollM.D.Lilly Oxford & T Publishers. 10. General Microbiology –C.B. Powar, H.F. Daginawala, Himalayan Publishing House.

BIOCHEMISTRY

Principles of Biochemistry- Albert Lehninger CBS Publishers & Distributors. 2. Biochemistry-LUbretStryer Freeman International Edition. 3. Biochemistry-KeshavTrehan Wiley Eastern Publications. 4. Fundamentals of Biochemistry J.L. Jain S.Chand and company. 5. Biochemistry, Prasaranga, Bangalore University. 6. Fundamental of Biochemistry-Dr. A.C. Deb.
 Textbook of Organic Chemistry (A Modern approach) P.L. Soni, Sultan Chand and Sons, Publishers. 8. The Biochemistry of Nucleic acid-tenth Edition-Roger L.P. Adams, John T. Knower and David P. Leader, Chapman and Hall Publications.

BIOPHYSICS

 Essentials of Biophysics, New Age Int. Pub. New Delhi. 2. Bliss, C.J.K. (1967) Statistics in Biology, Vol. I McGraw hill. New York. 3. Campbell R.C. (1974) Statistics for Biologists, Cambridge Univ, Press, Cambridge. 4. Daniel (1999) Biostatistics (3rd edition) Panima Publishing, Compotation. 5. Sward Iaw, A. C. (1985) Practical Statistics for Exponents Biologists, John Wiley and Sons, Inc. 6. Khan (1999) Fundamentals of Biostatistics Publishing Corporation. 7. Roy R.N. (1999) A Text Book of Biophysics New Central Book Agency.

MOLECULAR BIOLOGY

1. Glick, B.R and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press.

2. Howe. C. (1995) Gene cloning and manipulation, Cambridge University Press, USA

3. Lewin, B., Gene VI New York, Oxford University Press.

4. Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc. Florida, USA.

5. Sambrook et al (2000) Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory Press New York, USA

6. Walker J. M. and Ging old, E.B. (1983) Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K.

7. Karp. G (2002) Cell & Molecular Biology, 3rdEdition, John Wiley & Sons; I

Genetic Engineering

1. Christopher H; Gene cloning and Manipulation, Cambridge University Press.

2. Nicholls D.S.T; An Introduction to Genetic Engineering, Cambridge University Press.

3. Old R.W and Primrose S. B; Principles of Gene manipulation, Blackwell Scientific Publication.

- 4. Kucherlpati R and Smith G.R. Editors; genetic recombination, American Society for Microbiology.
- 5. Lewin B; gene VI, Oxford University Press.
- 6. Jogdand S.N; Gene Biotechnology, Himalaya Publishing House.

7. Kumaresan V; Biotechnology, Saras Publication.

8. Glick B.R and Pasternak J.J; Molecular Biotechnology, Principles and Applications of recombinant DNA technology, ASM Press, Washington D.C.

9. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Bioinformatics

1. Dubey R. C.; A Text Book of Biotechnology, S Chand Publicatins.

2. Kumaresan V; Biotechnology (6th Edition), Saras Publication.

- 3. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.
- 4. Gladis Helen Hepsyba & Hemalatha C.R; Basic Bioinformatics, MJP Publishers.
- 5. Sundaralingam R. & Kuaresan V; Bioinformatics, Saras Publication

Environmental Biotechnology

1. Alexander N., Glazer Hiroshi N Ikaido; Microbial Biotechnology, W.H. freeman and Company.

2. Fungal Ecology and Biotechnology, Rastogi Publications.

3. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Immunology

1. Willium E. Paul; Fundamental Immunology, Raven Press, New York.

2. Willium R Clark; The Experimental Foundations of Modern Immunology, John Wiley and Sons, NY.

3. Shyamasree Ghosh; Immunology & Immunotechnology, Books and Allieds Publication.

4. Dulsy Fatima and Arumugam N; Immunology; Saras Publication

5. Ivan M. Roitt; Immunology, Blackwell Scientific Publication.

Animal Biotechnology

- 1. Ian Freshney; Animal Cell culture (4th Edition)
- 2. Gupta P.K; Elements of Biotechnology, Rastogi Publications

3. Kumaresan V; Biotechnology(6th Edition), Saras Publication.

- 4. Dubey R. C.; A Text Book of Biotechnology, S Chand Publicatins
- 5. Animal Biotechnology; MJP Publishers.

6. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Plant Biotechnology

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1. Ravishankar G. A and Venkataraman L.V; Biotechnology- Applications of Plant Tissue culture, Oxford & IBH Publishing Co. Pvt. Ltd.

