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ADIKAVI NANNAYA UNIVERSITY

RAJAMAHENDRAVARAM

CBCS / Semester System

(W.e.f. 2016-17 Admitted Batch)

I Semester Syllabus

BIOTECHNOLOGY

BTT- 101 MICROBIOLOGY AND CELL BIOLOGY

UNIT I

History, Development and Microscopy

History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner. 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, limitations of electron microscopy.

Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining.

UNIT II

Bacteria: 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, 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. Morphology of archaea, archaeal cell membrane (differences between bacterial and archaeal cell membrane), other cell structures, concept of the three distinct archaea groups.

Viruses: General characteristics of viruses, difference between virus and typical microbial cell, 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.

UNIT III

Microbial Nutrition: 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.

UNIT IV

Microbial growth and control:**Growth:** Growth rate and generation time, details of growth curve and its various phases. Concept of synchronous cultures, continuous and batch cultures (chemostat and turbidostat). Measurement of growth. 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. Microbial Control: Terminologies - Sterilization, disinfection, antiseptic, sanitization, germicide, microbistasis, preservative and antimicrobial agents. Mechanism of cell injury: Damage to cell wall, cell membrane, denaturation of proteins, inhibition of protein synthesis, transcription, replication, other metabolic reactions and change in supercoiling of DNA. Physical control: Temperature (moist heat, autoclave, dry heat, hot air oven and incinerators), dessication, surface tension, osmotic pressure, radiation, UV light, electricity, ultrasonic sound waves, filtration. Chemical control: Antiseptics and disinfectants (halogens, alcohol, gaseous sterilization. Concept of biological control.

UNIT V

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

PRACTICAL: BTP-102 MICROBIOLOGY & CELL BIOLOGY

1. Demonstration, use and care of microbiological equipments.
2. Preparation of media, sterilization and isolation of bacteria.
3. Isolation of Bacteriophage from sewage / other sources.
4. Demonstration of motility of Bacteria.
5. Simple staining of bacteria
6. Gram staining of Bacteria
7. Acid fast staining of Bacteria
8. Endospore staining.
9. Demonstration of starch hydrolysis by bacterial cultures.
10. Growth of fecal coliforms on selective media.
11. Isolation of pure culture by pour plate method.
12. Isolation of pure culture by streak plate method.
13. Anaerobic cultivation of microorganisms.
14. Cultivation of yeast and moulds.
15. Antibiotic sensitivity assay.
16. Oligodynamic action of metals.
17. To study germicidal effect of UV light on bacterial growth.
18. Stages of mitosis.
19. Stages of meiosis.

Note: - Mandatory to perform at least ten practical.

ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM

CBCS/ SEMESTER SYSTEM

II SEMESTER: B.Sc. BIO-TECHNOLOGY

(FOR 2016-17 ADMITTED BATCH)

SEMESTER II

BTT- 201 MACROMOLECULES, ENZYMOLOGY AND BIOENERGETICS

UNIT I

Nucleic Acids and Chromosomes: Chemical structure and base composition of nucleic acids, Chargaff's rules, Watson Crick Model (B-DNA), deviations from Watson-Crick model, other forms of DNA (A- and Z-DNA), forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations, base stacking). RNA and its types.

UNIT II

Amino acids and Proteins: Structure of amino acids occurring in proteins, classification of amino acids (pH based, polarity based and nutrition based physico-chemical properties of amino acids. Primary, Secondary, Tertiary & Quaternary structure of proteins.

UNIT III:

Carbohydrates: Definition, classification, nomenclature of carbohydrates, structures of monosaccharides, disaccharides and polysaccharides. Concept and examples of heteropolysaccharides.

Lipid: Types of lipids, structures of saturated and unsaturated fatty acids, triglycerides, phospholipids, Concept of acid value, saponification value and iodine value. Sphingolipids and prostaglandins. Chemistry of Porphyrines, Heme, Cytochromes, and Chlorophylls

UNIT IV

Enzymes: Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature of enzymes. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity), lock and key and induced fit models.

Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature, temperature. Enzyme inhibition kinetics (reversible inhibition types – competitive, uncompetitive and non-competitive), brief idea of irreversible inhibition.

UNIT V

Bioenergetics: Concept of free energy, Entropy, Enthalpy & Redox Potential. Concept of high energy bonds as related to the structure of ATP, Phosphoenolpyruvate, Creatine phosphate etc. Glycolysis (pathway, entry of other monosaccharides and disaccharides, regulation, inhibitors) Gluconeogenesis: Bypass reactions.

PRACTICALS: BTP- 202 MACROMOLECULES & ENZYMOLOGY

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 (Dinitrosalicylic 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 19. Effect of temperature / pH on enzyme activity
12. Assay of protease activity.
13. Assay of alkaline phosphatase
14. Preparation of starch from Potato and its hydrolysis by salivary amylase
15. Isolation of urease and demonstration of its activity

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

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ADIKAVI NANNAYA UNIVERSITY

RAJAMAHENDRAVARAM

CBCS / Semester System

(W.e.f. 2015-16 Admitted Batch)

III Semester Syllabus

BIOTECHNOLOGY

BTT- 301: BIOPHYSICAL TECHNIQUES

UNIT – I:

Spectrophotometry: Spectrum of light, absorption of electromagnetic radiations, Beer's law - derivation and deviations, extinction coefficient. Instrumentation of UV and visible spectrophotometry, Double beam spectrometer; dual-wavelength spectrometer, Applications of UV and visible spectrophotometry. Colorimetry principles and its applications.

UNIT II:

Chromatography: Partition principle, partition coefficient, nature of partition forces, brief account 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.

UNIT III

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

UNIT – IV:

Isotopic tracer technique: Radioactive & stable isotopes, rate of radioactive decay. Units of radioactivity. Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique), Cerenkov radiation. Measurement of Stable isotopes: Falling drop method for deuterium measurement. Biological applications of Radioisotopes.

UNIT V:

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.

Biostatistics Basic concepts of mean, median, mode, Standard deviation and Standard error. Introduction to ANOVA

PRACTICALS: B T P : 3 0 2 - METABOLISM & BIOPHYSICAL TECHNIQUES

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 diacetyl 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.
14. Calculation of mean, median, and mode (manual/computer aided).
15. Calculation of standard deviation and standard error (manual/computer aided).
16. Biostatistical problem based on standard deviation.

Note: - Mandatory to perform at least 10 practicals

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ADIKAVI NANNAYA UNIVERSITY
CBCS/ SEMESTER SYSTEM
IV SEMESTER : B.SC BIOTECHNOLOGY
W.E.F 2015-16 ADMITTED BATCH

BTT-401: IMMUNOLOGY

UNIT I

Immune system: Organs and cells of immune system Immunity, Immune response, innate immune mechanism, Acquired immune mechanism, Antigen, Humoral immunity, main pathways of complement system.

UNIT II

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

UNIT III

Immunity: Cell mediated immunity: TC mediated immunity, NK cell mediated immunity, ADCC, brief description of cytokines and MHC (MHC types and diversity)

UNIT IV

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

UNIT V

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

PRACTICALS: BT- 402 IMMUNOLOGY & BIOPHYSICAL TECHNIQUES

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

Note: - Mandatory to perform atleast 6 practicals

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MODEL QUESTION PAPER FOR FOURTH SEMESTER END EXAM

B. Sc Degree Course (CBCS Semester pattern)

B. Sc Biotechnology (Theory)

Duration: 3hrs

Max. marks: 75

SECTION –A

Answer any Five questions

5x5 =25marks

- 1) Humoral immunity
- 2) Complement system
- 3) NK cell mediated immunity
- 4) Autoimmune response
- 5) ELISA
- 6) Agglutination
- 7) Define Antigen, Antibody, Hapten, Plasma cells, Macrophages
- 8) MHC types and diversity

SECTION-B

Answer the questions

5x10 =50marks

- 9) a) Describe Organs and cells of immune system Immunity
Or
b) Describe main pathways of complement system
- 10) a) Describe Antibody structure and classes
Or
b) Describe Types of Antigens and factors affecting antigenicity
- 11) a) Describe Cell mediated immunity and its types
Or
b) Describe cytokines and MHC
- 12) a) Describe General features of hypersensitivity and various types of hypersensitivity
Or
b) Describe principles, significance, Types of Vaccines
- 13) a) Describe Antigen-antibody reactions
Or
b) Describe Hybridoma technology and its applications.

**MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL
EXAMINATIONS**

B.Sc., IV Semester End Practical examination

B.Sc., Biotechnology

TIME: 3 hours

Max. Marks: 50

1. Determination of Blood group (Major experiment). 20 marks
(Principle-5M, Methodology-10M, Results-05)

2. Ouchterloney immunodiffusion (Minor experiment). 10 marks
(Principle -2M, Methodology-05M, Results-03)

1. Identify the given spotter and write a brief note on it- A, B, C,D,E, F
(5x2M)10 marks

2. Record 05 marks

3. Viva-voce 05 marks

B. Sc. III –Semester V
BIOTECHNOLOGY
BT 501: GENETICS AND MOLECULAR BIOLOGY

UNIT I

Mendel's Laws and Inheritance

Mendel experiments, Mendel Laws and deviations: incomplete dominance and Co dominance. Penetration and pleiotropism, Recessive and Dominant epistatic gene interactions. Concept of multiple alleles

UNIT II

Genes and their variations

Structure of gene, gene and environment, gene copies and heterogeneity, Meiotic nondisjunction of chromosomes, chromosome abnormalities in animals and plants. Linkage, recombination, gene maps, interference and coincidence. Sex determination, genetic population studies and Hardy Weinberg Equations.

UNIT III

DNA Replication

Enzymology of replication (detailed treatment of DNA polymerase I, brief treatment of pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase and RNA primers, distributive and processive properties of DNA polymerase I and III, importance of the β -subunit in polymerase III), proof for semiconservative replication, discontinuous replication and Okazaki fragments, Replication origins, initiation, primosome formation, elongation, and termination. Use of DNA replication mutants in the study of replication.

UNIT IV

Mutations & DNA Repair

Gene mutations: Induced and Spontaneous, Missense, nonsense and frameshift mutations. Mutagens: Physical and chemical mutagens.

Repair: Mismatch repair, light induced repair, SOS repair. Rec gene and its role in DNA repair, post replication repair

UNIT V

Transcription

Enzymatic synthesis of RNA. Basic features of transcription, structure of prokaryotic RNA polymerase (core enzyme and holoenzyme, significance of σ factor), concept of promoter (Pribnow box, -10 and -35 sequences and their significance).

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

BT 501: GENETICS AND MOLECULAR BIOLOGY
practicals

1. Effect of UV radiations on the growth of microorganisms.
2. Isolation of plasmid DNA from bacteria
3. Purity analysis of the Nucleic acids
4. Study of different phases of mitosis in onion root tips and meiosis in *Allium cepa* flower buds.
5. Karyotyping in *Allium* or *Drosophila*.
6. Problems and assignments in Mendelian genetics.
7. Isolation of auxotrophic mutants (plants or insects).

A. G. Prasad

8. Mutation of bacteria by UV.
9. Chemical induced mutation in bacteria

Note: - Mandatory to perform atleast 6 practical

B. Sc. III – Semester V
BT 502: GENE EXPRESSION & rDNA TECHNOLOGY

UNIT I

Genetic Code

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

The decoding system: aminoacyl synthetases, the adaptor hypothesis, attachment of amino acids to tRNA. Codon-anticodon interaction - the wobble hypothesis.

Selection of initiation codon - Shine and Dalgarno sequence and the 16S rRNA.

UNIT II

Protein synthesis:

Initiation, elongation, termination and post translational modification.

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

UNIT III

Gene Expression and regulation

Details of initiation, elongation, and termination (intrinsic and rho factor mediated termination).

