KANNUR UNIVERSITY

(Abstract)

B.Sc Biotechnology Programme-Scheme & Syllabus of Core/Complementary/Open/Common Courses under Choice Based Credit Semester System for Under Graduate Programme-implemented with effect from 2009 admission-Orders Issued.

ACADEMIC BRANCH

No.Acad/C2/8965/2008(1) Dated, K.U.Campus. P.O,09- 07-2009.

Read: 1.Minutes of the meeting of the Board of Studies in Biotechnology (Cd) held on 28-05-2009.

2. Minutes of the meeting of the Faculty of Science held on 16-06-2009.

3. U.O No.Acad/C2/3838/2008 (i) dated 07-07-2009.

4. Letter dated nil from the Chairman, BOS in Biotechnology (Cd).

ORDER

1. The Board of Studies in Biotechnology (Cd) vide paper read(1) above has prepared and finalised the Scheme and Syllabus of Bitechnology Core/Complementary/Open Courses under Choice Based Credit Semester System for implementation from 2009 admission.

2. The recommendations of the Board in restructuring the syllabus is considered by the Faculty of Science vide paper read (2) and recommended for the approval of the Academic Council.

3. The Regulations for Choice based Credit Semester System is implemented in this University vide paper read (3).

4. The Chairman, BOS in Biotechnology (Cd) vide paper read (4) above, forwarded the restructured scheme and syllabus of Biotechnology Core/Complementary/Open Courses along with Common Courses (4 Courses) under Choice Based Credit Semester System, prepared by the Board of Studies in Biotechnology (Cd) for implementation with effect from 2009 admission.

5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction ***to implement the scheme and syllabus of Biotechnology Core/Complementary/Open Courses along with Common Courses (4 Courses) restructured in line with Choice Based Credit Semester System***, with effect from 2009 admission, subject to ratification by the Academic Council.

6.The restructured scheme and syllabus of Core/Complementary/Open Courses under Biotechnology Programme along with Common Courses (4 Courses) restructured in line with Choice Based Credit Semester System, implemented with effect from 2009 admission is appended.

7. The Scheme and Syllabus of Complementary Courses offered for this Programme will be available along with the syllabus of Core Courses of the Complementary subject.

8. The affiliated Colleges are not permitted to offer Complementary Courses in violation to the provisional/permanent affiliation granted by the University. Changes in Complementary Courses are permitted with prior sanction /revision in the affiliation order already issued in this regard.

9. If there is any inconsistency between the Regulations for CCSS and its application to the Scheme & Syllabus prepared, the former shall prevail.

10. Orders are issued accordingly.

Sd/-

To: REGISTRAR

1. The Principals of Colleges offering Biotechnology Programme

2. The Examination Branch (through PA to CE)

Copy To:

1. The Chairman, BOS Biotechnology (Cd) Forwarded/By Order
2. PS to VC/PA to PVC/PA to Regr
3. DR/AR I Academic
4. Central Library 5. SF/DF/FC. SECTION OFFICER

Appendix to U.O.No.Acad/C2/8965/2008(1) dated 09- 07-2009

K A N N U R U N I V E R S I T Y

Course Structure
and
Syllabus

FOR

UNDERGRADUATE PROGRAMME

IN

BIOTECHNOLOGY

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Course Structure
B.Sc Biotechnology

SEMESTER 1

No	Title of the Course	Hours /week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	5	4	3
4	Core Course 1	3	3	3
5	Complementary 1 (Course I)	4	3	3
6	Complementary 2 (Course I)	4	3	3

SEMESTER 2

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	5	4	3
4	Core Course 2	3	3	3
5	Complementary 1 (Course II)	4	3	3
6	Complementary 2 (Course II)	4	3	3

SEMESTER 3

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (General)	5	4	3
2	Common Course (General)	5	4	3
3	Core Course 3	2	2	3
4	Core Course 4	3	3	3
4	Complementary 1 (Course III)	5	3	3
5	Complementary 2 (Course III)	5	3	3

SEMESTER 4

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (General)	5	4	3
2	Common Course (General)	5	4	3
3	Core Course 5	2	2	3
4	Core Course 6	3	3	3
5	Complementary 1 (Course IV)	5	3	3
6	Complementary 2 (Course IV)	5	3	3

SEMESTER 5

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 1	2	2	3
2	Core Course 7	4	4	3
3	Core Course 8	5	4	3
4	Core Course 9	5	4	3
5	Core Course 10	4	4	3
6	Core Course 11	5	4	3

SEMESTER 6

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 2	2	2	3
2	Core Course 12	4	4	3
3	Core Course 13	5	4	3
4	Core Course 14	3	2	3
5	Core Course 15	5	4	3
6	Core Course 16 Project	5	2	*

The Hour/Credit distribution for Complementary Theory/Practical examination shall be decided by the Board of Studies concerned.

The following are the Common Courses offered in III and IV Semesters.

1.3A07BTC Biophysics
2.3A08BTC Biostatistics
3.4A09BTC Genetics
4.4A10BTC Immunology

Scheme Biotechnology(Core)

No	Semester	Course code	Title of the course	Hours/ week	Credit
1	I	1B01 BTC	Methodology and Perspective of Sciences	3	3
2	II	2B02 BTC	Informatics and Introduction to Bioinformatics	3	3
3	III	3B03 BTC	Biotechnology Practical – I	3	3
4	III	3B04 BTC	Cell Biology	2	2
5	III	3A07BTC	Biophysics	5	4
6	III	3A08BTC	Biostatistics	5	4
7	IV	4A09BTC	Genetics	5	4
8	IV	4A10BTC	Immunology	5	4
9	IV	4B05 BTC	Plant Physiology and Development	2	2
10	IV	4B06 BTC	Biotechnology Practical – II	3	3
11	V	5B07 BTC	Animal Physiology and Development	5	4
12	V	5B08 BTC	Molecular Biology	4	4
13	V	5B09 BTC	Animal Cell Biotechnology	5	4
14	V	5B10 BTC	Environmental Biotechnology	4	4
15	V	5B11 BTC	Biotechnology Practical – III	5	4
16	VI	6B12 BTC	Principles and Applications of Genetic Engineering	4	4
17	VI	6B13 BTC	Plant Biotechnology and in Vitro Cell Culture	5	4
14	VI	6B14 BTC	Microbes in Environmental Biotechnology	4	4
18	VI	6B15 BTC	Biotechnology Practical – IV	5	4
19	VI	6B16 BTC	Project Work	5	2

Scheme Biotechnology(Complementary)

No	Semester	Course Code	Title of the course	Hours/ week	Credit
1	I	1C01 BTC	Plant Biotechnology 1	2	2
2	I	4C05 BTC	Practical	2	-
3	II	2C02 BTC	Plant Biotechnology 2	2	2
4	II	4C05 BTC	Practical	2	
5	III	3C03 BTC	Microbial Biotechnology 1	3	2
6	III	4C05 BTC	Practical	2	-
7	IV	4C04 BTC	Microbial Biotechnology 2	3	2
8	IV	4C05 BTC	Practical	2	4

Scheme Open Courses

No	Semester	Course code	Title of the course	Hours/ week	Credit
1	V	5D01 BTC	Bioinformatics-I	2	2
2	V	5D02 BTC	Fermentation technology - I	2	2
3	VI	6D01 BTC	Bioinformatics-II	2	2
4	VI	6D02 BTC	Fermentation technology – II	2	2

1B01 BTC- METHODOLOGY AND PERSPECTIVE OF SCIENCES

Hours/Week-3
Credits-3

Module I : Science and Science Studies

Types of knowledge: Practical, theoretical and scientific knowledge, Information:

What is science? What is not science? Laws of Science, Basis for scientific laws and factual truths.

