

University of Kota (Rajasthan)

Syllabus- M. Sc. (Biotechnology) I& II Semester

Course Structure with Distribution of Marks:

Year / Semester	Serial Number, Code & Nomenclature of Paper			Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
	Number	Code	Nomenclature		L	P	C	Conti. Assess.	Sem. Assess.	Total Marks	Conti. Assess.	Sem. Assess.
I Year/ I Semester	1.1	BTC101	Enzyme Technology	3 Hrs	4	--	4	30	70	100	12	28
	1.2	BTC102	Biophysics and Bioelectronics	3 Hrs	4	--	4	30	70	100	12	28
	1.3	BTC103	Concepts of Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	1.4	BTC104	Fundamentals of Molecular Biology	3 Hrs	4	--	4	30	70	100	12	28
	1.5	BTC111	Biotech Laboratory-I	5 Hrs	--	16	8	--	100	100	--	50
	Total				16	16	24	120	380	500	--	
I Year II Semester	2.1	BTC201	Fundamentals of Biochemistry	3 Hrs	4	--	4	30	70	100	12	28
	2.2	BTC202	Tools and Techniques of Molecular Biology	3 Hrs	4	--	4	30	70	100	12	28
	2.3	BTC203	Biostatistics	3 Hrs	4	--	4	30	70	100	12	28
	2.4	BTC204	Principles of Genetic Engineering	3 Hrs	4	--	4	30	70	100	12	28
	2.5	BTC211	Biotech Laboratory-II	5 Hrs	--	16	8	--	100	100	--	50
Total				16	16	24	120	380	500	--		
II Year / III Semester	Serial Number, Code & Nomenclature of Paper			Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
	Number	Code	Nomenclature		L	P	C	Conti. Assess.	Sem. Assess.	Total Marks	Conti. Assess.	Sem. Assess.
	3.1	BTC301	Basic and Applied Plant and Animal Biotech	3 Hrs	4	--	4	30	70	100	12	28
	3.2	BTC302	Environmental Biotechnology	3 Hrs	4	--	4	30	70	100	12	28
	3.3	BTC303	Immunology and Immunotechnology	3 Hrs	4	--	4	30	70	100	12	28
	3.4	BTC304	Elective- I 1) Recent trends in RNA Biology 2) Nanotechnology 3) Medical Biotechnology 4) Solid and liquid Waste Management	3 Hrs	4	--	4	30	70	100	12	28
	3.5	BTC311	Biotech Laboratory –III	5Hrs	--	16	8	--	100	100	--	50
	Total				16	16	24	120	380	500	--	
	II Year/ IV Semester	4.1	BTC401	Industrial Biotechnology	3 Hrs	4	--	4	30	70	100	12
4.2		BTC402	Computational Biology	3 Hrs	4	--	4	30	70	100	12	28
4.3		BTC403	Biosafety, Bioethics and IPR	3 Hrs	4	--	4	30	70	100	12	28
4.5		BTC404	Dissertation	----	4	--	4	30	70	100	12	28
4.6		BTC411	Biotech Laboratory-IV	5 Hrs	--	16	8	--	100	100	--	50
Total				16	16	24	120	380	500	--		

Note:

The allotment of an elective shall reserve with the department, which depends upon the availability of faculty members, infrastructure and laboratory facility available to run the elective and an elective cannot be offered by the department if the number of students is less than the 25% of the total sanctioned strength of the programme.

The syllabus for each theory paper is divided into five independent units and each theory question paper will be divided into three sections as mentioned below:

✂ **Section-A** shall have 01 compulsory question comprising 10 questions (maximum 20 words answer) taking two questions from each unit. Each question shall be of one mark and total marks of this section will be 10. This section will be compulsory in the paper.

✂ **Section-B** will carry 25 marks with equally divided into five long answer type questions (answer about in 250 words) and examiners are advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

✂ **Section-C** will contain five long answer type questions. One compulsory question of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) of and any two more questions (answer about in 400 words) out of remaining four questions. Paper setter shall be instructed to design question paper covering from all five units.

The pattern of question paper of internal and external shall be as follows:

(A) Continuous or Internal Assessment:

30% weightage of Maximum Marks (30 Marks out of 100 Maximum Marks)

First/Second Internal Test 20.....

