Semester wise Syllabus

For

Postgraduates

CBCS Pattern

Session

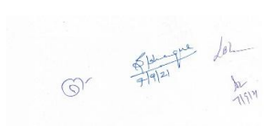
2018-20

M.Sc. Biotechnology

S. S. In Zoology & Biotechnology

Vikram University,

Ujjain



Preamble

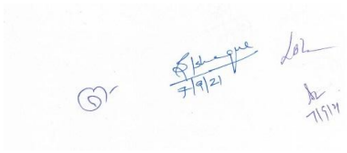
Biotechnology has grown, extensively in last couple of decades. This advanced 'interdisciplinary' life science branch has a tremendous networking potential with modern cutting edge technology. This has given it a separate status in fundamental research as well as in modern industrial enterprise. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. In the milieu of research and industrialization for economic development and social change, biotechnology is an ideal platform to work.

The interdisciplinary nature of biotechnology flags involves many fundamental research fields from cell biology to molecular biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology and to biodiversity, from microbiology to bioprocess engineering, from bioremediation to In silco drug discovery and so on. The proposed credit-based curriculum and grading system will even add much more to the existing interdisciplinary nature of biotechnology and will also offer many courses to the other branches of life science. The generative power of biological data is effectively harnessed by biotechnology like no other field. The relevance and application of these studies on living organisms and their bioprocesses is extensively covered in this field with the help of technology.

Economic and social renaissance is staged on biotechnology especially, since it's biomedical and cutting edge technological applications are tremendously powerful in shaping this century and exciting biofuture. Life science, IT industries and research institutes are always on a lookout for trained Biotechnologists as an efficient work force in fundamental research and industries. Education and research sectors require such interdisciplinary trained workforce to develop future generations of science leaders.

Introduction:

Master's in Biotechnology course syllabus is revised to cater to the needs of credit based semester and grading system. The changing scenario of higher education in India and abroad is taken into consideration to make this syllabus more oriented towards current need of modern research and industrial sectors. The syllabus encompasses the fundamental academics at one end and latest technologies in life science at the other. Theory courses will help students develop their knowledge sets on various topics of biotechnology, to which, they are introduced at the undergraduate level. Extensive practical courses are designed to supplement the theory courses with hands on experimentation in wet-lab and on fields.



Nature and extent of the M.Sc. degree Programme in Biotechnology:

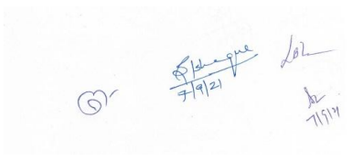
M.Sc. Biotechnology (CBCS) is introduced under the faculty of Biological Sciences. The course is designed to provide wider career options and increased employability of the students. In CBCS, the major change is a shift from the traditional marking system to a grading system. It provides an opportunity for the students to choose from the prescribed courses comprising core, elective (generic and discipline specific) or skill based courses according to their learning needs, interests, and aptitude.

Aim of the Programme :

Biotechnology is an interdisciplinary course that involves use of biological systems in product development. The principal aim of this program is to introduce the students to classical and modern concepts in biology and its applications in research. This program provides a hands on basic and comprehensive grounding in multidisciplinary science of modern and classical biomedical science. The most unique feature in M.Sc. Biotechnology is the year long project work/dissertation that a student can undertake from the fourth semester along with course-work. This final semester is dedicated to the project work. The project work provides a strong foundation for a career in innovation and advanced research competency.

Programme Learning Outcomes:

The Postgraduate Program in Biotechnology (M.Sc. Biotechnology) is a four-semester course spread over the period of two years. It is designed to offer in depth knowledge of the subject starting from its basic concepts of biotechnology. In the first semester, the prime focus is on providing the students a thorough foundation in the basic subjects. In the following semesters, students are trained in cutting edge areas of Biotechnology including Genetic Engineering, Bioprocess Engineering and animal and plant Biotechnology. Students are also provided extensive laboratory training on the course content and the current requirements of industries as well as research and development sectors. The curriculum also covers high end instrumental methods which enable the students to understand major qualitative and quantitative measurements and protocols which can facilitate the student to opt for research areas in field of life science programmes.In the final semester every student has to undertake a dissertation project, which is essential for strengthening the hands on skill and analytical thinking in designing and solving a problem relevant to modern biology.



Programme Specific Objectives:

- To develop strong student competencies in biotechnology and its applications in a technology-rich, interactive environment.
- To develop strong student skills in research, analysis and interpretation of problems and information relevant to modern biology.

- To prepare the students to successfully compete for employment in biotechnology based research and development sectors, industrial sectors and teaching, and to offer a wide range of experience in research methods, data analysis to meet the industrial needs.

Duration of the course

M.Sc. Biotechnology will be a full time two year program to be covered in 4 semesters each of six months duration. The first year of the program will complete the first and second semester and the final year will complete third and fourth semester.

Admission to the course

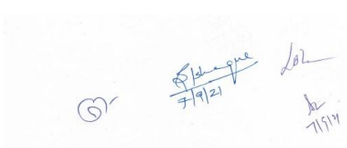
The number of seats shall be in accordance with directives by the university. A candidate after having graduation with at least 55% marks from a recognized university with a subject of life science shall be eligible for admission to the course. The admission to the course will be on basis of merit and according to guidelines from university and government of Madhya Pradesh. After the term end examination at the end of each semester the students will be provisionally admitted to next semester. Each semester will be followed by a break not exceeding 15 days.

Continuous evaluation

During the semester a teacher offering the course will do the continuous evolution of the students at three points of time by conducting three tests of 20 marks each. Of these, two must be written tests and third may be written test/quiz/seminar/assignment for theoretical courses. Marks obtained in two best tests out of three will be awarded to the students.

Attendance

Students who have less than 75% attendance will not be allowed to appear in the end semester examination and will be declared as fail in that semester.

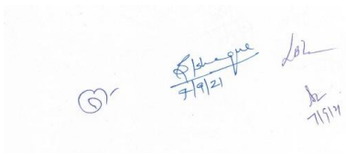


Tuition fees

The admitted candidate shall pay the course fee in addition to tuition fee and such other fees as prescribed by the university.

End semester Examination

There shall be end semester examination at the end of first, second, third semester, fourth, semesters respectively. The semester examination will be conducted every year normally in December and June or on the dates declared by the academic calendar of the university. A student proceeding to appear in end semester examination should submit his/her application through head of the department on prescribed form along with required examination fees etc. to the registrar of the university. Each student has to appear in the end semester examination otherwise will be awarded “Ab” grade in the course. The scheme of marks for evaluating the various components of the dissertation will be followed as per given the syllabus.

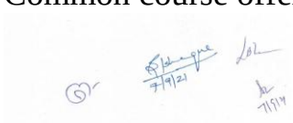


School of Studies in Zoology & Biotechnology
Vikram University, Ujjain
Biotechnology Sem-I

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2018-20 Academic session

M.Sc. Biotechnology Semester I						
Course Code	Title of course	Course Type	Marks			
			Internal Examination Marks	University Examination Marks	Total Marks	Credits
BT PG 101	Paper 1: Cell and Molecular Biology	Core	40	60	100	12
BT PG 102	Paper2: Immunology and Molecular Diagnostics	Core	40	60	100	5
BT PG 103	Paper 3:Molecular Endocrinology and Reproductive Technology	Core	40	60	100	5
BT PG 104 **BT PG 105**	Paper 4:Microbiology Or Biostatistics, Biodiversity and wild life	*Generic Elective	40	60	100	5
ED 106	Entrepreneurship Development	*Skill Development course	30	50	80	4
BT PG 107	Practical Based on theory papers	Core	16	24	40	2
BT PG 108	Comprehensive viva-Voce (Virtual Credits)	Core			80	4
	Total Marks		206	394	600	30

Any 01 out of 02 Elective can be opt
Elective papers shall be taught only if faculty is available
Common course offered by University

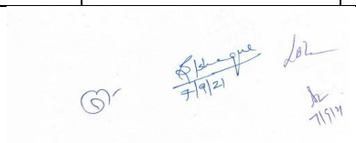


Revised Syllabus only for SS in Zoology & Biotechnology for 2018-20 Session

School of Studies in Zoology & Biotechnology
Vikram University, Ujjain
Biotechnology Sem-II

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2018-20 Academic session

M.Sc. Biotechnology Semester II						
Course Code	Title of course	Course Type	Marks			
			Internal Examination Marks	University Examination Marks	Total Marks	Credits
BT PG 201	Paper 1: Enzyme Technology	Core	40	60	100	12
BT PG 202	Paper2: Environmental Biotechnology	Core	40	60	100	5
BT PG 203	Paper 3: Biomolecules and Metabolism	Core	40	60	100	5
BT PG 204 **BT PG 205**	Paper 4:Bioinstrumentation Or Molecular Cell Biology and Genetics	*Generic Elective	40	60	100	5
CS 206	Communication Skills	*Skill Development course	30	50	80	4
BT PG 207	Practical Based on theory papers/Field work/MOOC/Skill Development	Core	16	24	40	2
BT PG 208	Comprehensive viva-Voce (Virtual Credits)	Core			80	4
	Total Marks		206	394	600	30



