

UNIVERSITY OF MUMBAI
No.UG./132 of 2009

REGULAR:-

A reference is invited to the Ordinances, Regulations and syllabi relating to the S.Y.B.Sc. (Bio-Technology) degree course vide Pamphlet No.340 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Ad-hoc Committee appointed by the Academic Council to advise it on all matters relating to the courses of study and examinations in the subject of Biotechnology at the S.Y.B.Sc. and M.Sc. degree course at its meeting held on 17th January, 2009 has been accepted by the Academic Council at its meeting held on 13th February, 2009 vide item 4.5 and that, in accordance therewith, the syllabus of the S.Y.B.Sc. Biotechnology paper pattern (Theory and Practicals) is revised as per Appendix and that the same has been brought into force with effect from the academic year 2009-2010.

MUMBAI-400 032
May, 2009

PRIN. K. VENKATARAMANI
REGISTRAR

The Principals of the affiliated colleges in Science.

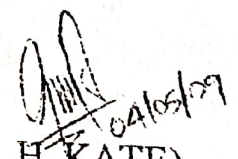
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UG/132-A of 2009, MUMBAI-400 032

4th May, 2009

Copy forwarded with compliments for information to :-

- 1) The Dean, Faculty of Science.
- 2) The Chairman, Ad-hoc Board of Studies in Biotechnology,
- 3) The Controller of Examinations,
- 4) The Co-ordinator, University Computerization Center.


(D. H. KATE)
DEPUTY REGISTRAR
(U.G./P.G.Section)

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Personal Assistant to the Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Migration Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computerization Center (IDE Building).



UNIVERSITY OF MUMBAI



Revised Syllabus and Paper Pattern
(Theory & Practicals)

for the

S. Y. B. Sc

In

Biotechnology

(With effect from the academic year 2009-2010)

UNIT STRUCTURE OF THE SYLLABUS

Paper I		Paper II		Paper III	
Unit	Topic	Unit	Topic	Unit	Topic
I	Microbiology	I	Inheritance Pattern	I	Biochemistry
II	Environmental Biotechnology	II	Molecular Biology	II	Catabolism
III	Industrial Biotechnology	III	Genetics	III	Instrumentation

PAPER-I

Unit-I

Microbiology

30 Lecture

Topic	Sub-Topic	No of lectures
A. Microbial growth kinetics	1. Definition of growth 2. Growth curve - 4 phases 3. Measurement of growth-direct and indirect methods 4. Mathematical nature and expression of growth, calculation of generation time 5. Efficiency of growth 6. Growth yield 7. Synchronous growth 8. Effect of nutrients concentration 9. Continuous culture, arithmetic growth 10. Diauxic growth	10
B. Biotechnology Medical Applications	1. Diagnostics- Introduction, medical and diagnostic products: Diagnostic kits, DNA probe and Monoclonal antibodies as diagnostic tools and application. 2. Preventive- Vaccines-Introduction, types and application (no production to be included) 3. Hormones – Insulin, human growth hormone, somatostatin, erythropoietin. Microbial enzymes – medical uses.	10
C. Virology	1. Structure of viruses - Bacteriophage, Animal viruses - Small pox, Influenza, Plant viruses- TMV, CMV 2. Classification and Enumeration 3. Cultivation - Plant, Animal and Bacterial viruses 4. Life cycle of Bacterial Viruses – T-4, Lambda	10

Topic	Sub-Topic	No of lectures
A. Microbiology of Air	1. The atmosphere 2. Aeromicrobiological pathway 3. Number and kind of microorganism in air. Airborne diseases 4. Dust, droplet and droplet nuclei 5. Sampling, Quantitative and qualitative methods for enumeration of bacteria in air 6. Air sanitation (chemical and physical methods) 7. Biosafety in laboratory.	10
B. Microbiology of Water and Waste Water	1. Introduction to hydrosphere environment its distribution on the planet, its diversity, scope of study, water as a valuable limiting resource for human development. 2. Introduction to aquatic microbiology- Distribution of aquatic environment (fresh water, ground water, springs, rivers, ponds, lakes, brackish water, marine) their characteristic ecological features. Types of microorganisms. 3. Microbiology of potable water a. Introduction-Definition and characteristics of potable water, standards for potable water, demand and use of potable water, various sources of potable water available, water borne diseases. b. Methods of purification of water-Types of impurities encountered and treated, general steps in municipal water treatment, principle behind each steps, its working and significance, other methods for small scale/domestic purification based on filtration, chlorination, iodine treatment, UV treatment, reverse osmosis their advantages and limitation, various commercial equipment. c. Analysis of Potable water-List of physical, chemical and biological parameters analyzed. d. Microbiological analysis of drinking water-concept of microbiologically safe drinking water, concept of indicator organism of fecal pollutions, different indicator organism used/ proposed for this purpose, their advantages and limitations, Methods of detecting faecal	10

