UNIVERSITY OF KERALA

Scheme for M.Tech.in Biotechnology and Biochemical Engineering with Specialisation in Molecular Medicine

2013 Scheme

SEMESTER-I

Code	Name of the Subject	Credits	Hours/ week	Exam Duration (hrs)	Marks			Remarks
					Continuous Assessment	University exam	Total	
BMM1001	Advanced Mathematics and Computational Biology	3	3	3	40	60	100	End semester exam is conducted by the university
BMC1001	Molecular and Cellular Biology	3	3	3	40	60	100	do
BMC1002	Downstream Processing in Biotechnology	3	3	3	40	60	100	do
BMC1003	Structural Biology, Genomics and Proteomics	3	3	3	40	60	100	do
BMC1004	Drugs and Pharmaceutical Technology	3	3	3	40	60	100	do
BMC1005	Molecular Modeling and Drug Design	3	3	3	40	60	100	do
BMC1101	Advanced Genetic Engineering Lab	1	2	-	100	-	100	No End semester exam
BMC1102	Seminar	2	2	-	100	-	100	do
	TOTAL	21	22		440	360	800	

SEMESTER-II

Code	Name of the Subject	Credits	Hours/week	Exam duration	Marks			Remarks
					Continuous Assessment	End Semester Exam	Total	
BMC2001	Bioprocess Plant Design	3	3	3	40	60	100	End semester exam is conducted by the university
BMC2002	Concepts and Perspectives of Molecular Medicine	3	3	3	40	60	100	do
	Stream Elective-I	3	3	3	40	60	100	do
	Stream Elective-II	3	3	3	40	60	100	do
	Departmental Elective	3	3	3	40	60	100	do
BCC 2003	Research Methodology	2	2	3	40	60	100	End sem exam is conducted by the individual institutions
BMC2101	Advanced Biochemical Engineering. Lab	1	2	-	100	-	100	End sem exam is conducted by the individual institutions
BMC2102	Thesis Preliminary - Part I	2	2	-	100	-	100	do
BMC2103	Seminar	2	2	-	100	-	100	do
	TOTAL	22	23	--	540	360	900	

STREAM ELECTIVE I OFFERED FOR SEMESTER II

BMS 2001 Molecular Basis Of Genetic Diseases And Metabolic Disorders

BMS 2002 Molecular Diagnostics

BMS 2003 Molecular Human Genetics

STREAM ELECTIVE II OFFERED FOR SEMESTER II

BMS 2004 Immunotechnology

BMS 2005 Molecular Endocrinology

BMS 2006 Nanobiotechnology

DEPARTMENTAL ELECTIVES OFFERED FOR SEMESTER II

BMD 2001 Advanced Fermentation Engineering

BMD 2002 Modelling And Simulation Of Process Plants

BMD 2003 Process Control & Instrumentation For Bioprocesses

BMD 2004 Transport Phenomenon In Bioprocess

SEMESTER-III

Code	Name of the Subject	Credits	Hours/week	Exam Duration (hrs)	Marks			Remarks
					Continuous Assessment	End Semester Exam	Total	
	Stream Elective-III	3	3	3	40	60	100	End semester exam is conducted by the individual institutions
	Stream Elective-IV	3	3	3	40	60	100	do
BMC3001	Non- Dept (Interdisciplinary) Elective	3	3	3	40	60	100	do
BMC3101	Thesis Preliminary Part II	5	14	-	200	-	200	No end semester exam
	TOTAL	14	23	-	320	180	500	

STREAM ELECTIVE III FOR SEMESTER III

BMS 3001 Molecular Carcinogenesis

BMS 3002 Neurobiology

BMS 3003 Intellectual Property Rights

STREAM ELECTIVE IV FOR SEMESTER III

BMS 3004 Stem Cell Biology

BMS 3005 Advanced Genetic Engineering

BMS 3006 Molecular Basis Of Infectious Diseases

SEMESTER-IV

Code	Name of the Subject	Credits	Hours/week	Marks				
				Continuous Assessment		University Exam		Total
				Guide	Evaluation Committee	Thesis evaluation	Viva Voce	
BMC4101	Thesis Final	12	21	150	150	200	100	600

Note: 6 to 10 hrs per week is for department assistance

SEMESTER I

BMM 1001 APPLIED MATHEMATICS AND COMPUTATIONAL BIOLOGY 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objective:

To understand the fundamentals of probability and mathematical applications in molecular medicine to solve problems.