Science as a human activity, scientific temper, empiricism, vocabulary of science, science disciplines.

Revolutions in science, Science and Technology.

Module II : Methods and Tools of Science

Hypotheses: theories and laws in science, Observations, evidences and proofs. Peer reviews.

Posing a question; formulation of hypothesis; Hypothetico-deductive model, Inductive model. Significance of verification (proving), corroboration and falsification (disproving), auxiliary hypothesis, adhoc hypothesis.

Revision of scientific theories and laws.

Importance of models, simulations and virtual testing. Mathematical methods versus Scientific methods.

Module III : Experimentation in Science

Design of an experiment; experimentation; observation; data collection; interpretation and deduction.

Necessity of units and dimensions; repeatability and replication; Documentation of experiments, Record keeping. Connection between measurements and underlying theory.

Types of experiments. Experiments to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments.

Planning of experiments: Design, selection of controls, observational requirements, instrumental requirements.

Scientific Instruments; Sensory extension; choice and selection of instruments; sensitivity of instruments; Accuracy and precision, Types of instrumentation; Historical development and evolution of scientific instruments. Robotics. (*Only a general orientation of scientific instruments required*).

Making observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations.

Examples of great experiments in science. (*To illustrate how various tools were applied to answer a question*).

Module IV : Data handling in ethics science

Documentation of experiments. Nature and Types of data – typical examples; Data acquisition; Treatment of data; Data interpretation, Significance of statistical tools in data interpretation, errors and inaccuracies, instrumental errors and variables, human errors (basic idea).

Data presentation: graphs, tables, histograms and pi diagrams.

Statistical testing of hypothesis, null hypothesis, Significance test – Statistics based acceptance or rejection of a hypothesis. Deduction of scientific correlation, patterns and trends.

Ethics in Science: Scientific information, Depositories of scientific information, primary, secondary and digital sources, Sharing of knowledge; transparency and honesty; danger of preconceived ideas.

Reporting of observational and experimental data, human bias, Biased observations, Influence of observer on observations, using and acknowledge observations by others. Publications and Patents. Plagiarism.

Reference Books

Gieryn, T.f. Cultural Boundaries of Science., Univ. Chicago Press, 1999.

Collins H. and T. Pinch. The Golem: What Everyone should know about Science ., Cambridge Univ Press, 1993

Hewitt, Paul G, Suzanne Lyons, *John* a. Suchocki-Wesley, 2007

Newton R G. The Truth of Science: New Delhi, 2nd edition Bass, Joel, E and et. al, Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009.

2B02 BTC – INFORMATICS AND INTRODUCTION TO

Hours/Week-3 **BIOINFORMATICS**
Credits-3

Module I – Overview of Information Technology Features of the modern personal computer and peripherals, computer networks & Internet, wireless technology, cellular wireless networks, introduction to mobile phone technology, introduction to ATM, purchase of technology, License, Guarantee, Warranty, overview of Operating Systems & major application software.

Module II – Knowledge Skills for Higher Education Data, information and knowledge, knowledge management – Internet access methods – Dial-up, DSL, Cable, ISDN, Wi-Fi – Internet as a knowledge repository, academic search techniques, creating cyber presence, case study of academic websites, open access initiatives, open access publishing models. Basic concepts of IPR, copyrights and patents, plagiarism, introduction to use of IT in teaching and learning, case study of educational software, academic services – INFLIBNET, NICNET, BRNET.

Module III – Social Informatics IT & Society-issue and concerns-digital divide, IT & development, the free software movement, IT industry; new opportunities and new threats, software piracy, cyber ethics, cyber crime, cyber threats, cyber security, privacy issues, cyber laws, cyber addictions, information overload, health issues – guide lines for proper usages of computers, internet and mobile phones, e-wastes and green computing, impact of IT on language & culture-localization issues – Unicode – IT and regional languages.

Module IV – Application e-Governance applications at national and state level, IT for national integration, overview of IT application in medicine, healthcare, business, commerce, industry, defense, law, crime detection, publishing, communication, resource management, weather forecasting, education, film and media, IT in service of disabled, futuristic IT-Artificial Intelligence, Virtual Reality, Bio-Computing.

Module V - Introduction to Bioinformatics History, definition, bioinformatics introduction, importance and uses of bioinformatics, information technology, biological data, databases, protein sequencing, nucleic acid sequencing, sequence to structure relationship.

Module VI-Human Genome Project History, Nucleic acids, Genes, Genomes; Contribution of various countries, about National Institutes of Human Genome Project (NHGRI); Introduction and need of Human Genome Project, rough and final draft of the Human Genome Project, Goals of the HGP, uses and applications; overview of genomics and proteomics.

References

1.Introduction to Bioinformatics: by T.K. Altwood, D.J. Parry-Smith and S. Phukan.
2.Bioinformatics: Sequence and Genome Analysis David. W. Mount.
3.Bioinformatics: Genes, Proteins, and Computers by C.A. Orengo, D.T. Jones and J.M. Thornton

3AO7 BTC- BIOPHYSICS

Hours/Week-5
Credits-4

Module 1- Introduction to biophysics, its importance in modern biology, Hydrogen bond and water structure, Importance of hydrogen bond in biological systems, pH.

Module II -Surface tension, adsorption, osmosis, dialysis and colloids - definition brief discussion and their importance in biological systems.

Module III -Osmosis and osmotic pressure, The role of osmosis in cell volume regulation. The iso, hypo, and hypertonic solutions, their influence on the cell. Ionic diffusion. Active and passive bioelectric properties of membranes.

Module IV -Thermodynamics and kinetics: Open, closed and isolated systems, laws of thermodynamics, thermodynamic equilibrium, concept of enthalpy, entropy and free energy. Chemical kinetics; rate, order, molecularity of a reaction, energy of activation

Module V - Structural hierarchy of proteins, primary,secondary, tertiary and quaternary structure, α and π helices, β plated sheets, Omega loops, Irregular and random structures in proteins.

Module VI - Structural hierarchy of nucleic acids A, B, Z DNA and their inter conversions, Watson and Crick base pairing, Hoogsteen base pairing, Triple and quadruple helical structures in nucleic acids, DNA super coiling, DNA protein assemblies, t RNA structure Ribosomes.

Module VII- Conformation of oligo and polysaccharides, Their conjugate forms with proteins and lipids

Module VIII -The structure of biological membranes, Modern membrane theories, the Singer - Nicolson, "fluid-mosaic" membrane model, The transport processes through biological membranes. Active and passive forms of the membrane transport. Diffusion as the main way of passive transport.

