



Janardan Bhagat Shikshan Prasarak Sanstha's

**CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS)**

**Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai**

Program: Certificate Course in Applied Biotechnology'

**Revised Syllabus of Certificate Course in Applied Biotechnology
for F.Y.B.Sc. Microbiology
w.e.f. Academic Year 2019-20**

**Syllabus for Certificate Course in Applied Biotechnology
for F.Y.B.Sc Microbiology**

Sr. No.	Heading	Particulars
1	Title of Course	Certificate Course in Applied Biotechnology
2	Eligibility for Admission	Sudents enrolled for F.Y.B.Sc.
3	Passing marks	40%
4	Ordinances/Regulations (if any)	-
5	Duration	60 hrs
6	Level	U.G.
7	Pattern	-
8	Status	New
9	To be implemented from Academic year	2019-2020

Preamble of the Syllabus:

Biotechnology is a combination of biological sciences, and engineering and technology, where properties of biological molecules are harnessed for the benefit of human kind. This course is designed for First Year B.Sc. Microbiology learners, to be completed in 60 hours (one academic year). On the successful completion, learners will be awarded with certificate. By integrating the knowledge and information presented in the course taught by faculty into a Certificate program in Applied Biotechnology will prepare learners to meet and exceed the expectation of growing industrial needs. This certificate program offers an opportunity to undergraduate student's for the interdisciplinary training. The units of the syllabus are well defined, taking into consideration the level and capacity of the students. The syllabus for this course is divided into two units, practicals and case study. The topics prescribed in the syllabus mainly emphasis on general introduction to the nature and scope of Biotechnology covering basic concepts and importance of biotechnology, tools of genetic engineer and

Syllabus for 'Certificate Course in Applied Biotechnology'

Cloning techniques . In the later section of syllabus, Biological Fundamentals will be taught to create interest among students about biotechnology. This course provides learners the opportunity to study science on the edge of innovation; technology and even science itself. This course may be helpful to learners enrolled for FYBSc to decide their career goals.

The new syllabus is based on a basic and applied approach with vigor and depth at the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research field.

The syllabus is prepared after discussion at length with numbers of the faculty members of the subjects and experts from industries and reserch fields.

Objectives of the Course:

- To promote understanding of basic cocepts in Biotechnology.
- To introduce the learners to various emerging areas of Biotechnology.
- To develops skills required in various industries, research labs, and in the field of human health

Course Outcome: By the end of the course:

Learners will develop interest in the subject of Biotechnology and its application in various fields. Leraners of Microbiology will develop the understanding of applied aspects of Biotechnology with respect to need of industry.

Certificate Course in Applied Biotechnology:

For this course there shall be two papers comprising 15 hrs for lectures and 15 hrs for practicals in each paper..

Paper I: Introduction to Biotechnology

- Nature and Scope of Biotechnology
- Tools of genetic engineering

Paper II: Basic Skills

- Biological Fundamentals

Syllabus for 'Certificate Course in Applied Biotechnology'

Course content:

Course Name	Contact Hours				Credits			
	Paper-I	Paper-II	Practical	Project/ Industrial Visit	Theory	Practical	Project/ I.V.	Total Credits
Certificate course in Applied Biotchnology	15	15	15	15	02	01	01	04
Total Duration: 60 hrs (One academic Year). Theory: 30 hrs. Practical :15Hrs; Project/ I.V. / Case study: 15Hrs								

Scheme of Examination:

- Theory Examination of 50 Marks will be as follows -:

Question 1	From Unit 1, 2	20 marks
Question 2	From Unit 1	15 marks
Question 3	From Unit 2	15 marks
	Total	50 marks

- There will be separate practical Examination of 50 Marks

Syllabus for 'Certificate Course in Applied Biotechnology'

'Certificate Course in Applied Biotechnology'