Revised Syllabus only for SS in Zoology & Biotechnology for 2018-20 Session

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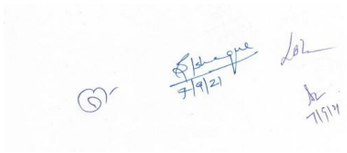
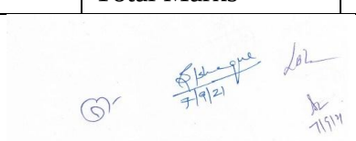
Common course offered by University



School of Studies in Zoology & Biotechnology
Vikram University, Ujjain
Biotechnology Sem-III

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2018-20 Academic session

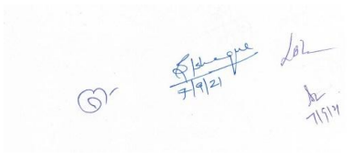
M.Sc. Biotechnology Semester III						
Course Code	Title of course	Course Type	Marks			
			Internal Examination Marks	University Examination Marks	Total Marks	Credits
BT PG 301	Paper 1: Genetic Engineering	Core	40	60	100	12
BT PG 302	Paper2: Bioprocess Enginerring and Bioinformatics	Core	40	60	100	5
BT PG 303	Paper 3: Industrial Biotechnology and Animal Cell Culture	Core	40	60	100	5
BT PG 304 **BT PG 305**	Paper 4: Plant Biotechnology Or Genomics and Proteomics	*Generic Elective	40	60	100	5
PD 306	Personality Development	*Skill Development course	30	50	80	4
BT PG 307	Practical Based on theory papers/Field work/MOOC/Skill Development	Core	16	24	40	2
BT PG 308	Comprehensive viva-Voce (Virtual Credits)	Core			80	4
	Total Marks		206	394	600	30



Any 01 out of 02 Elective can be opt

Elective papers shall be taught only if faculty is available

Common course offered by University



School of Studies in Zoology & Biotechnology
Vikram University, Ujjain
Biotechnology Sem-IV

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology w .e. f 2018-20 Academic session

M.Sc. Biotechnology Semester IV						
Course Code	Title of course	Course Type	Marks			
			Internal Examination Marks	University Examination Marks	Total Marks	Credits
BT PG 401	Project work/onsite Training Project Presentation Project Report Assessment Viva-Voce	Core	100 Project work + Presentation	140 Project Report Assessment + Viva-Voce	240	12
BT PG 402	Industrial Visit /Scientific Lab Visit	Core	30 (Report)	50 (Viva-Voce)	80	4
BT PG 403	Review Writing	Core	30 (Write up)	50 (Viva-Voce)	80	4
BT PG 404	Seminar	Core	25 (Write up)	35 Presentation	60	3
BT PG 405	Poster Presentation	Core	25 Poster	35 Presentation	60	3
BT PG 406	Comprehensive viva-Voce (Virtual Credits)	Core		80	80	4
	Total		210	390	600	30

Grand Total of all 4 Semesters:
Total Credits = 120(Each credits is equal 20 marks)
Total Marks = 2400

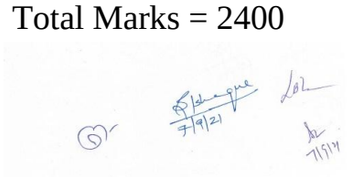


TABLE: GRADES, GRADE POINTS AND RANGE OF PERCENTAGE OF MARKS

Letter Grade	Grade Points	Percentage Range of Marks
O - Outstanding	10	Above 80.0%
A^+ - Excellent	9	Above 70.0 - 80.0%
A - Very Good	8	Above 60.0 - 70.0%
B^+ - Good	7	Above 55.0 - 60.0%
B - Above Average	6	Above 50.0 - 55.0%
C - Average	5	Above 45.0 - 50.0%
P - PASS	4	40.0 - 45.0%
F - FAIL .	0	Less than 40.0%
Ab - Absent	0	--

Note: While calculating percentage of Marks and for determination of the Grade rounding of Marks **shall not be done**.

The Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

The UGC recommended the following procedure to The Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the Grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i. e.

SGPA (Si) = Σ (Ci x Gi) / Σ Ci
Where, Ci – is the number of credits of the i^{th} course and
Gi –is the Grade Point scored by the student in the i^{th} course

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student overall the semesters of a program, i. e.

CGPA = Σ (Ci x Si) / Σ Ci
Where, Si –is the SGPA of the i^{th} semester and
Ci –is the Total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of computation of SGPA and CGPA and format for Transcripts

i. Computation of SGPA and CGPA

Illustration for **SGPA**

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course- 1	3	A	8	3 x 8 = 24
Course- 2	4	B+	7	4 x 7 = 28
Course- 3	3	B	6	3 x 6 = 18
Course- 4	3	O	10	3 x 10 = 30
Course- 5	3	C	5	3 x 5 = 15
Course- 6	4	B	6	4 x 6 = 24
	20			**139**

Thus, **SGPA = 139/ 20 = 6.95**

Illustration for **CGPA**

Points	Semester- 1	Semester- 2	Semester- 3	Semester- 4	Semester- 5	Semester- 6
Credits	20	22	25	26	26	25
SGPA	6.9	7.8	5.6	6.0	6.3	8.0

Thus, **CGPA** = 20x6.9 + 22x7.8 + 25x5.6 + 26x6 + 26x6.3 + 25x8 / 144 = **6.73**

ii. **Transcript (Format)**: Based on the above, on Letter Grades, grade points and SGPA and CGPA, the Vikram University may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain

Session 2018-20

M.Sc. Biotechnology

Semester I

Students of the first semester will study various specializations which include the following paper.

Paper 1: Cell and Molecular Biology

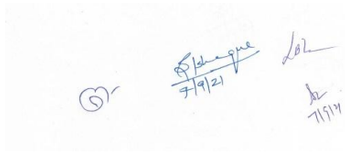
Paper 2: Immunology & Molecular Diagnostics

Paper 3: Molecular Endocrinology and Reproductive Technology

Paper 4: Microbiology (Elective)

Paper 5: Biostatistics, Biodiversity and wild life (Elective)

This course will provide the comprehensive knowledge and interdisciplinary skills in the field of Cell and Molecular Biology, Immunology, Molecular Endocrinology and Microbiology, Biostatistics, Biodiversity and wild life. By reading these papers students will get scientific knowledge, which will make them research and employment prospects, which will brighten their future.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester I
Paper I

Core BT PG 101. CELL AND MOLECULAR BIOLOGY

Course learning Outcomes: The course will build student's knowledge about cell structure and function and will extend student's knowledge about working of prokaryotic and eukaryotic cell at molecular level. The paper will provide an overview of flow of information from genes to protein, regulation of cellular processes, signaling and proliferation in eukaryotic cells which will induce some of the major ideas and experimental approaches in cell and molecular biology.

UNIT-1

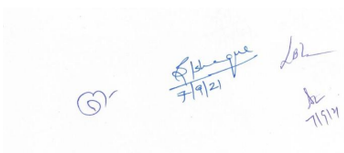
1. Molecular organization of Plasma Membrane
2. Modes of transport across Plasma Membrane
3. Structure & function of Microfilaments
4. Structure & function of Microtubules
5. Structure & function of connexins
6. Structure & function of Integrins

UNIT-2

1. Smooth Endoplasmic Reticulam (SER)
2. Rough Endoplasmic Reticulum (RER): Role in the synthesis, modification and targeting protein
3. Eukaryotic Cell Cycle: Check points, genetic regulation by CdK & cyclins
4. Biology of Cancer: Types, development and causes
5. Apoptosis: Definition, mechanism and significance
6. Various modes of cell signaling

UNIT-3

1. Nuclear Envelope (NE): Ultra structure of pore complex, import of proteins and transport of RNA
2. Metaphase chromosome: Molecular organization of chromatin based on nucleosome concept, nuclear scaffold
3. Genomic organization in Eukaryotes: 'C'value paradox, repetitive and non repetitive DNA
4. Molecular structure of DNA: A, B and Z forms
5. Molecular mechanism of replication of prokaryotic DNA
6. DNA damage and repair: general process



UNIT-4

1. Genetic code: Universal and exceptional
2. Transcription in Prokaryotes: Typical features
3. Transcription in Eukaryote by pol II: Typical features
4. Translation: The general process in prokaryotes and eukaryotes
5. Gene regulation in Prokaryotes (lac-operon): Repressor and induction, positive and negative control, gratuitous inducer (IGPT)
6. Gene regulation in Eukaryotes: Different levels of regulation of gene expression

REFERENCE BOOKS:

1. Molecular cell Biology: J. Darnell, H.Lodish and D. Baltimore scientific American book, inc. USA.

2. Molecular Biology of the cell: B.Alberts, D.Bray , J.Lewis ,M.Raff, and J.D.Watson ,Garlend Publisher inc. N.Y.

3. The science of genetics: Atherly, A.G., J.R. Girton and J.F. Mc Donald, Saunders college publishing Co. ITP N.Y.

4. Genetics: Analysis and Principles: Brooker R.J. Benjamin / Cummings, Longman .inc.

5. Genetics : The continuity of Life , Fairbanks, D.J. and W.R. Anderson, Brooks / cole Publishing co. ITP NY,

6. Principal of Genetics: Gardner, E.J., M.T. Simons and D.P. Snustad Inc.

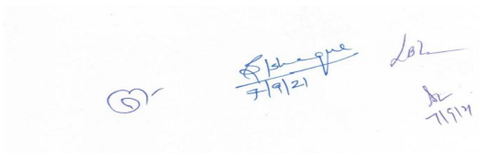
7. Genes VI & VII Lewin , B. Oxford University.