Reference:

1) Essentials of Biophysics – P. Narayanan, New Age International Publishers
2) Introduction to protein structure – Branden and tooz, Garland Press, New York
3) Principles of Biochemistry - Lehninger.
4) Text Book of Biochemistry - Harper.
5) Outlines of Biochemistry - Conn & Stumpf.
6) Biochemistry -Nelson & Cox.
7) Biochemistry - Stryer.
8) Biochemistry - Voiet & Voiet
9) Biochemistry - Hames & Hopper

3A08 BTC BIOSTASTISTICS

Hours/Week-5
Credits-4

Module I- The meaning of Statistics.
Scope of Statistics in Biological and Medical Sciences. Definition of population and sample. Collection of data: Primary and secondary data. Attributes and variables. Qualitative and quantitative data. Types of data: Ungrouped data, grouped data, discrete data and continuous data.

Module II Graphical and diagrammatic representation:
Histogram, ogives, simple bar diagrams, and stem and leaf chart. Frequency distribution. Inclusive and exclusive methods. Cumulative frequency distribution.

Module III Measures of central tendency
Concept of measures of central tendency. Arithmetic mean, median, mode, quartiles, and weighted mean. Definitions and examples for ungrouped as well as grouped data. Properties of arithmetic mean

Module IV Measures of dispersion
Absolute and relative measures, range, quartile deviation, variance, and standard deviation. Coefficient of variation (with simple examples)

Module V Correlation
Introduction, definition and types of correlation between two variables. Scatter diagram.
Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient. Definition and examples for ungrouped data.

Module VI Probability
Random experiments. Sample space, Event, Elementary event, Compound event, Impossible events, certain events, equally likely events, mutually exclusive events, and exhaustive events. Dependent and independent events. Definition of probability. Addition law of probability with illustration. Definition of conditional probability. Multiplicative law of probability with illustrative examples.

References
Marcello Pagano and Kimberlee Gauvreau, Principles of Biostatistics
Methi J. , Statistical Methods An Introductory Text. New Age international (p) Ltd.
Bhat. B. R. ,Srivenkatramana T. & Madhav Rao K. S. (1996) Statistics. A
Beginners Text. Vol . I New Age International (p) Ltd.
Ithal U. B. And Naik B. U., Statistical MethodS I, Phadake Prakashan, Kolhapur.
Ithal U. B. And Naik B. U., Statistical MethodS II, Phadake Prakashan, Kolhapur.
Gupta S. C. And V. K. Kapoor Fundamentals of Mathematical Statistics.
Sulthan Chand & sons

3B04 BTC- CELL BIOLOGY

Hours/Week-2
Credits-2

Module I Cell as a basic unit of living systems - The celltheory .Pre -cellular evolution - Artificial creation of cells.

Module II Broad classification of cell types: PPLOs, Bacteria, Eukaryotic microbes, Plant and animal cells - A detailed classification of cell types within an organism - Cell, tissue, organ and organism as different levels of organization of otherwise genetically similar cells

Module III Biochemical composition of cells - Proteins, lipids, carbohydrates, nucleic acids and the metabolic pool, Ultra structure of the cell membrane.

Module IV Structure and function of cell organelles - ultra structure of cell membrane, cytosol, golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes - cytoskeletal structures (actin, microtubules etc.) - Mitochondria, chloroplasts, lysosomes, Peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin)

Module V Chromosomes - chromatin reticulum, chromosome morphology, fine structure, chemical organizations - Organization of DNA- nucleoproteins - Histones and non histones ; Special types of chromosomes - salivary gland chromosomes and lamp brush chromosomes ; Mitosis and Meiosis, significance of mitosis and meiosis. Cell division and cell cycle (including cell synchrony and its applications)

Module VI Cell to cell interactions, Cell locomotion (amoeboid, flagellar and ciliar) -muscle and nerve cells Cell senescence and death, Cell differentiation in plants and animals

References

1.Cohn, N.S. (1964). Elements of Cytology Brace and World Inc., New Delhi.

2. Darington, C.D.(1965). Cytology, Churchill, London.

3.Darnell, J., Lodish, KL and Baltimore, D (1991). Molecular Cell biology, Scientific American books.

4.De Robertis, E.D.P. and Robertis, E.M.F.(1991). Cell and Molecular biology. Lea and Febiger, Washington.

5Dobzhansky, B (1961).Genetks$_i$and The origin of species, Columbia University press,New York.

6.J Roy, S.C. and Kalyan Kumar De (1997). Cell Biology. New Central Book Agency,Calcutta

3BO3 BTC BIOTECHNOLOGY PRACTICAL I

Hours/Week-3
Credits-3

1. Preparation of buffer

2. Verification of Beer-Lambert Law.

3. Measurements with the help of light microscope

4. Calibration of ocular micrometer

5. Cell size measurement.

6. Separation of cell organelles:
Methods for cell lysis: rupture-osmotic/chemical /enzymatic lysis of cells followed by centrifugation.

7. Monitoring cell lysis by release of cellular material and any change in light scattering etc.

8 Mechanical rupture of .cells: Ultra sonic vibrations;
French pressure cell followed by centrifugation for cell organelles

4A09 BTC – GENETICS

Hours/Week-5
Credits-4

Module 1 Mendelian laws of inheritance, Gene interactions - incomplete dominance-Mirabilis, co-dominance-coat colour in cattle, lethal genes-Albinism and coat colour in mice, Interaction of genes-comb pattern in poultry, complementary genes- flower colour in lathyrus, Epistasis- fruit colour in summer squashes, Duplicate genes with cumulative effect-fruit shape in summer squashes, Inhibitory factor- Leaf colour in Paddy, Pleiotropism

Module II Quantitative inheritance: General characters - skin colour in man, ear size in corn-transgressive variation . Multiple alleles: Albino series in Rabbits- ABO blood group in man-self sterility in tobacco., Sex determination in plants and animals; sex linkage ; non-disjunction as a proof of chromosomal theory of inheritance. Linkage and crossing over-mechanism of crossing over- proof of crossing over-two point and three point test cross-interference and coincidence-Linkage maps. Sex linked inheritance - eye colour in Drosophila, Hemophilia in man- Holanclric inheritance- sex limited and sex influenced characters. Extra chromosomal inheritance; mitochondrial and chloroplast genetic systems

Module III Structural and numerical aberration involving chromosomes; Hereditary defects-Kleinfelter, Turner and Down syndromes.Mutations- spontaneous and induced; chemical and physical mutagens; induced mutation in plants, animals and microbes for economic benefit of man.

Module IV Basic microbial genetics- conjugation, transduction, transformation; isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemicalpathways, one gene-one enzyme hypothesis. Population genetics; Hardy-Weinberg equilibrium, gene and genotypic frequencies.