Regulation of Transcription in Prokaryotes: Basic idea of lac- and trp-operons. Negative and positive control of lac operon

Eukaryotic Gene Regulation: Gal operon

UNIT IV

rDNA Technology

DNA cloning: Basics of genetic engineering, restriction endonucleases, other enzymes of DNA manipulation. Vectors: Plasmid vectors (pBR322 and pUC 18/19)

Phage vector: Lambda replacement and insertion vectors Cosmids, phagemids, and YAC.

Cutting and joining DNA (cohesive end ligation, methods of blunt end ligation). Transfection and transformation. Selection of transformed cells. Screening methods.

UNIT V

Genomic DNA library and cDNA library – concept and methods of creating these libraries. Advantages and disadvantages of cDNA library over genomic DNA library.

General consideration of Polymerase chain reaction, designing of primers for PCR.

Expression of cloned genes: General features of an expression vector. Expression of a eukaryotic gene in prokaryotes – advantages and problems. Applications of recombinant DNA technology.

SEMESTER V
BT 502: GENE EXPRESSION & rDNA TECHNOLOGY

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.

M. Prasad

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

S. S. Manta

**MODEL QUESTION PAPER FOR FIFTH SEMESTER END EXAM
GENETICS AND MOLECULAR BIOLOGY**

B. Sc Degree Course (CBCS Semester pattern)

B. Sc Biotechnology (Theory)

Duration: 3hrs

Max. marks: 75

SECTION -A

Answer any Five questions

5x5 =25marks

- 1) Incomplete dominance and co dominance
- 2) Linkage
- 3) DNA polymerase and types
- 4) Missense and Nonsense mutation
- 5) Concept of Promotor
- 6) Reverse transcription
- 7) Hardy weinberg law and equation
- 8) Penetration and pleiotropism

SECTION-B

Answer the questions

5x10 =50marks

- 9) a) Describe Mendel's Laws and deviations
Or
b) Describe Recessive and dominant epistatic gene interaction.

- 10) a) Describe Chromosome abnormalities in plants and animals
Or
b) Describe recombination process and types

- 11) a) Describe use of DNA replication mutants in study of replication
- 12) Or
b) Describe process of replication, proof of semi conservative method of replication

- 9) a) Describe Physical and chemical mutagens
- 10) Or
b) Describe SOS repair of DNA

- 11) a) Describe Enzymes involved in transcription and process of transcription
Or
b) Describe Concept of Promoter.

14.10.20

**MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS
GENETICS AND MOLECULAR BIOLOGY**

B.Sc., V Semester End Practical examination

B.Sc., Biotechnology

TIME: 3 hours

Max. Marks: 50

1. Isolation of plasmid DNA from bacteria
(Major experiment).20marks (Principle-5M, Methodology-10M, Results-05)
2. Problems and assignments in Mendilian genetics (Minor experiment). 10 marks
(Principle -2M, Methodology-05M, Results-03)
3. Identify the given spotter and write a brief note on it- A, B, C,D,E, F
(5x2M)10 marks
4. Record 05 marks
5. Viva-voce 05 marks

S. H. M. S.

MODEL QUESTION PAPER FOR FIFTH SEMESTER END EXAM

GENE EXPRESSION & rDNA TECHNOLOGY

B. Sc Degree Course (CBCS Semester pattern)

B. Sc Biotechnology (Theory)

Duration: 3hrs

Max. marks: 75

SECTION -A

Answer any Five questions

5x5 =25marks

- 1) Characteristics of Codon
- 2) Antibiotics effecting translation
- 3) lac operon
- 4) YAC
- 5) PCR
- 6) Vector
- 7) Shine Dalgarno sequence
- 8) Ligation

SECTION-B

Answer the questions

5x10 =50marks

13) a) Describe Codon and its characteristics

Or

b) Describe Codon and anticodon interaction and selection of initiation codon

14) a) Describe post translational modification

Or

b) Describe regulation of translation

15) a) Describe Operon concept and types

16) Or

b) Describe Eukaryotic gene regulation

12) a) Describe different types of Cloning vectors

13) Or

b) Describe bacterial transformation process

14) a) Describe construction of cDNA library and its applications

Or

b) Describe expression of eukaryotic gene in prokaryotes.