Course outcome

The Applied Mathematics and Computational Biology subject will enable the students to tackle biological problems: genomic analysis and data-mining, computational structural biology, structure-based drug design, signaling and gene-regulatory networks, and cell and tissue models.

MODULE I

Ordinary differential equations of the first order: exactness and integrating factors, variations of parameters; Ordinary linear differential equations of n^{th} order: solution of homogenous and non homogenous equations and variation of parameters.

Laplace transforms and its applications: Laplace transforms, inverse laplace transform, convolution theorem, unit step function, unit impulse function and periodic functions, second shifting function, solution of ordinary differential equations with constant coefficients using Laplace transforms.

MODULE II

Fourier series: Fourier series of periodic function of period 2π, Dirichlet's condition for convergence. Half range expansion.

Fourier transforms: Fourier integral theorem, Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms and properties. Applications in Biomedical Engineering.

Partial Differential Equations: Introduction to solution techniques such as variable separation, product method and Laplace transforms method.

MODULE III

Probability: Probability in medicine, biology and genetics, Baye's theorem, Binomial, Poisson, and Normal Distributions and their applications. Observational data- Description and analysis, Random sampling- population parameters and sample statistics, measures of dispersion. Comparison with hypothetical values, measures of association, prediction of values, Elements of estimation- Interval estimation of population mean and proportions. Testing of hypothesis- Hypothesis concerning a mean, Equality of mean, Hypothesis concerning one proportion, difference of two proportion. Sampling of variables- small samples- t-distribtion, chi-square test, goodness of fit, F-distribution, Regression correlation- Karl Pearson Coefficient of correlation. Analysis of Variance- one way classification and two way classification.

References:

1. E- kreyszig, Advanced Engineering Mathematics 5th Edition, Wiley Easten 1991.
2. Murray J D,Mathematical Biology, Springer Verlag, Berlin 1989
3. Aulay Macenzie, Mathematics & Statistics for Life Scientists, Viva Books Private Limited, 2007.
4. Mathematics for biological Scientists, Aitken and Mike; Garland Science; 2009
5. Mathematical models in biology, Allman, Elizabeth S; Cambridge university;2004
6. Applied Mathematics, Murthy,RamananV;McGraw Hill comp; 2008

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1001 MOLECULAR AND CELLULAR BIOLOGY 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objective:

To develop basic knowledge and skills in cell and molecular biology and become aware of the complexity and harmony of the cell

Course Outcome:

Molecular and cell biology will enable students to learn various molecular and cellular mechanisms which would help in better understanding of diseases and discover novel drugs based on these mechanisms.

MODULE I

Cell structure and function: Plasma membrane, Endoplasmic Reticulum, Golgi Complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria, Nucleus, Cytoskeleton; Protein Glycosylation, Sorting and Transport. Transport across Cell Membranes Passive and Active Transport, Permeases, Na^+/K^+ Pump, ATPase pumps, Lysosomal& Vacuolar membrane ATP dependent Proton Pumps, Co-Transport Symport, Antiport, Transport into Prokaryotic Cells, Endocytosis and Exocytosis. Overview of the Cell Cycle, Cell Cycle Control & Checkpoints.

MODULE II

Replication. Models of DNA replication: semi conservative Mechanism of DNA replication in E.coli (bi-directional). Mitochondrial (D-loop), Viral DNA (Rolling circle), Single stranded-DNA phages (M13), Eukaryotic telomeres and its replication. Inhibitors of DNA Enzymes involved in replication, step by step process., Transcription apparatus, RNA polymerases and proteins involved in transcription (initiation, elongation and termination steps). Protein synthesis

Prokaryotes and eukaryotes. Post translation modifications. Mutations & mutagens - their types, classifications and mode of action, Site - directed mutagenesis and reverse genetics. DNA damage and repair mechanisms.Mutagenicity testing using microbial systems, Ames TEST.

MODULE III

Molecular mechanisms of signal transduction, Gated ion channel, Receptor enzymes, G-protein coupled receptors & second messengers, Regulation of transcription by steroid hormones, Regulation of cell cycle by protein kinases. Vertebrate development- Fertilization, blastulation, gastrulation, Neurulation. Role of gap genes, maternal genes, segmentation genes, homeotic genes in development is controlled by cascades of regulatory proteins. Role of SRY, DAX1, Wnt4a, Sxl in sex determination.

