Department of Biotechnology(Optional)

B.Sc. Part II

Semester III & IV

Semester	Paper No.	Course code	Course title	No. of Credits
III	III	DSC-1009C	Enzyme Technology	4
			Molecular Biology	
IV	IV	DSC-1009D	Immunology	4
			rDNA Technology	

CBCS Syllabus to be implemented from June 2019 onwards

HEAD
DEPARTMENT OF BIOTECHNOLOGY (OPTIONAL)
VIVEKANAND COLLEGE, KOLHAPUR
(AUTONOMOUS)

VIVEKANAND COLLEGE ESTD. JUNE 1964 KOLHAPUR-416

CHOICE BASED CREDIT SYSTEM SYLLABUS
For Bachelor of Science Part - II
BIOTECHNOLOGY (Optional)

1. TITLE: Biotechnology-Optional

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

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students at first year of three years of B.Sc. degree course. Students learn Biotechnology as a separate subject from B.Sc. II. 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 units 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 it's 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.

3) OTHER FEATURES:

(A) LIBRARY:

Reference and Text Books, Journals and Periodicals, Reference Books – List Attached

(B) LABORATORY SAFETY EQUIPMENT:

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.

- **Guidelines shall be as per B. Sc. Regular Program.**
- **Rules and Regulations shall be as per B. Sc. Regular Program except CBCS BSc. II Structure of Program and List of Courses.**
- **Preamble :**

  This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students of B. Sc. Biotechnology Optional Program.
- **The goal of the syllabus is to make the study of Biotechnology popular, Interesting and encouraging students for higher studies including Research.**
- **Structure of Program and List of Courses are as follows:**

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Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)
Department of Biotechnology Optional
The academic year 2019-20
B.Sc. II Biotechnology Optional
COS for Semester III And IV

Semester	Course outcomes
Semester III	
Paper-III	DSC-1009C Enzyme Technology and Molecular Biology
	CO1: Enzyme Technology deals with the study of the detailed structure & and function of Enzymes. The course will allow an understanding the following concepts; IUB classification and Steady-state kinetics. Students can understand the effect of various factors on enzyme activity. CO2: Students are gaining knowledge regarding various methods in industries used for enzyme and cell immobilization. After completion of this course students will understand the use of biosensors in daily life. CO3: Molecular Biology gives knowledge about structure and function of the macromolecules, essential to life. of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms. CO4: After completion of this course students will understand the following techniques; a) Gel Electrophoresis b) Blotting Techniques c) Polymerase Chain Reaction
Semester IV	
Paper-IV	DSC-1009D Immunology and rDNA technology
	CO1: The course discusses basic immunology including cellular and molecular processes that represents the human immune system. CO2: This subject offers detailed study of following concepts; a) Immunological processes at a cellular and molecular level b) Defense mechanism (Physico-chemical barriers) c) Innate & Acquired Immunity d) Antigen & Antibody (Reactions) e) Hypersensitivity. CO3: In r-DNA technology By virtue of this technology, crucial proteins required for health problems and dietary purposes can be produced safely, affordably, and sufficiently. CO4: After completion of this course students will understand following Concepts; a) Restriction Digestion b) Ligation c) Plasmid Construction d) Gene Transfer Methods e) Recombinant Insulin f) Recombinant Vaccines

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	Semester III Paper III- Enzyme Technology &Molecular Biology	Lectures
1.	**Credit I** **Enzyme-** Definition, IUB Classification of Enzymes. Active site of enzyme, Mechanism of action of enzyme -Lock and Key hypothesis , Induced-fit hypothesis. Factors affecting enzyme activity – Temperature, pH, Substrate concentration, enzyme concentration. Structure and function of Isozyme. Concept of steady state kinetics, Concept of activation energy Derivation of Km. Determination of km by Lineweaver Burk plot and Eadie Hofstee plot. Allosteric enzymes – Definition, properties, models explaining mechanism of action – Sequential model, Symmetry Model. Regulation of enzyme activity- Irreversible changes in covalent structure of enzyme, Reversible changes in covalent structure of enzyme, (competitive inhibition, Non-competitive, Un-competitive inhibition) Feed back or end product inhibition.	15
	Credit II	
2.	**Biosensors-** Definition , Components,Features. Types-1)Enzyme electrodes (glucose oxidase) 2)Bacterial Electrodes/Cell Based Electrodes 3)Enzyme Immuno sensors 4)Environmental Biosensor Bioreports **concept of immobilization** Properties of immobilized Enzymes Advantages of immobilization Disadvantages of immobilization Methods of immobilization 1. Physical adsorption 2. Covalent bonding 3. Cross linking 4. Entrapment 5. Encapsulation Applications of immobilized enzyme.	15
	Section II	
	Credit III	15