S. G. Kaito

MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS
GENE EXPRESSION & rDNA TECHNOLOGY
B.Sc., V Semester End Practical examination
B.Sc., Biotechnology

TIME: 3 hours

Max. Marks: 50

1. To measure concentration of DNA & RNA by UV spectrophotometry
(Major experiment).20marks (Principle-5M, Methodology-10M, Results-05)
2. Restriction digestion of DNA (Minor experiment). 10 marks
(Principle -2M, Methodology-05M, Results-03)
3. Identify the given spotter and write a brief note on it- A, B, C,D,E, F
(5x2M)10 marks
4. Record 05 marks
5. Viva-voce 05 marks

Aly Kanto

Adikavi Nannaya University
B.Sc. Biotechnology Syllabus under CBCS

w.e.f. 2015-16 admitted batch

Structure and Syllabus Under CBCS

III YEAR	* Any one Paper from VII A, B and C	VII (A)*	Developmental Biology	100	03		
			Practical - VII A	50	02		
		VII (B)*	Ecology	100	03		
			Practical - VII B	50	02		
		VII (C)*	Biostatistics, bioinformatics and IPRS	100	03		
			Practical - VII C	50	02		
		** Any one cluster from VIII, A, B and C	VIII (A)**	Cluster Electives - I :			
				VIII-A-1: Plant Physiology	100	03	
				VIII-A-2: Animal Physiology	100	03	
	VIII-A-3: Inheritance Biology			100	03		
	Practical VIII A-I			50	02		
	Practical VIII A-2			50	02		
	Practical VIII A-3			50	02		
	VIII (B)**		Cluster Electives - II ::				
			VIII-B-1: Diversity in Life	100	03		
VIII- B-2 :Evolution			100	03			
VIII-B-3 :Project			100	03			
Practical VIII B-I			50	02			
Practical VIII B-2		50	02				
Viva-Voce VIII B-3	50	02					
VIII (C)**	Cluster Electives - III ::						
	VIII-C-1: Plant Biotechnology and Animal Biotechnology	100	03				
	VIII-C-2 :Environmental Biotechnology	100	03				
	VIII-C-3 :Industrial Biotechnology	100	03				
	Practical VIII C-I	50	02				
	Practical VIII C-2	50	02				
	Practical VIII C-3	50	02				

*Candidate has to choose only one paper

** Candidates are advised to choose Cluster (A) if they have chosen VII (A) and Choose Cluster (B) if they have chosen VII(B) etc. However, it is suggestive.

Biotechnology

VI Semester

Elective A: DEVELOPMENTAL BIOLOGY

Unit I

Potency, commitment, specification, induction, competence, determination and differentiation; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants

Unit II

Production of gametes; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

Unit III

Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis– vulva formation in Caenorhabditis elegans, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.

Unit IV

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum

Unit V

Programmed cell death, aging and senescence

PRACTICALS

1. Structure of young anther wall, microsporogenesis, mature anther (permanent slides).
2. Study of monosporic (Polygonum) type of embryo sac development (permanent slides/photographs).
3. Study of embryo sac through electron micrographs showing egg apparatus.
4. Determination of stomatal index of leaf of the given plant material.
5. Determination of an effect of an environmental factor on the rate of transpiration by an excised twig using photometer.

Biotechnology

VI Semester

Elective B: ECOLOGY

Unit I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Unit II

Population Ecology: Characteristics of a population; population growth curves; population regulation;

Unit III

Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit IV

Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Unit V

Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

PRACTICALS

1. To determine basal cover of trees in a forest ecosystem/forest plantation.
2. Quantitative analysis of soil organic carbon.
3. Quantitative analysis of soil pH.
4. To study pore space, water holding capacity and bulk density of soil.
5. Identification of rocks and minerals on the basis of physical characters.

