

Revised Syllabus only for SS in Zoology for 2016-17 Session

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

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-17 Academic session

M.Sc. Biotechnology Semester II											
Code	Theory/Practical	Teaching scheme (Hrs./Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT PG 201	Paper 1: Enzyme Technology	6		6	6	3	40	10	50	16	
Core BT PG 202	Paper 2: Environmental Bio Technology	6		6	6	3	40	10	50	16	
Core BT PG 203	Paper 3: Bio Molecules and Metabolism	6		6	6	3	40	10	50	16	
Core BT PG 204	Paper:4 Bioinstrumentation	6		6	6	3	40	10	50	16	
Practical on core 1-4	Practical based on Core Paper 1 - 4	-	6	6	6	4-6	80	20	100		40
	Total	24	6	30	30		260	40	300		

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Revised Syllabus only for SS in Zoology for 2016-17 Session

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

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-17 Academic session

M.Sc. Biotechnology Semester III											
Code	Theory/Practical	Teaching scheme (House/Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in hr	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT PG 301	Paper 1: Genetic Engineering	6		6	6	3	40	10	50	16	
Core BT PG 302	Paper 2: Bioprocess Engineering and bioinformatics	6		6	6	3	40	10	50	16	
Core BT PG 303	Paper 3: Industrial Biotechnology and animal cell <i>tissue</i> culture	6		6	6	3	40	10	50	16	
Elective BT PG 304	Paper: 4 1. Plant Biotechnology* 2. Genomics and Proteomics	6		6	6	3	40	10	50	16	
Practical on core 1-4	Practical based on Core Paper 1 - 4	-	6	6	6	4-6	80 100	20	100		40
	Total	24	6	30	30		260	40	300		

* Currently available

Dr. K. B. Singh
Ms. Anshu

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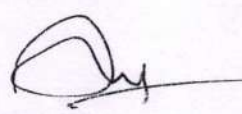
Vikram University, Ujjain
School of Studies in Zoology & Biotechnology
Biotechnology Sem-IV

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology w .e. f 2016-18 Academic session

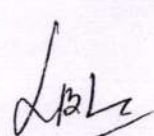
M.Sc. Biotechnology Semester IV				
Code	Theory/Practical	Credits	Total Marks	Minimum Passing Marks
BT PG 401	Major Project work in any Institution or University	18	200	80
BT PG 402	Viva Voce on the project work	6	50	20
BT PG 403	Seminar on project work	6	50	20
	Total	30	300	

Grand Total of all 4 Semesters: Total Credits = 120
Total Marks = 1200

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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.

$$SGPA (S_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where, C_i - is the number of credits of the i^{th} course and
 G_i - 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.

$$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where, S_i - is the SGPA of the i^{th} semester and
 C_i - 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.





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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 = $20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6 + 26 \times 6.3 + 25 \times 8 / 144 = 6.73$

- 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.

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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester I
Paper I

Core BT PG 101. CELL AND MOLECULAR BIOLOGY

UNIT-1

1. Rough Endoplasmic Reticulum (RER): Role in the synthesis, modification and targeting of proteins.
2. Eukaryotic Cell Cycle: Check points, genetic regulation by CdK & cyclins.
3. Biology of Cancer: Types, development and causes.
4. Apoptosis: Definition, mechanism and significance.

UNIT-2

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.

UNIT-3

1. Molecular mechanism of replication of prokaryotic DNA.
2. DNA damage and repair: general process.
3. Genetic code: Universal and exceptional.
4. Transcription in Prokaryotes: Typical features.

UNIT-4

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

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REFERENCES 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 ,Garland 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 : Geoffrey 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 mitochondria by vital staining.
10. Use of Light Microscope, calculation of magnification , measurements of cell nucleuse 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.

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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-18

M.Sc. Biotechnology
Semester I
Paper II

Core BT PG 102. Immunology and Molecular Diagnostics

Unit-1

1. Component of Innate and Acquired Immunity.
2. Complement system and Inflammatory responses
3. Organ and cells of the Immune system: primary and secondary lymphoid organs.
4. Major histocompatibility complex.