Reference

1. Dobzhansky, B (1961).Genetks$_i$and The origin of species, Columbia University press,New York.
2 Gardner, E.J. and Snustad, D.P.(1984). Principles of Genetics. John Wiley, New York.
3. Lewin, B. (1994) Genes, Oxford University Press, London.
4 Lewis, W.H. (1980) Polyploidy. Plenum Press, New York.
5 Sharma, A.K. and Sharma, a. (1980). Chromosome technique : theory and practice. ,Aditya Books, NewDelhi.
6. Sinnot, E.W., Dunn, L.C. and Dobzhansky, T.(1958). Principles of Genetics, Mc Gaw Hill, New York.
7.Swanson, C.P. (1957). Cytology and Cytogenetics, Englewood cliffs, New York.

4A10 BTC - IMMUNOLOGY

Hours/Week-5
Credits-4

Module1 The immune system and immunity along with historical perspective.
The cells of the immune system .Organs of the immune system and their functions.

Module II Innate Immunity- Phagocytosis Inflammation, Complement,

Module III Antigen structure: epitopes Antibody structure and types of Antibody Antigen-antibody interactions Forces involved.

Module IV Humoral Immunity Cell mediated immunity (role of MHC and genetic restriction). Hypersensititvity,Autoimmunity. Uses of Antibody, Monoclonal antibody, vaccines

Reference

1. Roitt –Immunology
2. Kuby Immunology

4B05 BTC – PLANT PHYSIOLOGY AND DEVELOPMENT

Hours/Week-2
Credits-2

Plant Development

Module 1 Introduction and general account of embryology, Microsporangium – Microsporogenesis and male gametophyte-pollination-pollen structure, palynology. Megasporangium –Megasporogenesis and female gametophyte- Structure of mature embryosac.

Module II Fertilization – Pollen pistil interaction- double fertilization- triple fusion.Embryo – Structure- Dicot- Monocot, Polyembryony, Endosperm, Apomixis. Haploid production, parthenocarpy, parthenogenesis.

Plant Physiology

Module III Growth – Pattern of growth-steps in cell growth and development-primary wall changes- Water potential.Growth kinetics- Growth curve- flow analogy of plant growth-growth of different organs- root, leaves, flowers, seeds and fruits.Metabolism & growth in relation with minerals, carbohydrates, fats, proteins, enzymes & nucleic acids.

Module IV Morphogenesis Juvenility totipotency-principles & differentiation hotomorphogenesis- phytochromes. Dormancy- quiescence-seed longevity-seed dormancy-dormancy breaking. Biological clock-endogenous& exogenous- circadian & other rhythms-stress physiology.

Reference

1Maheswari P. Introduction to Embryology of Angiosperms
2 Datta, S,C. (1989) Plant Physiology , Central Book Depot, Allahabad.
3. Hopkins,W.G.(1999) Introduction to Plant Physiology,John Wiley &SonInc. New York
4. Levitt, J.(1969) Introduction to plant physiology , C.V.Koshy Co. Tokyo.
5 Malik, C.P. (1980) Plant Physiology, Kalyani Publishers, New Delhi.
6. Mayer, A.M.,Poljakoff Mayber,A (1989) The Germination of Seeds 4
edn.,PergamonPress, New York
7Moore, T.C. (1981) Research Experiences in Plant Physiology, Springer Verlag,Berlin.
8.Noggle, G.K, Fritz, GJ. (1983) Introductory Plant Physiology, Prentice Hall New Delhi
9.Salisbury, F.B., Ross, C. (1994) Plant Physiology, Wordsworth Pub, California.
10Teiz and. Zeiger (1999) Plant Physiology, Sinaeur Associates Inc. Pub. Sunderland

4B06 BTC BIOTECHNOLOGY PRACTICAL II

Hours/Week-3
Credits-3

1. Meiosis in grass hopper testis
2. Mitosis in onion root tip
3. Study of chromosomal aberrations in onion root tip
4. Identification if C.S. of mature anther, Dicot and Monocot embryos.
5. To make slides of pollen grains of Hibiscus, Balsam & Datura.
6. Study of pollen germination of Hibiscus.
7. Embryo dissection and mounting – Tridax, Capsicum.
8. Double staining
9 Purification of antigens .
10. Raising polyclonal antibodies
11. Purification of antibodies
12. Enzyme linked immunoassay
13. Radial immuno diffusion
14. Generation of ascetic fluid
15 Diagnosis of an infectious disease by an immunoassay

5B07BTC- ANIMAL PHYSIOLOGY AND DEVELOPMENT

Hours/Week-4
Credits-4

Animal Physiology

Module 1 Molecular basis of muscle contraction- energetics of muscle contraction- Vertebrate muscle types- neuronal control of muscle.

Module II Respiration – Fundamentals of gas exchange – respiratory pigments – structure biological properties, functions – O_2 and CO_2 transport- factors that determine oxygen binding to hemoglobin – PO2, pH, temperature, DPG levels.

Module III Blood vascular system – structure and function, closed and open- mechanism of blood circulation in man-peripheral circulation-microcirculation and capillary function, haematopoiesis, haemodynamics, cardiac rhythms, factors modifying cardiac rhythms- mechanical, chemical, thermal, nervous.

Module IV Homeostasis- Regulation of body fluid composition in invertebrates and vertebrates. Renal function – ultra filtration, absorption, secretion, plasma clearance, counter current mechanism, counter current multiplier, factors regulating homeostasis.

Module V Sensory receptors – visual systems, mechanoreceptors proprioceptors, hearing, chemoreceptor, olfactory receptors- cutaneous receptors-touch-pressure, pain & thermal.

Module VI Nervous system- Synapses, electrically mediated transmission and chemical transmission, synaptic potential, synaptic polarity.

Animal Developmental Biology

Module VII Gametogenesis- embryonic origin, migration and fate of germ cells; oogenesis, spermatogenesis- ultrastructural organization of mammalian sperm, different phases of spermatogenesis,spermiogenesis, gene function during spermatogenesis and hormonal control.

Module VIII Fertilization – Activation of egg-change in cell permeability and membrane potential, Ca+ level and cortical reaction, metabolic activation, sperm egg interaction- primary and secondary binding, sequence of events in sperm entry to egg, pronucleus fusion, egg surface changes during fertilization and molecular mechanism of the blocks to polyspermy. Post fertilization changes- cleavage and gastrulation.

Endocrinology

Module IX Introduction- Endocrine glands-classification, hormones-classification based on chemical nature, arenas of endocrine control. Major human endocrine glands- structure, secretions, its synthesis, storage, transport, metabolism and physiological functions. Mode of action- protein hormones and steroid hormones with examples. Neuroendocrine secretions.

Module X Major human endocrine glands- structure, secretions, its synthesis, storage, transport, metabolism and physiological functions. Regulation of endocrine factors- hypothalamus, hypophysial axis, feed back mechanisms, nervous system.

