**ANDHRA KESARI UNIVERSITY**

**Programme: B.Sc. Honours in Biotechnology (Major)**

**w.e.f. AY 2023-24**

**COURSE STRUCTURE**

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | I | 1 | Introduction to Classical Biology | 5 | 4 |
| | | 2 | Introduction to Applied Biology | 5 | 4 |
| | II | 3 | Biomolecules and Analytical Techniques – (T) | 3 | 3 |
| | | | Biomolecules and Analytical Techniques – (P) | 2 | 1 |
| | | 4 | Microbiology, Cell Biology – (T) | 3 | 3 |
| | | | Microbiology, Cell Biology – (P) | 2 | 1 |
| II | III | 5 | Plant and Animal Biotechnology -(T) | 3 | 3 |
| | | | Plant and Animal Biotechnology – (P) | 2 | 1 |
| | | 6 | Molecular Biology – (T) | 3 | 3 |
| | | | Molecular Biology – (P) | 2 | 1 |
| | | 7 | Genetic Engineering –(T) | 3 | 3 |
| | | | Genetic Engineering –(P) | 2 | 1 |
| | | 8 | Metabolism – (T) | 3 | 3 |
| | | | Metabolism – (P) | 2 | 1 |
| | IV | 9 | Immunology – (T) | 3 | 3 |
| | | | Immunology – (P) | 2 | 1 |
| | | 10 | Bioinformatics and Biostatistics – (T) | 3 | 3 |
| | | | Bioinformatics and Biostatistics – (P) | 2 | 1 |
| | | 11 | Medical Biotechnology – (T) | 3 | 3 |
| | | | Medical Biotechnology – (P) | 2 | 1 |

## SEMESTER-III

## COURSE 5: PLANT AND ANIMAL BIOTECHNOLOGY

Practical Credits: 1 2 hrs/week

1. plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. suspension cell culture
7. Cell count by hemocytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Animal tissue culture – maintenance of established cell lines.
10. Animal tissue culture – virus cultivation.
11. Estimation of cell viability by dye exclusion (Trypan blue).
12. ELISA – Demonstration

**V. REFERENCES**


1. .Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers

2. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency

3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998

4. Biotechnology – By U. Satyanarayana ;1997

5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard ,2001

6. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers

7. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing

8. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications

9. R. Ian Freshney, "Culture of animal cells – A manual of basic techniques" 4th edition, John Wiley & Sons, 2000 ,Inc, publication, New York

10. Daniel R. Marshak, Richard L. Gardner, David Gottllieb "Stem cell Biology" edited by Daniel 2001,Cold Spring Harbour Laboratory press, New York

11. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.

**VI. CO-Curricular Activities**

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on different medias
4. Visit to plant tissue culture lab

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**SEMESTER-III**

**COURSE 6: MOLECULAR BIOLOGY**

Theory Credits: 3 3 hrs/week

## I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about genome structure and organization.

2. Learn about mechanism and enzymes of DNA replication.

3. Learn about enzymatic synthesis and features of transcription.

4. Learn about regulation of gene expression.

5. Learn about genetic code and protein synthesis.

## II. Syllabus

**Unit I Genome Structure**

1. Watson and Crick model of DNA; Genome organization with specific reference to prokaryotic and eukaryotic genomes; Genome size.
2. Concepts of Genetic Material, Gene, Chromosome and Genome.
3. Experiments to prove DNA as genetic material (Griffith experiment, Hershey- Chase experiment)

**Unit II DNA Replication**

1. Enzymology of replication (DNA polymerase I, pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase.
2. Proof of semiconservative replication, Replication origins,
3. Rolling circle replication of DNA

**Unit III Transcription:**

1. Enzymatic synthesis of RNA: Basic features of transcription, the structure of prokaryotic RNA polymerase (core enzyme and hollo enzyme, sigma factor ),
2. concept of promoter ( Pribnow box, -10 and -35 sequences ),
3. Four steps of transcription (promoter binding and activation, RNA chain initiation, chain elongation, termination and release). Reverse transcription.