Unit-2

1. Immunoglobulins: structures and classes
2. B cell maturation, activation and differentiation
3. T cell maturation, activation and differentiation
4. Hypersensitivity – Type I – IV

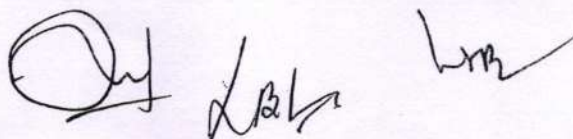
Unit-3

- 1 Hybridoma technology and Monoclonal Antibodies.
- 2 Recombinant vaccines and clinical applications
- 3 Microchips & Taqman.
- 4 Real time PCR methodologies in clinical diagnostics.

Unit-4

- 1 Protein based molecular diagnostics e. g. immunoproteomics, ELISA and western blotting applications.
- 2 Molecular diagnostics of some common genetic and non- genetic diseases e.g. trinucleotide repeats, fragile X Syndrome.
- 3 Molecular diagnostics of diabetes mellitus and cystic fibrosis
- 4 Genetic counselling and genetic testing.

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REFERENCES: -

1. Immunology 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.

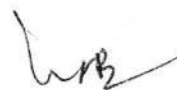
PRACTICALS

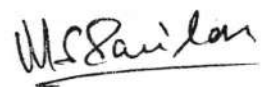
1. Blood film preparation and identification of cell.
2. Demonstration of lymphoid organs and their microscopic Examination .
3. Immunization and production polyclonal antibodies
4. Immunodiffusion.
5. Agglutination .
6. ELISA Antibody capture Elisa
7. ELISA Antigen capture Elisa.
8. Sepration of mononuclear 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.

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Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester I
Paper III

**Core BT PG 103. MOLECULAR ENDOCRINOLOGY
AND REPRODUCTIVE TECHNOLOGY**

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.

UNIT -2

1. Hormones receptors – Identification, quantitation, purification, and physico-chemical properties.
2. Membrane receptors Structure and signal transduction mechanism .
3. Nuclear receptors –Structure and function, orphan receptors .
4. Eicasonoids and Harmon action.

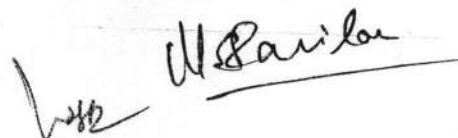
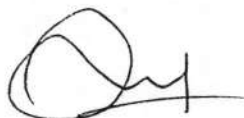
UNIT -3

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.

UNIT -4

1. Sex determination.
2. Embryo sexing and cloning
3. Genetic analysis of hormonal disorders
4. Transcriptional and post Transcriptional regulation of Hormones .

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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 sieroid 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 .

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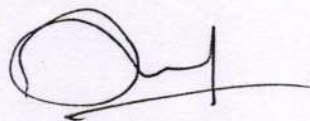
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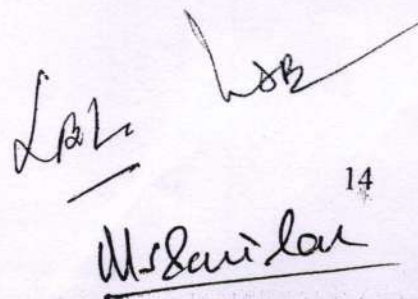
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15. Histological demonstration of glycogen during reproductive cycle and pregnancy.
16. Effect of testosterone, estradiol and progesterone.
 - (a) Male reproductive study by Weight/ volume Measurement .
 - (b) Female reproductive structure by Weight/ volume Measurement
17. Study of accessory reproductive structure after castration or ovariectomy
18. Sperm count .
19. Demonstration of surgical techniques.
 - (a) castration (b) Ovariectomy (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.



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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester I
Paper IV

Core BT PG 104. MICROBIOLOGY

UNIT - 1

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

UNIT - 2

1. Virus : Types, Isolation , Cultivation , Identification, and viral replication.
2. Structure and morphology of Bacteriophage, lytic and lysogenic cycle.
3. Life cycle of DNA Viruses: SV 40, RNA. Viruses: Retroviruses.
4. Cyanobacteria : General account and their importance.