	pollution of drinking water , routine analysis steps, their interpretation, inferences its causes and correction, significance and limitations. Methods of detecting other nuisance bacteria- iron, sulphur and slime producers. 4. Microbiology of waste water- a. Definition, source, types and composition of waste water, domestic sewage and industrial waste water. Impact of waste water on environment, need and objective of processing, obligatory/legal responsibility. b. Methods of analysis of waste water- Std. parameters for physical, chemical and biological analysis, microbiological analysis, rationales and methods, their significance and limitations. c. Treatment of waste water- Objectives of waste water treatment and uses of treated water. General steps used in domestic/ municipal/industrial waste water treatment, principle behind each step, its working and significance d. Primary treatment: (Chemical/Physical) sedimentation, screening, coagulation, flocculation, dilution, neutralization, equalization etc. Secondary treatment: (Biological/ biochemical) Activated sludge process, Trickling filters, anaerobic filters, sludge digestion, Aerated lagoons, Algal ponds, Evapo- transpiration system. Tertiary treatment-clarification, disinfections- Disposal of treated water and sludge methods, Imhoff tank, septic tank.	
C. Microbiology of Soil	1. Introduction 2. Physical and chemical properties of soil. 3. Microbial flora of soil 4. Methods used for isolation and studying soil flora-Winogradsky's column. 5. Rhizosphere flora- definition of Rhizosphere, rhizosphere effect, associative and antagonistic effect of rhizosphere, root exudates. 6. Biogeochemical cycles- carbon, nitrogen and sulfur. 7. Nitrogen fixation- symbiotic and non-symbiotic. 8. Nitrification and Denitrification.	10

Topic	Sub-Topic	No of lectures
A. Fermenter and Fermentation media	1. Basic design of a fermentor-baffles, spargers, impeller. 2. Media composition – Water, energy sources, carbon, nitrogen, minerals, growth factors, buffers, precursors, 3. inducers, antifoams. 4. Inoculum and production media	08
B. Sterilization	1. Media sterilization 2. Sterilization of fermentor 3. Sterilization of feed 4. Sterilization of liquid wastes 5. Filter sterilization	07
C. Types of fermentor	1. Introduction and concept-Batch and Continuous fermentation 2. Surface and submerged fermentation 3. Aerobic and Anaerobic fermentation 4. Solid state fermentation.	05
D. Industrial Microbiology	1. Introduction to screening-Primary and secondary 2. Preservation 3. Strain development- general, mutation, selection of mutants, recombination, regulation (one example of each)	10

References

Sr. No	Title of the Book	Author	Publisher
1	Microbiology, <i>5th Edition, 2003.</i>	R. Stanier, J. Ingraham, M. Wheelis, P. Painter	Macmillan Press limited
2	Microbiology: An Introduction , <i>8th Edition, 2003.</i>	G. Tortora, B. Funke, C. Case	Benjamin-Cummings Publishing Company;
3	Fundamentals of Microbiology, <i>9th Ed.</i>	Frobisher, Hinsdill, Cabtree, Gooheart	Toppan Company, limited.
4	Microbiology, <i>5th Edition, 2003.</i>	M. Pelzar, E. Chan, N. Kriez	TATA McGraw Hill
9	Introduction to Microbiology, <i>2nd Edition, 2002.</i>	J. Ingrahm, C. Ingraham	Thomson Brooks/Cole
10	Foundations in Microbiology, <i>6th Edition, 2006.</i>	K. Talaro, A. Talaro	McGraw Hill Higher Education;)
11	Brock biology of Microorganisms, <i>10th Edition, 2003</i>	M. Madigan, J. Martinco, J. Parker	Prentice Hall
12	Advances in Biotechnology, <i>5th Edition, 2005.</i>	S. N. Jogdand	Himalaya Publishing House
13	Principles of Fermentation Technology <i>2nd Edition, 2003.</i>	P. Stanbury, A. Whitaker, S. Hall	Butterworth Heineman An An Imprint of Elsevier Science
14	Prescott & Dunn's Industrial Microbiology, <i>4th Edition,</i>	Gerald Reed	Cbs Publishers
15	Industrial Microbiology	L.E. Casida	John Wiley & Sons Inc