Reference:

1. Guyton, A.C, 1981, Functions of the Human Body (W.H. Saunders Co, USA).
2. Strand, F.L. 1978, Physiology- A Regulatory Systems Approach (Macmillan Publishing Co.
3. Mitchell Embryology (2004) Elsevier
4. Carlson Human Embryology and Developmental Biology 3rd Ed (2004) Elsevier.
5. Griffin J.E. Textbook of Endocrine Physiology (2004) Saunders Philadelphia
6. Williams Text Book of Endocrinology (2007) Elsevier

5B08 BTC - MOLECULAR BIOLOGY

Hours/Week-5
Credits-4

Module 1 History and development of Molecular Biology. Nucleic acids- DNA and RNA as genetic materials. Structure of nucleic acids - nucleosides and nucleotides - DNA double helix. Nature of genetic code - deciphering genetic code - wobble hypothesis -universalities and exceptions.

Module II Properties of DNA - Absorbance - ionic interaction - denaturation and renaturation - sedimentation.DNA replication in prokaryotes & eukaryotes - semi conservative replication- replication fork- rolling model. .Enzymes involved in nucleic acid synthesis

Module III Structure of genes in prokaryotes & eukaryotes- definition - molecular structure
Fine structure of gene- muton - recon – cistron. Organisation of transcriptional unit - leader sequences - promoter sequences -terminator sequences - introns and exons - transcription factors.Transcription in prokaryotes & eukaryotes.Types of transcribed RNAs.RNA processing - methyl capping, polyadenylation & splicing of m RNA-mRNA editing.Processing of rRNA and tRNA.Translation in prokaryotes & eukaryotes - Ribosome structure and function –polysome. Gene Expression - one gene one polypeptide hypothesis - Operon concept.Negative and positive regulation of operon- lac, his and trp operon - catabolic repression

Module IV Eukaryotic gene expression. Gene expression in yeast. Gene expression in protozoan parasites, Gene regulation in eukaryotes - regulation at transcriptional level
Gene regulation in eukaryotes -regulation at translational level
Gene regulation in eukaryotes - post translational modifications
Developmental & environmental regulation of gene expression
Insertion elements & transposones, Gene organization & expression in mitochondria & chloroplasts

Module V Gene mutations - Types of DNA mutations-point, frameshift etc. deletion, inversion, translocation etc. - mutator genes, hot spots , Physical and chemical mutagens
DNA repair – photo activation - excision repair -post replication repair , recombination repair, Oncogenes

Reference

1.Molecular Biology of the Gene -Lewin
2.Molecular biology Watson

5B09 BTC - ANIMAL CELL BIOTECHNOLOGY

Hours/Week-5
Credits-4

Animal cell biotechnology

Module 1 Special secondary metabolites / products (insulin, growth hormone, interferon, t-plasminogen activator, factor VIII etc.). Expressing cloned proteins in animal cells. Over production and processing of chosen protein.

Module II The need to express in animal cells Production of vaccines in animal cells
Production of monoclonal antibodies Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, 1L-1JL-2, NGF, erythroprotein etc.) Bioreactors for large scale culture of cells

Animal cell culture

Module III History of development of cell cultures. The natural surroundings of animal cells. Metabolic capabilities of animal cells. Simulating natural condition for growing animal cells. Importance of growth factors of the serum.

Module IV Primary cultures- Anchorage dependence of growth - Non- anchorage dependent cells. Secondary cultures- transformed animal cells- established / continuous cell lines .Commonly used animal cell lines — their origin and characteristics.
Growth kinetics of cells in culture

Module V Application of animal cell culture for studies on gene expression
Organ culture.Transfection of animal cells: selectable markers, HAT selection, antibiotic resistance etc.Cell fusion.Transplantation of cultured cells

Reference

1.Freshny –animal cell culture

5B10 BTC - ENVIRONMENTAL BIOTECHNOLOGY

Hours/Week-4
Credits-4

Module 1 Renewable and non- renewable resources. Major consumer items; food, fuel and fibers. Conventional fuels and their environmental impacts; Firewood, Plant and animal wastes, Coal, Gas, Animal oils Modern fuels and their environmental impacts; methanogenic bacteria and biogas microbial hydrogen production, conversion of sugars to ethanol-the gasohol experiment solar energy converters - hopes from the photosynthetic pigments plant based petroleum industry cellulose degradation for combustible fuel.

Module II Environmental pollution-air and water pollution-source, types and effects of pollution on human beings and plants- greenhouse effect- acid rain.
Environmental management- Air, water and soil quality management, advantages and control measures, treatment and recycling of industrial and domestic solid waste and waste water. Chemical control of pests.

Module III Management of forest: social forestry, biofarming, biomonitoring - management of mangrove vegetation, role of FAO, IUCN, UNEP, UNESCO, CH1PKO movement. National parks and sanctuaries

Module IV Biotechnological inputs in producing good quality natural fibers transgenic sheep and transgenic plants

Reference

1. Kormonty- Concept of ecology- -Prentice hall
2. OdumE.P. Ecology- -Prentice hall
3. Kumar -H.D. Modern concepts in ecology- Vikas books.
4. . Ambast R.S Textbook of plant ecology- Students French &Co,Varanasi.
5. Black C.A. Soil plant relation ship- -Weily Eastern.
6. Verrna V. Text book of plant ecology- -Emkay publication
7 Odum. Fundamentals of ecology-
8. Misra &Puri Indian manual of plant ecology-.
9. Michael AJlaby Ecology- -Hamlin book.
10. Jain S,K. & Sastry Threatened plants- -Botanical Survey Of India
11. Kumaresan B. Plant Ecology and Phytogeography- -Saras Publications.
12. Sharma P.D. Ecology and Enviornmcnt -Rastogi Publications
13. Jordening and Winter Environmental biotechnology Wiley

5B11 BTC – BIOTECHNOLOGY PRACTICAL III

Hours/Week-5
Credits-4

1. Assay of salivary amylase by colorimetric method.
2. Effect of temperature, pH substrate concentration on salivary amylase activity.
3. Demonstration of osmotic heamolysis.
4. Determination of vertebrate hemoglobin using colorimeter.
5. Total and differential count of WBC.
6. Determination of blood pressure and pulse rate.
7. Observe permanent slides of gastrulation, cleavage, blastula & gastrula.
8. Preparation of sections using micro technique and staining
9. Restriction and digestion of DNA and assigning restriction sites (demonstraton)
10. Making competent E. coli
11. Determination of BOD of the water sample by Winklers method.
12 Study of root nodules of leguminous plants by hanging drop method
13. Stained preparation of Rhizobium from the root nodules

6B12 BTC - PRINCIPLES & APPLICATIONS OF GENETIC ENGINEERING

Hours/Week-4
Credits-4

Module 1 Genetic engineering - history & principles. Isolation & purification of genomic DNA from bacterial, plant and animal cells.Isolation of Plasmid DNA Isolation of RNA, cDNA synthesis. Identification of the genes Concept of recombinant DNA. DNA cloning strategies - steps involved. Characteristics of vectors - plasmids, phages, phagemids, cosmids and viruses ascloning vehicles. Cloning vectors for E coli and other organisms. Enzymes for molecular cloning - exo and endo nucleases-restriction enzymes-classes of restriction enzymes-mode of action.

Module II Gene Sequencing, Preparation and screening of genomic and cDNA libraries. cDNA cloning. Structural and regulatory genes. Methods of genetic transformation-direct and indirect methods. Ti, Ri and helper plasmids-mechanism of gene transfer-modification of vectors.

