



SIES

College of Arts,
Science &
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

**Sion (West), Mumbai – 400022.
(Autonomous)**

Faculty: Science

Program: Bachelor of Science

Program code: SIUSBT

Subject: BIOTECHNOLOGY

Academic Year: 2023 – 2024

F.Y.B.Sc. Biotechnology

**Credit Based Semester and Grading Syllabi as per NEP
2020 approved by Board of Studies in Biotechnology to be
brought into effect from June 2023.**

PREAMBLE:

Biotechnology, broadly defined, includes any technique that uses living organisms, or parts of such organisms, to make or modify products, to improve plants or animals, or to develop microorganisms for specific use. The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology to biodiversity, from microbiology to bioprocess engineering, from bioremediation to material transformation and so on. Biotechnology is the science of today and tomorrow. It has applications in all major service sectors i.e. health, agriculture, industry, environment etc. Biotechnology as an application science has taken firm footing in many countries, abroad where a number of transgenic crops, genetically modified food and recombinant therapeutic molecules for human and animal health are available in the market. Biotechnology as a science of service to human society is yet to make inroads in India

With the advent of the World Wide Web in the early nineties and its subsequent growth, the latest research trends have become accessible from drawing rooms across the globe. This acted as a positive feedback mechanism in increasing the pace of research in all fields including Chemical Engineering and Biotechnology. This was the motivation for an in-depth analysis of what is actually required for today's technology. It is also important to take advantage of the freely available software to enhance the quality and quantity of material that can be covered in the classroom.

This restructured syllabus is therefore intended to combine the principles of physical, chemical and biological sciences along with developing advanced technology. The undergraduate curriculum is prepared to impart primarily basic knowledge of the respective subject from all possible aspects. In addition, students will be trained to apply this knowledge particularly in day-to-day applications of biotechnology and hence get a flavor of research.

SEMESTER I

Course Code	Course Type	Course Title	Credits	Lectures (Hrs.)/ week
SIUBTMJ111	DSC-Major	Basic Biotechnology I	3	3
SIUBTMJP111	DSC-Major	Practical in Basic Biotechnology I	1	2
SIUBTMN111	DSC-Minor	Bioorganic Chemistry I	3	3
SIUBTMNP111	DSC-Minor	Practical in Bioorganic Chemistry I	1	2
SIUBTOE111	OE	Food and Nutrition	4	4
SIUENAE111	AEC	English	2	2
SIUSFVE111	VEC	Environment Studies	2	2
SIUSFIK111	IKS	Indian knowledge system	2	2
SIUBTVS111	VSC	Microbial Techniques	1(Theory) + 1(Practical)	2
SIUBTSE111	SEC	Analytical Skills	1(Theory) + 1(Practical)	2
		Total	22	

SEMESTER II

Course Code	Course Type	Course Title	Credits	Lectures (Hrs.)/ week
SIUBTMJ121	DSC-Major	Basic Biotechnology II	3	3
SIUBTMJP121	DSC-Major	Practical in Basic Biotechnology I	1	2
SIUBTMN121	DSC-Minor	Bioorganic Chemistry-II	3	3
SIUBTMNP121	DSC-Minor	Practical in Bioorganic Chemistry-II	1	2
SIUBTOE121	OE	Introduction to Forensic Science	4	4
SIUENAE121	AEC	Language-English	2	2
SIUSFVE121	VEC	Understanding India	2	2
SIUBTVS121	VSC	Biofertilizers	1(Theory) + 1(Practical)	2
SIUBTSE121	SEC	Tissue Culture	1(Theory) + 1(Practical)	2
	Field projects/ Internships/ Apprenticeship / Community engagement and services	NCC/NSS/ Sports / Cultural	2	2
		Total	22	