References:

1. BenjaminLewin, Genes VIII, Pearson Prentice Hall, 2004
2. Lodish, H., Berk A., Zipursky, S.L. Matsudaria, P. Baltimore, D.and Darnell,J., Molecular Cell Biology, W H Freeman & Co, 2003
3. William H. Elliott, Daphne C. Elliott, Bio Chemistry and Molecular Biology, Oxford University Press, USA**,** 2005
4. Wayne M. Becker, Lewis J. Kleinsmith, Jeff Hardin, The world of Cell 4th Edition**,** Addison-Wesley, 1999.
5. Scott F Gilbert, Developmental Biology, Sinauer Associates Inc, 2003
6. A. Lehninger, David L Nelson, Michael M Cox, Principles of Biochemistry, W H Freeman & Co (Sd), 1993

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1002 DOWNSTREAM PROCESSING IN BIOTECHNOLOGY 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objective:

To enable the students to learn the separation processes in a systematic way on the basis of common features and differences among the individual processes and thus make them capable to choose the process judicially .

Course outcome:

The course covers cell breakage and recovery of intracellular material, Isolation of solids, Product recovery, Product enrichment/purification, Product polishing and finishing. This course is suitable for students pursuing their biotechnology& biochemical engineering or other allied fields. This course is also suitable for chemical engineers who would like to learn about separation techniques in biotechnology industries.

MODULE I

Applications of Chemical, Physical and Biological properties to Bioseparations-

Thermodynamic and Transport Properties: Chemical equilibria, solubility, diffusivity, isoelectric point and charge dependence on pH, hydrophobicity, Acid-base scales, Metal ion binding constants. Biological Interactions and Forces: Short range interactions, vander Waal forces, Electrostatic interactions and DLVO theory, Hydrophobic effects, Magnetic interactions. Bioaffinity: Molecular recognition processes, Receptor- ligand interactions, specific interactions. Synthesis of downstream processes-process synthesis, mathematical programming techniques, Heuristics, Artificial Intelligence/ Expert systems, Evolutionary methods, Downstream process case studies- Purification of human insulin and Streptomycin.

MODULE II

Primary separation and recovery processes: Cell Disruption Methods: Cell disruption by homogenizer-mechanism, process design considerations, scale up. Bead mill disruption-operating parameters, mixing characteristics, economic considerations.Enzyme cell lysis-mathematical models, methods, process design simulations, chemical

permeabilization.Flocculation and Sedimentation. Centrifugation - Principle, selection, types, design and scale up theory. Filtration- theory of filtration, equipment design. Precipitation methods: with salts, organic solvents and polymers. Extraction-Organic aqueous extraction, two phase extraction, bioconversions in aqueous two phase extraction, supercritical fluid extraction, configuration for stagewise contacting. Product Polishing-Crystallization: Saturation and supersaturation, nucleation phenomena, growth of crystals, batch and continuous crystallization, yield calculations. Drying.

MODULE III

Enrichment Operations- Membrane Separations: Membrane materials, concentration polarization, theory of micro filtration and ultra filtration, reverse osmosis, flux analysis electrodialysis, emulsion liquid membranes.

Product resolution / fractionation- Adsorptive Chromatographic Separation Processes: Detection methods, analysis of chromatographic processes- Gaussian solutions, staged models, Newtonian Continuum mechanism and linear equilibria, van Deemter equation, gel partitioning model. Gel permeation chromatography, reversed phase and hydrophobic interaction chromatography, displacement chromatography, radial flow chromatography, membrane chromatography, scale up strategies. Electrophoresis separation processes.

References:

1. Asenjo.J.M, Separation Process in Biotechnology, Taylor & Francis, 1990
2. Wankat PC, Rate controlled Separations**,** Springer (SIE), New Delhi, 2005,
3. Charles L Cooney and Arthur E Humphrey, Comprehensive Biotechnology,vol 2 ;Pergamon press;1985.
4. Bioseparations Science and Engineering; Roger Harrison; Oxford University press.