**Unit IV Gene Expression and regulation**

1. Regulation of gene expression; Clustered genes
2. the operon concepts - Negative and positive control of the Lac Operon, trp operon,
3. Control of gene expression. Poly and Mono cistronic m-RNA,

**Unit V Genetic Code and Protein Synthesis**

1. Genetic code: Features of genetic code, Structure of m RNA, brief structure of tRNA,
2. The adaptor hypothesis, attachment of amino acids to tRNA.
3. Codon-anticodon interaction - the wobble hypothesis. Initiation, elongation, termination protein.

**III . Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. Learn about Quantitative estimation of Nucleic Acids
2. Learn about isolation of DNA from different sources
3. Learn about purity analysis of DNA

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**SEMESTER-III**

## COURSE 6: MOLECULAR BIOLOGY

Practical Credits: 1 2 hrs/week

1. Effect of UV radiations on the growth of microorganisms.
2. Determination of absorption maxima of DNA and RNA and their quantification
3. Quantitative estimation of RNA
4. Quantitative estimation of DNA
5. Isolation of plasmid DNA from bacteria
6. Isolation of genomic DNA from *E.coli*
7. Isolation of DNA from sheep liver
8. Isolation of DNA from plant leaves (Rice or Tobacco or any other plant)
9. Separation of DNA by Agarose gel Electrophoresis
10. Purity analysis of the Nucleic acids

## V. REFERENCES


1. Cell and Molecular Biology, 8th edition. De Robertis, E.D.P. and De Robertis, E.M.F. 2006; Lippincott Williams and Wilkins, Philadelphia.
2. Cell Biology, (2017), De Robertis & De Roberis, Blaze Publishers & Distributors Pvt. Ltd.
3. The Cell: A Molecular Approach. 5th edition. Cooper, G.M. and Hausman, R.E. 2009. ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. The World of the Cell, 7th edition, Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 Pearson Benjamin Cummings Publishing, San Francisco.
5. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
6. P.Gunasekaran. 2007. Laboratory Manual in Microbiology. New Age International.
7. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
8. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by Ron Jon Publishing. Incorporated.
9. Gunasekaran, P. 2009. Laboratory Manual in Microbiology. 1st Edition. New Age International Publishers.
10. Dr. T. Sundararaj. Microbiology Laboratory Manual. 2005. Dr.A.L. MPGIBMS, University of Madras, Taramani, Chennai – 600 113.
11. James G. Cappuccino and Natalie Sherman. 2013. Microbiology: A Laboratory Manual. 10th Edition. Benjamin Cummings.
12. Dr. David A Thompson. 2011. Cell and Molecular Biology Lab Manual.
13. George M. Malacinski. 2013. Freifeder's Essentials of Molecular Biology. Narosa Publishing House.


## VI. CO-Curricular Activities

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on Replication, Transcription, and Translation.

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**SEMESTER-III**

## COURSE 7: GENETIC ENGINEERING

Theory Credits: 3 3 hrs/week

## I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about the history and tools of genetic engineering
2. Learn about vectors used in genetic engineering
3. Learn about Hybridization techniques
4. Learn about vectors and their screening techniques
5. Learn about gene editing tools

## II. Syllabus

### UNIT-I

1. Basics, history, scope, and recent developments in Genetic Engineering; guidelines; strategies in plant and animal genetic engineering.
2. Molecular tools in genetic engineering- Restriction enzymes: Endo & Exonucleases. Modifying enzymes
3. Ligation (cohesive & blunt end ligation) – linkers & adaptor.

### UNIT-II

1. Cloning vectors: plasmid - definition, properties and types. pUC19 & pBR322- phage vectors (λ & M13),
2. Cosmid vectors, Shuttle and expression vectors; YAC (S.cerevisiae as a model )& BAC (E.coli);
3. Screening and selection of recombinants; Gene transfer methods

### UNIT-III

1. Hybridization techniques: Probes (radioactive & non-radioactive), detection.
2. Polymerase Chain Reaction (PCR) – Principle , Applications and types of PCR
3. Labeling of DNA- Nick translation, Random priming method & labeling by primer extension.

### UNIT-IV

1. Construction of genomic & c DNA libraries.
2. Vector engineering & codon optimization, strategies of gene delivery, invitro translation
3. Expression in bacteria, yeast, insects, plant & mammalian cells

### UNIT-V

1. Chromosome engineering, targeted gene replacement,
2. gene editing, gene regulation & silencing. Site-directed mutagenesis.
3. DNA sequencing – Maxam Gilbert (chemical) & Sanger's, Nicolson sequencing, Pyrosequencing. Gene therapy, Human Genome Project.