PAPER II

Unit-I Inheritance Pattern 30 Lecture

Topic	Sub-Topic	No of lectures
A. Chromosomal basis of inheritance, sex linkage and sex determination	1. Chromosome theory of inheritance 2. Sex chromosome 3. Sex linkage 4. X linked inheritance 5. Non disjunction 6. Gene and chromosome segregation in meiosis 7. Sex determination 8. Analysis of sex related traits in humans	10
B. Genetic Recombination	1. Mechanisms of Recombination – breakage and reunion, breakage & copying, complete copy choice. 2. Types of Recombination – General, Holliday model (strand breakage, strand pairing, strand invasion/assimilation, branch migration, Chiasma, breakage reunion, mismatch repair, gene conversion, site specific recombination)	10
C. Genetic Tools	1. Tetrad analysis, problems 2. Pedigree analysis, problems	05
D. Genetic mapping in eukaryotes	1. Discovery of genetic linkage 2. Crossing over 3. Mapping of chromosome using three point cross.	05

Unit-II Molecular Biology 30 Lecture

Topic	Sub-Topic	No. of lectures
A. Replication of DNA	1. Semiconservative mode of replication, Messelsons and Stahls experiment 2. Enzymology of DNA synthesis 3. Initiation, elongation, termination of replication Types of replication – Semi discontinuous, Rolling circle, Bidirectional, looped rolling circle. Replication in Eukaryotes.	10
B. Transcription	1. Initiation, elongation and termination 2. RNA polymerase in E. coli	10

	4. Genetics of Chlamydomonas 5. Mitochondrial DNA defects, maternal effects.	
D. Gene mutation	1. Detection of mutation in bacteria and viruses 2. Detection of mutation in Neurospora 3. Detection of mutation in Drosophila 4. Detection of mutation in Humans 5. Reverse mutations 6. Mutation rate	05

References

Sr. No	Title of the Book	Author	Publisher
1	Genetics, <i>3rd Edition, 2003</i>	Monroe W. Strickberger	Prentice Hall of India Private Limited
2	Microbial Genetics <i>2nd Edition, 2006.</i>	J Cronan, S. Maloy, D. Freifelder	Narosa Publishing House
3	Essential iGenetics, <i>2003.</i>	Peter J. Russell	Benjamin Cummings
4	Genetics <i>3rd Ed. 1966</i>	A.M. Winchester	Oxford & IBH Publishing Pvt. Ltd.
5	Introduction to Genetic analysis <i>8th Edition, 2005</i>	A.Griffith, S. Wessler, R. Lewontin	W H Freeman and Company
6	Principles of Genetics, <i>8th Edition, 2003.</i>	E Gardener, M. Simmons, D Snustad	John Wiley & Sons

PAPER III

Unit-I

Biochemistry

30 Lecture

Topic	Sub-Topic	No of lectures
A. Enzymes	i. Working of Enzymes ii. Concept of activation energy, transition state. iii. Concept of optimum conditions – pH, temperature, enzyme concentration & substrate concentration iv. Enzyme kinetics – Michaelis Menton equation, derivation, Lineweaver Burk equation, Haldane equation. v. Enzyme inhibition – competitive, noncompetitive, uncompetitive, mixed inhibition, feed back inhibition with suitable example.	10
B. Enzyme regulation	i. Enzyme regulation – allosteric enzymes ii. Isoenzymes with suitable examples iii. Concept of turnover number iv. Difference between synthase and synthetase	05
C. Bioenergetics	i. Laws of thermodynamics ii. Concept of enthalpy, Entropy iii. Free energy with relation to living system. iv. Standard free energy change and equilibrium constant v. Energy rich compounds – ATP as energy currency vi. Structure of ATP hydrolysis vii. Other energy rich compounds other than ATP.	05
D. Vitamins and Coenzymes	i. Vitamin A, D, E, K – structure, function ii. Water soluble vitamins – function and gross structure – thiamine, riboflavin, folic acid, pyridoxine, B-12, niacin, pantothenic acid, biotin, Vitamin C, lipoic acid.	10

Unit-II Metabolism 30 Lectures

Topic	Sub-Topic	No of lectures
A. Catabolism	1. Carbohydrates – Glycolysis, TCA, with energy yield and brief regulation. 2. Lipid – Digestion by GI enzymes and breakdown of triacylglyceride.; α, β, ω oxidation of fatty acids; odd and even fatty acid	10
B. Amino acid metabolism	1. Amino acids – decarboxylation, deamination (oxidative and non-oxidative), transamination with mechanism; 2. Urea cycle; fate of amino acids (Connection to TCA)	05
C. Oxidative and reductive phosphorylation	1. ETC –Concept of redox potential Electrochemical gradient 2. Electron flow from complexes I – V (in brief) 3. Inhibitors of ETC 4. Reductive TCA	05
D. Photophosphorylation	1. Photophosphorylation – photosystems, reaction centers, pigments, cyclic and non cyclic photophosphorylation, Z pathway 2. Comparison of oxidative and reductive phosphorylation	10