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1003 STRUCTURAL BIOLOGY, GENOMICS AND PROTEOMICS 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objectives

Structural biology deals with the molecular structure of biomolecules, especially proteins and nucleic acids. It is also concerned with the structural-functional relationship of biomolecules and how alterations in their structures affect their function

Course outcome

An in depth study on this topic will help the students to understand the mechanism of origin of various diseases and thereby drug designing and therapy.

MODULE I

Levels of structures in Biological macromolecules; carbohydrates, lipids, proteins and nucleic acids, chirality of biomolecules.Forces that determine Protein and Nucleic acid structure, hydrogen bonding, hydrophobic interactions, ionic interactions, disulphide bonds and water structures. Types of proteins, protein structure; primary, secondary, tertiary and quaternary structures. Ramachandran Plot. Supersecondary structures; motifs, helix loop helix, hairpin beta-motifs, The beta- alpha- beta motif, greek key models. Fibrous proteins; collagen, alpha-keratin.Globular proteins; myoglobin and hemoglobin.Domains, interactions that govern protein folding, folding mechanisms, membrane proteins.

MODULE II

Molecular recognition, supramolecular interactions, Functional importance of Protein- Protein and Protein-Nucleic acid interactions.Prediction of protein structure; Sequence-structure relationships, Protein identification, peptide mass fingerprinting.Structure comparison methods.Prediction of secondary structure from sequence. Secondary structure based fold and

classification (CATH and SCOP), CASP. Protein homology modeling, Protein threading. Protein abinitio structure prediction.Protein design. X- ray crystallography; Circular dichroism, NMR spectroscopy, Mass spectroscopy; MALDI - TOF.

MODULE III

Nucleic acids; general characteristics of nucleic acid structure, geometric, glycosidic bond rotational isomers, backbone rotational isomers and ribose puckering, base pairing, base stacking. Structure of double stranded DNA and physical properties.DNA bending; DNA bending in gene regulation, DNA replication and in DNA repair. Protein induced DNA bending. DNA supercoiling, cruciform structures in DNA, left handed Z-DNA, triplex DNA. DNA – protein interactions. Sequence assembly and gene identification. Homology based gene prediction. Restriction mapping analysis, coding region identification.SNPs and applications.Methods of studying gene expression.

References

1. Physical Chemistry: Principles and Applications in Biological Sciences, Tinoco, I., Jr., Sauer, K., Wang, J. C. and Puglisi, J. D. Edition IV, 2001
2. Introduction to Protein Architecture, A.M. Lesk, Edition I, 2001
3. Introduction to Protein Structure, Branden and Tooze, Edition II, 1999
4. Genomics of Disease, J.P. Gustafson, J. Taylor, and G. Stacey
5. Introduction to Structural Biology, Carl-IvarBranden and John Tooze
6. Biochemistry, Donald Voet& Judith G. Voet
7. Introduction to proteomics *Tools for the New Biology*, Daniel C. Liebler; Humana Press
8. DNA structure and function, Richard R. Sinden; Academic Press, An imprint of Elsevier

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1004 DRUGS AND PHARMACEUTICAL TECHNOLOGY 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objective:

The course aims to teach the students about the interactions and mechanisms of drug molecules in the human body. It will give an idea about drug composition, packaging, manufacture, physicochemical properties, toxicology, therapy, and ethical applications.

Course outcome:

This course helps the students to acquire knowledge on drugs and how it can be applied to pharmaceutical industry.

MODULE I

Drug Metabolism and Pharmacokinetics:Drug metabolism-physico chemical principles, pharma kinetic action of drugs on human bodies. Transduction mechanisms as targets of drug action, voltage sensitive ion channels–structure and function, K^+channels.Voltage sensitive Ca^{+2} channels and the pharmacology of their inhibitors.Agonists at β-adrenoceptors.Pharmacology of Na^+/K^+ ATPase and gap junctions.Molecular and cellular mechanisms – Glutamate receptors, GABA and its receptors, Catecholamine receptors (α- and β-adrenoceptors, dopamine receptors), Acetylcholine receptors (nicotinic and muscarinic receptors), 5-HT receptors, Opioid receptors.

MODULE II

Manufacturing Principles: Compressed table, wet granulation-dry granulation or slugging-direct compression-tablet presses, coating of tablets, capsules, sustained action dosage forms-parental solution-oral liquids-injections-ointment-topical applications, Therapeutic categories such as vitamins, laxatives, analgesics, non-steroidal contraceptives, Antibiotics, biologicals, hormones.