8. Molecular Biology of Gene: Watson J.D., N.H. Hopkins, J.W. Roberts, and Weiner the Benjamin Pub. Co. inc.Tokyo.

9. Principal of cell & Molecular Biology: Lewish j.Klensmith and M.Kish , Harper Collins College Pub. USA.

10. The cella Molecular Approach: Geoffrcy M.Cooper ,ASM Press DC.USA.

11. Concept of Genetics: Williams S. Klug and Michael R. Cummings, Prentice Hall International Inc. USA.



LIST OF PRACTICALS:

1. Study of chromosome behavior during Mitosis & Meosis.
2. Calculation of mitotic index in growing root tips.(onion/garlic)
3. Influence of chemical (insecticide / drug) on Mitosis and observe breakage of chromosomes at anaphase.
4. Barr- Body (sex-chromatin) preparation in buccal epithelial cells.
5. Chromosomes Bridge & Lagging chromosomes in permanent Slids.
6. Culture of locally available **Drosophila w.m**. preparation of eggs, larva, adult Male & female.
7. Squash preparation: polytene chromosomes in the larva salivary gland of locally available **Drosophila OR chironomus.**
8. Study of liver OR whole mount preparation (slide) of **Drosophila** mutants obtained from recognized stock center only.
9. Demonstration of mitocondria by vital staining.
10. Use of Light Microscope, calculation of magnification , measurements of cell nuclease NC ratio , counting cells/ field (hepatic OR testicular)
11. Colorimetric estimation of glucose, cholesterol, protein, RNA & DNA., ascorbic acid.
12. Absorption spectra of any colored solution of a substance.
13. Chromatography of **Drosophila** eye pigment.

School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester I
Paper II

Core BT PG 102. Immunology and Molecular Diagnostics

Course learning Outcomes: The paper aims to build conceptual understanding about types of immune response generated by human body. The offered course will enable students' deep foundation in immunological processes. Students will gain knowledge on how the immune system works and also on the immune system network and interactions during a disease or pathogen invasion.

UNIT- 1

1. Component of Innate and Acquired Immunity
2. Organs of the Immune system: primary and secondary lymphoid organs
3. Cells of the Immune system
4. Complement system
5. Immunoglobulins: structures and classes
6. Inflammatory responses

UNIT- 2

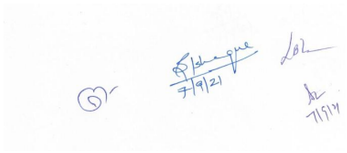
1. Antigen processing and presentation
2. Major Histocompatibilty complex
3. B cell receptors
4. B cell maturation, activation and differentiation
5. T cell receptors
6. T cell maturation, activation and differentiation

UNIT-3

1. Hypersensitivity – Type I – IV
2. Autoimmunity and Autoimmune diseases
3. Transplantation Immunology
4. Hybridoma technology and Monoclonal Antibodies
5. Recombinant vaccines and clinical applications
6. Microchips and their applications

UNIT- 4

1. Protein based molecular diagnostics by immunoproteomics, ELISA
2. Protein based molecular diagnostics by western blotting
3. Real time PCR methodologies in clinical diagnostics
4. Molecular diagnostics of some common genetic and non- genetic diseases e.g. trinucleotide repeats, fragile X Syndrome
5. Molecular diagnostics of diabetes mellitus and cystic fibrosis
6. Genetic counselling



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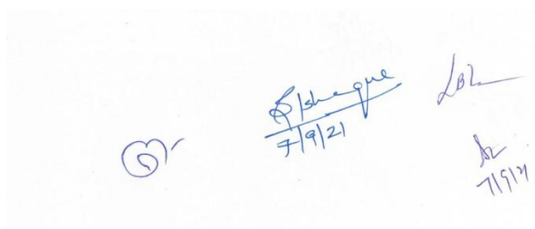
1. **I**mmunology by Janis Kuby.
2. Essential Immunology By I.M.Roitt ELBS edition.
3. Fundamentals of Immunology by William Paul.
4. Immunology : An Introduction by Tizzart
5. Advance Immunology by David Male & others.
6. A Hand Book of Practical and clinical Immunology by G.P.Talwar & S.C.Gupta.
7. The enzyme linked Immunosorbent assay (ELISA) – Volume 1 & 2 by Alister Voller and Danis Bidwell.
8. W.B. coleman & GJ Tsongalis Molecular diagnosis for the clinical Laboratories, 2nd edition
9. Francesco falciani, Microarray technology through Applications, Taylor & Francis,2007
10. Jochen decker , Molecular diagnosis of Infectious diseases, Humana Press.

PRACTICAL EXCERSICES :

1. Blood film preparation and identification of cell.
2. Demonstration of lymphoid organs and their microscopic Examination.
3. Immunization and production polyclonal antibodies
4. Immunodiffusion.
5. Agglutination.
6. ELISA Antibody capture Elisa
7. ELISA Antigen capture Elisa.
8. Sepration of mononuclear by Ficoll Hypaque .
9. Breeding of animals by different Routes.
10. Blood Group Antigen.
11. Specific primer designing
12. Extraction of nucleic acids (DNA & RNA) & Proteins
13. Primer designing.



School of Studies in Zoology & Biotechnology,
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Session 2018-20

M.Sc. Biotechnology
Semester I
Paper III

Core BT PG 103. MOLECULAR ENDOCRINOLOGY AND REPRODUCTIVE TECHNOLOGY

Course learning Outcomes: The course will provide students knowledge about mechanism of hormone production, regulation and action which will further aid in the development of the students and will help them to understand endocrinology at molecular level. The paper also focuses on modern methods of reproductive technology which will be helpful for understanding of different diagnostic and treatment techniques.

UNIT –1

1. Definition and scope of molecular Endocrinology
2. Chemical nature of Hormones
3. Purification and characterization of Hormones
4. Production of Hormones by DNA technology
5. Neurohormons as neural messengers
6. Mechanism of hormones production

UNIT – 2

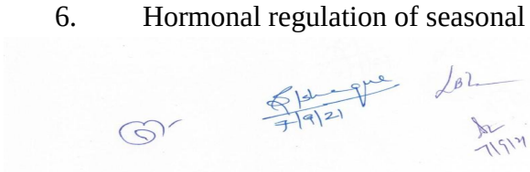
1. Hormones receptors – Identification, quantitation, purification, and physic-chemical properties
2. Membrane receptors Structure and signal transudation mechanism
3. Nuclear receptors –Stricter and function, orphan receptors
4. Eicosonoids and Harmon action
5. Concentration and transport of hormone in blood
6. Hormones and aging

UNIT – 3

1. Contraception
2. Multiple ovulation and embryo transfer technology
3. Study of estrus cycle by vaginal smear technique
4. Surgical technique – castration, ovariectomy, vasectomy, tubectomy and laprotomy
5. Extraction and estimation of Pregnanediol from urine
6. Extraction of gonadotropins

UNIT – 4

1. Sex determination
2. Embryo sexing and cloning
3. Genetic analysis of hormonal disorders
4. Transcriptional and post Transcriptional regulation of Hormones
5. Hormonal regulation of continuous breeders
6. Hormonal regulation of seasonal breeders

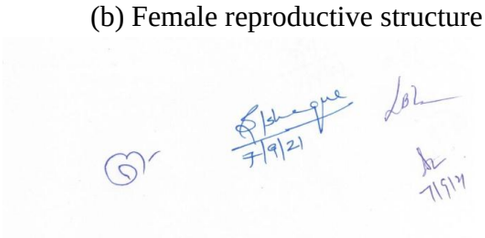


REFERENCE BOOKS:

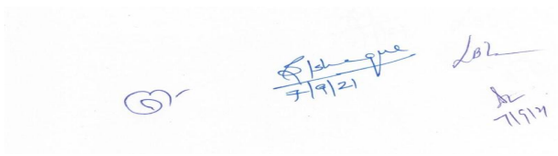
1. Benjamin Lewin – Genes VII / VIII, oxford University press.
2. Lodish etal – Molecular Cell Biology.
3. Ethan Bier – The coiled spring Harbor press.
4. Freedman L.P., Molecular biology of steroid and nuclear hormone receptors.
5. Litwack, G. – Biochemical action of Hormones, Academic press.
6. Zarrow , M.X. yochin J.M. and Machrthy , J.L. – Experimental endocrinology.
7. Chatterjee C.C. – Human Physiology (vol.II)
8. Bentley, P.J. - Comparative Vertebrate endocrinology.
9. Hadley Mac.E. – Endocrinology.
10. Greenstein, B. – Endocrine at a glance.
11. Puri C.P. and varlook , P.R. – Current concepts of fertility regulation and reproduction .
12. Austin, C.R. and frshort, R.V. – Reproduction in mammal.
13. Chinoy,N.J.Rao,M.V., Desaraj ,K.J. and High Land ,H.N. –Essential Techniques.
14. Jubiz, W. – Endocrinology: A logical approach for clinicians.
15. Horrobin,D,F. Essantial biochemistry ,Endocrinology and nutrition.
16. Norris,D.O. – Vertebrate Endocrinology.
17. Austen, C.R. and short, R.V. –Reproduction in animals.
18. Edwards, R.G. – Human Reproduction.