Duration of Exam: 1.00 Hr Max. Marks: 15

Class: M.Sc. Semester:

Subject: Paper:

Note: The question paper contains three sections as under:

Section-A : One compulsory question with 04 parts. Please give short answers in 20 words for each part.

Section-B : 02 questions to be attempted having answers approximately in 250 words.

Section-C : 01 question to be attempted having answer in about 500 words.

SECTION A

Q.1(a) 1

(b) 1

(c) 1

(d) 1

SECTION B

Q.2 3

Q.3 3

Q.4 3

Q.5 3

SECTION C

Q.6 5

Q.7 5

(B) Semester or External Assessment:

70% weightage of Max. Marks (70 Marks out of 100 Max. Marks)

Duration of Examination: 3 Hours Max. Marks: 70

SECTION-A: 10x1=10

(Answer all questions)

(Two question from each unit with no internal choice)

Q. No. 1

- (i) **1 Mark**
- (ii) **1 Mark**
- (iii) **1 Mark**
- (iv) **1 Mark**
- (v) **1 Mark**
- (vi) **1 Mark**
- (vii) **1 Mark**
- (viii) **1 Mark**
- (ix) **1 Mark**
- (x) **1 Mark**

SECTION-B: 5x5=25

(Answer all questions)

(One question from each unit with internal choice)

(Maximum two sub-divisions only)

Q. No. 2.

Or

.....
5 Marks

Q. No. 3.

Or

.....
5 Marks

Q. No. 4.

Or

.....
5 Marks

Q. No. 5.

Or

.....
5 Marks

Q. No. 6.

Or

.....
5 Marks

SECTION-C: 1x15 + 2x10=35

(Answer any three questions including compulsory Q.No. 7)

(Maximum four sub-divisions only)

Q. No. 7. **15 Marks**

Q. No. 8. **10 Marks**

Q. No. 9. **10 Marks**

Q. No. 10. **10 Marks**

Q. No. 11. **10 Marks**

Distribution of Marks for Practical Examinations:

Time - 5 hrs	Max. Marks –100
	Min. Marks -50
Major Exercise	25
Minor Exercise	15
Preparation	05
Spotting	10
Seminar/Project	20
Record	10
Viva-voce	15
Total	100

SEMESTER-I
BTC101 - Enzyme Technology

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

Unit- I

Introduction to enzyme and enzyme technology: History of enzyme and enzyme technology. Enzymes: -Classification, Nomenclature and general properties of enzymes. Effects of substrate, temperature, pH and inhibitors of enzyme activity.

Unit- II

Enzyme isolation, purification and large scale Production: Source and screening strategies for novel enzymes. Isolation methods of enzyme. Purification methods and concentration of intracellular and extracellular enzymes. Factors affecting enzyme stability. Media and large scale production of enzyme. Large scale use of enzymes in different fields.

Unit- III

Steady state kinetics: Methods of estimation of rate of enzyme catalyzed reaction with special reference to Michaelis-menton kinetics. Mechanism of enzyme action and regulation: Active and regulatory sites, chemical modification. General mechanistic principles, feedback inhibition. Isozymes, enzyme activation, zymogens, multi-enzymes complexes and multifunctional enzymes.

Unit- IV

Preparation of kinetics of immobilized enzymes: Methods of immobilization, physical adsorption, covalent binding, entrapment, kinetics of immobilized enzymes and factors effecting. Immobilized enzyme processes: production of high fructose corn syrup, production of antibiotics, production of acrylamide.

Unit-V

Advancement in enzyme technology: Enzyme reactions in biphasic liquid system proteases, glycosidases, lipases in synthetic reactions, inter-estrification of lipids, artificial enzymes, unnatural substrate enzyme engineering, extremophilic enzyme.