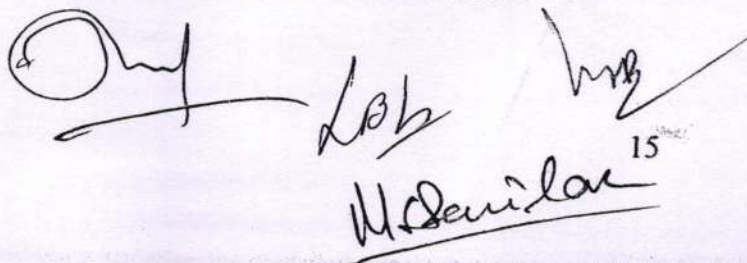
UNIT - 3

1. Infection and diseases, type of Infection, Mechanism of pathogenicity.
2. Bacterial Diseases: Staphylococcal and Clostridial food poisoning, Salmonellosis Shigellosis.
3. Fungal Diseases, Histoplasmosis, Aspergillosis.
4. Viral Diseases: Chicken Pox, Hepatitis B, and Poliomyelitis.

UNIT - 4

1. Mycoplasma and diseases caused by them.
2. Bacterial Recombination : Transformation , Conjugation, Transduction, Plasmids and transposons.
3. Chemotherapeutic agents: Classification of antibiotics, Broad spectrum antibiotics; Antibiotics from prokaryotes.
4. Anti- fungal and antiviral antibiotics, mode of action of antibiotics

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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.

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

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SEMESTER - I BIOTECHNOLOGY PRACTICAL EXAMINATION -

(6 hrs.)

Based on theory Papers 101 to 104

Max. Marks - 100

1.	Microbiological Exercise - 1	04 Marks
2.	Microbiological Exercise - 2	04 Marks
3.	Microbiological Exercise - 3	04 Marks
4.	Microbiological Exercise - 4	04 Marks
5.	Microbiological Exercise - 4	04 Marks
6.	Reproductive Endocrinology Exercise - 1	05 Marks
7.	Reproductive Endocrinology Exercise - 2	05 Marks
8.	Spots based on Endocrinology	10 Marks
9.	Cytological Exercise - 1	04 Marks
10.	Cytological Exercise - 2	04 Marks
11.	Cytological Exercise - 3	04 Marks
12.	Cytological Exercise - 4	04 Marks
13.	Spotting based on cytogenetics & Immunology	08 Marks
14.	Immunological Exercise - 1	05 Marks
15.	Immunological Exercise - 2	05 Marks
16.	Immunological Exercise - 3	06 Marks
17.	Viva - Voce	10 Marks
18.	Practical Record	10 Marks

Total Marks - 100

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

2016-18

Scheme of teaching and examination under semester pattern Choice Based
Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-18
Academic session

M.Sc. Biotechnology Semester II												
Code	Theory/Practical	Teaching scheme (Hrs./Week)				Credits	Examination Scheme					
		Th	Pract	Total	Duration in		Max. Marks		Total Marks	Minimum Passing Marks		
							External	Internal		Th	Prac	
Core BT PG 201	Paper 1: Enzyme Technology	6		6	6	3	40	10	50	16		
Core BT PG 202	Paper 2: Environmental Bio Technology	6		6	6	3	40	10	50	16		
Core BT PG 203	Paper 3: Bio Molecules and Metabolism	6		6	6	3	40	10	50	16		
Core BT PG 204	Paper:4 Bioinstrumentation	6		6	6	3	40	10	50	16		
Practicals Core 201-4	Practical 1: Based on theory Papers 1-4	-	6	6	6	3	100	-	100		40	
Practical Core 205	Practical 2: Based on theory Papers 3 & 4	-	6	6	6	3	50	-	50		20	
Total		24	6	30	30		260	40	300			

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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-18

M.Sc. Biotechnology
Semester II
Paper I

Core BT PG 201. ENZYME TECHNOLOGY

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

UNIT-2

1. Enzyme Kinetics: The Michaelis-Menten equation
2. Analysis of Kinetic data (Determination of V_{max} , Lineweaver-Burk plot)
3. Enzyme regulation: Reversible Inhibition, Irreversible Inhibition and Allosteric Regulation
4. Enzyme Purification; Ion-exchange chromatography, Gel filtration chromatography, Affinity chromatography

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.