PRACTICAL EXERCISES:

1. Bioassay of any hormone involving target tissue growth / differentiation.
2. Radioreceptor assay for any hormone.
3. RIA and ELISA for any hormone or second messenger.
4. Purification of any protein hormone.
5. Assay of steroid dehydrogenase.
6. Isolation and characterization of steroid / prostaglandin.
7. Gel retardation assay for transcription like protein.
8. Assay for protein phosphorylation c AMP dependent protein – Kinase.
9. Guanylcyclase assay in vitro.
10. Histological studies of endocrine gland.
11. Cytological studies of endocrine gland.
12. Histochemical studies of endocrine gland.
13. Study of vaginal histological during estrus cycle.
14. Demonstration of estrus cycle study by vaginal smear technique.
15. Histological demonstration of glycogen during reproductive cycle and pregnancy.
16. Effect of testosterone, estradiol and progesterone.
    (a) Male reproductive study by Weight/ volume Measurement.
    (b) Female reproductive structure by Weight/ volume Measurement



17. Study of accessory reproductive structure after castration or ovariectomy
18. Sperm count.
19. Demonstration of surgical techniques.
    (a) Castration (b) Overiectomy (c) Laparotomy (d) Parabiosis (e) vasectomy (f) tubectomy etc.
20. Demonstration of perfusion technique for the fixation of endocrine tissue.
21. Implantation of endocrine gland / tissue.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester I
Paper IV

Core BT PG 104. MICROBIOLOGY

Course learning Outcomes: The students get trained in all aspects of microbiology as it is required for biotechnology. The course explains detail knowledge of structure, function and application of microorganism. It will also enable students for understanding of applications of microorganisms in the industry, health-care, environmental protection, food agriculture and research. Students will be able to address application skills of microbiological techniques and tools in fields of microbiology including microbe and plants.

UNIT – 1

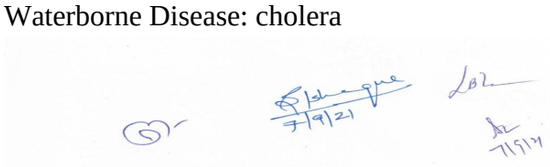
1. Pure culture techniques and preservation methods
2. Preparation of Culture media, microbial staining
3. Sterilization: Physical and chemical methods
4. Bacterial growth curve and their mathematical expression
5. Measurement of growth and factors affecting growth
6. Nutritional classification of Microorganisms

UNIT – 2

1. Isolation, types and cultivation of virus
2. Replication of virus
3. Life cycle of DNA Viruses
4. Retroviruses
5. Structure and morphology of Bacteriophage
6. Lytic and lysogenic cycle

UNIT – 3

1. Cyanobacteria: General account and their importance
2. Type of Infection, Mechanism of pathogenecity
3. Bacterial Diseases: Staphylococcal and Salmonellosis Shigellosis
4. Fungal Diseases, Histoplasmosis
5. Viral Diseases: Chicken Pox, Hepatitis B
6. Waterborne Disease: cholera



UNIT – 4

1. Mycoplasma and diseases caused by them
2. Bacterial Recombination : Transformation, Transduction
3. Plasmids and transposons
4. Chemotherapeutic agents: Classification of antibiotics, Broad spectrum antibiotics
5. Symbiosis: types of symbiosis, function and examples of commensalism
6. Anti- fungal and antiviral antibiotic

REFERENCE BOOKS:

1. General Microbiology, R.Y.Ingraham , J.L.Wheelis, M.L.and Painter, P.R. the MacMillan Press ltd.

2. Brock Biology of Microorganism, M.T.,Martinko, J.M.and Parker, J.Prentic Hall.

3. Microbiology, Pelzer,M.J., chan , E.C.S. and Kreig ,N.R. Tata McGraw Hill.

4. Microbial Genetics, Maloy ,s.R., Cronan, J.E. Jr and Freifelder, D.Jones, Bartlett Pub.

5. Microbiology- A laboratory manual, cappuccino, J.G. and Sherman, N. Addison Weseley.

6. Microbiological Application, (A laboratory Manual in general Microbiology) Benson, H.J.WCB: Wm C. Brown Publishers.

PRACTICAL EXERCISES:

1. Preparation of liquid and solid media for growth of microorganisms.

2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of Microorganisms.

3. Isolation of pure cultures from soil and water.

4. Growth; Growth curve; Measurement of bacteria population by turbidometry and serial dilution methods. Effect of temperature, pH and carbon and nitrogen sources on growth.

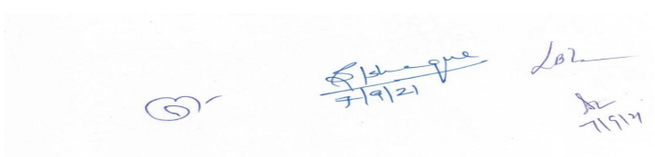
5. Microscopic examination of bacteria, Yeast and molds and study of organism by gram stain, Acid fast stain and staining for spores.

6. Study of mutation by Ames test.

7. Assay of antibiotics and demonstration of antibiotic resistance.

8. Analysis of water for potability and determination of MPN.

9. Biochemical characterizations of selected microbes.



School of Studies in Zoology & Biotechnology,

Vikram University, Ujjain

Session 2018-20

M.Sc. Biotechnology

Semester I

Practical based on paper 101-104

Total marks 16+24 = 40

(A) INTERNAL EXAMINATION **16 Marks**

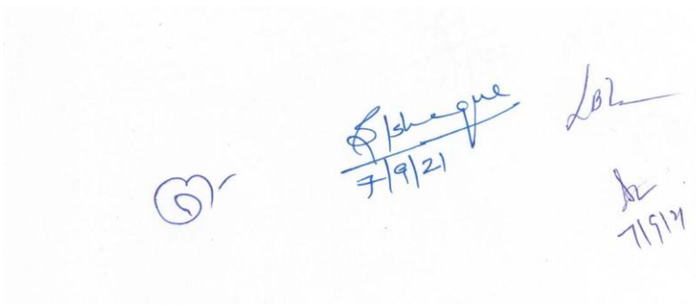
Exercise:

1. Practical Record 6 Marks
2. Viva-voce/ Oral test 6 Marks
3. Preparation of culture media for the growth of microorganism 2 Marks
4. Determination of blood group in sample 2 Marks

(B)UNIVERSITY EXIMINATION 24 Marks

1. Identify the fungus present in the given soil sample. 02
2. Study the morphology of given bacterial culture using Gram staining.02
3. Separate the Amino acids in the mixture provided by paper chromatography02.
4. Identify and comment upon given spots related to the following: 10
   Endocrinology, Cytology-Cytogenetic and Immunology.
5. Squash given root tips, observe and report *'Mitotic index'.* 02
6. Squash given anther, observe and report Stages of *'Meiosis'* 02
7. Demonstrate '*Bar-body'* if present in your own buccal cells. 02
8. Demonstrate *'Mitochondrial'* using vital stain. 02

Total Marks (16+24)= 40



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester II

Students of the second semester will study various specializations which include the following paper.

Paper 1: Enzyme Technology

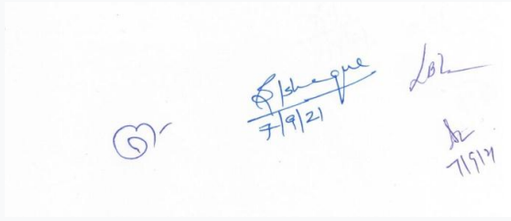
Paper 2: Environmental Biotechnology

Paper 3: Biomolecules and Metabolism

Paper 4: Bioinstrumentation (Elective)

Paper 5: Molecular Cell Biology and Genetics (Elective)

The student will be able to get scientific knowledge about applications of biotechnological techniques and tools in the field of biomolecules including enzymes, environment, animals, microbes and plants. Which will make them research and employment prospects.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester II
Paper I

Core BT PG 201. ENZYME TECHNOLOGY

Course learning Outcomes: This course will provide knowledge in all aspects of enzyme technology as it is required for biotechnology including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics. Students will also be introduced to the theory as well as applications of enzyme technology in food, medical and household industries.