Semester I

COURSE CODE	TITLE	CREDITS	LECTURES
VSC	Microbial techniques	2 (1+1)	1 lecture = 1 hour
Course Outcomes	On successful completion of the course, students will be able to <ul style="list-style-type: none"> describe the principles which underlie sterilization of culture media, glassware and plasticware to be used for microbiological work 		
Unit I	<p>Enumeration of Microorganisms: Direct and Indirect Methods: Direct microscopic count – Breed’s count, Petroff -Hausser counting chamber, Hemocytometer. Viable count – Spread plate and Pour plate technique. Turbidity measurements – Nephelometer and spectrophotometer techniques (7L)</p> <p>Growth curve: Phases of growth, generation time, growth rate (3L)</p> <p>Sterilization and Disinfection: Definition, Sterilization of media and glass wares; Types and Applications- Dry Heat, Steam under pressure, Gases, Radiation and Filtration; Chemical Agents and their Mode of Action- Aldehydes, Halogens, Phenol, Alcohol, and Detergents; Ideal Disinfectant- Properties, and Evaluation of Disinfectant (5L)</p>	1	15
Practical	<ol style="list-style-type: none"> Introduction of laboratory instruments- Autoclave, Hot air Oven, Incubator, pH meter, Rotary Shaker and Centrifuge Sterilization of media and glassware Enumeration of microorganism by pour plate and spread plate method Enumeration by Breed’s count Growth curve of <i>E. coli</i> Effect of pH and temperature on growth of microorganisms Principles and practices of lab safety, Decontamination and disposal 	1	15

SEMESTER II

COURSE CODE	TITLE	CREDITS	LECTURES
VSC	Biofertilizer production	2	1 lecture = 1 hour
Course Outcomes	On successful completion of the course, the student will understand the basics of biofertilizer production, examples of bacterial biofertilizers, and composting.		
Unit I	<p>Introduction, History and concept of Bio fertilizers, status scope and importance of Bio fertilizers, Classification of Bio fertilizers.(3L) Nitrogen fixation(2L)</p> <p>Features of bacterial Biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cyanobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza.(3L)</p> <p>Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of bio fertilizers.(3L)</p> <p>Composting - Procedure and factors involved in the development of compost.(2L)</p> <p>Determination of good quality compost using various physical and chemical parameters(2L)</p>	1	15
Practical	<ol style="list-style-type: none"> 1. Study of Permanent slides of Cyanobacteria 2. Isolation and enrichment of <i>Azotobacter</i> species 3. Isolation and enrichment of <i>Rhizobium</i> species 4. Production of compost at the lab scale 5. Determination of good quality of compost using physical parameters viz. pH, Moisture content, Specific gravity, Water holding capacity etc. 6. Determination of good quality of compost using chemical parameters viz. Carbon content and Calcium content. 7. Production technology: Strain selection, sterilization, growth 	1	15

References:

1. Applegate, E. (2014). Study guide for the anatomy and physiology learning system-e-book. Elsevier Health Sciences.
2. Arora, P. N., & Malhan, P. K. (2010). Biostatistics. Himalaya Publishing House.
3. Bahl, B.S., Tuli, G.D. & Bahl, A. (2000). Essentials of physical chemistry, 24th edn. S. Chand & Company Limited.
4. Baker, T. A., Watson, J. D., Bell, S. P., Gann, A., Losick, M. A., & Levine, R. (2003). Molecular biology of the gene. Benjamin-Cummings Publishing Company.
5. Chang, R. (2005). Physical chemistry for the biosciences, 1st edn. University Science Books.
6. Chaudhuri, S. K. (1997). Concise medical physiology. New Central Book Agency.
7. Concise Inorganic Chemistry, 5th edition, (2008). Author: J.D. Lee, John Wiley & Sons, USA.
8. Conn, E., & Stumpf, P. (2009). Outlines of biochemistry. John Wiley & Sons.
9. Cooper, G. M., & Hausman, R. E. (2004). The cell: molecular approach. Medicinska naklada.
10. De, K. K. (1997). Plant tissue culture. New Central Book Agency.
11. Dubey, R.C. (2014). Advanced Biotechnology. S. Chand & Company Limited.
12. Frazier, W. C., & Westhoff, D. C. (1988). Food microbiology, 4th edn. McGraw-Hill.
13. Freshney, R. I. (2015). Culture of animal cells: a manual of basic technique and specialized applications. John Wiley & Sons.
14. Frobisher, M., Hinsdill, R., Crabtree, K.T. & Goodheart, C.R. (1968). Fundamentals of microbiology, 8th edn. W.B. Saunders Co.
15. Gangal, S. (2007). Principles and practice of animal tissue culture. Universities Press.
16. Guyton, A. C. (1979). Physiology of the human body. Saunders Limited.
17. Hall, J. E. (2015). Guyton and Hall textbook of medical physiology. Elsevier Health Sciences.
18. Jain, J.L., Jain, S. & Jain, N. (2016). Fundamentals of Biochemistry, 7th edn. S. Chand & Company Limited.
19. Jordan, E.L. and Verma, P. S. (1978). Chordate zoology. S. Chand & Company Limited.
20. Jordan, E.L. and Verma, P. S. (1978). Invertebrate Zoology. S. Chand & Company Limited.
21. Karp, G. (2009). Cell and molecular biology: concepts and experiments. John Wiley & Sons.
22. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kuby, J. (2007). Kuby immunology, 6th edn. Macmillan.
23. Kotpal, R. L. (2012). Modern text book of zoology: invertebrates. Rastogi Publications.
24. Lee, J.D. (2008). Concise inorganic chemistry, 5th edn. John Wiley & Sons.
25. Marieb, E. N., & Hoehn, K. (2007). Human anatomy & physiology. Pearson Education.
26. Mendham, J. (2006). Vogel's textbook of quantitative chemical analysis. Pearson Education India.
27. Mitra, S. (1996). Genetic engineering: principles and practice. McGraw-Hill Education.
28. Morrison, R.T. & Boyd, R.N. (1992). Organic chemistry. Pearson Education Inc.
29. Mu, P., & Plummer, D. T. (1988). Introduction to practical biochemistry. Tata McGraw-Hill Education.
30. Murphy, K.M. & Weaver, C. (2017). Janeway's immunology, 9th edn. W.W. Norton and Company.
31. Narayan, A., Paniker. (2009). TextBook of Microbiology. Universities Press.

32. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). *Lehninger principles of biochemistry*. Macmillan.
33. Patel, A.H. (2015). *Industrial microbiology*, 2nd edn. Laxmi Publications.
34. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2001). *Microbiology*, 5th edn. Tata McGraw-Hill publications.
35. Rao, C. V. (2002). *An introduction to immunology*. CRC Press.
36. Rao, C.N.R. (2000). *University general chemistry*, 1st edn. Macmillan India Ltd.
37. Razdan, M. K. (2003). *Introduction to plant tissue culture*. Science Publishers.
38. Russell, P. J., & Gordey, K. (2002). *IGenetics*, 3rd edn. San Francisco: Benjamin Cummings.
39. Salle, A. J. (1973). *Fundamental principles of bacteriology* (Vol. 7). McGraw-Hill.
40. Satyanarayan, U., & Chakrapani, U. (1999). *Textbook of Biochemistry*. Books and Allied Pvt Ltd.
41. Sharma, B. K. (2000). *Instrumental methods of chemical analysis*. Krishna Prakashan Media.
42. Singh, B. D. (2015). *Fundamentals of Genetics*. Kalyani Publishers.
43. Singh, B. K. (2004). *Biodiversity: Conservation and Management*. Mangal Deep Publications.
44. Singh, B.D. (2017). *Biotechnology*. Kalyani Publishers.
45. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. (2013). *Fundamentals of analytical chemistry*. Nelson Education.
46. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). *Principles of fermentation technology*. Elsevier.
47. Verma, P. S., Agarwal, V. K., & Verma, P. S. (2007). *Cell biology, genetics, molecular biology, evolution and ecology*. S. Chand & Company Limited.
48. Verma, V. (2011). *Textbook of plant physiology*. Ane Books Pvt Ltd.
49. West, E. S., Todd, W. R., Mascon, H. S., & Van Bruggen, J. T. (1974). *Textbook of biochemistry*. Oxford and IBH Publishing.
50. Willey, J.M., Sherwood, L., Woolverton, C.J. (2008). *Prescott, Harley and Klein's Microbiology*. McGraw-Hill.
