

Uttarakhand Technical University

B.TECH (BIOTECHNOLOGY)

IV YEAR, SEMESTER VII

S.No.	Subject Code	Subject Title	Contact Hours / Week			Evaluation Scheme					Subject Total Marks
						Sessional Marks			ESE		
			L	T	P	CT	TA	Total	Marks	Duration (hrs)	
THEORY SUBJECTS											
1.	TBT701	Biophysics	3	1	-	30	20	50	100	3	150
2.	TBT 702	Plant Biotechnology	3	1	-	30	20	50	100	3	150
3.	TBT703	Food Biotechnology	3	1	-	30	20	50	100	3	150
4.	TBTXX	*Open elective	3	1	-	30	20	50	100	3	150
5.	TEC 034	Biomedical Signal Processing	3	1	-	30	20	50	100	3	150
PRACTICAL / DESIGN / DRAWING											
6.	PBT 701	Food Biotechnology	0	0	2	10	15	25	25	2	50
7.	PBT702	**Industrial interaction	0	0	2	10	15	25	25	3	50
8.	PBT 703	***Project	0	0	3	20	30	50	50	2	100
9.	PBT704	Seminar-I			2	-	-	50	-		50
TOTAL			15	5	6			400	600		1000

* Any one Elective to be opted from the list of open Elective subjects.

** The students will go to various organizations for practical training in summer vacations after semester VI. The presentation and evaluation will be done in semester VII.

***Project marks for { Stage I}

CT- Cumulative Test

TA - Teacher's Assessment

ESE- End Semester Examination

BIOPHYSICS

TBT 701

Unit I

Introduction: Elements of Quantum Mechanics: Quantization of energy, Atomic structure wave equation, Quantum Mechanical Tunnelling

Unit II

Energies, Forces & Bonds: Intraatomic Potentials for strong bonds intraatomic potentials & weak bands, non central forces, Bond energies, spring constant. Bio Membrane physics & transport process (Diffusion, Viscosity).

Unit III

Nucleic acid configuration of DNA, RNA, Isomers of nucleotides, Glycosidic bond rotation, base stacking. Proteins: zwitter ionic properties & amino acids and titration curves, peptide bonds, disulfide cross links Ramachandran plot, α -helix, β -sheet, Helix-coil transition, Protein folding.

Unit IV

Muscular movement: Molecular structure of muscle - actin, myosin, troponin, tropomyosin, physico & bio chemical events, muscle contraction, Mechanical properties of skeletal muscles, mechanical model of muscle. Mechanical events of muscle contraction, Force velocity, Power velocity and Tension, Length relationship curves.

Unit V

Ion channels: Neurons, synopsis, Action potential and its propagation through nerve fiber. Neural networks. Photo chemical events of vision

Recommended Books:

1. Biophysics: An introduction Kluwer, Dordrecht
2. Biophysics: Cantor -I, II & III vol.
3. Biophysics an introduction; Rodney Cotton II
4. An introduction to Neural computing - Aleksander & Morten
5. Biological membranes: architecture & function: Hand book of biological physics: Lipowsky & sackmann all volumes techniques & methods

PLANT BIOTECHNOLOGY

TBT 702

Unit I

Introduction Definition, Classical versus modern approach. Production of disease free plants explant, shoot tip culture, shoot tip grafting. Micropropagation Basic technique, Automation in the area scope as an commercial venture.

Unit II

Tissue Culture as some of Genetic Variability Somaclonal and gametoclinal variation, Selection, Sources and causes of variation, Application in crop improvement.

Unit III

Protoplast Related Techniques Protoplast, Isolation, Culture and fusion, Selection of hybrid cells, regeneration of hybrid plants, somatic hybridization and cybridization, Applications in crop improvement. Plant as Biofactories Concept, Production of Chemicals, Pigments, Perfume, Flavors, Insecticides, anticancer agents and other important compounds.