UNIT-1

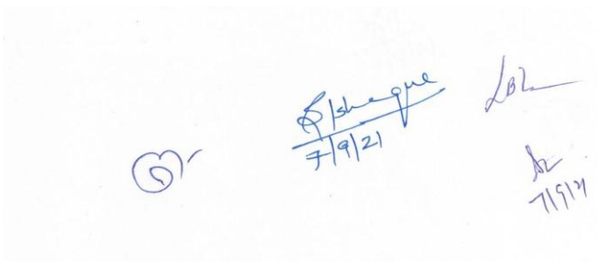
1. Enzyme: Enzyme classification & Nomenclature, EC number
2. Mechanism of enzyme catalysis: Acid-Base catalysis
3. Mechanism of enzyme catalysis: Metal ion catalysis
4. Enzymes: Active sites, Substrate specificity
5. Regulation of enzyme action

UNIT-2

1. Enzyme Kinetics: The Michaelis-Menten equation
2. Analysis of Kinetic data (Determination of Vmax , Lineweaver-Burk plot)
3. Enzyme regulation: Reversible Inhibition, Irreversible Inhibition
4. Allosteric Regulation
5. Enzyme Purification; Ion-exchange chromatography, Gel filtration chrom-atography, Affinity chromatography
6. Nontraditional enzymes

UNIT-3

1. Characterization of purified enzymes: X-ray crystallography, Mass Spectroscopy
2. Enzyme in medical diagnosis
3. Enzyme therapy
4. Enzyme disorders in human diseases
5. Biological roles of enzymes
6. Use of enzymes in solution



UNIT-4

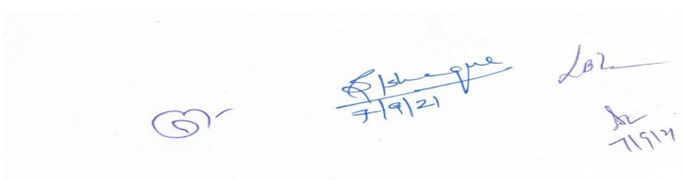
1. Enzyme stability
2. Enzyme Immobilization:Techniques of immobilization, experimental Procedures of immobilization
3. Effect of immobilization on enzyme activity
4. Industrial Application of immobilized enzyme
5. Biosensors
6. Enzyme reactors

REFERENCE BOOKS:

1. The nature of Enzymology by R.L. Foster.
2. Enzymes by Dixon and Webb.
3. Fundamental of Enzymology by Pric and Stevens.
4. Enzyme Catalysis and Regulation by Hammes.
5. Enzyme Reaction Mechanism by Walsch.
6. The Enzyme vol. I & II by Boyer.
7. Enzyme Structure and Mechanism by Alan Fersht.
8. Enzyme Assays: A Practical Approach by Eisenthal and Danson.
9. Enzyme Biotechnology G.Tripathi.
10. Practical Biochemistry by Plummer.
11. Practical Biochemistry by Sawhney and R. Singh.
12. Biotechnology – A new industrial revolution by steve prentis

PRACTICAL EXERCISES:

1. Protein estimation methods: Lowry, Bradford and Spectrophotometeric.
2. Urease estimation in plant tissues.
3. Assay of acid phosphatase.
4. Assay of Alkaline phosphatase.
5. Determination of optimum pH.
6. Determination of Km value.
7. assay of enzyme activity and Acetylcholinesterase estimation
8. Enzyme purification: Ammonium sulphate precipitation, Ion exchange chromatography, Molecular sieve chromatography.
9. Checking of purity of enzyme by chromatography.
10. Molecular Weight determination of enzyme by electrophoresis
11. Sub- cellular fractionation of enzymes and assays



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester II
Paper II

Core BT PG 202 ENVIRONMENTAL BIOTECHNOLOGY

Course learning Outcomes: The students will know about the principles and techniques underpinning the application of biosciences to the environment. Obtain knowledge on basic principles and technologies of decontamination of persistent organic pollutants mainly by means of the Biological approaches i.e., using Bioremediation.

UNIT – 1

1. Introduction to Environmental pollution
2. Measurements of Environmental pollution
3. Air pollution technologies: Biofilters & Bioscrubbers for treatment of Industrial waste
4. Management of solid waste
5. Bioreporter gene technology
6. Biotechnology for enhanced oil recovery

UNIT – 2

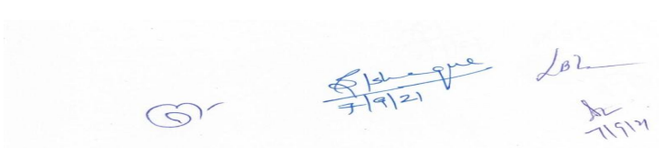
1. Definition and types of waste water
2. Major contaminants in waste water
3. Concept of ETP
4. Physical methods of waste water treatment
5. Chemical methods of waste water treatment
6. Biological methods of waste water treatment

UNIT – 3

1. Bioremediation: Types of Bioremediation
2. Types of reaction in bioremediation,factors affecting Bioremediation
3. Degradation of xenobiotics in environment
4. Biofuels: Bioethenol, Biodiesel, Biohydrogen
5. Biofertilizers
6. Biopestecides

UNIT – 4

1. Parameters and standards of noise, air, water : Significance of Various parameters, Standard adopted by CPCB & WHO
2. Bio indicators of aquatic pollution
3. Biosensors
4. Integrated pest management
5. Biopolymer production and Bio plastic
6. Vermicomposting

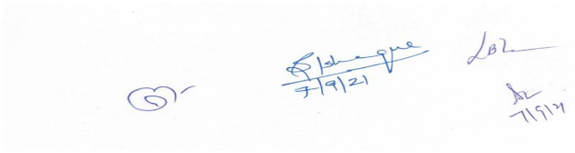


REFERENCE BOOKS:

1. Environmental Biotechnology by Dr. Hans Soachim Jordning,Prof. Dr. Joseph Winter
2. Environmental Biotechnology by Lawrence K. Wang. Joo-Haw Tay,Volodymyr
3. Environmental Biotechnology by Geetha Bali
4. Environmental Biotechnology by Arvind Kumar
5. Environmental Biotechnology: Theory & Application By Evans,Greeth M., Furlong. Judith C.
6. Environmental Biotechnology: Advancement in water & waste water: By Z.Ujang. M. Henze
7. Text book of Environmental Biotechnology: by Vinod Soni, Vinay Sharma
8. Environmental Biotechnology: Principal & Applications By Bruce Rittmann & Perry McCarty
9. Environmental Biotechnology: Concept & Application by Soachim Jordning, Prof. Dr. Joseph Winter

PRACTICAL EXERCISES:

1. Determination of pH in the given water sample
2. Determination of DO in the given water sample
3. Determination of Cl in the given water sample
4. Determination of BOD in the given water sample
5. Determination of Hardness in the given water sample
6. Determination of CO2 in the given water sample



School of Studies in Zoology & Biotechnology,

Vikram University, Ujjain

Session 2018-20

M.Sc. Biotechnology

Semester II

Paper III

Core BT PG 203 BIOMOLECULES AND METABOLISM

Course learning Outcomes: On completion of the course, the student will achieve an understanding of the following: the structure of proteins, methods for isolating and characterizations of proteins and interrelation of each of their metabolic pathway. This course gives an idea of different biological molecules and application of the knowledge generated in the practical aspects of Biotechnology.

UNIT 1

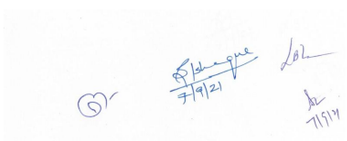
1. Chromatographical methods of Protein Purifications
2. Electrophoretic methods of separation of proteins, differential centrifugation and ultracentrifugation techniques for proteins separation
3. Primary structure determination of proteins: sequencing and detection of sequenced proteins.
4. Secondary structure of proteins: alpha helix and beta sheet structures, turns and loops.
5. Tertiary structures of proteins: super secondary structures, domains
6. Quaternary structures of proteins

UNIT 2

1. Fractionation and isolation of nucleic acids
2. Structure of DNA
3. Biosynthesis of purine ribonucleotides, synthesis of purine deoxy-ribonucleotides
4. Methods of salvage of purine Biosynthesis
5. Biosynthesis of pyrimidine, synthesis of pyrimidine deoxy-ribonucleotides
6. DNA methylation

UNIT 3

1. Transcription factors, importance of transcription factors in gene expression
2. DNA denaturation, renaturation and DNA damage
3. DNA repair: base excision repair, nucleotide excision repair, mismatch repair, error-pron repair
4. Transport through membranes, Passive mediated transport, active transport
5. Energy rich bonds: High energy compounds, coupled reactions involving ATP
6. Lipid metabolism: Pathways of Beta-oxidation of fatty acids



UNIT 4

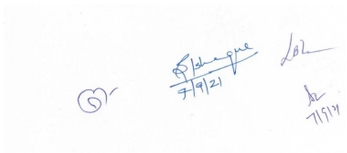
1. Pathway of Glycolysis
2. Pathway of Tricarboxylic acid cycle.
3. Pathway of Respiratory chain complexes and electron transport system
4. Oxidative phosphorylation and ATP synthesis.
5. Reactive oxygen species and oxidative stress
6. Reactive nitrogen species and its role in diseases

REFERENCE BOOKS:

1. Fundamentals of Biochemistry 3rd edition by D. Voet, JG Voet, CW. Pratt, John Wiley & Sons
2. Principles of Biochemistry 5th edition by Nelson, Cox and Lehinger, WH Freeman & Company
3. Molecular Cell Biology by Lodish, Berk, Kaiser, Kreiger, Scott, Zipursky, Darnell
4. Biochemistry with clinical correlations by TJ Devlin, Wiley Leiss
5. Biochemistry by Zubey, Macmilan Publishing Company, New York
6. Biochemistry by CK Mathews, KE Van Holde, the Benjamin Cummings Publishing Company, Melano Park.

