**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2017-2018)

**SEMESTER - I**

#  MICROBIOLOGY AND CELL BIOLOGY COURSE CODE – BT 1210 CG

**Hrs : 4 CREDITS-3**

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**INSTRUCTIONAL OBJECTIVES**

1. To impart Knowledge on Classification, Structure, Characters of Micro-organisms.
2. To Impart Knowledge on Sterilization methods and Preparation of Pure Cultures.
3. To Impart Knowledge about Cell Structure functions of various cell organelles and their interrelationship.
4. To Impart Knowledge on Chromosome organization and cell cycle.

**MODULE I**

**History, Development and Microscopy**

* 1. History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner.
	2. Microscopy: Compound microscopy: Numerical aperture and its importance, resolving power, oil immersion objectives and their significance, principles and applications of dark field, phase contrast, fluorescent microscopy. Electron microscopy: Principle, ray diagram and applications, TEM and SEM, comparison between optical and electron microscope.
	3. Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining.

**MODULE II**

**Bacteria**

* 1. Bacterial morphology and subcellular structures, general morphology of bacteria,shapes and sizes, generalized diagram of typical bacterial cell. Slime layer and capsule, difference between the structure, function and the position of the two structures, Cell wall of gram +ve and Gram -ve cells.
	2. Prokaryotic classification - General account of flagella and fimbriae. Chromatin material, plasmids; definition and kind of plasmids (conjugative and non-conjugative) F, R, and Col plasmids. Endospores: Detailed study of endospore structure and its formation, germination, basis of resistance. A brief idea Bergey’s manual.

**Viruses**

* 1. General characteristics of viruses, difference between virus and typical microbialcell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance. Brief idea of lytic cycle and lysogeny.

**MODULE III**

**Microbial Nutrition Microbial growth and control Growth**

**3.1** Basic nutritional requirements: Basic idea of such nutrients as water,carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enriched media, Enrichment media.

**3.2** Growth rate and generation time, details of growthcurve and its various phases. Concept of synchronous cultures, continuous and batch cultures (chemostat and turbidostat). Measurement of growth.

**3.3** Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), pH etc. Pure cultures and cultural characteristics. Maintenance of pure culture.

**3.4** Microbial Control: Terminologies - Sterilization, disinfection, antiseptic, sanitization, germicide, microbistasis, preservative and antimicrobial agents. Physical control: Temperature (moist heat, autoclave, dry heat, hot air oven and incinerators), desiccation, surface tension, osmotic pressure, radiation, UV light, filtration. Chemical control: Antiseptics and disinfectants (halogens, alcohol, gaseous sterilization.

**MODULE IV**

**Cell Biology**: Eukaryotic Cell - Structure and function of the following: nucleus, nuclearmembrane, nucleoplasm, nucleolus, Golgi complex, Mitochondria, Chloroplast, endoplasmic reticulum, lysosomes, peroxisomes, glyoxisomes and vacuoles, cell division, cell cycle.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

(WITH EFFECTIVE FROM 2017-2018)

 **MICROBIOLOGY AND CELL BIOLOGY**

 **BLUE PRINT FOR QUESTION PAPER SETTER**

**Time : 21/2hours Max marks: 60**

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| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
| **MODULE – I** | 01 | 03 | 25 |
| **MODULE – II** | 02 | 02 | 30 |
| **MODULE – III** | 02 | 02 | 30 |
| **MODULE – IV**  | 01 | 03 | 25 |
| **Total no. of Questions** | **06****Of which 3 to be answered** | **10****Of which 6 to be answered** | **110****Marks including choice. Of which 60marks to be answered** |

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 **NOTE: The question paper setters are requested to kindly adhere to the format given in the above table.**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**(WITH EFFECTIVE FROM 2017-2018)**

**SEMESTER – I**

**PRACTICAL: MICROBIOLOGY & CELL BIOLOGY**

**COURSE CODE – BT 2210P**

**Hrs : 3 CREDITS-2**

1. Demonstration, use and care of microbiological equipments.
2. Preparation of media, sterilization and isolation of bacteria.
3. Demonstration of motility of Bacteria.
4. Simple staining of bacteria
5. Gram staining of Bacteria
6. Acid fast staining of Bacteria
7. Growth of fecal coliforms on selective media.
8. Isolation of pure culture by pour plate method.
9. Isolation of pure culture by streak plate method.
10. Antibiotic sensitivity assay.
11. Study of different phases of mitosis in onion root tip and meiosis in *Allium cepa* flower buds.