Unit IV

Transformation Techniques Physical methods, *Agrobacterium*, Mediated transformation Transgenics Basic concept and essential steps of the process, Some examples of transgenic plants, Use of suitable promoters, Gene silencing and measures to overcome it, Commercial aspects of the technology.

Unit V

Nitrogen Fixation Basic concepts, nif genes and their regulation, potential scope in crop Improvement. Transformation of organelles: Methods and success, advantages of organller transformation. Molecular Markers Concept, SNPs, RAPD, RFLP, ISSR, STMS, role in crop improvement and genome mapping.

Text / Reference Books

1. Plant Tissue Culture: Applications and Limitations. S.S. Bhojwani (1990), Elsevier, Amsterdam.
2. Micropropagation: P.C. Debergh and R.H. Zimmerman (1990), Kluwer Academic Publ. Dordrecht.
3. Transgenic plants – Lindsey and Jones
4. Plants, genes & crop improvement, Crispeels – ASPB, 2002
5. Agricultural Biotechnology – A. Altman.

FOOD BIOTECHNOLOGY

TBT 703

Unit I

History of Microorganisms in food, Historical Developments. role and significance of microorganisms in foods. Intrinsic and Extrinsic Parameters of Foods that affect microbial growth.,(pH, Moisture content, Water activity, Oxidation reduction Potential, Nutrient content, Biological Structure and Other inhibitory substance).

Unit II

Microorganism important in Food microbiology: Yeast, Mould, Protozoa, Helminthes, Bacteria and Viruses, Contamination of Food From soil, water, air and through handling and during. Processing, General principle of Spoilage, cause of spoilage, Factor affecting and Kind and number of Microorganism in Food.

Unit III

Preservation of Food: Asepsis, Aseptic, Removal of Microorganism, Maintenance of Anaerobic condition, Preservation by Using High temperature, Low temperature and Chemical, Concept of Thermal Death Point, Z value, D-Value and ¹² D Concept, Preservation by Radiation Processing of Foods for Irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of Foods Legal Status of Food Irradiation, Effect of Irradiation of Food constituents..

Unit IV

Food fermentation: Bread, Beer, Cheese Production, SCP, medical foods, probiotics and health benefits of fermented milk and foods products. Food borne Illness by *Bacillus cereus*, *Salmonellae*, *Clostridium perfringens* and Enteropathogenic *E. coli*.

Unit V

Quality control of Food, Detection of food borne pathogen, Bacteriology of Water, Microbiology of the food product, Good Manufacturing Practice.

Text / Reference Books:

1. Modern Food Micro-Biology by James M. Jay, (2000), 6th edition, An Aspen Publication, Maryland, USA.
2. Food Microbiology: Fundamentals and frontiers by M.P. Doyle, L.R. Beuchat and Thoma J. Montville, (2001), 2nd edition, ASM press, USA.
3. Food Science and Food Biotechnology by G.F.G. Lopez & G.V.B. Canovas (2003), CRC Press, Florida, USA.

FOOD BIOTECHNOLOGY
PBT 701

1. Total bacterial count of Food sample
2. Detection of presence of Coliforms in water sample
3. MPN test
4. MBRT test for testing the quality of Milk
5. Detection and identification of Salmonella from meat.
6. Yeast and Mould count in food sample

BIOMEDICAL SIGNAL PROCESSING

TEC 034

Unit 1

Introduction to Bio-Medical Signals: Classification, Acquisition and Difficulties during Acquisition Basics of Electrocardiography, Electroencephalography, Electromyography & electro-retinography 3. Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field

Unit 2

ECG: Measurement of Amplitude and Time Intervals, QRS Detection(Different Methods), ST Segment Analysis, Removal of Baseline Wander And Power line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors

Unit 3

Data Reduction: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding.

Unit 4

EEG:Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep/Wake transition. Study of pattern of brain waves, Epilepsy-Transition, detection and Estimation.