MODULE III

Development of Drug and Pharmaceutical Industry:Regulatory aspects. Important Unit Processes and their Applications:Bulk drug manufacturers, Type of reactions in bulk drug manufacture and processes. Special requirement for bulk drug manufacture. Preservation, analytical methods and test for various drug and pharmaceuticals, packing-packing techniques, quality management, GMP.

Toxicology: Dose response relationship, risk and its assessment, spectrum of undesired effects-types of toxic reactions, toxicity tests in animals, New drug approval process and clinical trials design-phase 1, phase 2 and phase 3.

References:

1) Remington's The science and practices of pharmacy 21st edition, volume 1 and volume 2.Lippincott Williams and Wilkins publishers.
2) The Pharmacological Basis of Therapeutics: Goodman and Gilman.11th edition, McGraw Hill publishers
3) Clinical Pharmacology by P.N.Bennett and M.J.Brown, 9th edition, Elsevier Publishers
4) Pharmacology and Pharmacotherapeutics: R.S. Satoskar et al.
5) Essentials of Medical Pharmacology: K.D. Tripatti**,** Jaypee Brothers, 2008

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1005 MOLECULAR MODELLING AND DRUG DESIGN 3-0-0-3

Structure of the Course

Lecture: 3hrs/week Credits: 3

Internal continuous assessment: 40 Marks

End semester Examination: 60 Marks

Objective

The main objective in molecular modeling is to study intra and inter molecular interactions in coordination compounds in order to gather information on the molecular properties of the materials.

Course outcome

Molecular modeling has become a valuable and essential tool to medicinal chemist in the drug design process. With the thorough knowledge of the subject, students will be able to design the new and novel drug.

MODULE I

Introduction to Molecular Modelling., applications Drawbacks of mechanical models as compared to graphical models.Co-ordinate systems two – matrix, potential energy surface. Empirical Force Field Models (molecular mechanisms, energy calculations, Bond stretch, angle bending, torsional term. Electrostatic interaction- Van der waals interactions. Databases- Structure and sequence databases of proteins.

MODULE II

Molecular Dynamics (Introduction, Molecular Dynamics using simple models. Dynamics with continuous potentials. Constant temperature and constant dynamics.Conformation searching, Systematic search. Applications to protein folding)

Comparative protein modeling (Modelling by Homology-the alignment, construction of frame work ,selecting variable regions, side chain placement and refinement, validation of protein models –Ramchandran plot, threading and ab initio modeling), Protein Structure visualization tools- Swiss PDB viewer, Rasmol

MODULE III

Analog Based Drug Design (Introduction to QSAR. lead module, linear and nonlinear modeled equations, biological activities, physicochemical parameter and molecular descriptors, molecular modelling in drug discovery.), Drugs Structure drawing tools- Chemsketch, ISIS Draw

Structure Based Drug Design (3D pharmacophores,molecular docking, De novo Ligand design, Free energies and solvation, electrostatic and non-electrostatic contribution to free energies.)

Future perspectives in Molecular modeling (3D data base searching and virtual screening, Sources of data, molecular similarity and similarity searching, combinatorial libraries – generation and utility)

References:

1. Andrew R. Leach ,MolecularModelling: Principles and Applications, Pearson Education .
2. Guy H, Grant & W. Graham Richards, Computational Chemistry, Oxford University Press, 1995
3. Ronald T. Borchardt Edward H. Kerns, Michael J. Hageman ,DhirenR. Thakker and James L. Stevens, Optimizing the "Drug-Like" Properties of Leads in Drug Discovery, Springer, 2006
4. Feng Wang, Biomarker Methods in Drug Discovery and Development, Humana Press, 2008

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 1101 ADVANCED GENETIC ENGINEERING LAB 0-0-3-3

Structure of the Course

Lab: 3hrs/week Credits: 1

Internal continuous assessment: 100 Marks

1. Isolation of Genomic DNA, visualization and quantification.
2. Restriction mapping.
3. Competent cell preparation, Transformation and screening for recombinants (Antibiotic resistance).
4. Denaturing gel electrophoresis and silver staining.
5. SDS PAGE for protein separation
6. Western blotting
7. PCR
8. RFLP
9. GFP Cloning