Reference Books:

1. Enzyme Technology- M F Chaplin and D C Bucks
2. Industrial Enzymology- Godfrey and West
3. Enzyme – Copeland
4. Enzyme in Industry – W. Gerhartz
5. Principles of Biochemistry. Ed Lehninger, Nelson and Cox. CBS publishers and distributors.
6. Biochemistry. Ed Donald Voet and Judith G. Voet. John Wiley & sons, Inc
7. Plant enzymology and plant histoenzymology- Malick CP singh MB, Kalyani Publishers, New Delhi

SEMESTER-I
BTC102 - Biophysics and Bioelectronics

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

Unit- I

Bioenergetics: Basic bioenergetics. Cellular bioenergetics, whole body bioenergetics. Entropy. Gibbs free energy. Bioenergetic pathways. Bioenergetics and biocommunication. Control of bioenergetics.

Unit- II

Molecular interactions: Molecular interactions of primary importance. Strong and weak interactions. Biomolecular interactions- DNA protein interactions, Elementary account of DNA drug interactions. Molecular interaction forces-intermolecular and intramolecular forces. Attractive and repulsive forces generated within molecules and their overall effect on molecular interactions.

Unit- III

Radiation Biophysics: Interaction of radiation with matter- ionizing radiation, non-ionizing radiation, ion pairs, radiation units and dosimetry, dose effect graphs and target theory, direct and indirect radiation action, radiation on proteins, nucleic acids, carbohydrates, cell and whole organism, genetic effects of radiation, repair of radiation induced damage, radiation in diagnosis and therapeutics, protection from radiation.

Unit- IV

Nucleic Acids Biophysics: Basis of Watson Cricks original model Different, base- pairing schemes Unsatisfactory nature of Hoogsteen and other base pairing schemes, biological implication of Watson Crick base pairing scheme refinement of Watson-Crick model by linked-atom least squares, fiber X- ray diffraction studies, single crystal X-ray diffraction, and NMR studies on mono- and oligo- nucleotides, spectroscopic study of DNA polymorphism.

Unit-V

Biochip and Biocomputers: Biochip principle, micro fluidic chips, silicon chips and molecular chips. Eye chip vision sensors and Dobelle artificial vision system. Biocomputers. Genetic discrimination and biocomputing. Sound and image processing with optical bio computers. Future of Biocomputers.

Text/Reference books:

1. Introduction to Electron Microscopy - S. Wischnitzer.
2. Electron Microscopy in Biology - J.R.Harris (ed.).
3. Biophysics by R.N.ROY
4. Biophysics - V. Pattabhi & N. Gautham (Narosa, New Delhi).
5. Fundamentals of Molecular Spectroscopy - C.N. Banwell, (Tata-McGraw Hill)
6. Radiation Biophysics-Edward L. Alpen

SEMESTER-I
BTC103- Concepts of Microbiology

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

UNIT I

History and Scope of microbiology. Classification up to class level and distinctive characters of major groups: Bacteria, Fungi, Algae and Protozoa.

Classification of microorganisms – Haeckel's three kingdom concept, Whittaker's five kingdom concept, Classification and salient features of bacteria according to the Bergey's manual of determinative bacteriology.

UNIT II

Principles, Function & application of Microscopy: Bright field, Dark field, Phase contrast, confocal. Fluorescence and Electron (Transmission and Scanning) microscopy.

Staining techniques: Stains and Dyes, Simple, Gram, Negative, Capsule, Endospore, Acid fast.

UNIT III

Sterilization and Disinfection (Physical and Chemical methods): Heat, Temperature, Filtration Pasteurization, Dehydration, Radiation, Alcohol, Surface active agents, Aldehyde, Halogen, Gases.

Isolation Techniques: Serial Dilution, Streak plate, Pour plate and Spread plate method.

Culture Media: Types of Media.

UNIT IV

Bacterial morphology- size, shape, cell wall, cell Membrane, capsule, flagella, fimbriae and pili, nucleoid, ribosomes, mesosomes and reserve Food.

Bacterial Growth– Growth curve and its kinetics and growth yield, growth synchronization.

Determination of biomass, Environmental factors affecting growth.

Unit V

Biological nitrogen fixation

Geochemical cycles (nitrogen, carbon, phosphorus, sulphur)

Study of Viruses: General structure and properties of viruses, Taxonomy, reproduction, cultivation, Purification and assay.

Bacteriophage - Structure and reproduction, Prions and Virioids.