For F.Y.B.Sc Microbiology

Detailed Syllabus

To be implemented from the Academic year 2019-20

Theory Unit I – Introduction to Biotechnology (15 Lectures)		
	Nature and Scope of Biotechnology	[7]
	<p>a. Definitions of Biotechnology and objectives</p> <p style="padding-left: 40px;">Extrapolation of traditional technology in the light of new all round developments in the field of sciences</p> <p style="padding-left: 40px;">Branches of Biotechnology</p> <p>b. Historical perspective – from ancient alchemy to industrial microbiology to biotechnology with suitable illustrations.</p> <p>c. Current Status of the field</p> <p style="padding-left: 40px;">Type and range of products produced</p> <p style="padding-left: 40px;">Status of the biotechnology in India</p> <p>d. Biogas production & vermicomposting</p>	[4]
		[3]
	Tools of genetic engineering	[3]
	Restriction enzymes, DNA ligases, Vectors (Plasmid DNA vectors), Cloning techniques	
	Instrumentation in Biotechnology	[05]
	<p>Analytical instruments – principle, construction, working and applications of following techniques.</p> <p>Spectrophotometric techniques – UV, Visible</p> <p>Chromatographic techniques – methods of Adsorption, partition, ion exchange, gel filtration and affinity</p>	
Theory Unit II - Basic Skills (15 Lectures)		
	Biological Fundamentals	[15]
	<p>Potential of biological systems, their handling and manipulation</p> <p>a. Cellular basis of biological systems – cell theory, cell cycle, bacterial cells</p> <p>b. Nature of biological information</p> <p style="padding-left: 40px;">Central Dogma</p> <p style="padding-left: 40px;">Nucleic acids and proteins as information molecules</p>	[2]
		[4]

Syllabus for 'Certificate Course in Applied Biotechnology'

	Introduction to transcription	[2]
	Introduction to translation	
	c. Implementation of genetic information	
	Metabolic processes – anabolic and catabolic pathways.	[3]
	d. Principles and steps involved in the purification of nucleic acids and proteins demonstration by using ICT (Virtual Lab)	
	e. Culturing of living systems – techniques and methods of cultivation of microorganisms, plants and animal cells/tissues using pure culture techniques	[4]

Books and References:

1. Glick B.R. and Pasternak J.J., "Molecular Biotechnology, Principles and applications of recombinant DNA". 3rd edition, (2003), ASM Press/CBS Publishers, New Delhi.
 2. Purohit S.S., "Biotechnology, Fundamentals and Applications, 3rd edition (2001), Agrobios (India), Jodhpur.
 3. Williams and Wilson, Methods of Instrumental analysis
 4. Lehninger- Principles of Biochemistry- David Nelson, Michael Cox. 4th edition W.H. Freeman & Company.
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Program: Diploma Course in Applied Biotechnology'

Revised Syllabus of Diploma Course in Applied Biotechnology
for S.Y.B.Sc. Microbiology
w.e.f. Academic Year 2019-20

**Syllabus for Diploma Course in Applied Biotechnology
for S.Y.B.Sc Microbiology**

Sr. No.	Heading	Particulars
1	Title of Course	Diploma Course in Applied Biotechnology
2	Eligibility for Admission	Students enrolled for S.Y.B.Sc.
3	Passing marks	40%
4	Ordinances/Regulations (if any)	-
5	Duration	60 hrs
6	Level	U.G.
7	Pattern	-
8	Status	New
9	To be implemented from Academic year	2019-2020

Preamble of the Syllabus:

Diploma course in Applied Biotechnology is a diploma level course which provides an inquiry-focus curriculum for bio-enthusiasts learners who love to learn through self discovery. Diploma is designed to equip learners with the modern technological skills especially in the microbiological techniques and sub-professional levels. An area of the study includes the application of microorganisms such as virus, bacteria and fungi in relation to their importance to mankind.