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

M. S. Dhanika

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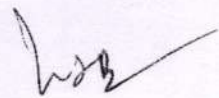
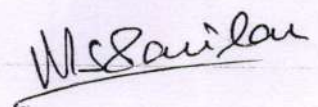
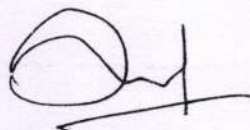
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PRACTICAL EXERCISES:

1. Protein estimation methods: Lowry, Bradford and Spectrophotometric.
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

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



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Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester II
Paper II

Core BT PG 202 ENVIRONMENTAL BIOTECHNOLOGY

UNIT - 1

1. Introduction to Environmental pollution and control measures .
2. Air pollution technologies: Biofilters & Bioscrubbers for treatment of Industrial waste.
3. Environmental pollution in human health.
4. Management of solid waste.

UNIT - 2

1. Waste water treatment technology: Types of waste water, Major contaminants in waste water, concept of ETP.
2. Physical & Chemical methods of waste water treatment..
3. Biological methods of waste water treatment: Aerobic methods(Activated sludge process, Trickling filters, Biological filters, Rotating Biological contractors, fluidized Bed reactor) .
4. Biological Methods (contact digestors, packed column reactors)

UNIT - 3

1. Bioremediation: Types of Bioremediation, In- Situ & Ex- Situ Bioremediation techniques, factors affecting Bioremediation .
2. Biofuels: Bioethanol, Biodiesel, Biohydrogen, Bioremediation.
3. Biofertilizers, Biopesticides .
4. Biosensors

UNIT - 4

1. Parameters and standards of noise, air, water & waste water: Significance of various parameters, Standard adopted by CPCB & WHO.
2. Drinking water quality standards; effluent discharge standards for disposal on land, rivers & streams.
3. Bioindicators of aquatic pollution
4. Degradation of xenobiotics in environment.

Dr. Lal

M. Saurav

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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

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









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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester II
Paper III

Core BT PG 204 BIOMOLECULES ^{and} METABOLISM

Unit 1.

1. Protein Purifications: Chromatography and electrophoretic separation of proteins, differential centrifugation and ultracentrifugation techniques for proteins separation.
2. Primary structure determination of proteins: sequencing and detection of sequenced proteins.
3. Secondary structure of proteins: alpha helix and beta sheet structures, turns and loops.
4. Tertiary and quaternary structures of proteins: super secondary structures, domains, peptide symmetry.

Unit 2.

1. Fractionation and isolation of nucleic acids, Structure of DNA
2. Biosynthesis of purine ribonucleotides, regulation of purine ribonucleotide synthesis, salvage ^{pathways} of purines, synthesis of purine deoxy-ribonucleotides.
3. Biosynthesis of pyrimidine, regulation of pyrimidine biosynthesis, synthesis of pyrimidine deoxy-ribonucleotides.
4. 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

Unit 4

1. Carbohydrate metabolism: Pathways of glycolysis and tricarboxylic acid cycle.
2. Energy metabolism: Respiratory chain complexes, electron transport and oxidative phosphorylation.
3. Energy rich bonds: High energy compounds, coupled reactions involving ATP
4. Lipid metabolism: Pathways of Beta-oxidation of fatty acids

Prof. L. S. Mishra
Ms. S. S. Mishra

Revised Syllabus only for SS in Zoology for 2016-17 Session

Practical

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

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.

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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester II
Paper IV

Core BT PG 204 BIOINSTRUMENTATION

UNIT - 1

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

UNIT - 2

1. Column Chromatography.
2. Biosafely Cabinets.
3. Gas-liquid chromatography and HPLC.
4. Electrophoresis: paper electrophoresis, agarose, Polyacrylamide and SDS - PAGE electrophoresis; Isoelectric focusing.