Text/Reference books:

1. Prescott, L.M., J.P Harley and D.A Klein, 2007. Microbiology VII Ed. Mc Grow Hill,
2. Davis R.Y. E.A. Adeberg and J.L. Ingram, 1991 General Microbiology
3. Stainer .General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
4. Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
5. Alexopoulos CJ et al, Introductory Mycology 4th Edition
6. Woese, C, R 1981 Archeabacteria , Sci. Am. 244:98-122

SEMESTER-I

BTC104 – Fundamentals of Molecular Biology

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

UNIT- I

Genetic Material: Structure, chemical composition and organization of DNA. Difference between euchromatin and heterochromatin. DNA super coiling, Different forms of DNA. Repetitive DNA and satellite DNA. Experimental proof of DNA as genetic material.

UNIT- II

DNA replication in prokaryotes and eukaryotes-Initiation, elongation, termination, fidelity of replication, enzymology of replication. Regulation at replication level. Chromosome walking extrachromosomal replicons, DNA damage and repair mechanisms. Mutation- Types and various mutagens. repair and recombination repair.

UNIT- III

Transcription: transcription in prokaryotes and eukaryotes- Initiation, elongation and termination. Transcription factors and machinery, transcription activator and repressor. RNA processing-RNA editing, splicing and polyadenylation, Structure and function of different types of RNA, RNA transport. Ribozymes

UNIT- IV

Proteins Synthesis: Mechanism of translation in Prokaryotes and Eukaryotes–initiation, elongation, termination. DNA Recombination- Holliday model, Site specific Recombination. Transposons – Transposable Elements, Classification of Transposons, Types in Eukaryotes.

UNIT- V

Gene Regulation: Prokaryotic Gene Regulatory Mechanism; Operon concept: Lac and Trp operons. Gene Regulation in Eukaryotes – Attenuation control, Regulation by DNA Methylation, Transcription Factors, Enhancer Element.
Genetic Code – Salient Features and Wobble Hypothesis, Initiation and Termination Codon.

Text/Reference books:

1. Molecular Biology of the Gene :Watson-Baker-Bell-Gann-Levine-Losick, 5 th Edn., Pearson Education
2. Molecular Biology: D. Freifelder, Narosa Publishing House, New Delhi
3. Genome: T.A. Brown, John Wiley & Sons
4. Microbial Genetics:. Freifelder, Narosa Publishing House, New Delhi
5. Gene VII: Lewin Benjamin (Oxford)
6. Molecular Cell Biology: J.Darnell, H.Lodhis & D.Baltimore (W.H.Freeman & Co.)
7. DNA Repair & Mutagenesis: E.C.Friedberg, G.C.Walker and W. Seide (ASM Publisher)
8. Molecular biotechnology: S.B. Primrose
9. Molecular biotechnology: Glick

M. SC. (BIOTECHNOLOGY) I SEMESTER
LIST OF PRACTICALS

BIOTECH LAB I (111)

1. Quantitative assays – (i) Enzyme assays (ii) DNA, RNA & proteins
2. Enzymology – purification of enzyme & its kinetics
3. Enzyme assays (LDH, beta galactosidase, acid phosphatase, arginase, succinic dehydrogenase): Time, Temperature, Protein concentration, cofactors. LDH: K_m and V_{max} various kinetic plots.
4. Microscopy: simple, compound, Dark Field, phase contrast
5. Micrometry: Calibration of stage and Occular micrometer and measurement of the given biological sample
6. Spectrophotometry: To find out absorption spectrum of given chromophore and /or oxidised and reduced forms (sodium nitrate and borohydrate).
7. Haemoglobin and Methemoglobin (b) NAD and NADH
8. Colorimetry: To determine the association constant of given indicator colorimetrically and to prepare the buffer solutions in pH range of 2.2 to 8.0.
9. Cleanliness, media preparation, sterilization, culture methods, dilution techniques in microbiology.
10. Staining techniques in microbiology i) Flagella staining ii) Negative staining iii) Differential staining iv) Spore staining v) Capsule staining.
11. Isolation of pure culture- Serial Dilution, Pour, Spread, Streak.
12. Identification of unknown bacteria by biochemical tests.
13. Bacterial growth curve-serial dilution, plating and turbidity measurement.
14. Standard qualitative analysis of water (microorganisms).
15. Competent cell preparation. Replica plating, Isolation of auxotrophic mutants in bacteria, recombination in bacteria.
16. Extracellular enzymatic activities of microbes.
17. Immobilization of *Saccharomyces cerevisiae*.
18. DNA: a) Isolation of DNA (nuclear and Mt)
b) Agarose gel electrophoresis
c) Demonstration of DNA modifications
d) Restriction endonuclease digestions and separation of fragments by gel chromatography
19. Thermal melting of DNA.
20. 2-D gel electrophoresis of proteins.
21. Isolation of plasmid DNA - i) minipreparation ii) large scale isolation.
22. DNA ligation, transformation of E.coli.
23. Immobilization of Enzyme.
24. Gel Filtration Chromatography.