Unit 5

EP Estimation: by Signal Averaging, Adaptive Filtering:- General Structures of Adaptive filters, LMS Adaptive Filter, Adaptive Noise Canceling, Wavelet Detection:- Introduction, Detection By Structural features, Matched Filtering, Adaptive Wavelet Detection, detection of Overlapping Wavelets.

TEXT BOOKS

1. Biomedical Digital Signal Processing, Willis J Tomkin, Phi.
2. Biomedical Signal Processing, D.C Reddy McGrawhill
3. Biomedical Instrumentation and Measurement.,Crommwel,Weibel and Pfeifer, PHI

REFERENCE BOOKS:

4. Biomedical Signal Processing, Arnon Cohen, volume I & Licrc Press 5
- Biomedical Signal Analysis A Case Study Approach, Rangaraj M. Rangayyan, John Wiley and Sons Inc.
6. Medical instrumentation Application and Design, john G. Webster, john Wiley & Sons Inc.

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S.No.	Subject Code	Subject Title	Contact Hours / Week			Evaluation Scheme					Subject Total Marks
						Sessional Marks			ESE		
			L	T	P	CT	TA	Total	Marks	Duration (hrs)	
THEORY SUBJECTS											
1	TBT801X	*Elective-I	3	1	-	30	20	50	100	3	150
2	TBT802X	**Elective-II	3	1	-	30	20	50	100	3	150
3	TBT 803	Animal Biotechnology	3	1	-	30	20	50	100	3	150
4.	TBT805	Biodiversity and Conservation			-	30	20	50	100	3	150
PRACTICAL / DESIGN / DRAWING											
5.	PBT 801	***Project (All Labs)			6			100	200		300
6.	GP 801	General Proficiency	-	-	-	-	-	50	-		50
7.	TBT804	Seminar-II			2				50	2	50
TOTAL			15	5	9			400	550		1000

*Any one Elective to be opted from the list of Departmental Electives I .

**Any one Elective to be opted from the list of Departmental Electives II.

** *Project marks for { Stage II}

List of Departmental electives

Elective 1

1. Herbal biotechnology
2. Biotechnology & Entrepreneurship Development
3. Vaccine Biotechnology
4. Cancer Biology
5. Industrial Biotechnology

Elective II

1. Drug Designing
2. Metabolic Engineering
3. Nano-Biotechnology
4. Molecular Diagnostics and Therapeutics
5. Biosensors

ANIMAL BIOTECHNOLOGY

TBT 803

Unit I

Introduction to Animal Tissue Culture: Background, Advantages, Limitations, Application, Culture Environment, Cell Adhesion, Cell Proliferation, Differentiation Structure and organization of animal cell and equipments and material for animal cell culture technology.

Unit II

Design, Layout and Equipment: Planning, Construction, Layout, Essential Equipments, Aseptic Technique, Objectives, Elements, Sterile Handling, Safety, Risk Assessment, General Safety, Fire, Radiation, Biohazards. Media used for Animal Cell culture: Physicochemical Properties, Balanced Salt Solutions, Complete Media, Serum, Serum-Free Media, Disadvantages of Serum, Advantages of Serum-Free media.

Unit III

Primary Culture: Isolation of Tissue, Steps involved in primary cell culture, Cell Lines, Nomenclature, Subculture and Propagation, Immortalization of cell lines, Cell line designations, Routine maintenance. Need for characterization, Morphology, Chromosome Analysis, DNA Content, RNA and Protein, Enzyme Activity, Antigenic Markers, Transformation, Immortalization, Source of contamination, Type of microbial contamination, Monitoring, Eradication of Contamination, Cross-Contamination

Unit IV

Cryopreservation: Need of Cryopreservation, Preservation, Cell banks, Transporting Cells, **Cytotoxicity its** in vitro limitations, Nature of assay, Viability assay, Survival assay, Microtitration assay, Transformation assay, Methods of Producing Transgenic Animals: Embryonic Stem Cell method, Microinjection. method, Retroviral vector method, Applications of transgenic animals