UNIT - 3

1. X-ray crystallography and NMR: Principle, Instrumentation and applications.
2. Nephelometry and Turbidometry
3. Centrifugation : Principle, Instrumentation and applications
4. Ultrasonication: Principle, Instrumentation and applications.

UNIT - 4

1. Microtomy, types, principals and applications.
2. Microscopy : Light, Phase contrast , fluorescence and electron Microscopies.
3. Radioactivity Liquid, Scintillation Counter, solid Scintillation counters, .
4. RIA and Autoradiography: Principle and applications.

Dr. L. B. L.

M. S. B. S. L.

L. B. L.

W. S. L.

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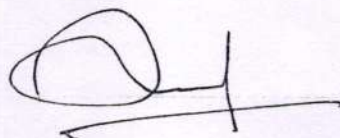
Revised Syllabus only for SS in Zoology for 2016-18 Session

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.

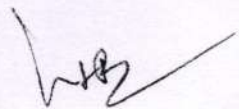
REFERENCE BOOKS

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.



M. S. Sankar

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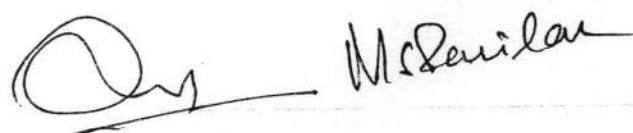
Revised Syllabus only for SS in Zoology for 2016-17 Session

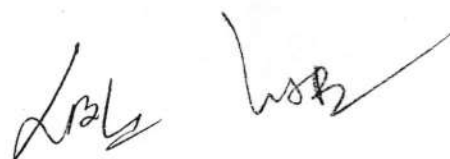
SEMESTER - II BIOTECHNOLOGY PRACTICAL EXAMINATION -
(6 hrs.)

Based on theory Papers 201 to 204

		Max. Marks - 100
1	Enzymology Exercise - 1	8 Marks
2	Enzymology Exercise - 2	6 Marks
3	Enzymology Exercise - 3	6 Marks
4	Environment Exercise -1	6 Marks
5	Environment Exercise - 2	6 Marks
6	Spots based on Environment	8 Marks
7	Biochemical Exercise - 1	4 Marks
8	Biochemical Exercise - 2	6 Marks
9	Biochemical Exercise - 3	5 Marks
10	Biochemical Exercise -4	5 Marks
11	Bioinstrumentation Exercise - 1	4 Marks
12	Bioinstrumentation Exercise - 2	4 Marks.
13	Bioinstrumentation Exercise - 3	6 Marks
14	Bioinstrumentation Exercise - 4	6 Marks
15	Viva - Voce	10 Marks
16	Practical Record	10 Marks

Total Marks - 100

 M. Benilan



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

Scheme of teaching and examination under semester pattern Choice Based
Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-18
Academic session

M.Sc. Biotechnology Semester III											
Code	Theory/Practical	Teaching scheme (House/Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in hr	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT PG 301	Paper 1: Genetic Engineering	6		6	6	3	40	10	50	16	
Core BT PG 302	Paper 2: Bioprocess Engineering and bioinformatics	6		6	6	3	40	10	50	16	
Core BT PG 303	Paper 3: Industrial Biotechnology and animal tissue culture	6		6	6	3	40	10	50	16	
Elective BT PG 304	Paper: 4 1. Plant Biotechnology* 2. Genomics and Proteomics	6		6	6	3	40	10	50	16	
Practical on core 4	Practical based on Core Paper 1 - 4	-	6	6	6	4-6	100		100		40
Total		24	6	30	30		260	40	300		

* Currently available

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Vikram University, Ujjain
School of Studies In Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester III
Paper I

Core BT PG 301 GENETIC ENGINEERING

Unit - 1

1. Restriction Endonucleases and DNA polymerases.
2. Cloning vectors : plasmids, bacteriophages, M13, PUC 19, Cosmids and artificial chromosomal vectors:
3. Gene cloning strategies: C DNA and genomic cloning; C DNA and genomic libraries
4. Method of gene transfer in Prokaryotic and Eukaryotic cells.

