Shivaji University,Kolhapur

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Accredited By NAAC with 'A' Grade

CHOICE BASED CREDIT SYSTEM SYLLABUS

Syllabus For

Bachelor of Science

Part – II (Sem. III & IV)

BIOTECHNOLOGY (Optional)

(To be implemented from June, 2019 onwards)

17-C:- Biophysics and enzyme technology (Semester-III)

18-C:- Molecular Biology (Semester-III)

17-D:- Immunology (Semester-IV)

18-D:- r-DNA technology Paper-IV (Semester-IV)

Shivaji University, Kolhapur
CBCS Syllabus For Bachelor of Science Part – II : Biotechnology

1. TITLE : Biotechnology

2. YEAR OF IMPLEMENTATION:- CBCS Syllabus will be implemented from June, 2019 onwards

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3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students at second year of three years of B.Sc. degree course. Students learn Biotechnology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Biotechnology popular, interesting and encouraging to the students for higher studies including research.

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.

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

The credits of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE / PAPER:

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in Biotechnology.
3) To expose the students to various emerging areas of Biotechnology.
4) To prepare students for further studies, helping in their bright career in the subject.
5) To expose the students to different processes used in industries and in research field.
6) To prepare the students to accept the challenges in life sciences.
7) To develop skills required in various industries, research labs and in the field of human health.

5. DURATION

• The course shall be three year full time course.

6. PATTERN:-

Pattern of theory Examination will be Semester. Practical examination will be annual

7. MEDIUM OF INSTRUCTION:
The medium of instruction shall be English.

8. STRUCTURE OF COURSE-

Semester –III
(Marks -50 for each paper) **Total credits : -04**

Paper- III DSC -17-C: Biophysics and enzyme technology Credit – 2 (30 hrs.)
Paper- IV DSC -18-C : Molecular Biology Credit – 2 (30 hrs.)

Semester – IV
(Marks -50 for each paper) **Total credits : -04**

Paper- V DSC -17-D: Immunology - Credit – 2 (30 hrs.)
Paper- VI DSC -18-D: r-DNA technology -Credit – 2 (30 hrs.)

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3) OTHER FEATURES :
(A) LIBRARY :
Reference and Text Books, Journals and Periodicals, Reference Books. – List Attached
(B) LABORATORY SAFETY EQUIPMENTS :
1) Fire extinguisher
2) First aid kit
3) Fumigation chamber
4) Stabilized power supply
5) Insulated wiring for electric supply.
6) Good valves & regulators for gas supply.
7) Operational manuals for instruments.
8) Emergency exits.

CBCS Syllabus for the B.Sc- I Biotechnology Optional / Vocational to be implemented from June, 2017.

THIRD SEMESTER------ (No of Papers- II)

CORE COURSE	Paper No. and Title of Paper	MARKS
17-C	PAPER- V :- Biophysics and enzyme technology	50 Marks
18-C	PAPER- VI :- Molecular Biology	50 Marks

FOURTH SEMESTER------ (No of Papers- II)

CORE COURSE	Paper No. and Title of Paper	MARKS
17-D	PAPER-VII:- Immunology	50 Marks
18-D	PAPER-VIII- r-DNA technology	50 Marks

	Practical	
I	Lab. exercises in Enzymology & Molecular Biology	MARKS-100
II	Lab . exercises in Immunology & r-DNA technology	

Note: - Practical Examination will be conducted Annually

	Semester III **Paper-V: Biophysics and enzyme technology**	
	Credit -1	
	1.1Enzyme- Definition 1.2 IUB Classification of Enzymes. 1.3 Active site of enzyme, Mechanism of action of enzyme -Lock and Key hypothesis , Induced-fit hypothesis. 1.4 Factors affecting enzyme activity – Temperature, pH, Substrate concentration, inhibitors, enzyme concentration, Activators. 1.5 Structure and function of Isozyme. 1.6 Concept of steady state kinetics, 1.7 Concept of activation energy 1.8 Derivation of Km., Significance of Km and Vmax Determination of km by Lineweaver Burk plot and Eadie Hofstee plot. 1.9 Allosteric enzymes – Definition, properties, models explaining mechanism of action – Sequential model, Symmetry Model. 2.0 Regulation of enzyme activity- Irreversible changes in covalent structure of enzyme, Reversible changes in covalent structure of enzyme, Feed back or end product inhibition.	15
	Credit -2	
	2.1Spectroscopy :- Principle, working and applications of- a) Principle, working and applications of-Florescence spectroscopy b) Principle, working and applications of-Infra red spectroscopy c) Principle, working and applications of-Atomic absorption spectroscopy 2.2 concept of immobilization 2.3 Advantages of immobilization 2.4 Disadvantages of immobilization 2.5 Methods of immobilization 1. Physical adsorption 2. Covalent bonding 3. Cross-linking 4. Entrapment 5. Encapsulation 2.6 Applications of immobilized enzyme. 2.7 Biosensor-Types & applications	15