Unit V

Gene Therapy: Ex-vivo gene therapy, In vivo gene therapy, Viral gene delivery system, Retrovirus vector system, Adenovirus vector system, Adeno-Associated virus vector system, Herpes simplex virus vector system, Non-viral gene delivery system, Prodrug activation therapy, Nucleic acid therapeutic agents

Text / Reference Books:

1. Animal Cell Culture by John R.W. Masters
Oxford University Press
2. Introduction to Cell and Tissue Culture by Jennie P. Mather and Penelope E. Roberts
Plenum Press, New York and London
3. Molecular Biotechnology: Primrose.
4. Animal Cell Biotechnology: R.E. Spier and J.B. Griffiths (1988), Academic press.

LIST OF ELECTIVE I

HERBAL BIOTECHNOLOGY

TBT 8011

Unit-I

History, definition and scope of herbal medicine, the great contributors of medicine. Traditional and alternative system of medicine. Medicinal plants of Uttarakhand scope of plant origin medicine in Uttarakhand.

Unit II

Classification of crude drugs of plant origin. Alphabetical classification, taxonomical classification, morphological classification, chemical classification, pharmacological (Therapeutic classification), Chemotaxonomic classification.

Unit III

Introduction to parts of medicinal plant cell organelles of plant cell, plant tissue, microscopy of plant, leaves, stems, flowers, fruits, seeds, barks, woods, underground drugs.

Unit IV

Cultivation Methods Of propagation, methods of pest control, types of insertions used in cultivation and part harvest the of herbal plants Plant growth regulators.

Unit V

Cultivation and utilization of medicinal and aromatic plant in India. Genetic as applied to medicinal herbs research, genetic engineering and recombinant DNA technology. Plant tissue culture as source of biomedical Bio medicinal.

Reference book

- 1- Pharmacogony by Hohate, Purohit Gothallec by Nirali publication.
- 2- Sumant SS, Phar UP palni LMS, medicinal plant of Indian Himalaya. Diversity, Distribution and potential values. Gyanoly pranasha mainital 1928.
- 3- Jain S.H 1991 Dictionary of Indian Folk medicinal Deep publications New Delhi.
- 4- Chaula H.S. plant Biotechnology Oxfords IBH publication.
- 5- Challrzee M.N. and Shindi, R 1995 textbook of medical biochemistry. Japee brother medicinal pub ltd. New Delhi.

BIOTECHNOLOGY AND ENTREPRENEURSHIP DEVELOPMENT

TBT 8012

Unit I

Need to commercialize biotechnology. Development process, success rates and costs etc., Creating and marketing the image of the biotechnology company. Art of negotiation & effective communication.

Unit II

Role of venture capitalism, business plan, selection of CEO and personnel, real estate for a biotech start-up., Management portray and role of a biotechnology manager, technology decision-making and resource decision-making etc., Product marketing decision.

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Unit III

Role of research & development, university-industry technology transfer arrangements, benefits of a biotech company.

Unit IV

Positioning, power and importance of a company name, product, workable marketing and the strength of distribution., Effective advertising and marketing.

Unit V

Opportunities international, marketing and lessons to be learned, Indian and foreign prospective of biotechnology and current challenges for the biotechnology based products.

Recommended books:

1. Positioning by All Rise and Jack Trout (1986), Warner Books.
2. Biotechnology: The science & the business by V. Moser & R.E. Cape (1999) Harwood.
3. Latest review articles and papers on the subject.

VACCINE TECHNOLOGY

TBT 8013

Unit I

History of Immunisation, Immunisation types: active and passive immunization, Rationale of immunization, Adjuvant, Age of commencement of immunization, Dosage and Dosage spacing. Vaccine schedule, Hazard of immunization

Unit II

Vaccine: Difference between live and killed vaccine, Rationale vaccine design based on clinical requirements, Different types of vaccine: subunit vaccine, Recombinant Vaccine, edible vaccine, Subunit vaccine, antidiotype vaccine, live vaccine, killed vaccine etc.