Unit - 2

1. DNA sequencing: Maxam and Gilbert method; using bacteriophage M13 method.
2. Site directed Mutagenesis: oligonucleotide- directed mutagenesis, PCR- amplified; oligonucleotide- - directed mutagenesis, Random mutagenesis
3. Gene knockouts and creation of knockout mice: disease model.
4. Gene Expression Analysis.

Unit-3

1. Gene therapy for Genetic disorders: Ex vivo Gene therapy, in vivo Gene therapy.
2. Molecular Diagnosis of Genetic Diseases.
3. Gene Silencing: Si RNA technology, Micro RNA, Principles and applications of gene silencing.
4. PCR and DNA Amplification.

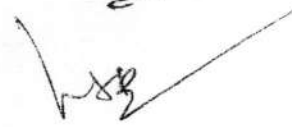
Unit-4

1. Methods of Primer designing and Gene construction.
2. Restriction fragment length polymorphism (RFLP) and DNA fingerprinting.
3. Bio safety Measures and Regulations for Genetically Engineered Products.
4. Patenting biotechnological products.









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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.

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 & 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 – Bernari R. Glick , Jack j. Pasternak.
14. Genome – T.A. Brown
15. Biotechnology – A laboratory Course- Jeffrey M.Beckes, Guy A. Caldwell, Eue Ann Zachgo

Note : All text books are of latest editions:

Dr. Labh

MS Bawlan
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Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester III
Paper II

Core BT PG 302 BIOPROCESS ENGINEERING AND BIOINFORMATICS

Unit-1

- 1- Isolation, screening and maintenance of industrially important microbes.
- 2- Strain improvement for increased yield and other desirable characteristics.
- 3- Bioreactor design: Types of fermentation, fermenters and fermentation media
- 4- Upstream processing: Sterilization, Aeration, agitation in bioprocess scale up and scale down process.

Unit-2

- 1- Downstream processing: Filtration, centrifugation, sedimentation and flocculation method of bioseparation of fermentation products; Drying, crystallization, storage and packaging of fermentation products.
- 2- Enzymatic bioconversions e.g. starch and sugar conversion process.
- 3- Cheese making by proteases and various other enzyme catalytic action in food processing.
- 4- Food ingredients and additives prepared by fermentation, their purification and preservations.

Unit-3

- 1- Microbes and their use in pickling, producing colors and flavors.
- 2- Bacteriocins from lactic acid Bacteria.
- 3- Proteins and nucleic acid Databases
- 4- The gene bank sequences to the databases, submitting DNA sequences to the databases and database searching.

Unit-4

- 1- Computational tools for DNA sequence analysis.
- 2- Sequence alignment, pair wise alignment techniques, multiple sequence alignment.(use of CLUSTAL)
- 3- Gene Annotation .
- 4- Submitting DNA protein sequences to databases.

Om Kishor

VSR

M. S. Bhatnagar

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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

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:

Ang *Kaly* *hob* *MSBewlar*

Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester III
Paper III

Core BT PG 303 INDUSTRIAL BIOTECHNOLOGY
AND ANIMAL TISSUE CULTURE

Unit-1

1. History Importance and applications of Industrial Biotechnology.
2. Microbial production of antibiotics : Penicillin; Streptomycin
3. Microbial production of Vitamins & amino acids (Vitamin B12 & Glutamic acid)
4. Microbial production of enzymes: Amylase , Protease.

Unit-2

1. Microbial production of alcoholic beverages: Distilled alcoholic beverage Beer, Wines
2. Microbial production of organic acids: Citric acid & Acetic acid
3. Microbial production of solvents : Glycerol & Acetone
4. Microbial production of food- SCP

Unit-3

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

Unit - 4

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

Dr. LBL *Waz*
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Abbas

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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

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, Stockholm.
 5. Process Engineering in Biotechnology, Jackson, A.T., Prentice hall, Englewood 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:*

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Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-18

M.Sc. Biotechnology
Semester III
Paper IV

Elective 1 BT PG 304 PLANT BIOTECHNOLOGY

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; shoot tip culture; Anther culture; Cybrids.

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. Insect & pathogens resistance.