3.	Historical and conceptual background Structure of DNA, RNA & Protein. Structure of prokaryotic and eukaryotic genome DNA replication in prokaryotes:- Rolling circle model & θ- model of replication. DNA replication in eukaryotes - Mechanism of replication, Inhibitors of replication Genetic code and its properties Transcription- a) Transcription in Prokaryotes: -Initiation, elongation and termination. b)Transcription in eukaryotes- Initiation, elongation & termination, Post - transcriptional modification. c) Inhibitors of transcription.	
	Credit IV	
4.	Translation in Eukaryotes: - Activation of amino acids, initiation, elongation and termination, Post-translational modification. Inhibitors of translation. Gene regulation and Expression in Prokaryotes & eukaryotes. Operon model - Lactose operon, Structure and role of Lac repressor and inducer. DNA Damage & Repair Mechanisms-DNA damage- physical, chemical & biological. DNA Repair Mechanisms- a) Photoreactivation b) Excision Repair- Base excision and nucleotide excision repair. c)SOS Repair system	15

References:

[Enzyme Technology]

1. Fundamentals of Biochemistry -J.L. Jain
2. Enzyme technology - S. Shanmugam and T. Sathishkumar
3. Biotechnology - R.C. Dubey
4. Enzymes – Trevar Palmer
5. Biochemistry- U. Satynarayanan
6. Bioinstrumentation- L. Veerakumari

[Molecular Biology]

1) Molecular biology -Watson
2) Genetics -Strickbeger
3) Molecular Biology -Glickpastornack
4) Molecular Biology- Geralad Carph
5) Cell Biology - DeRobertis

Semester IV

	Paper IV -Immunology & rDNA technology	Lecture 45
	Credit I	
1.	Introduction 1.2. Types of immunity- i) Innate immunity - Types, Factors influencing innate immunity ii) Acquired immunity - Active and Passive 1.3. Types of Defense – A) Nonspecific - a) First line of defense- (Physico-chemical barriers) b)Second line of defense- (phagocytes and mechanism of phagocytosis) B) Specific defense mechanism-Third line of defense 2.1. Organs of immune system-Structure and role of primary and secondary lymphoid organs. 2.2. Cells of immune system- monocytes and macrophages, granulocytes, mast cells,dentritic cells, NK cells, B and T lymphocytes.	15
	Credit II	15
	4.1. Antigen- definition , chemical l nature, types of antigen, factors affecting antigenicity. Antibodies- defination,chemical nature,basic structure of immunoglobulin,properties and functions of major human immunoglobulin classes, theories of antibody production. 4.2.Immune response-Primary and secondary immune response 4.3.Antigen-antibody reactions-Principle, mechanism and applications of- a) Agglutination b) Precipitation c) Complement fixation d)ELISA (Sandwich) 4.4. Hypersensitivity- definition, types Immediate hypersensitivity – Anaphylaxis Delayed hypersensitivity – Homograft rejection	
	Section II	
	Credit III	15
	1.3. Introduction to r-DNA technology:- 1.4. A)Nucleases (Types & Uses),	

	B)Restriction Enzymes-Types (I ,II,III,), Recognition sequences, cleavage patterns. 1.4. Enzymes to modify ends of DNA – Alkaline phosphatase, S1 nuclease ,DNA ligase Terminal transferase Adaptors, Linkers. 1.5. Cloning vectors:- Plasmids(Pbr322,pUC18), Bacteriophages(λphage), cosmids, phagemids(pEMBL8), Animal vectors, Plant vectors(Ti & Ri), Shuttle vectors(YAC & BAC). Construction of c-DNA and genomic library	
	Credit IV	15
	Techniques in r-DNA technology A) Probes- Preparation , Labeling and Applications B) Blotting techniques :- a)Southern Blotting, b)Northern Blotting, c) Western Blotting . C) PCR- concept , types(Reverse Transcriptase-PCR, Real time PCR, Nested PCR, Hot start PCR, Multiplex PCR, Colony PCR), applications. D) DNA sequencing techniques- a) Maxam and Gilbert's method b) Sanger's method c)Automated Sequencing Selection of transformed cells:- Colony hybridization, immunological screening, Blue-White Screening, Insertional inactivation. Applications of gene cloning 1)Production of r-Insulin 2)Production of r-Somatostatin Safety measures and biological risk for r-DNA work -Hazards in genetic engineering.	
	References: **[Immunology]** 1. Essential Immunology- Riott 2. Immunology- Kuby 3. General Microbiology- Stanier 4. Immunology An Introduction –Tizzard 4th Edition 5. Medical Bacteriology – Dey & Dey 6. Immunology & Serology – Ashim Chakravar **[rDNA Technology]** 1. Biotechnology -U. Satynarayan 2. Biotechnology - R.C. Dubey 3. Gene technology- S.N.Jogdand 4. Fundamentals of Biotechnology- H.S.Chawala 5. Introduction to Biotechnology- B.D.Singh 6. Principle of gene manipulation- Old and Primrose 7. Genome by T.A. Brown	