Biotechnology

Semester- VI

Elective C: BIOSTATISTICS, BIOINFORMATICS AND IPRS

UNIT I

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

UNIT 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.

UNIT III

Correlation and Regression analysis: Correlations and regressions-: Relation between two variables, scatter diagram, definition of correlations. Probability theory: Random experiments, sample space, probability theory, conditional probability. Baye's theorem.

UNIT IV

Sequence Analysis: Introduction to biological databases: NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP. 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.

UNIT V

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

PRACTICALS

- Calculation of Mean of given data
- Draw pie chart of the following data
- Align the given sequences and calculate genetic similarity of the sequences
- Calculate median and mode of the following given data
- Arrange the given data in continuous and discrete form

- Calculate standard deviation of the given following data
- Identify the sequence of the given gene through blast
- Align the sequences using multiple alignment tool.

Note: perform any 5 practicals

Biotechnology

Semester- VI

Cluster Elective- A1: PLANT PHYSIOLOGY

Unit I

Photosynthesis-Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation -C₃, C₄ and CAM pathways.

Unit II

Respiration and photorespiration–Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

Unit III

Nitrogen metabolism- Nitrate and ammonium assimilation; amino acid biosynthesis

Unit IV

Solute transport and photoassimilate translocation–uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates

Unit V

Sensory photobiology-Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks

PRACTICALS

1. Osmosis – by potato osmoscope experiment
2. Determination of osmotic potential of plant cell sap by plasmolytic method using leaves of *Rhoeo* / *Tradescantia*.
3. Structure of stomata (dicot & monocot)
4. Determination of rate of transpiration using cobalt chloride method.
5. Demonstration of transpiration by Ganong's photometer
6. Demonstration of ascent of sap/Transpiration pull.
7. Effect of Temperature on membrane permeability by colorimetric method.
8. Study of mineral deficiency symptoms using plant material/photographs.
9. Separation of chloroplast pigments using paper chromatography technique.
10. Rate of photosynthesis under varying CO₂ concentrations.
11. Effect of light intensity on oxygen evolution in photosynthesis using

NOTE: Perform any 6 practical

Biotechnology
Semester- V

Cluster Elective- A2: ANIMAL PHYSIOLOGY

Unit I

Blood and circulation- Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Unit II

Respiratory system- Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Unit III

Nervous system- Neurons, action potential, neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Sense organs - Vision, hearing and tactile response.

Unit IV

Digestive system -Digestion, absorption, energy balance, BMR.

Unit V

Endocrinology and reproduction- Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation

PRACTICALS

1. Detection of protein, carbohydrate and lipid.
2. Study of Human salivary enzyme activity in relation to pH.
3. Detection of nitrogenous waste products - Ammonia & Urea
4. Exercise on Haematology - Counting of RBC /WBC and Blood grouping in blood samples.
5. Estimation of Haemoglobin in blood samples.

Biotechnology
Semester- VI

Cluster Elective- A3:INHERITANCE BIOLOGY

Unit I

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids.

Unit II

Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

Unit III

Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Unit IV

Mutation: Types, causes and detection, mutant types– lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.

Unit V

Recombination: Homologous and non-homologous recombination including transposition.

PRACTICAL

1. Scoring of Drosophila and Maize cobs for Monohybrid and Dihybrid segregations.
2. Problems on Mendelian Segregations (Monohybrid, Dihybrid & Trihybrid Crosses).
3. Problems on Multiple alleles and non-allelic interactions.
4. Problems on Linkage analysis and mapping of genes.
5. Phenotyping of ABO blood groups.
6. Screening for Barr body.

Biotechnology
Semester- VI

Cluster Elective- B1: DIVERSITY IN LIFE

Unit I

Principles & methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants, animals and microorganisms.

Unit II

Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications.

Unit III

Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species.

Unit IV

Organisms of health & agricultural importance: Common parasites and pathogens of humans, domestic animals and crops.

Unit V

Organisms of conservation concern: Rare, endangered species. Conservation strategies.