**III . Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. Learn about problems in genetic engineering
2. Learn about restriction digestion
3. Learn about isolation of Plasmid
4. Learn about activity of enzymes

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**SEMESTER-III**

**COURSE 7: GENETIC ENGINEERING**

Practical Credits: 1 2 hrs/week

1. Problem in Genetic engineering.
2. Transformation in Bacteria using plasmid
3. Restriction digestion of DNA and its electrophoretic separation.
4. Ligation of DNA molecules and their testing using electrophoresis.
5. Activity of DNAase and RNAse on DNA and RNA.
6. Isolation of Plasmid DNA
7. Demonstration of PCR

**V. REFERENCES**


1. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
2. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
3. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
4. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
5. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
6. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
7. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
8. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
9. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.
10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
11. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7thedition. Blackwell Publishing, Oxford, U.K.
12. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.


**VI. CO-Curricular Activities**

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topic
3. Visit to instrumentation labs

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**SEMESTER-III**

**COURSE 8: METABOLISM**

Theory Credits: 3 3 hrs/week

## I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about Carbohydrate metabolism
2. Learn about Lipid metabolism
3. Learn about Amino Acid metabolism
4. Learn about nomenclature and specificity of enzymes
5. Learn about enzyme kinetics of enzyme

## II. Syllabus

### Unit I : Carbohydrate metabolism

1. Anabolism & catabolism , Photosynthesis – light and dark reactions. C3 cycle, C4 pathway,
2. Glycolysis – formation of lactate and pyruvate, TCA cycle and its regulation
3. gluconeogenesis, HMP stunt pathway , Disorders of Carbohydrate metabolism- Diabetes mellitus

### Unit II : lipids metabolism

1. Denovo synthesis of Fatty Acids , Biosynthesis & degradation of TAG (Triacyl Glycerol),
2. Disorders of Lipid metabolism
3. Biosynthesis of cholesterol , Ketogenesis

### Unit III :Amino acid Metabolism

1. General reactions of amino acids, deamination, decarboxylation & transamination.
2. Urea cycle. Biosynthesis of creatine
3. Inborn errors of aromatic and branched-chain amino acid metabolism.

### UNIT IV Enzymes:

1. Difference between chemical and biological catalyst, definitions of Holoenzyme apoenzyme coenzyme
2. Classification and nomenclature of enzymes.
3. Enzyme specificity , interaction between enzyme and substrate -lock and key and induced fit models.

### UNIT – V Enzyme kinetics:

1. Michaelis-Menten equation, Factors affecting enzyme activity- substrate concentration, enzyme concentration,pH a n d temperature.
2. Enzyme inhibition kinetics -competitive, uncompetitive, and non-competitive
3. Immobilized enzymes and their applications

**III . Skills Outcome**

On Successful Completion of this Course, the Student shall be able to

1. Learn about assay of enzymes from various sources
2. Learn about estimations of glucose by various methods
3. Learn about titrations of glucose and carbohydrates

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**SEMESTER-III**

**COURSE 8: METABOLISM**

Practical Credits: 1 2 hrs/week

1. Immobilization of enzymes / cells by entrapment in alginate gel 19. Effect of temperature / pH on enzyme activity
2. Assay of protease activity.
3. Assay of alkaline phosphatase
4. Preparation of starch from Potato and its hydrolysis by salivary amylase
5. Isolation of urease and demonstration of its activity
6. Estimation of amino acids by ninhydrin method
7. Estimation of protein by Biuret method
8. Estimation of glucose by DNS method
9. Estimation of glucose by Benedicts titrimetric method
10 Estimation of total carbohydrates by anthrone method

**V. REFERENCES**


1. Understanding enzymes: Palmer T., Ellis Harwood ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.
8. Text of Biochemistry, West and Todd.
9. Metabolic pathways – Greenberg.