Unit III

Hypersensitivity: Types of hypersensitivity, IgE-Mediated (Type I) Hypersensitivity, Antibody-Mediated Cytotoxic (Type II), Immune Complex-Mediated (Type III), Type IV or Delayed-Type Hypersensitivity (DTH) Immunity to Infection.

Unit IV

Autoimmunity, Transplantation, Tumor immunology, immunodeficiency; Active immunization, live, killed, attenuated, Sub unit vaccines;

Unit V

Recombinant DNA and protein based vaccines, plant-based vaccines; Peptide vaccines, conjugate vaccines; Passive Immunization; Antibody, Transfusion of immunocompetent cells, Stem cell therapy; Cell based vaccines.

References:

1. **Medical Microbiology: Mackie and McCartney**
2. **Immunology by Janis Kuby**

CANCER BIOLOGY

TBT 8014

Unit I

Fundamentals of Cancer Biology Regulation of Cell cycle, mutations that cause changes in signal molecules, effectson receptor, signal switches, Tumor Suppression tumour suppressor genes, modulation of cell cycle in cancer. Different forms of cancers, Diet and cancer.

Unit II

Principles of Carcinogenesis I Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis. Principles of Carcinogenesis II, Principles of Physical Carcinogenesis, X - Ray radiation - mechanism of radiation Carcinogenesis.

Unit III

Molecular Cell Biology Of Cancer Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes. Oncogenes / Proto Oncogene activity. Growth factors related to transformations.

Unit IV

Principles of Cancer Metastasis Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of Invasion, Proteinases and tumour cell invasion.

Unit V

Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection. New Molecules for Cancer Therapy, Different forms of therapy, Chemotherapy, radiation Therapy, and Immuno-therapy: Advantages and Limitations.

TEXT BOOKS

1. Maly B.W.J. Virology a practical approach, IRL Press, Oxford, 1987.
2. Dunmock N.J and Primrose.S.B., Introduction to modern Virology, Blackwel Scientific Publications. Oxford, 1988
3. The Biology of Cancer by Robert Weinberg. Garland Science, Taylor & Francis Group, New York, N.Y. ISBN 0-8153-4076-1
4. Cotran R.S, VinayKumar, Collins.T, Robbins,S.L., 1999, "Robbin's Pathologic Basis of Disease", 6th edn., W.B.Saunders, Philadelphia.
5. Maxwell M. Wintrobe, G.Richard Lee,1998,10 Ed, "Wintrobe's Clinical Haematology",Lippincott Williams & Wilkins Publishers, New York.
6. Molecular Biology of Cancer by F. Macdonald, C.H.J. Ford, and A.G. Casson;Garland Science / Bios Scientific Publishers.
7. Molecular Biology of Human Cancers by Wolfgang Arthur Schulz Springer.

INDUSTRIAL BIOTECHNOLOGY

TBT 8015

Unit I

Introduction, public awareness of genetic engineering, Regulatory requirements-safety of genetically modified food, policy making, area of significant public concern. Process economics-cost estimates, process design, design exercise, capital cost estimates, operating cost estimates.

Unit II

Introduction to bioprocess technology, Isolation, preservation and improvement of industrially important organisms, Substrates for fermentation processes, Medium optimization Elements of biochemical engineering: Bioreactor design: Laboratory, pilot and large scale reactors. Plug flow reactors, enzyme reactors. Sterilization of media and air Mass transfer of oxygen: Agitation and aeration, Determination of $K_L a$, factors affecting $K_L a$, fluid rheology, Inoculum development, aseptic inoculation and sampling. Bioprocess kinetics: Kinetics of growth and substrate utilization in batch, fed batch and continuous systems.