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 and viral vectors (CaMV based vectors, Gemini viruses, TMV based vectors)
3. Plant transformation: Agrobacterium mediated gene transfer & direct gene transfer.
4. Chloroplast transformation: Vectors, Markers, Methods, Advantages & limitations.

Unit – 4

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

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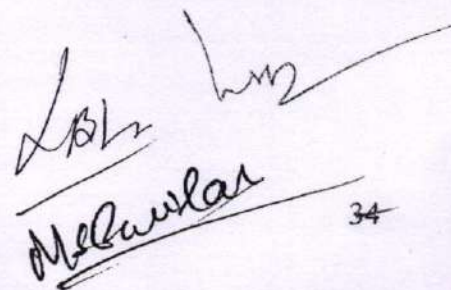
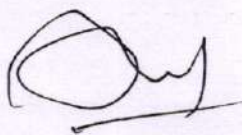
PRACTICAL EXERCISES :-

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.

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:



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Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain
School of Studies in Zoology & Biotechnology,
Session 2016-17

M.Sc. Biotechnology
Semester III
Paper IV

Elective 2 BT PG 304 GENOMICS AND PROTEOMICS

Unit: 1

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

Unit: 2

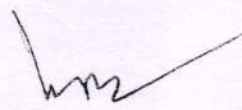
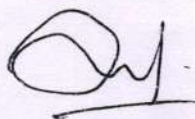
1. Genome identification using markers 16s RNA typing
2. ESTS and SNPS
3. DNA Microarray technology
4. Polymerase chain Reaction

Unit: 3

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

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.



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PRACTICAL EXERCISES :-

3. Preparation of cell free lysates.
4. Isolation & extraction of Proteins
5. Isolation & extraction of nucleic acid
6. Agarose/ Polyacrylanide gel electrophoresis

REFERENCE BOOKS:-

1. Voet D, Voet, J.M.- Fundamental of Biotechnology, Wiley, New York
2. Brown, TA. Genomics, Garland science
3. Campell, 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.

Dr. J. M. Voet

M. S. Saurav

Dr. J. M. Voet

Dr. J. M. Voet

Revised Syllabus only for SS in Zoology for 2016-17 Session

SCHEME OF PRACTICAL EXAMINATION

M.Sc. (IIIrd Semester) BIOTECHNOLOGY

Based on theory Papers 301 to 304

06 hrs.

1. Genetic Engineering Exercise -1	04 Marks
2. Genetic Engineering Exercise -2	04 Marks
3. Genetic Engineering Exercise -3	04 Marks
4. Genetic Engineering Exercise -4	04 Marks
5. Spotting based on Genetic Engineering & Frontiers in Biotech.	08 Marks
6. Bioprocess engineering & Bioinformatics Exercise -1	05 Marks
7. Bioprocess engineering & Bioinformatics Exercise-2	05 Marks
8. Bioprocess engineering & Bioinformatics Exercise -3	05 Marks
9. Industrial Biotechnology Exercise -1	04 Marks
10. Industrial Biotechnology Exercise -2	04 Marks
11. Industrial Biotechnology Exercise -3	04 Marks
12. Industrial Biotechnology Exercise -4	04 Marks
13. Spotting based on Industrial & Plant Biotechnology/ Genomics and Proteomics	08 Marks
14. Plant Biotechnology/ Genomics and Proteomics Exercise -1	05 Marks
15. Plant Biotechnology/ Genomics and Proteomics Exercise -2	05 Marks
16. Plant Biotechnology/ Genomics and Proteomics Exercise -3	05 Marks
17. Viva Voce	05 Marks
18. Practical Record	05 Marks

Total Marks - 100

W. S. Sawal
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Revised Syllabus only for SS in Zoology for 2016-18 Session

Vikram University, Ujjain

School of Studies in Zoology & Biotechnology

Biotechnology Sem-I

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-18 Academic session

M.Sc. Biotechnology Semester I											
Code	Theory/Practical	Teaching scheme (Hrs./Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in hrs	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT PG 101	Paper 1: Celi and Molecular Biology	6		6	6	3	40	10	50	16	
Core BT PG 102	Paper 2: Immunology & Molecular Diagnostics	6		6	6	3	40	10	50	16	
Core BT PG 103	Paper 3: Molecular Endocrinology and Reproductive Technology	6		6	6	3	40	10	50	16	
Core BT PG 104	Paper 4: Microbiology	6		6	6	3	40	10	50	16	
Practical on core 1-4	Practical based on Core Paper 1-4	-	6	6	6	4-6	80	20	100		40
	Total	24	6	30	30		260	40	300		