**VI. CO-Curricular Activities**

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on cycles – carbohydrate , lipid, amino acid metabolism

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**SEMESTER-IV**

**COURSE 9: IMMUNOLOGY**

Theory Credits: 3 3 hrs/week

## I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about types of immunity and cells of immunity
2. Learn about Antigen and Antibody
3. Learn about cell , humoral immunity and MHC molecules
4. Learn about Hypersensitivity and vaccines
5. Learn about immunological techniques

## II. Syllabus

**UNIT I Immune system**:

1. History and scope of immunology, cells of imthe mune system -Tcells , B cells
2. Immunity, innate immune mechanism, Acquired immune mechanism
3. Organs of the immune system (Bone marrow, spleen thymus MALT)

**UNIT II Antibody and Antigen:**

1. Antibody structure and classes(Ig G,Ig M Ig A Ig E I g D , Antibody diversity
2. Antigen -Types of Antigens Antigenicity (factors affecting antigenicity).
3. Antigenic determinants – adjuvants and haptens , epitopes

**UNIT III Immunity:**

1. Humoral immunity, cell-mediated immunity -TC-mediated immunity, NK cell-mediated immunity, ADCC,
2. brief description of cytokines , Interleukins
3. Major histocompatibility complex (MHC )-Structure and Functions of Class I ,II , MHC Molecules

**UNIT IV Hypersensitivity and vaccination** :

1. General features of hypersensitivity, various types of hypersensitivity,
2. Vaccination: Discovery, principles, significance,
3. Types of Vaccines -live, attenuated, killed , recombinant, subunit

**UNIT V Immunological Techniques**

1. Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion, - Radial immune diffusion, ouchterlony , double immune diffusion
2. Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.
3. ELISA , RIA , immunoelectrophoretic , Rocket electrophoresis

**III . Skills Outcome**

On Successful Completion of this Course, the Student shall be able to

1. Learn about the determination of blood group
2. Learn about immunodiffusion methods
3. Learn about production of antibodies

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**SEMESTER-IV**

**COURSE 9: IMMUNOLOGY**

Practical Credits: 1 2 hrs/week

**IV. Practical Syllabus**: Hours 2 hours per week = 30 hours

1. Antigen – antibody reaction – determination of Blood group , Cross reactivity
2. Pregnancy test
3. Widal test
4. Ouchterloney immunodiffusion
5. Radial immunodiffusion
6. ELISA
7. Isolation of casein by isoelectric precipitation
8. Production of antibodies and their titration

**V. REFERENCES**


1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House


**VI. CO-Curricular Activities**

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on cell mediated immunity
4. Models on antibodies

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**SEMESTER-IV**

## COURSE 10: BIOINFORMATICS AND BIOSTATISTICS

Theory Credits: 3 3 hrs/week

### I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about concept and branches of bioinformatics
2. Learn about searching sequences using databases
3. Learn about computer phylogenetics
4. Learn about the measurement of central tendency
5. Learn about test hypothesis

### II. Syllabus

**UNIT – I**

1. Scope of computers in biological research, Introduction to Bioinformatics: Definition, nature and scope of bioinformatics.
2. Bioinformatics versus computational biology.
3. Branches of bioinformatics. Basic concepts in bioinformatics.

**UNIT – II**

1. Basic concepts of system biology. Protein Data Bases -visualization of proteins using database
2. Overview of computer-aided drug design.
3. Searching sequence database using BLAST. Concept of genomics and proteomics

**UNIT – III**

1. Computational phylogenetics – various applications.
2. Phy lip software. Microarray,
3. Bio informatics – Experimental design & Over view of data analysis.

**UNIT – IV**

1. Measurement of central tendency (mean, mode and range)
2. Dispersion (standard error and standard deviation).
3. Probability and distribution. Poisson and binomial distributions. Normal distribution

**UNIT – V**

1. Population and sampling test of significance. Test hypothesis.
2. Student t-test for small samples. ANOVA ,$Chi^2$ test for analysis, correlation and regression.
3. Computer applications in Biotechnology

**III . Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. Learn about problems of mean median mode
2. Learn about test hypothesis
3. Learn about sequence Retrieval from NCBI

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**SEMESTER-IV**

## COURSE 10: BIOINFORMATICS AND BIOSTATISTICS

Practical Credits: 1 2 hrs/week

1. Mean, Median, Mode
2. Standard deviation, variance and coefficient of variation
3. Testing of hypotheses regarding population mean
4. Testing of hypotheses about the difference between population means
5. Chi-square test
6. Testing of Correlation Coefficient
7. Fitting of simple linear regression
8. Sequence retrieval (protein and gene) from NCBI, Structure download (protein and DNA) from PDB

**V. REFERENCES**

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley and Sons, 2nd ed. .
2. Bland, M. (2006). An Introduction to Medical Statistics. Oxford University Press, 3rd ed.
3. Finney, D.J. (1980). Statistics for Biologists.Chapman and Hall Ltd.
4. Wayne, W, Daniel (1999). Biostatistics: A Foundation for Analysis in Health Sciences. John Wiley and Sons, 7th ed.