Unit III

Biological wastewater treatment- Waste water characterization: COD, BOD, Inorganic constituents, solids, biological components. Principles and aim of biological waste water treatment processes, biochemistry and microbiology of inorganic phosphorus and nitrogen removal. Suspended growth technologies: Activated sludge, oxidation ditches, lagoons, waste stabilization ponds. Fixed film technologies: Trickle filters, rotating biological contactors, activated biofilters, fluidized bed etc. Anaerobic waste water treatment systems: RBC, UASB, Anaerobic filters, etc. Environmental problems and treatment of industrial waste waters: distillery, tannery, paper pulp etc. Toxicity testing in waste water treatment plants using microorganisms. Solid waste management: Anaerobic digestion and composting.

Unit IV

Classification: IUB enzyme classification, techniques used in enzyme characterization, Principle and techniques of enzymatic analysis, factors affecting enzyme activity, Extraction and purification of enzyme, separation techniques, test of purity, substrate kinetics: Equilibrium and Steady state kinetics, significance of K_m , V_{max} & K_{cat} , Pre-steady state and Relaxation kinetics, Enzyme activators, co-enzymes and co-factors in enzyme catalysis, Experimental approaches to determine enzyme mechanisms. Enzyme mechanisms: Lysozyme, Chymotrypsin, Carboxypeptidase, Restriction endonuclease, Aspartate transcarbamoylase, Allosteric enzymes and sigmoidal kinetics: Protein ligand binding, Co-operativity, MWC & KNF models, Regulation of enzyme activity. Control of metabolic pathways, Isoenzymes and its physiological significance, Ribozymes and Abzymes Enzyme engineering: Chemical modification of enzymes: methods of modification of primary structure, catalytic and allosteric properties, use of group specific reagents. Enzymes in non conventional media; Enzymes sensors, Enzymes as analytical reagents

Unit V

General concept of Microbial biotechnology, Fermentation economics, Microbial production of: Antibiotics: Penicillin, streptomycin, Enzymes: proteases, amylases, Organic acids: Citric acid, acetic acid, Vitamins: Vit B12, B2, Amino acids: Glutamic acid, Lysine, Ergot Alkaloids,, Industrial Alcohol, Beer, wine, Microbial Exo Polysaccharides, Single cell protein, Single cell oil, Microbial Flavours, Food and dairy products: Cheese, bread and yogurt., Mushroom cultivation, Plant cell culture, animal cell culture, Steroid transformation, Biopolymers and Bioplastics.

Reference Books :

1. Plant design and economics for chemical engineers, Peters M.S. and Timmerhaus K.D. McGraw-Hill international editions.
2. Economic analysis of fermentation process. Resiman, H.B., CRC press, Boca Raton, Florida.
3. Waste water treatment for pollution control, 2nd edition. Arceivala.
4. Environmental Microbiology. R. M. Maier, I. L. Pepper & G. P. Gerba.
5. Fundamentals of Enzymology : Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
6. Enzyme Structure and mechanism : Alan Fersht, Reading, USA.
7. Understanding Enzymes : Trevor Palmer
8. The chemical kinetics of enzyme action : K. J. Laider and P. S. Bunting, Oxford University Press, London.
9. Enzymes : M. Dixon, E. C. Webb, C.J.R Thorne and K. F. Tipton, Longmans, London.
10. Proteins: Thomas Creighton
11. Biochemistry: Lubert Stryer
12. Biotechnology : Rehm and Reid.
13. Comprehensive biotechnology : Murray Moo Young.
14. Microbial Techonology: Pepler.

LIST OF ELECTIVE II

DRUG DESIGNING

TBT 8021

Unit I

Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Unit II

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins, Validation Strategies

Unit III

Drug Design Strategies:. Structure-based design-Docking and denovo methods..Design and development of combinatorial libraries for new lead generation, The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemometrics in drug design.QSAR:Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Unit IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Unit V

Survey of various Drug Classes – Anaesthetics (general, local), Analgesics, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids-Mechanism of action and applications.