**Minimum 6 practical’s are mandatory.**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2017-2018)

 **AT THE END OF I SEMESTER**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Mount the onion root tip and identify the stage of the cell cycle. **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Values and Report – 03**)**

1. Identify the given Spotters **and write a brief note on it – A,B,C 3 x 3 = 9M**

 (Identification– 01, Notes – 02).

1. . Practical Record **05 M**
2. . Viva voce **05 M**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2017-2018)

**SEMESTER - II**

**MACROMOLEULES AND ENZYMOLOGY**

**COURSE CODE – BT 2210 BBB**

**Hrs : 4 CREDITS-3**

**INSTRUCTIONAL OBJECTIVES**

1. To Provide Knowledge about classification, Structure and Properties of Biomolecules
2. To Impart Knowledge on Structure of DNA and Experiments that prove that DNA as Genetic Material.
3. To Provide Knowledge on Basic Metabolism.

**MODULE – I**

**Carbohydrates**

 1.1 Introduction, classification and properties

 Structure, Functions of monosaccharides - Glucose and fructose

* 1. Disaccharides – Introduction, classification, structure and functions of Disaccharides – sucrose and maltose

 Physiologically important glycosides (streptomycin, cardiac glycosides, ouabain)

 1.3 Structure and function of homo polysaccharides – starch, cellulose and glycogen

 Structure and function of heteropolysaccharides – Hyaluronic acid

**MODULE – II**

**Proteins**

* 1. Introduction, Classification, structure and properties of amino acids
	2. Peptide bond – Synthesis and characters

# Primary, secondary, tertiary and quaternary structures of proteins

# Lipids

### 2.4 Fatty acids : Introduction,classification,properties of Fatty acids.

### 2.5 Triacylglycerols, Sphingolipids, Sterols.

 **MODULE – III**

**Nucleic acids**

* 1. DNA as the genetic material – Griffiths experiments on transformation in *Streptococcus pneumoniae*. Avery, McEleod and Mc Carty’s experiments. Hershey – Chase experiments with radio-labeled T2 bacteriophage.
	2. RNA as genetic material – Tobacco Mosaic Virus.
	3. Structure of DNA – Watson and Crick Model.

 Forms of DNA – A, B and Z forms of DNA.

3.4 DNA damage and repair.

**MODULE – IV**

**Enzymes**

4.1Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme,substrate, inhibitor, activator, modulator etc. Classification and nomenclature of enzymes.

4.2 Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity), lock and key and induced fit models.

4.3 Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature, temperature.

4.4 Enzyme inhibition kinetics (reversible inhibition types – competitive, uncompetitive and non-competitive), brief idea of irreversible inhibition.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2017-2018)

 **II Semester – MACROMOLEULES AND ENZYMOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

**Time: 2 1/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

(WITH EFFECTIVE FROM 2017-2018)

**SEMESTER - II**

**PRACTICALS - MACROMOLECULES & ENZYMOLOGY**

**COURSE CODE – BT 2210P**

**Hrs : 3 CREDITS-2**

* 1. Qualitative estimation of Carbohydrates
	2. Qualitative estimation of Amino acids
	3. Quantitative Estimation of proteins by Biuret method
	4. Estimation of DNA by Diphenylamine method
	5. Estimation of RNA by Orcinol method
	6. Quantitative estimation of sugars (Di nitrosalicylic acid method).
	7. Estimation of glucose by Benedict’s quantitative method
	8. Quantitative estimation of proteins by Lowry’s method.
	9. Determination of saponification value of Fats
	10. Determination of Acid Value of Fats
	11. Immobilization of enzymes / cells by entrapment in alginate gel
	12. Effect of temperature / pH on enzyme activity
	13. Assay of protease activity.
	14. Assay of alkaline phosphatase
	15. Preparation of starch from Potato and its hydrolysis by salivary amylase
	16. Isolation of Urease and demonstration of its activity

**Minimum of Ten practical’s are mandatory**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2017-2018)

 **AT THE END OF II SEMESTER**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Estimation of DNA by Diphenylamine method. **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Values and Report – 03**)**

1. Identification of Spotters and write brief notes on it**. 3 x 3 = 9M**

(Identification– 01, Notes – 02).