Module III Screening of recombinants-selectable markers-reporter genes. Molecular techniques for confirmation of transformation. Southern blotting & hybridization and RFLP. The polymerase chain reaction- introduction and basic reaction, amplification and specificity - degenerate and nested primers- primer designing, RT-PCR, inverse PCR.

Module IV Applications of genetic engineering - gene cloning and expression of foreign genes in research & biotechnology- production of proteins from cloned genes
Gene cloning in medicine- pharmaceutical compounds- artificial insulin gene-recombinant vaccines- diagnostic reagents
Transgenic plants and animals
Forensic applications- DNA fingerprinting

Reference:
1.Old,R .W and Prmrose S. B 1994 Principles of Gene manipulation- An Introduction to genetic engineering.Fifth edition.Blackwell Scientific Publications.
2. Sambrook., Fritsch,E.F. and Maniatis.1989. Molecular Cloning- A laboratory Manuel.Second Edition. Cold Spring harbor Laboratory Press.

6B13 BTC - PLANT BIOTECHNOLOGY AND IN VITRO CELL CULTURE

Hours/Week-5
Credits-4

Module 1 Plant biotechnology definition-Harnessing bio-technology in crop improvement, conservation, propagation and industry-Different in vitro routes and principles.History and development of plant biotechnology-land marks-Progress in India.Influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture.

Module II Callus culture – types - cell division – differentiation - morphogenesis – organogenesis – embryogenesis.

Module III Use of bioreactors and in vitro methods for production of secondary metabolites - suspension culture - Nutrition of tissues and cells – regeneration of tissues – ex vitro - establishment of tissue cultured plants.

Module IV Organ culture – meristem, embryo, anther, ovule culture, embryo rescue.Endosperm culture-Production of triploids. Somaclonal and gametoclonal variation , routes-Applications.Protoplast culture and fusion-regeneration. Construction and identification of somatic hybrids and cybrids.Wide hybridisation – in vitro pollination and fertilization – haploids – in vitro mutagenesis.Artificial seeds – cryopreservation

Module V In vitro selection for biotic and abiotic stress.
Plant genetic manipulation – concepts, methods, applications. Identification and isolation of genes. Genomic and DNA libraries – nucleic acid blotting and hybridization – DNA sequencing – gene cloning techniques – cloning plastid and mitochondrial genes – defense genes identified in plants – traitor and terminator genes. Gene transfer systems for plants – direct and indirect methods – merits and demerits – electroporation – use of liposome – biolistics – micro-projectile gun.Vectors used – Ti and Ri plasmids – T DNA processing – mechanism of gene transfer – optimization of conditions – screening of transformants.

Module VI Molecular markers – DNA fingerprinting techniques – RAPD, RFLP, AFLP, STS markers – other modern techniques.
Application of molecular markers in crop improvement, conservation and propagation. Marker aided selection and breeding for QTLs.

Reference

Bains.W. 2004. Biotechnology from A to Z. Third edition Oxford University Press, London.
Das.S.N. 2004. Essentials of Biotechnology for Students. Peepee Publishers and Distributors (P) Ltd. New Delhi.
Keshavachandran,R and K V Peter.2008.Plant Biotechnology:Tissue Culture and Genetransfer .Orient and Longman,(Universal Press)Chennai
Pierik, R.L.M. 1987. Invitro culture of higher plants. Martinus nijhoff publishers.Netherlands.
Shivanna. K.R. 2003.Pollen Biology and Biotechnology. published by Mohan Oxford and IBH Publishing Co.Pvt.Ltd, New Delhi
Singh.B.D.2001.Biotechnology.Kalyani publishers.
Skoog, Y. and C.O.Miller, 1957. Chemical regulation of growth and formation in plant tissue cultured in vitro. Attidel. II Symp. On biotechnology Action of growth substance.
Vasil, T.k., M.Vasi, D.N.R While,H.R.Bery 1979. Somatic hybridization and genetic manipulation in plants. Plant regulation and world Agriculture, Planum press, New York.

6B14 BTC - MICROBES IN ENVIRONMENTAL BIOTECHNOLOGY

Hours/Week-4
Credits-4

Module 1

Microbiological quality of food and water
Treatment of municipal waste and industrial effluents

Module II

Degradation of pesticides and other toxic chemicals by microorganisms
Thuringiensis toxin as a natural pesticide
Biological control of other insects swarming the agricultural fields
Enrichment of ores by microorganisms.

Module III

Nitrogen fixation : Symbiotic and asymbiotic Nitrogen fixing systems
Leghaemoglobin and Nitrogen fixation in nature.Enzyme nitrogenase structure and chemical properties.
nif gene- organization - regulation of nif expression - nif LA operon Plasmid mediated engineering for nitrogen fixation. Biofertilizers

Reference

1. Jordening and Winter -Environmental Biotechnology Wiley
2. Evans and Furlong- Environmental Biotechnology Wiley
3. Rtimann,Mc Carty Environmental Biotechnology Amazon
4. Rawat Environmental Biotechnology Eastern Books
5. Raj Mohan Joshi Environmental Biotechnology

6B15 BTC– Biotechnology Practical IV

Hours/Week-5
Credits-4

1. Demonstration of genetic engineering of nif gene in yeast cell

2. An exposure to low cost, commercial and homestead tissue culture laboratories, media preparation

3. Inoculation of explants for clonal propagation – callus induction and culture – regeneration of plantlets from callus – sub-culturing.

4. Techniques on anther, ovule, embryo culture

5. Meristem culture using orchids/banana

6. Protoplast culture – fusion technique.

7. Isolation of DNA and quantification

8. Isolation of RNA and quantification

9. PCR techniques.

10. RFLP and RAPD assay

11.Cloning techniques – agrobacterium mediated gene transfer.

12. Isolation of chromosomal and plasmid DNA from bacterial

13. Transfection of plasmid DNA and selection for transformants

6B16 BTC – Project work

Hours/Week-5
Credits-2

Carry out a small research project on any topic related to Biotechnology and submit a brief dissertation at the end of 6th semester. The dissertation will be valued by external examiners

Sd/-
Dr.C.Sadasivan,
Chairman,BOS Biotechnology(Cd)

K A N N U R U N I V E R S I T Y

Course Structure
and
Syllabus

FOR

BIOTECHNOLOGY

(COMPLEMENTARY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Biotechnology(Complementary)					
No	**Semester**	**Course Code**	**Title of the course**	**Hours/ week**	**Credit**
1	I	1C01 BTC	Plant Biotechnology 1	2	2
2	I	4C05 BTC	Practical	2	-
3	II	2C02 BTC	Plant Biotechnology 2	2	2
4	II	4C05 BTC	Practical	2	
5	III	3C03 BTC	Microbial Biotechnology 1	3	2
6	III	4C05 BTC	Practical	2	-
7	IV	4C04 BTC	Microbial Biotechnology 2	3	2
8	IV	4C05 BTC	Practical	2	4

1C01 BTC - PLANT BIOTECHNOLOGY 1

Hours/Week-2
Credits-2

Module 1 History and development of plant biotechnology-land marks-Progress in India. Biotechnology in crop improvement, conservation, propagation and industry-Different in vitro routes and principles. Influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell culture.