2. Bhan; Tissue Culture, Mittal Publications, New Delhi.

3. Ramawat K. G; Plant Biotechnology, S Chand Publications.

4. Islan A.C; Plant Tissue Culture, Oxford & IBH Publishing Co. Pvt. Ltd.

5. Kumar H.D; a Text Book of Biotechnology, Affiliated East West Press, New Delhi.

6. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Industrial Biotechnology

1. Bisen P S; Frontiers in Microbial Technolog (1st Edition), CBS Publishers.

2. Glazer Hiroshi N Ikaido; Microbial Biotechnology, W.H. freeman and Company.

3. Prescott & Dum (2002); Industrial Microbiology, Agrobios (India) Publishers.

4. Kumaresan V; Biotechnology(6th Edition), Saras Publication.

5. Kalaichelvan; Bioprocess technology, MJP Publishers.

6. Stanbury P. F, Whitaker H, Hall S. J; Principles of Fermentation Technology, Aditya Books Ltd.

7. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Others titles

1.L.P Verma; Applied Biotechnology, MJP Publishers.

2. Shaleesha AS Stanley; Bioethics.

3. Sathyanarayana U; Biotechnology, Books & Allieds Publication.



BENGALURU CITY UNIVERSITY

REGULATIONS AND SYLLABUS FOR B.Sc. Biotechnology

CHOICE BASED CREDIT SYSTEM Scheme of Examination in Theory and Practical

2020-2021

B.Sc. V Semester:

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Biotechnology Paper V (Environmental & Immunotechnology)

Duration – 3 Hours	Maximum Marks – 35
Q 1. Estimate the total hardness of the given water sample.	8 8 0 Deleter des protopicas
Q 2. Prepare a temporary slide of VAM or Rhizobium .	5 Shear and mulata brine Printopen (C. D.
Q 3. Perform the differential count of WBC.	7 Q 3 Prepare synthetic seed
Q4. Perform RPR/WIDAL / ABO blood grouping from the given sample.	5
Q 5.VIVA VOCE	5 300 - 4340 - 252
Q6. Class record	5
Scheme of valuation: Q1. Performance – 4m Principle - 2m Calculation & result - 2m Q2. Performance – 4m Result – 1m	uis tium noud 8 region
Q3: Performance – 3m Calculation & result – 4m Q4: Principle – 2m	
Performance & result – 3m	
Q 5. Viva voce – questions related to theory & practical syllabus of this paper	r only.

B.Sc. V Semester:

Biotechnology Paper VI (Plant & Animal Biotechnology)

Duration – 3 Hours	Maximum Marks – 35		
Q 1. Isolate the protoplast from the given sample.	7		
Q 2. Isolate and stain the parenchymal cell from the given sampl	e. 8		
Q 3. Prepare synthetic seeds from the sample provided.	4		
Q4. Spotters a) PBT	2.2.6		
D) ABT	3x2=6		
Q5. VIVA VOCE	5		
Q6. Class record & report	5		
Scheme of valuation:			
Q1. Performance – 3m			
Result - 1m			
Q2. Performance – 4m Principle & procedure -3m			
Result – 1m			
Q3: Performance – 2m Comment – 2m			
Q4: identification – 1m			
Relevant points - 2m	ambria cultura, comocional		
spotters PBT- Photographs of callus culture, anther culture,	embryo culture, somacional		
Spotters ABT- EGF, FGF, PDGF, Serum, BSS, Roux bottle, Roller b	pottle.		
Q 5. Viva voce – questions related to theory & practical syllabus	s of this paper only.		

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B.Sc. VI Semester:

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Biotechnology Paper VII (Industrial Biotechnology)

Duration – 3 Hours	Maximum Marks – 35
Q 1. Estimate the amount of lactic acid/citric acid from the given sar	mple. 8
Q 2. Immobilise and estimate the amount of enzyme invertase from the year of the second secon	east culture. 12
Q 3. Estimate the percentage of alcohol from the given sample by sp	pecific gravity method. 5
Q 4. Industrial Tour Report.	5
Q5. Class record	5
 Scheme of valuation: Q1. Performance – 4m Principle & Calculation - 3m Result - 1m Q2. Performance – 6m Principle & protocol table -4m Graph & Result – 2m Note: Standard graph values to be provided. Q3: Performance – 2m Calculation & result –3m 	

B.Sc. VI Semester:

Biotechnology Paper VIII (Project Work)

Duration – 3 Hours	Maximum Marks – 35
Q1. Evaluation of Project Report	25
Q2. VIVA VOCE on the Project Work	na lo tearo na sel a montra pos calegora 10 o
A badron vitran altrage veralgeoni inaug ora a	Q.3. Estimate the particulate of alcohol from

.

And and the second

Scheme of valuation: GD- Performant -- 201 Principle & Catalian on -- 311 Research Lites

(2) Reference: - En-Renciple & protocol table - Am Graph & Result - Do vote: Readure er ab volues to be provide:

> 03. Performance - Cm. Calculation & Accult-CM