ANIMAL CELL CULTURE EXPERIMENTS

10. Sterilization procedures in animal cell culture
11. Preparation of media
12. Subculturing and maintenance of cell lines
13. Cytotoxicity evaluation by Trypan blue staining

BIOINFORMATICS TOOLS

14. Homology Search tools including BLAST, CD search, Homologene, Protein Clusters, Genome BLAST
15. NCBI tools : OMIM- Online Mendelian inheritance in man, Unigene- computational analysis of expression, MapViewer- provide a variety of genome mapping and sequencing data, ORF Finder: To find out ORF regions in a given sequence, Primer BLAST-To design PCR primer pairs, VecScreen- To quickly identify sequences that maybe of vector origin, mfold- predict secondary structure of RNA, Swiss PDB viewer, Rasmol- protein structure visualization tools, CN3D, Chempen3D- drug structure drawing tools

References:

1. Current Protocols in Molecular biology. 2003. Frederick M Ausubel, Roger Brent, Robert E Kingston er at. John Wiley & sons Inc.
2. Molecular Cloning: A Laboratory Manual, JosephSambrook and David W. Russell, Cold spring harbor Laboratory press.
3. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, R. Ian Freshney

Marks: Continuous evaluation: 100 (Attendance - 10, Record – 20, Test- I and viva-voce – (20+15) 35 marks, Test- II and viva- voce- (20 +15) 35 marks)

BMC 1102 SEMINAR

Structure of the Course

Seminar: 2 hrs/week Credits : 2

Internal Continuous Assessment: 100 Marks

The student is expected to present a seminar in one of the current topics in Industrial Instrumentation and Control and related areas. The student will undertake a detailed study based on current journals, published papers, books, on the chosen subject and submit seminar report at the end of the semester.

Marks:

Seminar Report Evaluation: 50
Seminar Presentation: 50

SEMESTER -II

BCC 2003 RESEARCH METHODOLOGY 2-0-0-2

Structure of the course

Credits: 2

Lecture : 2 hrs/week
Internal Assessment : 40 Marks

End semester Examination : 60 Marks

Course Objective

1. To formulate a viable research question
2. To distinguish probabilistic from deterministic explanations
3. To analyze the benefits and drawbacks of different methodologies
4. To understand how to prepare and execute a feasible research project

Learning Outcomes

Upon successful completion of this course, students will be able to understand research concepts in terms of identifying the research problem, collecting relevant data pertaining to the problem, to carry out the research and writing research papers/thesis/dissertation.

MODULE I

Introduction to Research Methodology - Objectives and types of research: Motivation towards research - Research methods *vs.* Methodology. Type of research: Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, and Conceptual *vs.* Empirical.

Research Formulation - Defining and formulating the research problem -Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem. Literature review: Primary and secondary sources - reviews, treatise, monographs, patents. Web as a source: searching the web. Critical literature review - Identifying gap areas from literature review - Development of working hypothesis. (15 Hours)

MODULE II

Research design and methods: Research design - Basic Principles- Need for research design — Features of a good design. Important concepts relating to research design: Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction. Development of Models and research plans: Exploration, Description, Diagnosis, Experimentation and sample designs. Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection - Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-Testing -Generalization and Interpretation. (15 Hours)

MODULE III

Reporting and thesis writing - Structure and components of scientific reports -Types of report - Technical reports and thesis - Significance - Different steps in the preparation, Layout, structure and

Language of typical reports, Illustrations and tables, Bibliography, referencing and footnotes. Presentation; Oral presentation - Planning - Preparation -Practice - Making presentation - Use of audio-visual aids - Importance of effective communication.

Application of results of research outcome: Environmental impacts –Professional ethics - Ethical issues -ethical committees. Commercialization of the work - Copy right - royalty - Intellectual property rights and patent law - Trade Related aspects of Intellectual Property Rights - Reproduction of published material - Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

Re**ferences**

1. C. R. Kothari, *Research Methodology*, Sultan Chand & Sons, New Delhi,1990
2. Panneerselvam, *Research Methodology*, Prentice Hall of India, New Delhi, 2012.
3. J. W. Bames, *Statistical Analysis for Engineers and Scientists*, Tata McGraw-Hill, New York.
4. Donald Cooper, *Business Research Methods*, Tata McGraw-Hill, New Delhi.
5. Leedy P. D., *Practical Research: Planning and Design*, McMillan Publishing Co.
6. Day R. A., *How to Write and Publish a Scientific Paper*, Cambridge University Press, 1989.
7. Manna, Chakraborti, *Values and Ethics in Business Profession*, Prentice Hall of India, New Delhi, 2012.
8. Sople, *Managing Intellectual Property: The Strategic Imperative*, Prentice Hall of India, New Delhi, 2012.