PRACTICAL EXERCISES:

1. Preparation of Standard curve of proteins, carbohydrate and lipids.
2. Estimation of total proteins, carbohydrates and lipids.
3. Estimation of nucleic acids.
4. Differential centrifugation and fractionation of subcellular organelles.
5. Assay of enzymes activity and determination of enzyme kinetics.
6. Fractionation of mitochondria and determination of ATPase activity in mitochondria.
7. Paper chromatography, thin layer chromatography, separation of amino acids, lipids and phospholipids.
8. Electrophoresis, separation of proteins.
9. Validation of Beer's Lambert Law
10. Determination of Absorption maxima



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester II
Paper IV

Core BT PG 204 BIOINSTRUMENTATION

Course learning Outcomes: Paper will introduce students to basic understanding about the bioinstrumentation techniques essential for life sciences and biotechnology. To get introduced to the fields of various instruments used in biotechnology including the basic principle, application and working.

UNIT – 1

1. Photometry: Basic principal of colorimetry
2. UV- visible spectrophotometry: Principle, instrumentation and applications
3. IR- spectrophotometry: Principle, instrumentation and applications
4. Atomic absorption Spectroscopy: Principle, instrumentation and applications
5. Mass Spectroscopy: Principle and application
6. Fluorescence Spectroscopy: Principle, instrumentation and applications

UNIT – 2

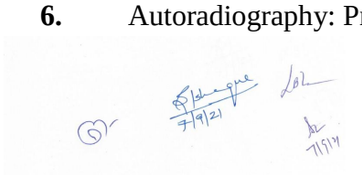
1. Chromatography: Paper and Thin layer Chromatography
2. Gel filtration Chromatography and Ion Exchange Chromatography
3. Gas-liquid chromatography and HPLC
4. Electrophoresis: paper electrophoresis, agarose, Polyacrylamide Gel electrophoresis
5. SDS – PAGE electrophoresis
6. Isoelectric focusing

UNIT – 3

1. X-ray crystallography
2. NMR: Principle, Instrumentation and applications
3. Nephelometry and Turbidimetry
4. Centrifugation: Principle, Instrumentation and applications
5. Ultrasonication: Principle, Instrumentation and applications
6. Microtomy, types, principals and applications

UNIT – 4

1. Microscopy: Light, Phase contrast, fluorescence Microscopies
2. Electron Microscopy
3. Newer Technique in Microscopy: Confocal Microscopy
4. Radioactivity Liquid, Scintillation Counter, solid Scintillation counters
5. Radio Immuno Assay (RIA)
6. Autoradiography: Principle and applications

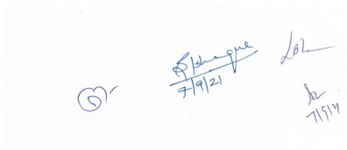


REFERENCE BOOKS:

1. Physical Biochemistry: Applications to Biochemistry and Molecular Biology by freifelder
2. Biochemical techniques : Theory and Practice by Robyet and White
3. Principals of Instrumental Analysis by Skoog and West.
4. Analytical Biochemistry by Holme and Peck
5. Biological Spectroscopy by Campbell and Dwek
6. Organic Spectroscopy by Kemp
7. A Biologist's Guide to principles and Techniques of practical Biochemistry by Willson and Goulding.
8. Principles of Instrumental Analysis by Skoog , Hollar And Nicman.

PRACTICAL EXERCISES:

1. Verification Beer**'s** Law
2. Determination of absorption maxima
3. Electrophoresis of Proteins – native and under denaturing conditions.
4. Amino acid and carbohydrate separation by paper & thin layer chromatography.
5. Gas chromatography
6. Ion exchange and gel filtration chromatography.
7. Separation of sub-cellular organelles by differential centrifugation
8. Separation of blood cells by density gradient centrifugation.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester II
Practical based on paper 201-204

Total marks 16+24 = 40

(B) INTERNAL EXAMINATION 16 Marks

Exercise:

1. Practical Record 6 Marks
2. Viva-voce/ Oral test 6 Marks
3. Demonstrate the microbial production of H2O2 4 Marks

(B)UNIVERSITY EXIMINATION 24 Marks

1. Demonstrate the starch hydrolysis by given bacterial culture. 02
2. Immobilization of plant pigment chlorophyll 03
3. Estimation of chloride in given water sample 03
4. Estimation of hardness in given water sample 03
5. Estimation of D.O. in given water sample . 03
6. Spot based on environmental biotechnology and Bioinstrumentation. 10

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Total Marks 40

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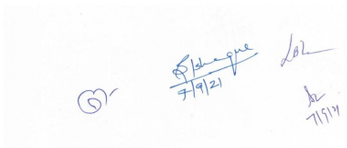


School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester III

Students of the third semester will study various specializations which include the following paper.

Paper 1: Genetic Engineering

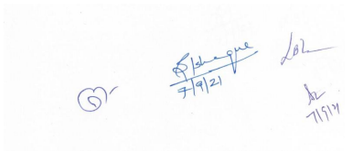
Paper 2: Bioprocess Engineering and Bioinformatics

Paper 3: Industrial Biotechnology and Animal Cell Culture

Paper 4: plant Biotechnology (Elective)

Paper 5: Genomics and Proteomics (Elective)

By reading these papers students will get scientific knowledge, which will make them research and employment prospects, which will brighten their future.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester III
Paper I

Core BT PG 301 GENETIC ENGINEERING

Course learning Outcomes: The students will achieve a sound knowledge on methodological repertoire which allows them to innovatively apply these techniques in basic and applied field of life science research. The course will provide students knowledge about to creative use of modern tools and techniques for manipulation and analysis of genomic sequences.

Unit – 1

1. Restriction Endonucleases
2. DNA polymerases and ligase
3. Cloning vectors : plasmids, bacteriophases
4. Plasmid vectors: Cosmids and artificial chromosomal vectors, retroviral vectors, expression vectors
5. Gene cloning strategies: cDNA and genomic cloning
6. Construction of genomic and cDNA libraries

Unit – 2

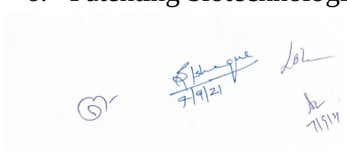
1. DNA sequencing: Maxam and Gilbert method; using bacteriophage M13 method
2. Site directed Mutagenesis: oligonucleotide- directed mutagenesis, PCR- amplified mutagenesis
3. Methods of gene transfer in eukaryotic cells
4. Gene knockouts and creation of knockout mice
5. Gene Expression Analysis
6. Types of PCR and PCR methods for DNA amplification

Unit-3

1. Methods of Primer designing and Gene construction
2. Ex vivo Gene therapy for Genetic disorders
3. In vivo Gene therapy for genetic disorders
4. Molecular Diagnosis of Genetic Diseases
5. Principles and applications of gene silencing SiRNA technology
6. Micro- RNA (miRNA) technology for gene silencing.

Unit-4

1. Restriction fragment length polymorphism (RFLP)
2. Method and applications of DNA fingerprinting.
3. Principals and methods of Fluorescence in situ hybridization (FISH)
4. Ethical Issues in Biotechnology
5. Bio safety Measures and Regulations for Genetically Engineered Products.
6. Patenting biotechnological products.