**VI. CO-Curricular Activities**

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on data bases

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**SEMESTER-IV**

## COURSE 11: MEDICAL BIOTECHNOLOGY

Theory Credits: 3 3 hrs/week

## I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about diseases caused by microbial sources
2. Learn about epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of bacterial diseases
3. Learn about fungal, viral and protozoan diseases
4. Learn about gene therapy and vectors used in gene therapy
5. Learn about drug discovery, therapeutic applications

## II. Syllabus

### UNIT-I

1. Diseases, introduction , types : genetic, chromosomal aberrations, numerical and structural autoimmune disorders
2. Disease caused by microbial sources . mechanism of pathogenicity, pathogenic islands , molecular basis of diseases
3. Antimicrobial compounds and their mode of action

### Unit -II

1. Characteristics of infectious diseases, herd immunity
2. Disease cycle ( source of disease , reservoir, carries) , transmission of pathogens ( air borne , contact transmission , and vector transmission)
3. Bacterial diseases – epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of the following diseases – tuberculosis, typhoid, tetanus, leprosy

### Unit -III

1. General account of fungal diseases : mycosis , subcutaneous and deep
2. General account of viral and protozoan diseases- pneumonia, mumps, AIDS, malaria
3. Brief account of sexually transmitted diseases

### Unit -IV

1. Gene therapy – *Exvivo, Invivo, Insitu* gene therapy
2. strategies of gene therapy , gene augmentation
3. Vectors used in gene therapy , biological vectors – retrovirus , adeno virus, herpes. Synthetic vectors - liposomes , receptor medicate gene transfer

**Unit -V**

1. Introduction to drug discovery. Stem cell based drug discovery , drug screening and toxicology
2. Therapeutic applications – neurological disorders - Parkinson's diseases , Alzheimer's disease
3. Antiviral therapy for AIDS, DNA/RNA based diagnosis, hepatitis

**III . Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. Learn about Laboratory Safety Regulations
2. Learn about staining techniques
3. Learn about Culture of bacteria and its cultural characteristics
4. Learn about serological diagnosis of diseases

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**SEMESTER-IV**

## COURSE 11: MEDICAL BIOTECHNOLOGY

Practical Credits: 1 2 hrs/week

1. Laboratory Safety Regulations
2. Culture media & isolation of pure culture
3. Smear Preparation & Simple stain
4. Gram stain
5. Culture of bacteria and its cultural characteristics
6. C Reactive protein test
7. Widal test
8. Serological diagnosis of tuberculosis
9. Serological diagnosis of HIV
10.

**V. REFERENCES**

1. Text book of microbiology R. Ananthanarayana and C.K. Jayaram Paniker, Orient longman 1997
2. Medical microbiology , vol 1 microbial infections : Mackie and MaCarty, Churcil Livingsione 1996
3. Bailey and Scotts Diagnostic microbiology : Baron EJ Peterson LR and Finegold SM Mosby 1990
4. Broude A.I (1981) Medical microbiology and infectious diseases , W.B Saunders &Co Philadelphia

**VI. CO-Curricular Activities**

a) **Suggested Co-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts / models on bacterial/fungal/ viral / protozoan diseases

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ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme-B.Sc. Honours Biotechnology - Question Paper model,
Second Year-Semester-III & IV

Time: 3 Hours Total Marks: 75

PART –A

**Answer Any five of the following**

**Draw labelled diagram wherever necessary and each unit must carry two questions**

**5X5=25 Marks**

**1.**

**2.**

**3.**

**4.**

**5.**

**6.**

**7.**

8.

9.

10

PART –B

**Answer Any Five of the following**

**Draw labelled diagram wherever necessary and each unit must carry two questions**

**5x10=50 Marks**

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.