1. Problem on Molarity calculation.
2. Colorimeter.
3. Identification of Reagent (Description).
4. . Practical Record **05 M**
5. . Viva voce **05 M**

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### Recommended Books

1. Biometry - By Sokal and Rohlf W.H. Freeman
2. Fundamentals of Biometry - By L.N. Balaram (George Allen and Unwin Ltd, London (1972)
3. Biostatistics - By N.T.J. Bailey
4. Biostatistics- Manual of biostatistical methods for use in health, nutrition and Anthropology - By K. Visweshwar Rao (Jaypee Publications).
5. Genetics - By Gardner (Macmillan Press)
6. An introduction to Genetic Analysis - By Griffith and others – Freeman and Company
7. Bioinformatics and Bioprogramming in C - By L.N. Chavali
8. Cell Biology - By S.C. Rastogi (New Age International (P) Ltd)
9. Statistical Genetics – Principles and Practice - By Prem Narain
10. Biotechnology - By K. Trehan
11. Biotechnology –1 - By R.S. Setty and G.R. Veena
12. Biotechnology – II - By R.S. Setty and V. Sreekrishna
13. Fundamentals of Genetics – By B.D. Singh, N. Pratibha, P.H. Rao and P.B. Kavi Kishor

14. Genetics - By B.D. Singh

15. Genetics - By Mohan P. Arora, Gurdarshan and S. Sandhu

16. Introduction to Bioinformatics - By V. Kothekar

17. An Introduction to Kothekar - By V. Kothekar and T. Nandi

18. Introduction to Bioinformatics - By Arthur M. Lesk

19. Cell and Molecular Biology - By De Robertis

20. Cell and Molecular Biology - By Lodish

21. Cell Biology and Genetics - By P.K. Gupta

22. Theory and Problems in Genetics - By Stransfield

23. Introduction to Bioinformatics - By T.K. Attwood, D.J. Parry-Smith,

 Samiron Phukan (Pearson Education)

24. Introduction to Biotechnology - By W.J. Thieman and M.A. Palladino

 (Pearson Education)

25. Discovering Genomics, Proteomics and Bioinformatics - By A.M. Campbell and L.J.

 Heyer (Pearson Education)

26. The World of the Cell - By Becker (Pearson Education)

27. Concepts of Genetics - By Klug (Pearson Education)

28. Genetics - By Strickberger (Pearson Education)

29. Biochemistry - By Dr. U. Satyanarayana, U. Chakrapani

30. Biochemistry - By Lehninger

31. Biochemistry - By J.L. Jain

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2018-2019)

**III Semester**

**BIOPHYSICAL** T**ECHNIQUES**

**COURSE CODE – BT 3210IM**

**Hrs : 4 CREDITS-3**

**INSTRUCTIONAL OBJECTIVES:**

1. To impart knowledge on Principles and applications of different chromatography techniques.
2. To impart knowledge on Principles and applications of electrophoretic techniques.
3. To Provide Basic Knowledge on Biostatistics and its applications related Biology.

**MODULE – I:**

**Centrifugation:** Basic principles, concept of RCF, types of centrifuges (clinical, high speed and ultracentrifuges).Preparative centrifugation: Differential and density gradient centrifugation, applications (Isolation of cell components). Analytical centrifugation: Sedimentation coefficient, determination of molecular weight by sedimentation velocity and sedimentation equilibrium methods.

**MODULE II:**

**Chromatography:** Partition principle, partition coefficient, nature of partition forces, briefaccount of paper chromatography. Thin layer chromatography and column chromatography. Gel filtration: Concept of distribution coefficient, types of gels and glass beads, applications. Ion-exchange chromatography: Principle, types of resins, choice of buffers, applications including amino acid analyzer. Affinity chromatography: Principle, selection of ligand, brief idea of ligand attachment, specific and non-specific elution, applications.

**MODULE III**

Spectrum of light, absorption of electromagnetic radiations

**Coloriemetry -** Beer’slaw - derivation and deviations, extinction coefficient and its applications

**Spectrophotometry:** Instrumentation of UV and visible Spectrophotometry, Double beam spectrometer, Applications of UV and visible Spectrophotometry.

**MODULE IV:**

**Electrophoresis**: Migration of ions in electric field, Factors affecting electrophoretic mobility.Paper electrophoresis, Gel electrophoresis: - Types of gels, Solubilizes, Procedure, Column & slab gels Detection, Recovery & Estimation of macromolecules. SDS-PAGE Electrophoresis and applications.

**Isotopic tracer technique:** Radioactive & stable isotopes, rate of radioactive decay. Units ofradioactivity. Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique). Biological applications of Radioisotopes.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2018-2019)

 **III Semester – BIOPHYSICAL** T**ECHNIQUES**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

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| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

(WITH EFFECTIVE FROM 2018-2019)

**SEMESTER - III**

**PRACTICALS – BIOPHYSICAL TECHNIQUES**

**COURSE CODE – BT 2210P**

**Hrs : 3 CREDITS-2**

1. Spectrophotometric analysis of DNA denaturation.
2. Determination of absorption spectrum of oxy- and deoxyhemoglobin and methemoglobin.
3. Protein estimation by E280/E260 method.
4. Paper chromatography of amino acids/sugars.
5. TLC of sugars/amino acids.
6. Estimation of Urea by diacetyle monoxime method.
7. Estimation of Sugars by Folin Wu method
8. Validity of Beer’s law for colorimetric estimation of creatinine.
9. Preparation of standard buffers and determination of pH of a solution
10. Titration of a mixture of strong & weak acid
11. Paper electrophoresis of proteins
12. Gel electrophoresis of DNA.
13. SDS-PAGE of an oligomeric protein.