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Revised Syllabus only for SS in Zoology for 2016-17 Session

Vikram University, Ujjain

School of Studies in Zoology & Biotechnology

Biotechnology Sem-II

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-17 Academic session

M.Sc. Biotechnology Semester II											
Code	Theory/Practical	Teaching scheme (Hrs./Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT G 201	Paper 1: Enzyme Technology	6		6	6	3	40	10	50	16	
Core BT G 202	Paper 2: Environmental Technology	6		6	6	3	40	10	50	16	
Core BT G 203	Paper 3: Bio Molecules and Metabolism	6		6	6	3	40	10	50	16	
Core BT G 204	Paper:4 Bioinstrumentation	6		6	6	3	40	10	50	16	
Practical core 4	Practical based on Core Paper 1 - 4	-	6	6	6	4-6	80	20	100		40
	Total	24	6	30	30		260	40	300		

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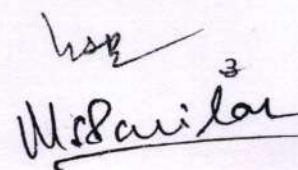
Vikram University, Ujjain
School of Studies in Zoology & Biotechnology
Biotechnology Sem-III

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Biotechnology we f 2016-18 Academic session

M.Sc. Biotechnology Semester III											
Code	Theory/Practical	Teaching scheme (House/Week)			Credits	Examination Scheme					
		Th	Pract	Total		Duration in hr	Max. Marks		Total Marks	Minimum Passing Marks	
							External	Internal		Th	Prac
Core BT G 301	Paper 1: Genetic Engineering	6		6	6	3	40	10	50	16	
Core BT G 302	Paper 2: Bioprocess Engineering and bioinformatics	6		6	6	3	40	10	50	16	
Core BT G 303	Paper 3: Industrial Biotechnology and animal cell culture	6		6	6	3	40	10	50	16	
Active PG 4	Paper: 4 1. Plant Biotechnology* 2. Genomics and Proteomics	6		6	6	3	40	10	50	16	
Practical Core 4	Practical based on Core Paper 1 - 4	-	6	6	6	4-6	80	20	100		40
	Total	24	6	30	30		260	40	300		

* Currently available



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Revised Syllabus only for SS in Zoology for 2016-18 Session

Vikram University, Ujjain

School of Studies in Zoology & Biotechnology

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 2016-18 Academic session

M.Sc. Biotechnology Semester IV					
Code	Theory/Practical	Credits	Total Marks	Minimum Marks	Passing Marks
BT PG 401	Major Project work in any Institution or university	18	200	80	
BT PG 402	Viva Voce on the project work	6	50	20	
BT PG 403	Seminar on project work	6	50	20	
	Total	30	300		

Grand Total of all 4 Semesters: Total Credits = 120

Total Marks = 1200

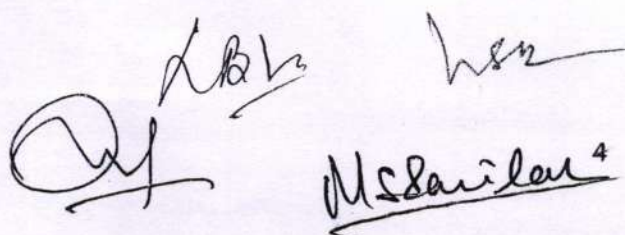
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MSBairan⁴

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.

$$SGPA (S_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where, C_i - is the number of credits of the i^{th} course and
 G_i - 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.

$$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where, S_i - is the SGPA of the i^{th} semester and
 C_i - 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.

Dr. Lohy

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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 = $20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6 + 26 \times 6.3 + 25 \times 8 / 144 = 6.73$

- 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.

LBL
MS Panikar
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