PRACTICALS

1. Identification of museum specimens of some economically important fishes.
2. Study of flora and fauna through charts and maps.
3. Preparation of field report based on the visit to a Wild Life Sanctuary/National Park/Zoo/Biosphere Reserve.
4. Preparation of field report based on the survey of local flora.
5. Study of centre of diversity of plants from maps.

Biotechnology
Semester- VI

Cluster Elective- B2: EVOLUTION

Unit I

Emergence of evolutionary thoughts Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis.

Unit II

Origin of cells and unicellular evolution: Origin of basic biological molecules; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

Unit III

Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification;

Unit IV

The Mechanism: Population genetics- Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift;

Unit V

Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

PRACTICALS

- 1) Give detailed description of different symbolic representation of Pedigree analysis
- 2) Give diagrammatic representation of X-linked recessive trait
- 3) In a plant species the ability to grow in soil contaminated with nickel is determined by a dominant allele.
 - i. If 60% of the seeds in a randomly mating population are able to germinate in contaminated soil, what is the frequency of the resistance allele?
 - ii. Among the plants that germinate, that proportion is homozygous?
- 4) $\alpha\beta\gamma$ is an autosomal recessive disorder of man. The frequency of effected newborn infants is about 1 in 14000. Assuming random mating, what is the frequency of heterozygotes?
- 5) DNA isolation and Polymerize chain reaction of the DNA

- 6) Agarose gel electrophoresis of the amplified solution and check the amplified bands in UV transilluminator/UV Gel documentation.

Biotechnology
Semester- VI

Cluster Elective- B3: PROJECT

Biotechnology
Semester- VI

Cluster Elective- C1: PLANT AND ANIMAL BIOTECHNOLOGY

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

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.

UNIT V:

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.

PRACTICALS

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 practicals

Biotechnology
Semester- VI

Cluster Elective C2: ENVIRONMENTAL BIOTECHNOLOGY

Unit I:

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

Unit II:

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

Unit III:

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

Unit IV:

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

Unit V:

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

PRACTICALS

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. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of xenobiotic degrading bacteria by selective enrichment technique
8. Estimation of heavy metals in water/soil
9. Estimation of nitrate in drinking water.
10. Preparation and formulation of microbial biopesticide (bacteria, fungi and viruses)
11. In vitro evaluation of medicinal plants against pathogenic microbes.
12. Effect of mycorrhizal fungi on growth promotion of plants.
13. Production of microbial fertilizers (Rhizobium, Azotobacter and AMF).

Note: perform any 8 practicals

Biotechnology
Semester- VI

Cluster Elective- C3: INDUSTRIAL BIOTECHNOLOGY (Cluster 703.3)

Unit I:

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

Unit II:

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

Unit 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.

Unit IV:

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

Unit V:

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

PRACTICALS

1. Isolation of industrially important microorganisms from soil.
2. Isolation of amylase producing organisms from soil.
3. Production of α – amylase from *Bacillus Spp.* by shake flask culture.
4. Production of alcohol or wine using different substrates.
5. Estimation of alcohol by titrimetry.
6. Estimation of alcohol by calorimetric method.
7. Production of citric acid.
8. Citric acid production by submerged fermentation.
9. Estimation of citric acid by titrimetry.

Note: perform any 6 practicals

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ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM

QUESTION PAPER PATTERN FOR ALL SEMESTER W.E. FROM 2016-17 ADMITTED

BATCH

(For all Papers except Foundation Course papers & Special English Paper)

Time: 3 Hours

Maximum Marks: 75

Section - A

I. Answer any five questions

(5x5=25)

1. Unit- I

2. Unit- II

3. Unit-III

4. Unit- IV

5. Unit-V

6.

7.

8.

Each one from any of the three units out of five units

Section- B

II. Answer All the Questions

(5x10=50)

1. (a) or (b) from Unit -I

2. (a) or (b) from Unit -II

3. (a) or (b) from Unit -III

4. (a) or (b) from Unit -IV

5. (a) or (b) from Unit -V