SEMESTER-II
BTC201- Fundamentals of Biochemistry

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

UNIT- I

High energy phosphate compounds: Introduction, Phosphate group transfer free energy of hydrolysis of ATP and sugar Phosphate. pH, buffer and water in reaction to biological system . Dissociation of water and its ion product. Henderson Hasselbalch equation, Clinical applications of Biochemistry.

UNIT- II

Amino Acid Metabolism- Overview of amino acid metabolism, Biodegradation of amino acids – deamination, transamination, decarboxylation, glutamine and glutamic acid pathway, urea cycle, uric acid biosynthesis. Protein structure (primary, secondary, tertiary and quaternary). Ramachandran plot. Protein degradation and Targeting.

UNIT-III

Carbohydrates: Classification, characteristics and functions. Reactions of carbohydrates, Isomerism of carbohydrates, Fischer projections, Haworth structures. Structure and functions of homo and heteropolysaccharides, glycoconjugates,
Carbohydrate Metabolism: Introduction, Aerobic and anaerobic pathways: Glycolysis, Gluconeogenesis.TCA cycle, Reductive TCA cycle, Glyoxylate cycle, amphibolic & anaplerotic reactions. Electron Transport chain, Oxidative phosphorylation, Pentose phosphate pathway (HMP shunt), Oxidative Pentose Pathway, Glycogen metabolism.

UNIT-IV

Lipids-Introduction, sources, Nomenclature, Classification. Properties & Functions. Steroids: Structure of steroid nucleus, biological role of cholesterol
Lipid Metabolism- Biodegradation of fatty acids, beta – oxidations of saturated & unsaturated fatty acids. Ketone bodies production during starving and diabetes
Biosynthesis of fatty acids – Acetyl-CoA carboxylase reaction, Fatty acid synthase complex, biosynthesis of palmitate. Biosynthesis of triacylglycerols, Biosynthesis of cholesterol, Prostaglandins .

UNIT- V

Nucleic Acid: Biosynthesis and degradation of Purines and Pyrimidines.
Coenzymes and cofactors: Role and mechanisms of action of $\text{NAD}^+/\text{NADP}^+$, FAD, lipoic acid, thiamine, Pyrophosphate, Biotin, Pyridoxal Phosphate, B_{12} co-enzymes and Metal ions with specific examples.

Text/Reference books:

1. Biochemistry Ed Lubert Stryer. W.H. Freeman and Company, New York.
2. Principles of Biochemistry. Ed Lehninger, Nelson and Cox. CBS publishers and distributors.

3. Harper's Biochemistry. Ed. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell. Appleton and Lange, Stanford, Connecticut.
4. Textbook of Biochemistry with Clinical Correlations. Ed. Thomas M. Devlin. Wiley-Liss Publishers
5. Principles and techniques of practical biochemistry. Ed Keith Wilson and John Walker. Cambridge University Press.
6. Biochemistry. Ed Donald Voet and Judith G. Voet. John Wiley & sons, Inc
7. Cell and Molecular Biology : deRobertis and deRobertis
8. Principle of Biochemistry: Leninger , A. L.
9. Fundamental of Biochemistry J. L. jain

SEMESTER-II
BTC202 - Tools and Techniques of Molecular Biology

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

UNIT- I

Microscopy: Microscopes types, use of techniques of preparing specimens, resolving power, optical microscope-Basic idea of light microscopy, Types- bright field, dark field, ultra-violet, fluorescence and phase-contrast microscopes, confocal microscopy Electron microscope. TEM, SEM.