Module II Callus culture – types - cell division – differentiation - morphogenesis – organogenesis – embryogenesis, artificial seeds, single cell culture, embryo culture, anther and pollen culture.

Module III Protoplast isolation, culture and fusion-regeneration. Construction and identification of somatic hybrids, in vitro pollination and fertilization – *Production of haploids, Somaclonal variations, Germplasm conservation* – in vitro mutagenesis. Artificial seeds –cryopreservation

Module IV Tissue Culture Applications: Production of secondary metabolites from plant cell cultures; Processes forenhancing the production of secondary metabolites. Technology of plant cell culture for production of chemicals; Bioreactors systems and models for mass cultivation of plant cells;

Module V Plant Transformation Technology:Agrobacterium mediated gene transfer; Agrobacterium based vectors, viral vectors and their application. Direct gene transfer methods; chemical methods, electroporation, microinjection, particle bombardment.

Reference

1.Bains.W. 2004. Biotechnology from A to Z. Third edition Oxford University Press, London.
2.Das.S.N. 2004. Essentials of Biotechnology for Students. Peepee Publishers and Distributors (P) Ltd. New Delhi.
3.Keshavachandran,R and K V Peter.2008.Plant Biotechnology:Tissue Culture and Genetransfer .Orient and Longman,(Universal Press)Chennai
4.Pierik, R.L.M. 1987. Invitro culture of higher plants. Martinus nijhoff publishers.Netherlands.
5.Shivanna. K.R. 2003.Pollen Biology and Biotechnology. published by Mohan Oxford and IBH Publishing Co.Pvt.Ltd, New Delhi
6Singh.B.D.2001.Biotechnology.Kalyani publishers.
7.Skoog, Y. and C.O.Miller, 1957. Chemical regulation of growth and formation in plant tissue cultured in vitro. Attidel. II Symp. On biotechnology Action of growth substance.
8.Vasil, T.k., M.Vasi, D.N.R While,H.R.Bery 1979. Somatic hybridization and genetic manipulation in plants. Plant regulation and world Agriculture, Planum press, New York.

2C02 BTC - PLANT BIOTECHNOLOGY 2

Hours/Week-2
Credits-2

Module 1 Plant genetic manipulation – concepts, methods and applications. Identification and isolation of genes. Genomic and DNA libraries – nucleic acid blotting and hybridization

Module II DNA sequencing – gene cloning techniques, amplification using PCR, cloning plastid and mitochondrial genes

Module III Gene transfer systems for plants – direct and indirect methods – merits and demerits – electroporation – use of liposome – biolistics – micro-projectile gun. Vectors used – Ti and Ri plasmids – T DNA processing – mechanism of gene transfer – optimization of conditions – screening of transformants.

Module IV Molecular markers – DNA fingerprinting techniques – RAPD, RFLP, AFLP, STS markers – other modern techniques.

Module V Application of molecular markers in crop improvement, conservation and propagation. Marker aided selection and breeding.

Refrence

Bains.W. 2004. Biotechnology from A to Z. Third edition Oxford University Press, London.
Das.S.N. 2004. Essentials of Biotechnology for Students. Peepee Publishers and Distributors (P) Ltd. New Delhi.
Keshavachandran,R and K V Peter.2008.Plant Biotechnology:Tissue Culture and Genetransfer .Orient and Longman,(Universal Press)Chennai
Pierik, R.L.M. 1987. Invitro culture of higher plants. Martinus nijhoff publishers.Netherlands.
Shivanna. K.R. 2003.Pollen Biology and Biotechnology. published by Mohan Oxford and IBH Publishing Co.Pvt.Ltd, New Delhi
Singh.B.D.2001.Biotechnology.Kalyani publishers.
Skoog, Y. and C.O.Miller, 1957. Chemical regulation of growth and formation in plant tissue cultured in vitro. Attidel. II Symp. On biotechnology Action of growth substance.
Vasil, T.k., M.Vasi, D.N.R While,H.R.Bery 1979. Somatic hybridization and genetic manipulation in plants. Plant regulation and world Agriculture, Planum press, New York.

3C03 BTC - MICROBIAL BIOTECHNOLOGY 1

Hours/Week-3
Credits-2

Module 1 History and scope of microbial biotechnology, principles of microbial growth, the bioreactor/fermenter-types and parts, scale-up, media design for fermentation processes. Economic aspects of fermentation.

Module II Enzyme technology, nature of enzymes, isolation of enzymes, immobilized enzymes, applications of enzymes in industry and environment. Production of microbial enzymes and their applications. Biotechnological application of microorganisms. Production of chemicals and pharmaceuticals (bioconversion).

Module III Role of microorganisms in the production and transformation of food and beverages -Food fermentation - Bread leavening - by yeast – by other micro organisms - chemical leavening, Brewing: Manufacture of Beer- microbiological aspects. Wine - Kinds of wines, manufacture, microbial spoilage, Distilled liquors. Vinegar -methods of manufacture

Module IV Fermented vegetables - Pickles - Fermented dairy products - Fermented milk , cheese, butter, yoghurt and other milk products - spoilage of milk - preservation of milk.

References

1.John E Smith – Biotechnology, Cambridge University Press
2.Presscott & Dunn - Industrial Mcrobiology, AVI publishing Co. USA
3.Mukerji, Singh & Garg - Frontiers in applied Microbiology, Prink House India, Lucknow
4.Peppler & Perlman – Microbial Technology, Academic Presss, New York
5.Nicholas C Price – Fundamentals of Enzymology
6.Chaplin & Bueke – Enzyme technology
7.Moses and Capes – Biotechnology- the Science and Business

4C04 BTC - MICROBIAL BIOTECHNOLOGY 2

Hours/Week-3
Credits-2

Module 1 Biofertilizers- manufacture, formulation and utilization, Microbes as Biofertilizers - Chemically fixed Nitrogen versus Biologically fixed Nitrogen, biopesticides.

Module II Sewage treatment- primary, secondary and tertiary treatments - Industrial effluents - microbes as indicators of waste water -pollution treatment process - septic tank - waste water treatment process -mechanical and biological treatment - trickling filters - inhoff tank - activated sludge process - oxidation ponds - anaerobic sludge digestion.

Module III Solid waste disposal: Sanitary land fills - composting - cermicompost - disposal of animal and agricultural wastes - Biogas - organic gas available in India - Gobar gas plant technology - Microbiology of Methane production - Biogas from plant wastes.

Module IV Microbes in mining, ore leaching, oil recovery. Application of microbes in pharmaceutical industry.