Sr. No.	Name of Practical	Practicals
	Techniques In (Molecular Biology rDNA Technology)	
1	Isolation of Genomic DNA from Bacteria	2
2	Isolation of Plasmid DNA from Bacteria	2
3	Separation of plasmid DNA by Gel Electrophoresis	1
4	Restriction Digestion of DNA	2
5	Ligation of DNA	2
6	Demonstration of DNA amplification by PCR.	1
7	DNA sequencing by Analysis of Autoradiogram.	1
	Techniques In (Enzymology)	
8	Amylase Assay	2
9	Effect of Temperature on Amylase Assay	2
10	Effect of Activator on Invertase	1
11	Effect of Inhibitor on Invertase	1
12	Determination of nitrate reductase activity from Plant Material	1
13	Separation of amino acid from mixture by Thin Layer Chromatography	1
14	Separation Macro & Micro molecules by Dialysis	1
15	Isolation of Mitochondria/Nucleus from goat Liver.	2
16	Estimation of Fructose by Resorcinol method	1
	Techniques In (Immunology)	
17	Dot ELISA	1
18	Quantitative Widal test	2
19	Radial Immuno Diffusion Assay	2
20	Rapid Plasma Reagan test	1
21	Measurement of Cell Size by Micrometry	1

List of minimum equipment's-for Biotechnology

1) Hot air oven - 1
2) Incubator - 1
3) Autoclave - 1
4) Refrigerator - 1
5) Students microscopes (oil immersion) - 10 nos. for one batch
6) Digital balance - 2
7) pH meter - 1
8) 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')

Practical Examination

(A) The practical examination will be conducted on two consecutive days for three 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 online 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 90% Practical's should be covered in practical examination.

SCHEME OF MARKING FOR (THEORY)

Sem	Core Course	Marks	Evaluation	Sections	Answer Books	Standard of passing
1	DSC-1009C	80	Semester wise	Two sections, each of 40 marks	As per instruction	35% (28 marks)
2	DSC-1009D	80	Semester wise	Two sections, each of 40 marks	As per instruction	35% (28 marks)

SCHEME OF MARKING (CIE) Continues Internal Evaluation

Sem	Core Course	Marks	Evaluation	Sections	Answer Books	Standard of passing
1	DSC-1009C	20	Semester wise	One	As per instruction	35% (7marks)
2	DSC-1009D	20	Semester wise	One	As per instruction	35% (7marks)

SCHEME OF MARKING (PRACTICAL)

Sem	Course	Marks	Evaluation	Section	Standard of passing
III & IV	DSC 1009C & DSC 1009D	100	Annual	As per instruction	35% (35marks)

*Separate passing is mandatory

Nature of Question Paper (Theory)

SECTION I

Instructions

1. All the questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat labeled diagram wherever necessary.

Time: 2 Hrs **Total Marks: 40**

Q. 1. Rewrite the sentences by selecting correct alternative from the following. **(8 Marks)**

i.)

a) b) c) d)

As above (i) to (viii.)

Q. 2. Attempt any two. **(16 Marks)**

i.

ii.

iii..

Q. 3. Attempt any four. **(16 Marks)**

i.

ii.

iii..

iv.

v.

vi.

SECTION II

(Same as above)

PRACTICAL EXAMINATION

First day

Q.1 Major Experiment 20
Q.2 Minor Experiment 10
Q.3 Spotting 10
Q.4 Viva-voce 10

Second day

Q.5 Major Experiment 20
Q.6 Minor Experiment 10
Q.7 Minor Experiment 10
Q.8 Journal 10

TOTAL **100 marks**

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