UNIT – II

Centrifugation techniques: - Differential, gradient, zonal or band and isopycnic density gradient centrifugation. Chromatography: principle and procedure of absorption, column, thin layer (TLC), partition, and gas-liquid ion-exchange chromatography.

UNIT – III

Electrophoresis: Principle, equipment and procedure of various types (vertical & horizontal) electrophoresis, SDS-PAGE electrophoresis.

Nucleic acid hybridizations Technique: colony, plaque, dot blot, southern, northern and western blotting.

UNIT- IV

DNA sequencing techniques: Sanger-Coulson method, Maxam Gilbert method and next generation sequencing.

Polymerized Chain Reaction: PCR -steps, Types of PCR and its applications.

Radio autography (autoradiography): principles and procedure of radio autography.

UNIT- V

Mass Spectroscopy (LC-MS, GC-MS). Fluorescent spectroscopy. Applications of different Spectroscopic techniques in Biology. GM counter, Scintillation counter, Flow cytometry. RIA, ELISA, DNA Fingerprinting.

Text/Reference books:

1. Nuclear Magnetic Resonance: Williams
2. A Biologist Guide to Principle and Techniques: Willson K. and Gounding K.H.
3. Biochemical Techniques theory and practice : White R
4. Molecular biotechnology- Glick
5. An Introduction to Practical Biochemistry: Plummer D. T.
6. Life Science in tools and Techniques: P. S. Bisen and Shruti Mathur.

SEMESTER-II
BTC203 – Biostatistics

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

Unit-I

Introduction to statistics: Aim, Need and Scope of statistics, Sampling & sampling design- Census method, sample method, random and non-random sampling. Size of sample . Tabulation and graphics representation. Measure of central tendency: Mean, Median and Mode. Measure of dispersion: Range, Standard deviation, Lorenz curve.

Unit-II

Skewness and kurtosis: Objectives and measures of skewness. Karl Pearson's coefficient of skewness. Bowley's coefficient of skewness. Kelly's measure of skewness. Kurtosis.

Correlation analysis: Types of correlation- Partial and Negative correlation, Linear and non-linear correlation, Methods of studying correlation- scatter diagram, graphic method, Karl Pearson's coefficient of correlation. Correlation of grouped data, Rank correlation, Concurrent deviation method, Partial and multiple correlation.

Regression analysis: Regression Line, regression equations- of X on Y and Y on X. regression in a bivariate grouped frequency distribution. Multiple regression.

Unit-III

Probability theory: Types of probability- Mathematical, posterior and axiomatic probability. Theorems of probability- Addition and multiple theorem. Theorems of probability- Addition and multiple theorem. Theoretical distributions: Binomial, Poission and Normal distribution. Software packages for statistical analysis: SAS, MINITAB, BMDP, SPSS, S-plus, MATLAB. Academic and research software- XGobi, Xlisp-Start, ExplorN, MANET. Pitfalls of data analysis by employing statistics

Unit-IV

Sampling and test of significance: Steps in tests of hypothesis. Sampling distribution. Standard error. Test of significance for attributes. Test for number of success and proportion of success. Test of significance for variables (Large samples)- tests of differences between means of two samples and between two standard deviations.

Unit-V

Tests of significance for variables (Small samples)- Students t-distribution to test the difference between means of two samples, and test the significance of an observed correlation coefficient. Variance ratio test (F-Test). Chi-square test and goodness of fit: Characteristics of χ^2 test, use of X-test, Analysis of variance: One way and two way classification. Multi variate analysis.

Text/Reference books:

1. Biostatistics: P.N.Arora, P.K.Malha
2. Introductory statistics for Biology : Mahajan , S. K.
3. Statistical Methods : Mishra and Mishra
4. Fundamental of Computers : P.K.Sinha
5. Statistical Methods : S.P. Gupta

SEMESTER-II
BTC204 – Principles of Genetic Engineering

Min. Pass Marks: 28

Duration: 3 Hours

Max. Marks: 70

UNIT- I

Genetic engineering tools and their applications: Restriction-modification system & different enzymes, Gene Cloning Vectors- Plasmids, bacteriophages, phagemids, cosmids. Artificial chromosome vectors (YAC, BAC, HAC), virus derived vectors-SV40, M13, retroviral vectors.