This course is designed for Second Year B.Sc. Microbiology learners who successfully completed certificate course in Applied Biotechnology for First year learners, to be completed in 60 hours (one academic year). On the successful completion, learners will be awarded with a certificate. The syllabus for this course divided into two units, practicals and case study. The topics prescribed in the syllabus mainly emphasis on Bioprocess

Syllabus for 'Diploma Course in Applied Biotechnology'

Technology – Microbial Biotechnology , Introduction to GMP,QA,QC,GLP,CGMP,CGLP which gives information about scope of fermentation technology and importance of quality in fermentation industries. In the later section of syllabus, fermentation process will be taught to create interest among students about the fermentation processes and different parameters required for fermentation. This course will be helpful to make student curious by providing and recommending them different reference books in Microbiology. This course provides an intensive and in depth learning to the learners in the field of biotechnology. The course majorly focusses on the application and allows learners to gain practical knowledge rather than mere theory.

The new and updated syllabus is based on a basic and applied approach with vigor and depth, at the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research field.

The syllabus is prepared after discussion at length with members of the faculty members of the subjects and experts from industries and research fields.

Objectives of the Course:

- To give Microbiology graduates a thorough training in a wide range of practical, analytical techniques and ancillary skills necessary for careers in manufacturing and service industries, especially the healthcare, food, biomedical and pharmaceutical sectors.
- To provide training through short, intensive courses, in relevant vocational skills such as laboratory , effective communication and statistics.

Course Outcome: By the end of the course students will be able to:

-
- Develop an understanding of the various aspects of Bioprocess Technology
- Develop skills associated with screening of Industrially Important Strains.
- Understand principles underlying designs of Fermentors and Fermentation Process.

Syllabus for 'Diploma Course in Applied Biotechnology'

Diploma Course in Applied Biotechnology:

For this course there shall be two papers comprising 15 hrs for lectures and 15 hrs for practicals in each paper.

Modules:

- **Bioprocess Technology – Microbial Biotechnology**
- **Fermentation Process**

Course content:

Course Name	Contact Hours				Credits			
	Paper-I	Paper-II	Practical	Project/Industrial Visit	Theory	Practical	Project/I.V.	Total Credits
Diploma course in Applied Biotchnology	15	15	15	15	02	01	01	04
Total Duration: 60 hrs (One academic Year). Theory: 30 hrs. Practical :15Hrs; Project/ I.V. / Case study: 15Hrs								

Scheme of Examination:

- Theory Examination of 50 Marks will be as follows -:

Question 1	From Unit 1, 2	20 marks
Question 2	From Unit 1	15 marks
Question 3	From Unit 2	15 marks
	Total	50 marks

- There will be separate practical Examination of 50 Marks

Syllabus for 'Diploma Course in Applied Biotechnology'

'Diploma Course in Applied Biotechnology'

For S.Y.B.Sc Microbiology

Detailed Syllabus

To be implemented from the Academic year 2019-20

Unit I – Bioprocess Technology – Microbial Biotechnology		
	i Scope of fermentation technology/Industrial Microbiology – types of products produced and their applications.	02
	ii. Role of molecular biological and bioinformatics techniques in product development 1) Review of basic molecular biological techniques and recombinant DNA techniques used in development and improvement of stains, recombinant microorganisms. Comparison of these techniques with traditional screening techniques. 2) Polymerase chain reaction, RT-PCR	05
	iv. Large scale production of proteins using recombinant microorganisms, Antimicrobial drugs and agents, Enzymes, Biocontrol agents (Microbial insecticides), Fine chemical Products, Organic transformations with enzymes and whole cells, Vaccines.	04
	v. Introduction to GMP,QA,QC,GLP,CGMP,CGLP	04
Unit-II Fermentation Process		
	1. Inoculums development and maintenance [1]	[15]
	2. Media Formulation and sterilization [1]	
	3. Fermentation proper a. Bioreactors and support Equipments – Types of reactors, typical construction of a fermentation vessel, various components and their role. [3] b. Process parameters – methods of their monitoring, control and importance – aeration, agitation, mixing, pH, foam and temperature control, monitoring metabolites – substrates, intermediates and products, power consumption.[3]	
	4. Product recovery – down stream processing [3] a. General principles involved b. Types of equipments used – centrifuges, filters, dryers, concentrators, solvent extractors, chromatographic systems c. Packaging and storage	

Syllabus for 'Diploma Course in Applied Biotechnology'