**Note: - Mandatory to perform at least 8 practicals**

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**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2018-2019)

 **AT THE END OF III SEMESTER**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Gel electrophoresis of DNA. **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Values and Report – 03**)**

1. Identify and write a brief notes on given spotters **– A,B,C 3 x 3 = 9M**

(Identification– 01, Notes – 02).

1. . Practical Record **05 M**
2. . Viva voce **05 M**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2018-2019)

**IV Semester – IMMUNOLOGY**

**COURSE CODE – BT 4210MBPT**

**Hrs : 4 CREDITS-3**

**INSTRUCTIONAL OBJECTIVES:**

1. To provide knowledge on basic classification of immune system.

2. To Provide Knowledge on Structure of Antigens, and Antibodies and different Antigen-Antibody reactions.

3. To Provide knowledge on structure MHC, role of MHC in tissue transplantation and different Hypersensitivity Reactions.

**MODULE I**

**Immune system**: Organs and cells of immune system Immunity, Immune response, innateimmune mechanism, acquired immune mechanism, Antigen, Humoral immunity, main pathways of complement system.

**Antibody and Antigen:** Antibody structure and classes, Antibody diversity, Types of Antigens,Antigenecity (factors affecting Antigenecity). Complement system.

**MODULE II**

**Immunological Techniques**: Antigen-antibody reactions: Precipitation, agglutination,complement fixation, Immunodiffusion, ELISA. Hybridoma technology: Monoclonal antibodies and their applications in Immunodiagnosis.

**MODULE III**

**Immunity:** Cell mediated immunity: TC mediated immunity, NK cell mediatedimmunity, Phagocytosis, ADCC, brief description of cytokines and MHC (MHC types and diversity), role of MHC in organ transplantation.

**MODULE IV**

**Hypersensitivity and vaccination:** General features of hypersensitivity, various types ofhypersensitivity, autoimmune response, Vaccination: Discovery, principles, significance, Types of Vaccines

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2018-2019)

 **IV Semester – IMMUNOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

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| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
| **MODULE – I** | 02 | 02 | 30 |
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| **Total no. of Questions** | **06****Of which 3 to be answered** | **10****Of which 6 to be answered** | **110****Marks including choice. Of which 60marks to be answered** |

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2018-2019)

**II B.Sc- BIOTECHNOLOGY– Practical Syllabus**

**semester – Iv - immunology**

**COURSE CODE – BT 4210P**

**Hrs : 3 CREDITS-2**

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

**Note: - Mandatory to perform atleast 6 practicals**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2018-2019)

 **AT THE END OF IV SEMESTER**

**MODEL PRACTICAL PAPER**

**Time: 1 1/2 hrs. Marks: 35**

1. Determine the blood group of given blood sample **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Values and Report – 03**)**

1. Identify and write a brief notes on given spotters **– A,B,C 3 x 3 = 9M**

(Identification– 01, Notes – 02).

1. . Practical Record **05 M**
2. . Viva voce **05 M**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - V**

 **GENETICS AND MOLECULAR BIOLOGY**

**Hrs : 4 CREDITS-3**

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**INSTRUCTIONAL OBJECTIVES**

1. To provide knowledge on Mendel’s laws, genetic variations and chromosomal abnormalities.

2. To provide knowledge on Enzymology of DNA Replication and steps in replication process.

3. To provide knowledge on enzymes involved in transcription and process of transcription.

4. To provide knowledge on types of mutations and different mutagenic agents.

**MODULE – I**

**Mendels Laws and Inheritance**

1.1Mendel experiments, Medals laws and deviations: Incomplete dominance and Co -dominance.

1.2 Penetration and Pleiotropism.

1.3 Recessive and dominant epistatic gene interactions. Concept of multiple alleles.

**MODULE – II**

**Genes and their variations**

2.1 Structure of gene – Prokaryotes and eukaryotes, gene and environment, gene copies and heterogeneity.

2.2 Meiotic non-disjunction of chromosomes, chromosome abnormalities in animals and plants.

2.3 Linkage, recombination and gene maps.

**2.4 Mutations** - Gene mutation: Induced and Spontaneous, Missense, nonsense and framshift mutations.

2.5 **Mutagens** – Physical and chemical mutagens.