UNIT-III INSTRUMENTATION 30 LECTURE

TOPIC	SUBTOPIC	NO OF LECTURES
A. Chromatography	Principles of chromatography, column, paper chromatography, TLC with application.	10
B. Colorimeter	Beer Lambert's law, construction working and application of simple colorimeter	05

C. Microscope	Principle, working and applications of 1. Confocal microscope 2. Fluorescent microscope 3. TEM, SEM	05
D. Electrophoresis	1. Principle, factors involved in electrophoresis, types. 2. Types of electrophoresis – free, zone, paper, gel, PAGE 3. Application in biotechnology	10

References

Sr. No	Title of the Book	Author	Publisher
7	Biochemistry, 4th Edition, 1998.	Geoffrey Zubay	Wm. C Brown Publishers
8	Biochemistry, 3rd Edition, 2004.	Voet, Donald & Voet, Judith	John Wiley & Sons
9	Biochemistry: The Chemical Reactions of Living Cells. Vol-I, 2 nd Edition, 2006.	David E. Metzler, Carol Metzler	Academic Press An Imprint of Elsevier
10	Lippincotts Illustrated Reviews: Biochemistry, 2 nd Edition,	P. Champe, R. Harvey	Lippincott Williams & Wilkins
11	Lehninger Principles of Biochemistry 5 th Edition 2008	M. Cox, D. Nelson	W. H. Freeman & Company
12	Harper's Illustrated Biochemistry, 26 th Edition, 2003.	R. Murray, D. Granner, P. Mayes, V. Rodwell	Mc Graw Hill
13	Biochemistry, 4 th Edition, 2003.	M. Campbell, S Fareeell	Thomson Brooks/Cole
14	Fundamentals of Analytical Chemistry 8 th Edition, 2004.	D. Skoog, D. West, F. Holler, S. Crouch	Thomson Brooks/Cole
15	A biologist's guide to principles and techniques of practical biochemistry	Wilson and Williams.	
16	Principles of Biochemistry,	David Rawn, Gray	Prentice Hall

	4 th Edition 2005.	Scrimgeour, Laurence Moran	
18	Biochemistry, 5 th Edition, 2003.	J. Berg, J. Tymoczko, L. Stryer	W. H. Freeman & Company

Practicals

List of Practical based on Paper I

1. Qualitative and quantitative analysis of air flora by solid impaction method.
2. Sterilization and sanitization effect of UV radiation.
3. Study Winogradsky's column
4. Routine analysis of potable water
5. Analysis of raw and treated sewage
6. Enrichment of *Clostridia*, *Streptococci faecalis*.
7. Determination of soil pH
8. Contact Slide method
9. Isolation of *Rhizobium* from root nodules
10. Isolation of *Azotobacter*
11. Isolation of nitrifying organism.
12. Study of blue green algae
13. Growth curve by Optical density

List of Practical based on Paper II

1. Pedigree analysis
2. Karyotype analysis
3. Study of *Drosophila* for mutation
4. Gradient plate technique
5. Isolation of antibiotic resistant mutants by replica plate technique.
6. Problems on gene mapping
7. Isolation of genomic DNA
8. Isolation of plasmid (extra chromosomal)-AGE-demonstration
9. Polyacrylamide gel electrophoresis. -demonstration

List of Practical based on Paper III

1. Study of Beer and Lambert's law and absorption maxima
2. Standard curve using glucose by DNSA.
3. Enzyme kinetics- Amylase: pH, Temp. , substrate conc., enzyme conc., and effect of inhibitor (copper sulphate)
4. Extraction and separation of plant pigment by paper chromatography
5. Hill reaction
6. Study of Absorption spectrum of plant pigment
7. Chromatography of amino acids and sugars
8. TLC of fatty acids.
9. Estimation of Vitamin C by iodometry

TERM I AND II

Paper	Unit	Term I	Term II
Paper I	I	A, B1,2,3	B3,C
	II		
	III		
Paper II	I	A, B	C,D
	II	A, B	C, D
	III	A, D	B, C
Paper III	I	A, D	B, C
	II	A,B	C,D
	III	A,B	C,D
		A,B	C,D

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