References

1. Fundamentals of Biochemistry -J.L. Jain
2. Biophysics -Daniel
3. Biophysics - NathUpadhyay
4. Enzyme structure and function - Dixon
5. Biotechnology - R.C. Dubey
6. Enzymes – Trevar Palmer
7. Biochemistry- U. Satynarayanan
8. Principles and Techniques in Biochemistry and Molecular Biology-Willson & Walker
9. Bioinstrumentation- L.Veerakumari
10. Principles of Biochemistry-Albert L.Lehninger

Semester III Paper-VI : Molecular Biology	Lectures
Credit-I	**30**
1.1Central dogma of life 1.2.Structural organization of prokaryotic and eukaryotic gene 1. 3 DNA replication-2.1Semi conservative model of replication (Meselson &.Stahl Expt.) 1.4 Prerequisites of replication- Enzymes involved in replication and their action, template DNA, Deoxyribonucleotides, primer 1.5 DNA replication in prokaryotes:-Initiation , elongation and termination and Rolling circle model & θ- model of replication. 1.6 DNA replication in eukaryotes – Initiation, elongation and termination. 1.7 Genetic code and its properties 1.8. Operon model - Lactose operon, Structure and role of Lac repressor and inducer. 1.9. Mutation- Definition, Types-spontaneous & induced mutation, missense, nonsense, insertion, deletion, frame-shift mutations. Mechanism of mutagenesis. 2.0 A. DNA damage by UV B. DNA Repair - a) Photoreactivation b) Excision Repair- Base excision and nucleotide excision repair c) SOS Repair system d) Mismatch repair	15
Credit II	
2.1 Transcription- a) Transcription in prokaryotes:-Initiation, elongation and termination. Post transcriptional processing - folding, modification of bases, removal of non-functioning sequences. b)Transcription in eukaryotes- Initiation, elongation & termination, post-transcriptional modifications/ processing. 2.2 Translation a) Translation in prokaryotes:- Activation of amino acids, initiation, elongation and termination. b)Translation in eukaryotes:- Activation of amino acids, initiation, elongation and termination, Post-translational modifications. 2.3Insertion elements and transposons- Properties and uses. 2.4Modes of gene transfer in bacteria – a)Transformation b)Transduction c)Conjugation	15

References:-
1) Molecular biology -Watson
2) Genetics -Strickbeger
3) Molecular Biology -Glickpastornack
4) Molecular Biology- Geralad Carph
5) Cell Biology - DeRobertis
6) Gene – Levin
7) Principles of Biochemistry-Albert L.Lehninger

Topic No.	Semester IV Paper –VII : Immunology	Lectures 30
	Credit- I	
1.	1.1 Introduction 1.2 Types of immunity- i) Innate - types, factors influencing innate immunity ii) Acquired - Active and Passive 1.3 Types of Defense- A) Nonspecific- a) First line of defense - physical and chemical barriers b) Second line of defense - chemical and biological barriers B) Specific - a) Third line of defense -specific defense mechanism 1.4 Organs of immune system-primary and secondary lymphoid organs - structure and their role 1.5 cells of immune system-monocytes and macrophages, granulocytes, mast cells, dendritic cells, NK cells, B and T lymphocytes and types	**15**
	Credit-II	
2.	2.1 Antigen- definition, nature, types of antigen, factors affecting on antigenicity 2.2 Antibody-definition, chemical nature, basic structure of immunoglobulin, major human immunoglobulin classes (their properties and functions), theories of antibody production. 2.3Immune response -Primary and secondary immune Response 2.4 Antigen - Antibody reactions-Principle, mechanism and applications of - a) Agglutination b) Precipitation c) Complement fixation d) ELISA e) Fluorescent antibody test 2.5 Hypersensitivity – definition, types – a) Immediate - Anaphylaxis b) Delayed – homograft rejection	**15**

References:

1. "Essential Immunology"-11th edition- Delves, Martin, Burton & Roitt
2. "Immunology"-6th edition-Kuby , Kindt, Goldsby & Osborne
3. ''Immunology and Serology''- Ashim Chakravar
4. Immunology-An Introduction - 4th edition-Tizzard
5. Essentials of Immunology- S.K.Gupta
6. Immunology- M.P.Arora