**MODULE – III**

**DNA Replication**

3.1 Enzyme machinery of replication (detailed treatment of DNA polymerase I, brief treatment of polymerase II and III) helicases, topoisomerases, single strand binding proteins, DNA melting proteins, Primase and RNA primer etc.),

3.2 Proof for semi conservative replication, discontinues replication and okazaki fragments.

3.3 Replication origins, initiation, primosome formation, elongation and termination.

**MODULE – IV**

4.1 **Transcription** – Enzymatic synthesis of RNA: Basic features of transcription, structure of prokaryotic RNA polymerase (core enzyme and holoenzyme, significant of sigma factor). Concept of promoter (Pribnow box -10 and -35 sequences and their significance).

4.2 Four steps of transcription (Promoter binding and activation, RNA chain initiation and promoter escape, chain elongation, termination and release) and regulation. Reverse transcription.

4.3 **Transcription – Eukaryotic transcription** – enzyme machinery of eukaryotic transcription and steps in eukaryotic transcription. Post-transcriptional modifications.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **V Semester**

**Paper – V GENETICS AND MOLECULAR BIOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 2 1/2hours Max marks: 60**

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| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - V**

 **PAPER – VI GENE EXPRESSION AND rDNA TECHNOLOGY**

**Hrs : 4 CREDITS-3**

#

**INSTRUCTIONAL OBJECTIVES**

1. To provide knowledge on how the information present on DNA is converted into Protein.

2. To provide knowledge on Gene Expression and Regulation.

3. To provide knowledge of types of restriction enzymes and vector used in recombinant DNA technology.

4. To provide knowledge on DNA libraries and applications of recombinant DNA technology in various fields.

**MODULE-I**

**Gene expression**

1.1 Genetic code: code and its characteristics, experimental elucidation of codons, identification of start and stop codons, universality, degeneracy and commaless nature of codons.

1.2 The decoding system: aminoacyl synthetases, the adaptor hypothesis, attachment of amino acids to tRNA.

1.3 Codon-anticodon interaction – the wobble hypothesis.

Selection of initiation codon – Importance of Shine-Dalgarno sequence.

1.4 Protein Synthesis:

Intiation, elongation, termination and post translational modification.

Regulation of translation: T4 protein p32 translation regulation. Antibiotics affecting translation.

**MODULE – II**

**Gene regulation**

2.1 Regulation of transcription in Prokaryotes - Lac- and Trp operons.

2.2 Components of Operon. Negative and positive control of lac operon.

2.3 Eukaryotic gene regulation – Gal-Operon

**MODULE - III**

3.1 DNA cloning: Basics of genetic engineering, restriction endonucleases, other enzymes of DNA manipulation.

3.2 Vectors – Plasmids, Phage vectors, Cosmids, Phagemids and YAC’s.

3.3 Cutting and joining of DNA (cohesive end ligation and methods of blunt end ligation).

3.4 Transfection and transformation. Selection of transformed cells and screening methods.

**MODULE - IV**

**Genomic DNA libraries and cDNA libraries**

4.1 Concept of Genome

4.2 Concept and methods of creating these libraries. Advantages and disadvantages of cDNA library over genomic DNA library.

4.3 PCR – Working of PCR

4.4 Expression of Cloned genes – general features of an expression vector. Expression of eukaryotic gene in prokaryotes – advantages and problems.

4.5 Applications of rDNA technology.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **V Semester**

**Paper – VI GENE EXPRESSION AND rDNA TECHNOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
| **MODULE – I** | 02 | 02 | 30 |
| **MODULE – II** | 01 | 03 | 25 |
| **MODULE – III** | 02 | 02 | 30 |
| **MODULE – IV**  | 01 | 03 | 25 |
| **Total no. of Questions** | **06****Of which 3 to be answered** | **10****Of which 6 to be answered** | **110****Marks including choice. Of which 60marks to be answered** |

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - V**

**Paper – V GENETICS AND MOLECULAR BIOLOGY**

**PRACTICAL SYLLABUS**

**Hrs : 3 CREDITS-2**

1. Effect of UV radiation on the growth of microorganisms.
2. Isolation of plasmid DNA from bacteria.
3. Purity analysis of nucleic acids.
4. Karyotyping of *Allium* or Drosophila.
5. Problems and assignments in Mendilian genetics.
6. Isolation of auxotrophic mutants (plants or insects).
7. Mutation of bacteria by UV.
8. Chemical induced mutation in bacteria.