METABOLIC ENGINEERING

TBT 8022

Unit I

Basic concepts of Metabolic Engineering- Overview of cellular metabolism. Introduction to various pathways. Primary and Secondary metabolites. Medical and agricultural importance of secondary metabolites.

Unit II

Different models for cellular reactions. Flexible and rigid in metabolic pathways. Metabolic regulation network at enzyme level and whole cell level- Examples of metabolic pathway manipulations.

Unit III

Metabolic pathway synthesis algorithms. Metabolic flux analysis and its applications. Mathematical calculation for the flow of carbon and nitrogen fluxes.

Unit IV

Methods for experimental determination of metabolic fluxes by isotope labeling. Stereochemistry of regulatory molecules. Concepts of regulatory analogs.

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Unit V

Genetic regulation of metabolic fluxes. Gene expression in response to environmental stimuli. Regulation of gene expression. Analysis of metabolic control and the structure metabolic networks.

Recommended Books:

1. "Computational Modeling of Genetic and Biochemical Networks" by James M. Bower & Hamid Bolouri.
2. "Metabolic Flux Analysis" by Valino.
3. "Comprehensive Biotechnology" Vol. 3, Moo & Young.
4. "Fundamentals of Biochemical Engg", by Bailey and Olis.

NANO-BIOTECHNOLOGY

TBT 8023

Unit I

Introduction. Legal considerations for nanotechnology. Environmental risk assessment, Health risk assessment, Hazards risk assessment.

Unit II

Prime Materials: Metals, Iron, Aluminum, Nickel, Silver, Gold, Copper and their oxides, Silica products. Nanomaterial Types: Nanowires, Nanotubes and their synthesis, properties, applications,

Unit III

Fullerenes, quantum dots, Dendrimers, Properties. Method of preparation: Top down, bottom up, plasma orcing, chemical vapour deposition, sel – gel methods.

Unit IV

Self assembled monolayers, Bio molecular motors and their functions. Proteins and applications, Drug delivery systems - Nanofluidic, fluids at micro and nanometer scale, fabrication of nanoporous and nanofluidic devices, applications.

Unit V

Current and future market applications: Semiconductor manufacturing, Advanced composites, Advanced ceramics, Catalytic and photocatalytic applications, Gas sensors & other analytical devices, consumer products, drug delivery mechanisms & medical therapeutics, Micro electronic applications.

Recommended Books:

1. Introduction to Nanoscale science and technology. Ed. By Mosimilano Di ventra I Edition, Kluwer Academic – 2004.
2. Nanotechnology, Grejory Timp – I Edition, Springer International – 2005.
3. Nanotehnology. Michel Kohler – I Edition, Wiley VCH-2004.
4. Nanotechnology : Environmental implications & solutions by Lous Theodove & Robert A. Kung.
5. Introduction to Nanotechnology- C.P. Poole & F.S. Owens.
6. Nanotechnology : Basic science & emerging technologies- M.Wilsin, K. Kannaranga, G. Smith, M. Simmons & b. Raguse.
7. An introduction to materials engineering & science for chemical & material engineers – B.S. Mitchell.
8. Essay: The coming technological revolutions, from the websites of the center for responsible nanotechnology; www.crnano.org/magic.htm.

MOLECULAR DIAGNOSTIC AND THERAPEUTICS

TBT 8024

Unit I

Host Parasite interaction in bacterial infections. Pathogenic properties of bacteria (colonization of surfaces, invasion of tissue, production of exo and endo toxins). Anti bacterial defence of the host. Protective immune response in Bacterial, Viral and Parasitic diseases;

Unit II

Biochemical disorders; Immune, Genetic and Neurological disorders; Molecular techniques for analysis of these disorders; Assays for the Diagnosis of inherited diseases; Cancer; Inappropriate Immune response; Disease pathology and clinical spectrum; Clinical diagnosis of diseases.