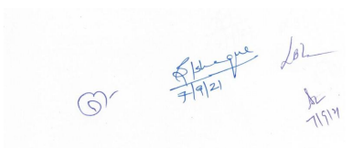
REFERENCE BOOKS:

1. Recombinant DNA – By Watson et al
2. Principles of Gene Manipulation, old and Primrose
3. Gene Cloning: An introduction, Brown
4. Biotechnology : Theory and Techniques (Vol I& II, 1995), Chirikjian
5. Molecular Genetics of Bacteria, Dale
6. Molecular Cloning (Vol I,II & III, 2001), Sambrook & Russell
7. Applied Molecular Genetics (1999), Miesfeld
8. Genes and Genome (1991) , Singer & Berg
9. Molecular Biotechnology , Glick & Pasternak
10. Plant Molecular Biology (vol. I 7 II ,2002), Glimartin & Bowler
11. Principles of Gene Manipulation and Genomics- Primrose and Twyman .
12. Concept of Genetics – William S. Klug, Michal R. Commings.
13. Molecular Biotechnology – Bernarl R. Glick , Jack j. Pasternak.
14. Genome – T.A. Brown
15. Biotechnology – A laboratory Course- Jefrey M.Beckes, Guy A. Caldwell, Eue Ann Zachgo

Note: All text books are of latest editions:

PRACTICAL EXERCISES:-

1. Bacterial Culture and Preparation of competent cells
2. Isolation of plasmid DNA
3. Quantitation of nucleic acids
4. Restriction mapping of plasmid DNA
5. Preparation of single stranded DNA template
6. Gene expression in E. coli and analysis of gene product
7. Transfection.
8. Purification & Quantitation of RNA.
9. Protein Analysis
10. Restriction Mapping
11. Bacterial Transformation.
12. Recombinant Protein Purification and Analysis.
13. Plasmid DNA preparation, Restriction Enzyme Digestion and cloning.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester III
Paper II

Core BT PG 302 BIOPROCESS ENGINEERING AND BIOINFORMATICS

Course learning Outcomes: The paper aims to build conceptual understanding about how to transfer a small scale laboratory process in to a large scale industrial process. This paper also deals with various important products produced by the bioprocess techniques. The students will also knowledge about the various bioinformatics and computation tools used in analyzing proteins, genes and genome data bases.

UNIT-1

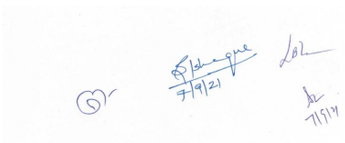
1. Isolation, screening and maintenance of industrially important microbes
2. Strain improvement for increased yield and other desirable characteristics
3. Bioreactor design: General design information and types of Bioreactors
4. Fermentation-Basic concept of fermentation, its types and applications of fermentation
5. Production of Lactic acid
6. Production of Vinegar

UNIT-2

1. Production of Amino acid (Lysine) and Insulin
2. Production of Antibiotics (Streptomycin)
3. Production of Protease Enzyme
4. Bioprocess Operations: Upstream processing: Sterilization, Aeration, agitation
5. Downstream processing: Biomass Removal and Disruption Techniques: Physical, Chemical and Enzymatic Methods
6. Downstream processing: Filtration, centrifugation, sedimentation and flocculation method of bioseparation of fermentation products; Drying, crystallization of fermentation products

UNIT-3

1. Aim and Tasks of Bioinformatics and their Applications
2. Biological Databases: Proteins and nucleic acid Databases
3. Introduction to NCBI, EBI
4. Search Tool: Basic Local Alignment tool (BLAST) and FASTA
5. Pair wise Alignment Technique
6. Multiple Sequence Alignment Technique



UNIT-4

1. Submitting DNA sequences to the databases
2. Submitting Protein sequences to the databases
3. Human Genome Project
4. Using BLAST for Gene discovery
5. Molecular Phylogenetics: Introduction and Historical information
6. Phylogenetic Analysis methods

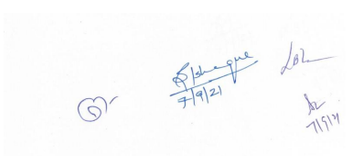
REFERENCE BOOKS:

1. Jakson AT, Bioprocess engineering in Biotechnology, Prentice Hall , Engelwood cliffs,1991
2. Shuler ML & Kargif, Bioprocess engineering : Basic concepts, 2nd edition, prentical Hall, Enngelwood cliffs,2002
3. Baily JE & Ollis DF, Biochemical engineering fundamentals, 2nd edition Mcgraw Hill Book Co., Newyork, 1986
4. Comprehensive Biotechnology: the principles, Applications & Regulation of Biotechnology in industry Agriculture & Medicine, Vol. 1,2,3,4, Young MM, Reed Elsevier India Privet. Ltd., India 2004
5. David W. Mount Bioinformatics: sequence & genome Analysis 2nd edition, CHSL, Press,2004
6. A. Baxevanis & F.B.F Ouellette, Bioinformatics: A practical guide to the analysis of genes & proteins , 2nd edition , John wiley, 2001
7. Jonathan Pevsner, Bioinformatics & functional genomics, 1st edition, Wiley Liss, 2003.
8. Scholar. Bioprocess Engineering.

Note: All text books are of latest editions:

PRACTICAL EXERCISES:

1. Various Immobilization techniques of cells, enzymes, use of alginate for cell Immobilization.
2. Microbial production & downstream processing of an enzyme eg. Amylase.
3. Studying the kinetics of enzymatic reaction
4. Alignment algorithms
5. Sequence based methods of structure prediction
6. Scoring techniques.
7. Sequence sequence scoring
8. Submitting DNA sequence to the database & database searching
9. Sequence alignments : Pair wise alignment techniques, Multiple sequence Alignment
10. Primer designing
11. Searching MEDLINE, pubmed, current contents, Science citation index , electronic journals. grants & funding information



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester III
Paper III

Core BT PG 303 INDUSTRIAL BIOTECHNOLOGY AND ANIMAL TISSUE CULTURE

Course learning Outcomes: The course will provide students knowledge about isolation and screening techniques of microbes. The students get trained in all aspects of industrial biotechnology as it is required for biotechnology. The students will gain an insight in to the concepts and techniques of animal biotechnology and its wide industrial and medical applications.

UNIT-1

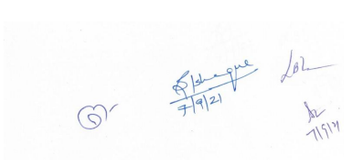
1. History Importance and applications of Industrial Biotechnology
2. Genetic improvement of strains and methods of strain development
3. Microbial production of Penicillins
4. Microbial production of Vitamins & amino acids (Vitamin B12)
5. Microbial production of enzymes (Amylase)
6. Operation of conventional Bioreactor

UNIT-2

1. Microbial production of alcoholic beverages: Bear and Wines
2. Microbial production of organic acids (Citric acid)
3. Microbial production of solvents (Glycerol)
4. Microbial production of Amino acids (Glutamic acid)
5. Microbial production of food (cheese)
6. Microbial metabolic products

UNIT-3

1. Bio-transformation : Steroids and antibiotics
2. Single cell protein
3. Mushroom cultivation
4. Bioleaching
5. Microbial polysaccharides
6. Immobilization of microbial cell for product enhancement and their applications



UNIT – 4

1. Introduction and organization of animal cell and tissue culture laboratory
2. Primary and established cell line cultures
3. Culture media for animal cells
4. Basic techniques of mammalian cell culture : disaggregation of tissue
5. Scaling up of animal cell culture, Cell synchronization
6. Biology and characterization of the cultured cells measurement of parameters of growth

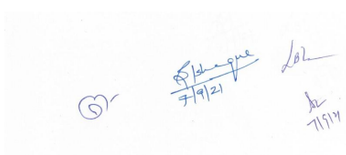
REFERENCE BOOKS:

1. Biochemical Engineering, Abia, S., Humphery, A.E. and millis, N.F. Univ. Tokyo Press, Tokyo.
2. Biochemical Reactors, Atkinson, B., pion Ltd. London.
3. Biochemical Engineering Fundamentals, Baily. J.E. and Ollis, D.F. Mcgraw- Hill Book Co. New York.
4. Bioprocess Technology: Fundamentals and Applications, KTH, Stockhlom.
5. Process Engineering in Biotechnology, Jackson, A.T., Prentice hall, Engelwood Cliffs.
6. Bioprocess Engineering: Basic concept Shuler, M.L. and Kargi, F., Prentice Hall Englewood Cliffs.
7. Principles of fermentation Technology, Stanbury, P.F. and Whitakar, A., Pergmon Press, Oxford.
8. Bioreaction Engineering principles, Nielson, J. and Viladsen, J., Plenum Press.
9. Chemical Engineering, Problems in Biotechnology, Shuler, M.L.(Ed.), AICHE.
10. Biochemical Engineering, Lee, J.M., Prentice Hall Inc.
11. Bioprocess Engineering – Kinetics, Mass Trasport, Reactors and Gene Expression, Veith W.F., John Wiley and Sons, Inc.
12. Culture of animal cells by RI Freshney.
13. Animal Cell culture practical approach John RW Masters.
14. Animal cell culture techniques by Ed. Martin Clynes.
15. Methods in Cell Biology Vol- 57, Animal cell culture methods.
16. Industrial Biotechnology by, A.H. Patel.
17. Fermentation by Casida.
18. Animal Cell Culture & Technology. M.Buth

Note: All text books are of latest editions:

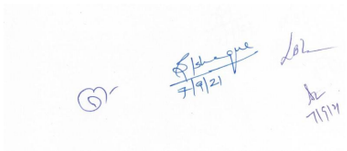
PRACTICAL EXERCISES: Industrial biotechnology

1. Isolation of industrially important micro organisms for microbial processes
2. Microbial production of citric acid using Aspergillus niger.
3. Production and estimation of Alkaline Protease
4. Biomass SCP from fungi , algae
5. Organic solvent production
6. Bio- transformations
7. Bio – insecticide isolation, purification and assay
8. Bio- fertilizer production
9. Use of alginate for cell immobilization



PRACTICAL EXERCISES: - Animal tissue culture

1. Preparation of tissue culture medium and membrane filtration
2. Preparation of single cell suspension from spleen and thymus
3. Cell counting and viability
4. Macrophage monolayer from PEC and measurement of phagocytic activity
5. Cell fusion with PEG
6. Primary tissue explantation technique



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20

M.Sc. Biotechnology
Semester III
Paper IV
Elective 1 BT PG 304 PLANT BIOTECHNOLOGY

Course learning Outcomes: The students will know about the principles and techniques underpinning the applications of basic plant tissue culture techniques. This paper provides a conceptual knowledge about the various transformation techniques employed in plant biotechnology. It also describes the application of genetically modified plants in the various fields of science.