**Note:- Mandatory to perform atleast 6 practicals.**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **AT THE END OF V SEMESTER**

**Paper – V GENETICS AND MOLECULAR BIOLOGY**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Isolation of plasmid DNA from bacteria. **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Result – 03**)**

1. Identification of Spotters and write brief notes on it**. 3 x 3 = 9M**

(Identification– 01, Notes – 02).

1. Problem in Mendilian genetics.
2. Electrophoretic chamber.
3. Identification of Reagent (Description).
4. . Practical Record **05 M**
5. . Viva voce **05 M**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - V**

**PAPER – VI GENE EXPRESSION AND rDNA TECHNOLOGY**

**PRACTICAL SYLLABUS**

**Hrs : 3 CREDITS-2**

1. To measure concentration of DNA & RNA by UV spectrophotometry.
2. Estimation of proteins by Bradford method.
3. Isolation of genomic DNA.
4. Isolation of plasmid DNA.
5. Restriction digestion of DNA.
6. Demonstration of replica plating technique.
7. Identification of Lac+ bacteria by blue white screening using IPTG.
8. Ligation of DNA.
9. Chemical mutagenesis and production of microbial mutants.

**Note:- Mandatory to perform atleast 6 practical.**

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **AT THE END OF V SEMESTER**

**PAPER – VI GENE EXPRESSION AND rDNA TECHNOLOGY**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Estimation of proteins by Bradford method. **16 M**

(Split: Principle & Procedure – 05, Conduct of Experiment – 08, Result – 03**)**

1. Identification of Spotters and write brief notes on it**. 3 x 3 = 9M**

(Identification– 01, Notes – 02).

1. Restriction enzymes.
2. Electrophoretic chamber.
3. Identification of Reagent (Description).
4. . Practical Record **05 M**
5. . Viva voce **05 M**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - VI**

**Elective A: BIOSTATISTICS, BIOINFORMATICSAND IPRs**

 **HOURS 2T+3P CREDITS 2+2**

**INSTRUCTIONAL OBJECTIVES**

1. To impart Knowledge on data collection and tabulation of data.
2. To impart Knowledge on standard statistical distribuitions.
3. To impart Knowledge on different biological databases and their role in biology.

 **MODULE I**

 Concept of Sampling, Collection, Classification and Tabulation of data, Bar diagrams and Pie diagrams, Histogram, Frequency curve and frequency polygon. Mean, median, mode, Standard deviation, standard error, ANOVA.

 **MODULE II**

Random variable,(.discrete and continuous), Probability density function(discrete and continuous), Distribution function for discrete random variable. Distribution function for continuous random variable, Joint probability distribution, Conditional and marginal distribution. Mathematical expectations: Introduction, The expected value of a random variable moments, Moment generating functions, Product moments, Conditional expectations. Standard distributions - Uniform distribution. (Discrete and continuous).Exponential distribution Gamma distribution, Beta distribution. Binomial distribution, Poisson distribution, Normal distributions. Standard normal distributions.

####  MODULE III

Sequence Analysis: Introduction to biological databases: NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTPP. Similarity measures - Euclidean, Mahalanobis distance, Edit distance, similarity matrices (PAM, BLOSUM) Searching sequence databases using BLAST. Multiple sequence alignment – progressive alignment – profiles – multidimensional dynamic programming.

####  MODULE IV

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **SEMESTER - VI**

**Elective A: BIOSTATISTICS, BIOINFORMATICSAND IPRs**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 2 1/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
| **MODULE – I** | 01 | 03 | 25 |
| **MODULE – II** | 02 | 02 | 30 |
| **MODULE – III** | 02 | 02 | 30 |
| **MODULE – IV**  | 01 | 03 | 25 |
| **Total no. of Questions** | **06****Of which 3 to be answered** | **10****Of which 6 to be answered** | **110****Marks including choice. Of which 60marks to be answered** |

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**(WITH EFFECTIVE FROM 2019-2020)**

**III B.Sc BIOTECHNOLOGY, SEMESTER - VI**

**Elective A: BIOSTATISTICS, BIOINFROMATICSAND IPRS**

**PRACTICAL SYALLABUS**

**Hrs : 3 CREDITS-2**

1. Calculation of Mean of given data
2. Draw pie chart of the following data
3. Align the given sequences and calculate genetic similarity of the sequences
4. Calculate median and mode of the following given data
5. Arrange the given data in continuous and discrete form
6. Calculate standard deviation of the given following data
7. Identify the sequence of the given gene through blast
8. Align the sequences using multiple alignment tool.