	5. Waste treatment [2] a. Nature of industrial waste b. Obligation of industry to that waste c. General principles and methods used	
	6. Intellectual property rights & Bioethics with special reference to Modern Biotechnology [2]	

Practicals

Overview of Molecular biological techniques as applied to industrial strain development

i. DNA extraction – Genomic – (mini and midi) (02)
ii. DNA polymerisation by Polymerase Chain Reaction (05)
iii. Transformation to demonstrate acquisition of new characters (04)
iv. Restriction digestion, electrophoretic analysis and integration of fragments of interest in a carrier plasmid (04)

Project or Industrial visit (15)

Projects [Equivalents of 15]

Consolidated exercise of process development and production, taking any one suitable product; starting from product selection, strain isolation and screening, strain improvement, lab scale production, purification (down stream processing), waste disposal, packaging. Suggested examples –

- a) amino acid production,
- b) antibiotic production,
- c) enzyme production,
- d) Biocontrol agents production,
- e) Biofertilizers production,
- f) **Alcohol production.**

Students can be divided in to several groups for undertaking multiple problems for complete coverage. [Equivalents of 15]

OR

Industrial visit [Equivalents of 15]

1. Visit to Biotechnology industry and discussion with the entrepreneur reporting the steps, difficulties and problems faced and solved while establishing such industry. Groups of students can cover 2 industries under the supervision of teaching staff.
2. Diagrammatic representation of plant layout organization of variou service with comment on its advantages and disadvantages and suggestion for improvements.

Books and References:

1. Casida L.E., "Industrial Microbiology" (1999), New Age International (P) Ltd, New Delhi
 2. Purohit S.S., (2001), "Biotechnology Fundamentals and Applications, "3rd Edition, Agrobios, Jodhpur.
 3. Stanbury P.F., Whitaker A. & Hall S. (1997), "Principles of fermentation Technology", 2nd Edition, Aditya Books Pvt. Ltd. New Delhi.
 4. Crueger W. and Crueger A.(2000) "Biotechnology – A Textbook of industrial Microbiology, 2nd Edition, Panima Publishing Corporation, New Delhi
 5. EI-Mansi E. M.T. & Bryce C.F.A. (2000), "Fermentation Microbiology and Biotechnology", Taylor and Francis Ltd., New Delhi
 6. Ratledge, C. & Kristiansen, B. (2001), "Basic Biotechnology", 2nd Edition, Cambridge University press.
 7. Primrose, S.B. Twyman, R.M. & Old R.W. (2001), "Principles of Gene Manipulation, 6th Edition, Blackwell ltd.
 8. H.A.Modi, (2009). 'Fermentation Technology' Vol.2, Pointer Publication, India.
 9. Peter J.Russell (2010), 'I Genetics-A molecular approach", 3rd edition.
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Program: Bridge Course in Microbial Studies

Revised Syllabus of Bridge Course in Microbial Studies

for F.Y.B.Sc. Microbiology

w.e.f. Academic Year 2019-20

**Bridge Course in Microbial Studies Syllabus
for F.Y.B.Sc Microbiology**

Sr. No.	Heading	Particulars
1	Title of Course	Bridge Course In Microbial Studies
2	Eligibility for Admission	12 th Science of all recognised Board and students enrolled for F.Y.B.Sc.
3	Passing marks	40%
4	Ordinances/Regulations (if any)	-
5	Duration	10hrs
6	Level	U.G.
7	Pattern	-
8	Status	New
9	To be implemented from Academic year	2019-2020

Preamble of the Syllabus:

This course is designed for First Year B.Sc. Microbiology learners, to be completed in ten hours. On the successful completion, learners will be awarded with certificate of course. The topics prescribed in the syllabus mainly emphasis on general introduction to the microbial World covering basic concepts and types of microorganisms. In the later section of syllabus, three important branches of microbiology viz. Medical, Industrial and Agricultural Microbiology will be taught to create awareness about scope of microbiology. This course will be helpful to make student curious by providing and recommending them different reference books in Microbiology. This course will fill the gap of subject knowledge between higher secondary and undergraduate studies. This course may be helpful to learners enrolled for FYBSc to decide their career goals.