BMC2001 BIOPROCESS PLANT DESIGN 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment : 40 marks

End semester examination : 60 marks

Objective

To facilitate better understanding of the various devices used, their working and the complications involved with respect to heat and mass transfer and biological reactions.

Course Outcome

Heat and mass transfer are fundamental unit operations. Thorough knowledge of the methods for carrying out these unit operations will help the student in the proper selection and design of the various biological reactors and separation equipments.

MODULE I

Heat exchangers - double pipe and shell and tube types; different parts, different flow patterns and influencing factors in the design; Evaporators, evaporator operation conditions and design concerns; use of Chemical Engineers' Handbook for the design of heat exchangers and evaporators.

MODULE II

Gas-liquid and liquid-liquid contacting columns; tray and packed columns; capacity ,flooding, entrainment, pressure drop; influencing factors ; turndown ratio; efficiency of contacting columns; Design of columns for a given internal material balance using Chemical Engineers' Handbook.

MODULE III

(Design Approach Only)

Design of bioreactors - stirred tank reactors, airlift bioreactor, fluidized bed bioreactor, packed bed bioreactor; Design of sterilizers-batch and continuous; Fermenter parts and design.

References

1. Perry's Chemical engineering hand book

2. Coulson and Richardson's Chemical Engineering Design Vol 6

3. Scragg A.H., Bioreactors in Biotechnology, Ellis Horwood Ltd, England

4. Peters Timmerhaus- Plant Design and Economics for Chemical Engineers

5. Mukhopadhyay, Process Biotechnology fundamentals, Viva Books

6. C. Judson King, Separation processes, TMH

Question Paper

The end semester question paper shall have total 6 questions covering the entire syllabus. Two questions, each for 20 marks, shall be there from each module .Student must answer one each from each module for a total marks of 60. Design problems (full or part) and theory shall form the basis of questions. Students can use Chemical Engineers' Handbook or similar data sources for answering problems.

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC2002 CONCEPTS AND PERSPECTIVES OF MOLECULAR MEDICINE 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment : 40 marks

End semester examination: 60 marks

Objective

The course integrates genetics, genomics, and molecular biology approaches to elucidate the pathogenesis of human diseases, and is intended to encourage students to unravel novel disease mechanism for improving management of human diseases.

Course Outcome

Students will understand the molecular mechanisms behind various life threatening diseases and thereby developing new strategies for disease management.

MODULE 1

Basic genetics and molecular biology relevant to molecular medicine: Mendelian inheritance and non-mendelian inheritance of diseases, polygenic inheritance and complex diseases, pedigree analysis, linkage, crossing over and gene frequency, Mutation and repair mechanisms. Human molecular genetics: Organization of human genome, human genome sequencing, Repetitive DNA, centromere and telomere, single nucleotide polymorphism, expressed sequence tags, Identification and mapping of disease genes, Genome comparison with other organisms and implications

MODULE II

Animals in research: animal models of diseases, transgenic and knockout animals, animal care and ethics in use of animals for research. Mutation analysis: Detecting, diagnosing and screening of human genetic disorders, high throughput expression analysis techniques. Gene therapy: general strategies, stem cell therapy, antisense &RNAi for therapy, genetic counseling, Ethics in human genetics, ELSI. Intellectual property rights, personalized medicine and System biology

MODULE III

Understanding diseases: Infectious diseases- Malaria, Avian flu, swine flu, AIDS; Metabolic disorders- Diabetes mellitus and inborn errors of phenylalanine metabolism; Carcinogenesis. Gene to protein to disease: Protein folding and degradation-chaperones & proteasome; RNA-splicing disorders; Polyglutamine disorders; Peptide aggregation disorders; Pathogenesis of prion diseases

References

1. Detlev Ganten, Klaus Ruckpaul; Encyclopedic Reference of Genomics and Proteomics in Molecular Medicine, Springer 2006
2. Bertrand Jordan; Travelling Around the Human Genome: An in Situ Investigation
3. Larry J. Jameson; Principles of Molecular Medicine, Springer-Verlag New York, LLC
4. R. J. Trent; Molecular Medicine: An Introductory Text
5. Alan David Blair Malcolm; Molecular Medicine, IRL Press, 1987
6. Molecular Medicine: Insight Into the Cellular and Molecular Basis of Disease Published by Baltimore, Md. : Johns Hopkins University Press
7. Dennis W. Ross, David Pounds; Introduction to Molecular Medicine.