#### Note: perform any 5 practicals

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **AT THE END OF VI SEMESTER**

**Elective A: BIOSTATISTICS, BIOINFORMATICSAND IPRs**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Calculate mode of the following given data **16 M**

|  |  |
| --- | --- |
| **Class Interval** | **Frequency** |
| 0-11 | 3 |
| 11-21 | 5 |
| 21-31 | 7 |
| 31-41 | 8 |
| 41-51 | 9 |

1. Identify and write a brief notes on given spotters **– 3 x 3 = 9M**

(Identification– 01, Notes – 02).

A.\_\_\_\_\_\_\_\_\_

B.­­­­\_\_\_\_\_\_\_\_\_

C.\_\_\_\_\_\_\_\_\_\_

1. . Practical Record **05 M**
2. . Viva voce **05 M**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - VI**

**Cluster Elective- A1: PLANT AND** **ANIMAL BIOTECHNOLOGY**

 **HOURS 2T+3P CREDITS 2+2**

**INSTRUCTIONAL OBJECTIVES:**

1. To provide basic knowledge on different media used in Plant cell culture.
2. To impart basic Principles of Micro propagation, Gene transfer techniques and production of transgenic plants.
3. To provide basic knowledge on different media used in Animal cell Culture.
4. To impart basic Principles of animal cell culture cell lines, IVF, and Embryo Transfer technology.

**MODULE I:**

**Cell and tissue culture:** Introduction to cell and tissue culture laboratory facilities, sterilization, Explant. Tissue culture media (composition and preparation) Callus and suspension cultures: initiation and maintenance of callus and suspension cultures; single cell clones.

**MODULE II:**

**Tissue and micropropagation**: Direct and indirect regeneration, production of haploids, protoplast culture and Somatic hybridization.

Cloning in plants -Ti plasmid organization. Concept of transgenic plants Bt-cotton and other plant applications.

**MODULE III:**

**Various techniques of animal cell and tissue culture**: Culture media, growth factors, laboratory facilities for animal cell culture. Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence; cell and tissue response to trophic factors. Primary culture, immortal cells, cell lines. Maintenance of cell lines in the laboratory.

#### MODULE IV:

**rDNA products:** Brief idea about recombinant DNA products in medicine (insulin, somatostatin, vaccines), Concept of Gene therapy, Production of recombinant vaccines–hepatitis. Concept of transgenic animals *In*-vitro fertilization and embryo transfer in humans and farm animals.

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **VI Semester**

**Cluster Elective- A1: PLANT AND** **ANIMAL BIOTECHNOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**(WITH EFFECTIVE FROM 2019-2020)**

**III B.Sc BIOTECHNOLOGY, SEMESTER - VI**

**Cluster Elective- A1: PLANT AND** **ANIMAL BIOTECHNOLOGY**

**PRACTICAL SYALLABUS**

**Hrs : 3 CREDITS-2**

1. Establishing a plant cell culture (both in solid and liquid media)–seed germination, callus culture, suspension cell culture, regeneration from callus cells.

2. Suspension culture.

3. Cell count by hemocytometer.

4. Cytology of callus.

5. Establishing primary cell culture of chicken embryo fibroblasts.

6. Animal tissue culture – maintenance of established cell lines.

7. Animal tissue culture –virus cultivation.

8. Measurement of cell size.

9. Microphotography.

10. IMViC test.

11. Determination of seed viability.

#### Note: perform any 8 practical’s

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **AT THE END OF VI SEMESTER**

**Cluster Elective- A1: PLANT AND** **ANIMAL BIOTECHNOLOGY**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Cell count by hemocytometer. **16 M**
2. Identify and write a brief notes on given spotters **– 3 x 3 = 9M**

(Identification– 01, Notes – 02).

A.\_\_\_\_\_\_\_\_\_

B.­­­­\_\_\_\_\_\_\_\_\_

C.\_\_\_\_\_\_\_\_\_\_

1. . Practical Record **05 M**
2. . Viva voce **05 M**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - VI**

**Cluster Elective A2: ENVIRONMENTAL BIOTECHNOLOGY**

**HOURS 2T+3P CREDITS 2+2**

**INSTRUCTIONAL OBJECTIVES:**

1. To provide basic knowledge on basic principles of ecology.
2. To study the principle biogeochemical cycles.
3. To provide basic knowledge on organic and inorganic pollutants of air, land and water.
4. To provide knowledge on waste water management and bioremediation.

**MODULE I**:

**Principles of Ecology:** Water, terrestrial and aquatic ecosystems, Bio-geo chemical cycles - Carbon, Nitrogen cycles. Role of microbes in bio-geochemical cycles.