References

1.John E Smith – Biotechnology, Cambridge University Press
2.Presscott & Dunn - Industrial Mcrobiology, AVI publishing Co. USA
3.Mukerji, Singh & Garg - Frontiers in applied Microbiology, Prink House India, Lucknow
4.Peppler & Perlman – Microbial Technology, Academic Presss, New York
5.Nicholas C Price – Fundamentals of Enzymology
6.Chaplin & Bueke – Enzyme technology
7.Moses and Capes – Biotechnology- the Science and Business

4C05 BTC - BIOTECHNOLOGY PRACTICAL

Hours/Week-8
Credits-4

Section 1

1. media preparation of plant cell culture
2. suspension culture – demonstration
3. micropropagation
4. transformation
5. selection of transformants
6. Cell immobilization
7. production of beverages
8. enzyme assay
9. factors affecting enzyme activity

Sd/-
Dr.C.Sadasivan,
Chairman,BOS Biotechnology(Cd)

K A N N U R U N I V E R S I T Y

Course Structure

and

Syllabus

FOR

OPEN COURSES

(BIOTECHNOLOGY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Open Courses

No	Semester	Course code	Title of the course	Hours/ week	Credit
1	V	5D01 BTC	Bioinformatics-I	2	2
2	V	5D02 BTC	Fermentation technology - I	2	2
3	VI	6D01 BTC	Bioinformatics-II	2	2
4	VI	6D02 BTC	Fermentation technology – II	2	2

5D01 BTC – BIOINFORMATICS – I

Hours/Week-2
Credits-2

Module I- Introduction Historical overview and definition, goal, scope, bioinformatics applications, limitations, major databases in bioinformatics, data management and analysis, molecular biology and bioinformatics

Module II- Biological databases Definition, type of databases, biological databases, Information retrieval from databases, tools for web search, Primary, secondary and composite databases, different databases such as - Entrez, PubMed, OMIM, PIR, Swiss-Prot, MIPS, NRL_3D, PROSITE, PROFILE, Pfam, IDENTIFY, BLOCKS, GenBank, EMBL, DDBJ, PDB, CATH, SCOP

Module III – Genomics and proteomics Genome mapping, Genome sequencing, assembly, annotation, comparative genomics, Functional genomics: Sequence based and micro array based approaches, Comparison of SAGE and DNA micro array. Proteomics: Protein expression analysis, post-translational modification, protein-protein interaction.

References

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers

5D02 BTC – FERMENTATION TECHNOLOGY – 1

Hours/Week-2
Credits-2

Module I Fermentation technology- isolation, screening and strain improvement of industrially important microorganisms. Introduction to fermentation processes- media for industrial fermentation, sterilization, innoculum preparation. Design and parts of fermenter- agitation, aeration. PH, temperature, dissolved oxygen- control and monitoring, difference in fermentation process for biomass, chemicals and conversion products-brief comparative account.

Module II Brief account of industrial production of beer and bread, industrial alcohol, acetone, butanol, vinegar and citric acid by microorganisms.

Module III Importance of amino acid fermentation- General aspects of mutant strains used for amino acid fermentation. Amino acid production by enzymes.

Reference

Microbial biotechnology fundamental of applied microbiology - Alexander and Glazer et al
Industrial microbiology - L.E Casidea
Industrial microbiology - Prescott and Dunn's
Brocks biology of microorganisms - Madidan et al

6D01 BTC – BIOINFORMATICS – II

Hours/Week-2
Credits-2

Module I– Sequence alignment

Sequence homology, similarity and identity, methods of sequence alignment, scoring matrices, Heuristic algorithms, Smith-Waterman method, BLAST, FASTA, multiple sequence alignment, Markov model and Hidden Markov model, identification of motifs and domains in multiple sequence alignment.

Module II – Gene identification and prediction

Basis of gene prediction, gene prediction methods, Pattern recognition, gene prediction in prokaryotes and eukaryotes. Prediction algorithms

Module III – Molecular Phylogenetics

Molecular evolution and molecular phylogenetics, gene phylogeny versus species phylogeny, Phylogenetic tree construction, distance based methods, character based methods, phylogenetic programs

Module IV – Structural Bioinformatics

Protein structure basics, hierarchy, dihedral angles, determination of protein three dimensional structures, Protein structure databases, Protein structure visualization, Structure comparison and classification, protein secondary and tertiary structure prediction

References

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers

6D02 BTC – FERMENTATION TECHNOLOGY II

Hours/Week-2
Credits-2

Module I Production of microbial enzymes and its importance- protease, invertase, amailes - brief account of enzyme technology. Immobilization of cells and enzymes- their important applications- biosensors.

Module II Industrial production of pharmaceutical products- classes of antibiotics, development of beta lactums and semi synthetic penicillin's. Industrial production of penicillin G. Production of vitamin B-12 and B-2.

Module III Bio insecticides-Bt, Baculoviruses- their importance.

Module IV Techniques of down stream processes-separation of cells- filtration, centrifugation. Purification methods-Chromatography and distillation. A brief account of economics of fermentation technology.

Reference

Microbial biotechnology fundamental of applied microbiology - Alexander and Glazer et al
Industrial microbiology - L.E Casidea
Industrial microbiology - Prescott and Dunn's
Brocks biology of microorganisms - Madidan et al

Sd/-
Dr.C.Sadasivan,
Chairman,BOS Biotechnology(Cd)

KANNUR UNIVERSITY

(Abstract)

B.Sc Biotechnology Programme– Model Question Papers for I Semester Examinations- Core &Complementary Courses- implemented with effect from 2009 Admission –Orders issued.

ACADEMIC BRANCH

U.O.No.Acad/C2/8965/2008(1) Dated, K.U.Campus.P.O, 28-10-2009.

Read:1. U.O.No.Acad/C2/3838/2008 (i) dated 07-07-2009.
2. U.O No.Acad/C2/8965/2008 (1) dated 09-07-2009.
3.Letter dated 01-10-2009 from the Chairman, Board of Studies in Biotechnology (Cd).

O R D E R

1. As per the paper read first above, Choice Based Credit Semester System is introduced in this University with effect from 2009 admission.

2. As per the paper read second above, the Scheme and Syllabus of B.Sc Biotechnology Programme (Core and Complementary Courses) under this scheme are implemented in this University.

3. As per paper read third above, the Chairman, Board of Studies in Biotechnology (Cd) has forwarded the Model Question Papers for I Semester B.Sc Biotechnology Examinations (Core & Complementary Courses) for implementation with effect from 2009 admission, under Choice Based Credit Semester System .

4. The Vice-Chancellor, after considering the matter in detail, and in exercise of the powers of the Academic Council, as per Section 11 (1) of Kannur University Act, 1996 and all other enabling provisions read together with, has accorded sanction ***to implement the Model Question Papers for I Semester B.Sc Biotechnology examinations(Core & Complementary Courses) under CCSS, submitted by the Chairman, Board of Studies in Biotechnology (Cd) with effect from 2009 admission,*** subject to report to the Academic Council.

5. The implemented Model Question Papers are appended.

6. Orders are therefore issued accordingly.

Sd/-
REGISTRAR

To:

1. The Principals of Colleges offering Biotechnology Core & Complementary Courses.

Copy to:
1. The Examination Branch (through PA to CE).
2. The Chairman, Board of Studies in Biotechnology(Cd)
3. PS to VC/PA to PVC/PA to Registrar.
4. DR/AR-I (Academic).
5. SF/DF/FC

Forwarded/By Order

SECTION OFFICER