UNIT- II

Gene manipulation: cDNA Synthesis and its Cloning; mRNA enrichment, DNA primers, linkers and adaptors, Library (cDNA and Genomic) construction and screening. Alternative Strategies of Gene Cloning- Two and three hybrid systems, cloning of genes in expression vectors and regulation, DNA microarrays.

UNIT-III

Protein Engineering & Processing of Recombinant proteins - Directed Mutagenesis- Oligo-nucleotide with M13 DNA, PCR amplified oligo-nucleotide and Random mutagenesis. Protein Engineering: adding disulfide bonds, reducing number of free sulfhydryl residues, changing amino-acids, increasing and modifying enzymatic activity.

UNIT- IV

Processing of Recombinant proteins: Purification and refolding. Characterization of recombinant proteins, stabilization of proteins. DNA markers. Molecular marker: RAPD, RFLP, AFLP, ISR, SNP. Protein markers.

UNIT- IV

Genome analysis: Introduction, DNA typing, human genome project, single nucleotide polymorphism
Genetically modified organisms: Introduction, Transgenic animals, Transgenic Technology.
Tools for analyzing gene expression: Antisense technology.

Text/Reference books:

1. Molecular Biology of the Gene: Watson-Baker-Bell-Gann-Levine-Losick, 5 th Edn., Pearson education
2. Molecular Biology: D. Freifelder, Narosa Publishing House, New Delhi
3. Genome: T.A. Brown, John Wiley & Sons
4. Microbial Genetics: D. Freifelder, Narosa Publishing House, New Delhi
5. Gene VII: Lewin Benjamin (Oxford)
6. Molecular Cell Biology: J.Darnell, H.Lodhis & D.Baltimore (W.H.Freeman & Co.)
7. DNA Repair & Mutagenesis: E.C.Friedberg, G.C.Walker and W. Seide (ASM Publisher)
8. Molecular biotechnology

BIOTECH LAB II (211)

1. pH meter: Buffering capacity of a buffer, indicators. To determine the pKa value and hence the dissociation constant of a given acid by using pH meter.
2. Potentiometry: Redox potential of Fe^{+2} and Fe^{+3} .
3. Estimation of protein: Lowry, Biuret and Bradford methods, standard curves, linear regression and assessment of ranges and reliability.
4. Protein purification: Ammonium sulphate, acetone, TCA pptn. dialysis, concentration.
5. Thin layer chromatography: lipids, mixture of dyes.
6. Chlorophyll estimation: spectrum and turbidity correction in chloroplasts.
7. Polyacrylamide gel electrophoresis of proteins.
8. cDNA synthesis and cloning.
9. Sequencing and computer analysis.
10. PCR/RFLP technique.
11. Characterization of transformants: DNA gel electrophoresis, blotting and hybridization with labeled DNA probes (Southern Blot) Techniques.
a) DNA blotting technique b) DNA hybridization.
12. Descriptive statistics: systematic tabular summarization of data (before analysis), measures of central tendency, measures of dispersion. measures of skewness (using calculators).
13. Correlations (product-moment coefficient, Spearman's rank coefficient) and regression (linear regression, curve fitting).
14. Statistical distributions: fitting discrete uniform, binomial, Poisson and Normal probability distribution of given data.
15. Testing of hypotheses -Tests of significance (Mean, Standard Deviation, and Correlation coefficient), Chi-square test for good-ness-of-fit, test for independence of attributes, non-parametric tests (run test) using calculators and printed tables, and using Minitab.
16. Sampling (drawing random samples using random number, tables, computer programs for random number generation), Design of experiments, ANOVA (one-way and two-way).
17. To study the production of transgenic crops for disease resistance.
18. To study the genetically modified crop plants production & their usefulness.
19. To study the Production of transgenic crops for disease resistance.
20. To study the genetically modified crop plants production & their usefulness.