Objectives of the Course:

- To make the learners aware about diversity of microorganisms
- To make the learners aware about scope of Microbiology
- To make the learners familiar with reference books in Microbiology
- To fill the gap of subject knowledge between higher secondary and undergraduate studies.

Course Outcome: By the end of the course:

Learners will develop interest in the subject of Microbiology and it will also be useful to fill the gap of subject knowledge between higher secondary and graduate studies.

Bridge Course in Microbial Studies:

For this course there shall be only one paper for 10 lectures comprising of two modules.

Module-I: Introduction to Microbiology

Module-II: Scope of Microbiology

Scheme of Examination:

Examination: 20 Marks will be as follows -:

Question 1	Objectives Questions with options: MCQs, Fill in the Blanks, Match the pairs, Definations/Concepts. (Any 20 out of 30)	20 Marks
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**Bridge course in microbial studies:
For F.Y.B.Sc Microbiology
Detailed Syllabus
To be implemented from the Academic year 2019-20**

Bridge Course in Microbial Studies	[10]
1 Introduction to Microbiology	
i. Microbial Diversity: Archaeobacteria, Eubacteria and Extremophiles	[03] [01]
ii. Reference books for Microbiology	
2 Scope of Microbiology	
i. Medical Microbiology	[02]
ii. Industrial Microbiology	[02]
iii. Agricultural Microbiology	[02]

Books and References:

1. Prescott L.M., Harley J.P. and Klein D.A., Microbiology, 5th Edition, October-2002, The McGraw-Hill Companies, 2002.
2. Stanier R.Y., General Microbiology, 5th Edition, 1987, Macmillan Press Ltd.
3. Pelczar, Elementary Microbiology, McGraw-Hill Companies



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Program: Bridge Course in Microbial Techniques

**Revised Syllabus of Bridge Course in Microbial Techniques
for T.Y.B.Sc. Microbiology
w.e.f. Academic Year 2019-20**

**Bridge Course in Microbial Techniques Syllabus
for T.Y.B.Sc Microbiology**

Sr. No.	Heading	Particulars
1	Title of Course	Bridge Course In Microbial Techniques
2	Eligibility for Admission	Sudents enrolled for T.Y.B.Sc.
3	Passing marks	40%
4	Ordinances/Regulations (if any)	-
5	Duration	10hrs
6	Level	U.G.
7	Pattern	-
8	Status	New
9	To be implemented from Academic year	2019-2020

Preamble of the Syllabus:

This course is designed for T.Y.B.Sc. Microbiology learners, to be completed in ten hours. On the successful completion, learners will be awarded with certificate of course. The topics prescribed in the syllabus mainly emphasis on basic aspects of microbiological practicals such as preparation of solutions, representation of data and reporting of observations, results and conclusion. In the later section of syllabus, some important techniques in Microbial Genetics, Medical Microbiology and Immunology, Biochemistry and Bioprocess technology will be taught to augment the theorotical aspects related to those different techniques. This course will be helpful to make student skillful by providing the different aspects of various bioassays. From this course, learners will enhance their technical as well as practical writing skills. This course will encourage the learners to get enrolled for post graduation and post graduate diploma and or other courses in Microbial techniques, Instrumentation, Bioanalytical Sciences etc.

Objectives of the Course:

- To enhance the learner's practicals skills and practical data compilation and its representation.
- To enhance the learner's skills about important techniques in Microbiology.

Course Outcome: By the end of the course:

- Learners will get more knowledge of Microbial techniques and it will also be useful to work smoothly on various practicals in the Microbiology. It will promote the learners towards bioanalytical techniques as well as inculcate practical skills into them.

Bridge Course in Microbial Techniques:

For this course there shall be only one paper for 10 lectures comprising of five modules of two lectures each.