	Semester IV **Paper –VIII : r-DNA technology**	Lectures 30
	Credit I	
	1.1.Isolation and purification of nucleic acids-DNA, RNA and plasmids 1.2.Methods of purification of DNA-Electro-elution from the gel, Agarose gel electrophoresis, PAGE 1.3.Probes-Preparation, Labelling and Applications 1.4. Introduction to r-DNA technology-Restriction enzymes (Exonuclease and Endonuclease) and their types. 1.5 Enzymes to modify ends of DNA-Alkaline phosphatase,S1 nuclease, DNA ligase Terminal transferase, Adaptors, Linkers 1.6.Cloning vectors-Plasmids(pBR 322 and pUC18), Bacteriophages- λ phage vector –(λ insertional e.g λgt 10) cosmids, phagemids (e.g pBlue script II KS/SK), Animal vectors(Retroviral), Plant vectors(Ti plasmid) Shuttle vectors (e.g pJBD 219) 1.7. Construction of c-DNA and genomic library	15
	Credit II	
	2.1. Techniques in r-DNA technology a) Blotting techniques-Southern, Northern , Western blotting techniques b) PCR-Types(RT-PCR, real time PCR, touch down PCR, hot start PCR, colony PCR) and applications c) DNA sequencing techniques- i)Maxam and Gilbert's method ii) Sanger's method iii)Automated DNA sequencing 2.2. Selection of transformed cells-Replica plate technique, colony hybridization, Hybrid arrested translation and Hybrid selection translation. 2.3 Applications of r-DNA technology a) Novel protein generation- r-Insulin b) r-Vaccines- r-vector vaccines 2.4. Safety measures and biological risk for r-DNA work –Hazards in genetic engineering. 2.5. Gene Silencing- Introduction, Principle of Si-RNA and Si- RNA technology	15

References-

1 .Biotechnology-U.Satyanarayan
2. Biotechnology-R.C.Dubey
3. Gene Technology-S.N.Jogdand
4. Immunology- Kuby
5. Introduction to Biotechnology- B.D.Singh
6. Principle of gene manipulation- Old and Primrose
7. Genome by T.A. Brown
8. Fundamentals of Biotechnology- H.S.Chawala

Laboratory exercise

Sr. No	Name of Practical
	Techniques in Enzymology
1	Amylase assay by DNSA method (Major)
2	Effect of pH on amylase (Major)
3	Effect of temperature on amylase (Major)
4	Effect of inhibitor on amylase ($HgCl_2$) (Minor)
5	Effect of activator on amylase (NaCl) (Minor)
	Techniques in Molecular Biology
1	UV survival curve (Major)
2	Isolation of lac negative mutants of *E.coli* by visual detection method.(Major)
3	Subcellular fractionation of mitochondria, nucleus (Major)
	Techniques in Immunology
1	Dot ELISA test (Minor)
2	Qualitative & Quantitative Widal test (Major)
3	Radial immunodiffusion-Single & double diffusion (Major)
4	RPR test (Minor)
	Techniques in r-DNA technology
1	Isolation of chromosomal DNA from bacteria (Major)
2	Isolation of plasmid DNA(Major)
3	Resriction digestion (Major)
4	Separation of plasmid DNA by Agarose Gel electrophoresis (Minor)
5	Ligation(Minor)
6	DNA sequencing by analysis of autoradiogram (Minor)

(Note:-Practical examination will be Annual)

Books recommended for Practicals-

References

1. Laboratory manual in Biochemistry- J. Jayraman.
2. Practical Biochemistry- David T. Plummer.

Nature of Practical Question paper 100M

Q.1 Major experiment	20M
Q.2 Minor experiment	15M
Q.3 Major experiment	20M
Q.4 Minor experiment	15M
Q.5 Spotting- A,B,C,D.E	10M
Q.6 Journal	10M
Q.7 Viva	10M

List of minimum equipments-

1) Hot air oven - 1
2) Incubator - 1
3) Autoclave - 1
4) Refrigerator - 1
5) Medical microscopes - 10 nos. for one batch
6) Chemical balance - 2
7) pH meter - 1
8) Cooling Centrifuge - 1
9) Colorimeter - 1
10) Distilled Water Plant - 1
11) Laminar air flow cabinet - 1
12) Colony counter - 1
13) Water bath - 1
14) Arrangements for gas supply and fitting of two burners per table.
15) One working table of 6' x 2½' for two students.
16) One separate sterilization room attach to the laboratory (10' x 15')
17) At least one wash basin for a group of five students
18) One separate instrument room attached to lab (10' x 15')
19) One laboratory for one batch including working tables (6' x 2½') per two students for one batch
20) Store room (10' x 15')
21) Electrophoresis assembly
22) UV transilluminator
23) Micropipettes (0.5-10 µl, 2-20 µl, 5-10 µl , 200-1000 µl)

Practical Examination

(A) The practical examination will be conducted on two consecutive days for four hours per day per batch of the practical examination.
(B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the year. Candidates must produce their journals at the time of practical examinations.

Note:- At least 80% Practicals should be covered in practical examination.