Unit III

Antibody based diagnosis; Monoclonal antibodies as diagnostic reagents; Production of monoclonal antibodies with potential for diagnosis; Diagnosis of bacterial, viral and parasitic diseases by using; ELISA and Western blot.

Unit IV

Isolation of DNA; purification and analysis; DNA sequencing and diagnosis; PCR and Array based techniques in diagnosis; Single nucleotide polymorphism and disease association; Two Dimensional gene scanning

Unit V

Isolation of proteins and other molecules associated with disease; Process and their profiling for diagnosis; 2D analysis of such proteins by sequencing individual spots by Mass Spectrometry; Protein Micro array; Present methods for diagnosis of Specific diseases like Tuberculosis, Malaria and AIDS; Ethics in Molecular Diagnosis

Texts/References:

- 1 Campbell, M.A and Heyer L.J., Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition, CSHL Press, Pearson/Benzamin, Cummings San Francisco, USA, 2007.
- 2 Andrew Read and Dian Donnai, New Clinical Genetics, Scion Publishing Ltd, Oxfordshire, UK, 2007.
- 3 James W Goding, Monoclonal antibodies: Principles and Practice, 3rd Edition, Academic Press, 1996.

BIOSENSORS AND BIOELECTRONICS

TBT 8025

Unit I

Definition, Advantages and limitations, various components of biosensors. Biocatalysis based biosensors, bioaffinity based biosensors & microorganisms based biosensors.

Unit II

Biologically active material and analyte. Types of membranes used in biosensor constructions. Various types of transducers; principles and applications - Calorimetric, optical, potentiometric / amperometric conductometric/resistometric.

Unit III

Piezoelectric, semiconductor, impedimetric, mechanical and molecular electronics based transducers. Chemiluminiscence - based biosensors.

Unit IV

Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food. Low cost- biosensor for industrial processes for online monitoring; biosensors for environmental monitoring.

Unit V

Potential advantages & Developments towards a biomolecular computer, development of molecular arrays as memory stores; molecular wires and switches; mechanisms of unit assembly.

TEXT BOOKS:

1. Aboul - Enein, H. V., Stefan, R. and Van Staden, (1999) Chemiluminiscence - based biosensors - An overview crit Rev. Anal. Chem. 29, 323-331.
2. Pearson, J.E. Gill, A., and Vadgama, P. (2000) Analytical aspects of biosensors Ann Clin Biochem 37, 119-145.

REFERENCES:

1. Roger, K.R. and Gerlach, C.L. 1~99. Update on environmental for biosensors. Env. Sci. Techno! 33 500A - 506A.
2. Bilitewski, U. Turner, A.P.F. 2000 Biosensors for environmental monitoring Harwood, Amsterdam.
3. Moses, V and Cape, R.E. 1991, Biotechnology the science and business, Harwood, Academic Publisher London
4. Rogers, K.R. and Mascini, M. 2001. Biosensors for analytical monitoring EPA biosensors group.

BIODIVERSITY AND CONSERVATION

TBT 805

Unit I

Definition, historical and geographical causes for diversity, Types of Biodiversity, Himalyan Biodiversity with emphasis on Uttarakhand specifically Garhwal and Kumaon region

Unit II

Germplasm, Gene pool, Genetic Erosion, Germplasm Collection, Germplasm Regeneration, Importance of germplasm in evolution

Unit III

Components of biodiversity, Plant Genetic Resources, Animal Genetics Resources, Fish Genetic Resources,
Molecular taxonomy, species and population biodiversity, quantifying biodiversity

Unit IV

Maintenance of ecological biodiversity, Biodiversity and centers of origin,
Biodiversity hot spots in India with emphasis to Uttarakhand, Loss of biodiversity, Biodiversity conservation of plant, animal, fish, microbial genetic resources

Unit V

Assessing, analyzing and documenting biodiversity, morphological and molecular characterization of biodiversity, vulnerability and extinction of biodiversity, introduction to biodiversity data base,
Endangered animals, endemism and Red Data books, Global biodiversity Information System

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