- 1 Module-I: Introduction to Basic Techniques**
- 2 Module-II: Techniques in Microbial Genetics**
- 3 Module-III: Techniques in Immunology and Medical Microbiology**
- 4 Module-IV: Techniques in Microbial Biochemistry**
- 5 Module-V: Techniques in Bioprocess Technology**

Scheme of Examination:

Examination: 20 Marks will be as follows -:

Question 1	Objectives Questions with options: MCQs, Fill in the Blanks, Match the pairs, Definitions/Concepts. (Any 20 out of 30)	20 Marks
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**Bridge course in Microbial Techniques:
For T.Y.B.Sc Microbiology
Detailed Syllabus
To be implemented from the Academic year 2019-20**

Bridge Course in Microbial Techniques	[10]
6 Introduction to Basic Techniques i. Preparation of Normal , Molar Solutions ii. Data Representation: Writing observations and Graphs Plotting iii. Interpretation of results and conclusion	[02]
7 Techniques in Microbial Genetics i. Transformation and Conjugation ii. Phage Assay	[02]
8 Techniques in Immunology and Medical Microbiology i. Coomb's Test and Reverse Typing ii. ELISA iii. WIDAL & VDRL	[02]
9 Techniques in Microbial Biochemistry i. Estimation of Phenol, Proteins, Uric Acid ii. Estimation of Penicillin iii. β -Galactosidase assay	[02]
10 Techniques in Bioprocess Technology i. Bioassay of Vitamin B ₁₂ & Penicillin ii. Production of invertase by immobilized yeast cells	[02]

Books and References:

1. Prescott L.M., Harley J.P. and Klein D.A., Microbiology, 5th Edition, October-2002, The McGraw-Hill Companies, 2002.
2. Stanier R.Y., General Microbiology, 5th Edition, 1987, Macmillan Press Ltd.
3. Pelczar, Elementary Microbiology, McGraw-Hill Companies

A.C. No. _____



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CHANGU KANA THAKUR

Arts Commerce and Science College, New Pancel

(AUTONOMOUS)

SYLLABUS

For

Remedial Course in Biochemical Pathways

(w.e.f. 2019-20)

Janardan Bhagat Shikshan Prasarak Santha's

Changu Kana Thakur Arts Commerce and Science College, New Panvel (Autonomous)

Department of Microbiology

Course: Remedial Course in Biochemical Pathways

Preamble:

This course is designed for T.Y.B.Sc. Microbiology learners, to be completed in ten hours. The course will help to simplify the concepts of biochemical pathways. It will cover basic aspects of biochemical pathways and tricks to remember molecular structures and reactions. The course will also cover important pathways in the metabolism of carbohydrates, lipids, proteins and nucleic acids. This course will help to overcome the fear of learners about biochemical pathways and will encourage them to understand different types of metabolism.

Course Rationale:

The purpose of this course is to simplify the conceptual understanding of biochemical pathways.

Course Objectives:

- To simplify the concepts of biochemical pathways

Course Outcome:

By completing this course successfully, learners will overcome the fear of biochemical pathways and will develop interest in it.

Detail Syllabus

SN	Topic	Hrs
1	<ul style="list-style-type: none">Types of Pathway: Linear, Branched, Circular, constitutive, Inducible, catabolic, anabolicLink between catabolic and anabolic pathway	01
2	Common Reactions of metabolic pathways: Isomerisation, Epimerisation, Oxidation-Reduction, Group Transfer, Condensation, Hydrolysis, lysis	01
3	Bioenergetics: Gibbs Free Energy Change, High energy compounds Classification of Enzyme	01
4	Glycolysis and Entner Doudoroff pathway	01
5	Pentose Phosphate Pathway	01
6	TCA cycle, Glyoxylate Bypass, ETC	01
7	Fermentation pathway: Alcohol, Lactic acid, Butyric acid, Mixed acid, Acetone Butanol, Butanediol	01
8	Synthesis and β -oxidation of Fatty acids	01
9	Synthesis of Pyrimidine, Degradation of Purin nucleotides upto uric acid	01
10	Synthesis of Purine nucleotide	01

References:

1. Nelson and Cox, Lehninger's Principles of Biochemistry, 4th Edn.
 2. Gottschalk, Microbial Biochemistry
 3. Luberts Stryer, Biochemistry
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