UNIT – 1

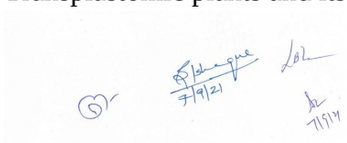
1. Introduction, History of plant tissue culture & its application, Tissue culture media preparation
2. Callus culture and its maintenance, Suspension culture
3. Organogenesis, Somatic embryogenesis, micro propagation and its applications
4. Somatic hybridization: Methods & application
5. Production of haploid (Anther culture and Ovary culture)
6. Cybridization, shoot tip culture

UNIT – 2

1. Protoplast isolation and fusion and its application
2. Somaclonal variation and its application
3. Germplasm conservation; cryopreservation and its application
4. Generation of genetically modified crops for resistance against biotic stress: Viral resistance, bacterial resistance, fungal resistance
5. Genetically resistance plants against Insect & pathogens resistance
6. Regulatory sequences of induced gene

UNIT- 3

1. Generation of genetically modified crops for resistance against abiotic stress: Herbicide resistance drought, salinity thermal stress
2. Plant cloning vectors: TI plasmid
3. Viral vectors (CaMV based vectors, Gemini viruses, TMV based vectors)
4. Plant transformation: Agrobacterium mediated gene transfer & direct gene transfer
5. Chloroplast transformation: Vectors, Markers, Methods, Advantages & limitations
6. Transplastomic plants and its applications



UNIT – 4

1. Transgenic plant for edible vaccines, Antibodies
2. Modification of plant nutritional content: Oil, starch amino acid & protein (golden rice)
3. Transgenic plants for floriculture
4. Transgenic plants for biopharmaceuticals
5. Molecular markers & maps: RFLP & RAPD
6. Plant breeders rights (PRPs) & farmer's rights

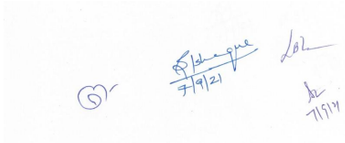
REFERENCE BOOKS:-

1. Plant Biotechnology, Springer Verlag, 2000.J. Hammond,P. Mc.Garvey and V. Yusibov(Eds.)
2. Introduction to plant tissue culture by Kalyan Kumar
3. Plant tissue culture by Bhojwani
4. Practical applications of plant molecular biology by Henry et al
5. Principles of plant Biotechnology by Montell SH et al
6. Plant Genome analysis by PM Gresshoff
7. Essentials of plant breeding by Phundan Singh
8. Biotechnology: Theory and Techniques Vol. I & II by Jack Chirikjian
9. Genetic engineering by Sandhya Mitra
10. Plant Molecular Biology Vol I & II by Phillip M Gimartin & Chris Bowler
11. Plant tissue culture by Razdan
12. Agriculture Biotechnology by Purohit.

Note: All text books are of latest editions:

PRACTICAL EXERCISES:-

1. Preparation of media
2. Surface sterilization.
3. Organ Culture.
4. Callus propagation, organogenesis, transfer of plants to soil.
5. Protoplast isolation and culture.
6. Anther culture, production of haploids.
7. Agrobacterium culture, selection of transformants, receptor gene (GUS) assays.
8. Genomic DNA isolation from seeds and plant tissues, electrophoretic analysis
9. Restriction digestion of plant genomic DNA
10. Setting up of PCR reactions.



School of Studies in Zoology & Biotechnology,
Vikram University, Ujjain
Session 2018-20
M.Sc. Biotechnology
Semester III
Paper IV

Elective 2 BT PG 304 GENOMICS AND PROTEOMICS

Course learning Outcomes: The paper will provide general overview of genomics and proteomics including fundamentals, current techniques and applications. The specific outcomes of the paper include understanding the diversity and complexity of eukaryotic genome, techniques commonly employed in studies of genomics and proteomics and the applications derived from the knowledge provided by this science. Techniques and method of proteomics can be used for drug targeting, biomarkers and pathogen identification.

UNIT: 1

1. The organization of nuclear DNA in eukaryotes
2. Sequencing of genome
3. Tools for genome analysis (RFLP, RAPD)
4. DNA fingerprinting
5. Transcription analysis using Northern blot, RNA dot blot, reverse transcriptase method

UNIT: 2

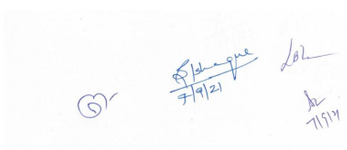
1. DNA Microarray technology
2. Normalization of microarray data
3. Polymerase chain Reaction
4. ESTs and SNPs
5. Human genome project
6. DNA sequencing

UNIT: 3

1. Protein analysis using biochemical method
2. Protein analysis using N – terminal sequencing and C- terminal Sequencing
3. Protein expressing analysis using Isoelectricfocusing and peptide fingerprinting
4. Protein characterization using multidimensional liquid chromatography and mass spectrophotometer
5. Protein microarray
6. Structural proteomics

UNIT: 4

1. Analysis of protein structure using X – ray diffraction method
2. Analysis of protein structure using Nuclear magnetic resonance spectroscopy
3. Genomics based method for detection of Protein – Protein interaction
4. Biochemical based methods for detection and Characterizing Protein- Protein interaction
5. PCR – directed protein in situ arrays
6. Situ directed mutagenesis method for sequence modification

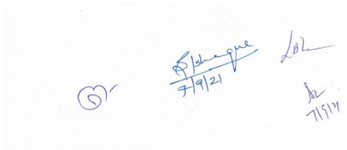


REFERENCE BOOKS:-

1.Voet D, Voet, J.M.- Fundamental of Biotechnology, Wiley, New York
2.Brown, TA. Genomics, Garland science
3.Camplell, AM and Heyer, L.J., Discovering Genomics, Proteomics & Bioinformatics, Banjamen cummings.
4.Primrose, S, Principals of Gene manipulation and Genomics, Black well.
5. Glick, B R & Pasternak, JJ, Molecular Biotechnology, ASM Press.

PRACTICAL EXERCISES:-

7. Preparation of cell free lysates.
8. Isolation & extraction of Proteins
9. Isolation & extraction of nucleic acid
10. Agarose/ Polyacrylanide gel electrophoresis



School of Studies in Zoology & Biotechnology,

Vikram University, Ujjain

Session 2018-20

M.Sc. Biotechnology

Semester III

Practical based on paper 301-304

Total marks 16+24 = 40

(C) INTERNAL EXAMINATION 16 Marks

Exercise:

1. Practical Record 6 Marks
2. Viva-voce/ Oral test 6 Marks
3. Genetic Engineering Exercise 4 Marks

(B)UNIVERSITY EXIMINATION 24 Marks

1. Genetic Engineering Exercise. 02
2. Industrial Biotechnology Exercise 03
3. Industrial Biotechnology Exercise 03
4. Plant Biotechnology/ Genomics and Proteomics Exercise 03
5. Bioprocess engineering & Bioinformatics Exercise. 03
6. Spot based on paper 301-304. 10

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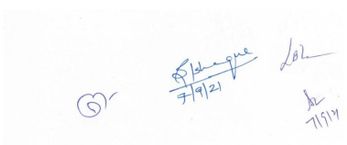
Total Marks 40



School of Studies in Zoology & Biotechnology,

Vikram University, Ujjain

Session 2020-22

M.Sc. Biotechnology

Semester IV

Course learning Outcomes: In the forth semester every student will be allotted dissertation work in lieu of four theory papers. This dissertation work will demonstrate the knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issue related to biotechnology industry, Pharma industry, Medical or hospital related organization, regulatory agencies and academia. It also enables the students to solve, analyze and interpret data generated from experiments done in project work. This project work also develops the skills of students to use modern analytical tools/software/equipments and analyze and solve problems in various courses of Biotechnology. This course built the skills, attitude and value required for self directed, lifelong learning and professional development.