#### MODULE II:

**Inorganic and Organic pollutants** of air, land and water; maintenance of standards, Environmental monitoring. Detection, treatment and prevention of pollution. Biological indicators

#### MODULE III:

**Biocides,** Four stage alternatives, Refuse disposal - Treatment methods, effluent from pharmaceuticals, fertilizers, pulp and paper industry.

**Waste water management** - Aerobic and anaerobic treatment, primary, secondary and tertiary treatment of municipal wastes, Solid waste management.

#### MODULE IV:

**Bioremediation,** Biodegradation of recalcitrant compounds and the role of genetically engineered microbes and genetically modified organisms in the environmental management.

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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **VI Semester**

**Cluster Elective A2: ENVIRONMENTAL BIOTECHNOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**(WITH EFFECTIVE FROM 2019-2020)**

**III B.Sc BIOTECHNOLOGY, SEMESTER - VI**

**Cluster Elective A2: ENVIRONMENTAL**

**BIOTECHNOLOGY**

**PRACTICAL SYALLABUS**

**Hrs : 3 CREDITS-2**

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample.
6. Estimation of heavy metals in water/soil
7. Estimation of nitrate in drinking water.
8. Isolation of industrially important microorganisms from soil.
9. Isolation of amylase producing organisms from soil.
10. Production of alcohol or wine using different substrates.
11. Estimation of alcohol by titrimetry.
12. Estimation of alcohol by calorimetric method

#### Note: perform any 8 practicals

#### \*\*\*

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

 (WITH EFFECTIVE FROM 2019-2020)

 **AT THE END OF VI SEMESTER**

**Cluster Elective A2: ENVIRONMENTAL**

**BIOTECHNOLOGY**

**MODEL PRACTICAL PAPER**

**Time: 11/2 hrs. Marks: 35**

1. Estimate the DO of the given water sample. **16 M**
2. Identify and write a brief notes on given spotters **– 3 x 3 = 9M**

(Identification– 01, Notes – 02).

A.\_\_\_\_\_\_\_\_\_

B.­­­­\_\_\_\_\_\_\_\_\_

C.\_\_\_\_\_\_\_\_\_\_

1. . Practical Record **05 M**
2. . Viva voce **05 M**

**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

**CHOICE BASED CREDIT SYSTEM**

**BIOTECHNOLOGY SYLLABUS**

(WITH EFFECTIVE FROM 2019-2020)

**SEMESTER - VI**

**Cluster Elective- A3: INDUSTRIAL BIOTECHNOLOGY**

**HOURS 2T+3P CREDITS 2+2**

**INSTRUCTIONAL OBJECTIVES:**

1. To provide basic knowledge on isolation, screening and preservation methods of industrially important microorganisms.
2. To study the principles of bioreactor and operational methods of different bioreactors.
3. To provide basic knowledge on steps involved in industrial production of ethanol and various important products like enzymes, antibiotics.

**MODULE I**:

**Isolation, Screening**, Preservation and Improvement of Industrially Important Microorganisms. Synthetic and Natural Medium, Precursors, Antifoams, Sterilization Methods and Inoculum Preparation.

#### MODULE II:

**Definition of bioreactor**, basic principles of bioreactor. Types of bioreactors. Analysis of batch, continuous, fed batch and semi-continuous bioreactors.

#### MODULE III:

**Ethanol Production** by Fermentation using Molasses, Starchy Substances. Production of Alcoholic Beverages like Beer and Wine. Production of Citric Acid by Submerged and Solid State Fermentations.

#### MODULE IV:

**Sources of Industrial Enzymes**, Production of Microbial Enzymes like Amylase and protease. Backer’s Yeast and SCP Production. Production of Antibiotics: Penicillin.

**Biotechnology Products**- Production of recombinant proteins having therapeutic and diagnostic applications(Insulin, Growth Hormone, Recombinant vaccines, Monoclonal Antibody).

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 **SEMESTER - VI**

**Cluster Elective- A3: INDUSTRIAL BIOTECHNOLOGY**

**BLUE PRINT FOR QUESTION PAPER SETTER**

 **Time: 21/2hours Max marks: 60**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODULE NO.**  | **ESSAY QUESTIONS****10 MARKS** | **SHORT ANSWER QUESTIONS****5 MARKS** | **MARKS ALLOTED TO THE UNIT** |
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**P.R.GOVERNMENT COLLEGE (A), KAKINADA**

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**(WITH EFFECTIVE FROM 2019-2020)**

**III B.Sc BIOTECHNOLOGY, SEMESTER – VI**

**PRACTICAL SYALLABUS**

**Cluster Elective- A3 : PROJECT WORK**