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 2001 MOLECULAR BASIS OF GENETIC DISEASES AND METABOLIC DISORDERS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the diseases related to errors that occur in different metabolic pathways in humans and basic mechanism of pathogenesis, pre and post natal detection, diagnosis and treatment strategies.

Course Outcome

Students will get an in depth knowledge about the molecular basis of various genetic and metabolic disorders and also familiar with different therapeutic approaches.

MODULE 1

Inborn errors of metabolism, diseases associated with carbohydrate metabolism; diabetes mellitus, lactose intolerance, glycogen storage diseases, and other carbohydrate diseases. Disorders of amino acid and protein metabolism; phenyl ketonuria, alcaptonuria, urea cycle disorder, cystinuria. Disorders associated with mineral metabolism; calcium, magnesium, phosphorus, potassium, selenium; parathyroid and bone diseases.

MODULE II

Disorders of purine and pyrimidine metabolism; Lesch-Nyhan syndrome, adenine phosphoribosyl transferase deficiency, disorders of purine nucleotide synthesis, disorders of purine catabolism. Fatty acid and glycerol metabolism disorders; lipids and lipoprotein disorders, lipid storage diseases, atherosclerosis, lysosomal storage diseases, mucopolysaccharidoses, sphingolipidoses.

MODULE III

Disorders of acid-base balance. Disorders of water, electrolytes and urine. Membrane, organelle and cytoskeleton disorders; mitochondrial oxidative phosphorylation disorders.

Aging and associated diseases. Detection, diagnosis and screening of human genetic disorders; biochemical and genetic analysis

References

1. John B. Holton; The Inherited Metabolic Diseases
2. Rafael A. Camerini-Davalos, Rolf Luft; .Advances in metabolic disorders, Rachmiel Levine, Academic Press
3. Nessar Ahmed, Maureen Dawson, Chris Smith and Ed Wood; Biology of Disease
4. Robert K. Murray; Harper's Biochemistry
5. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer and Neil D. Clarke Biochemistry
6. Biochemistry, Donald Voet and Judith G. Voet

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS2002 MOLECULAR DIAGNOSTICS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the basic and advanced molecular techniques used for detection and diagnosis of genetic and infectious diseases.

Course Outcome

Students will be familiar with advanced techniques currently used in the biomedical field for the diagnosis of diseases.

MODULE 1

Introduction to molecular basis of diagnosis. Polymerase chain reaction techniques- types of PCR- Colony -PCR. Hot start PCR, Insitu –PCR, RT-PCR, REAL TIME –PCR, multiplex PCR, Nested PCR, DNA, RNA and protein blotting. Human genetic disorders and their detection-autosomal dominant disorders, autosomal recessive disorders, X linked disorders, Y linked disorders,

MODULE II

Tumour markers-.Alpha-fetoprotein (AFP), Bcr-abl, Beta-2-microglobulin (B2M), Beta-HCG, Bladder tumor antigen (BTA), CA 15-3, CA 27.29, CA 125, Calcitonin, Carcinoembryonic antigen (CEA), Epidermal growth factor receptor (EGFR), HER2 (also known as HER2/neu, erbB-2, or EGFR2), Human chorionic gonadotropin (HCG), Lactate dehydrogenase (LDH), Neuron-specific enolase (NSE), Prostate-specific antigen (PSA), Prostatic acid phosphatase (PAP). Detection of single nucleotide polymorphism, application of human genome project in disease diagnosis. *In vitro* translation, Oligonucleotide arrays on chips.

MODULE III

Diagnostic methods of Infectious diseases (viral, bacterial and fungal). Viral diseases-RNA and DNA viruses- Pox virus, herpes virus, retrovirus, hepatitis, adenovirus,

Bacterial diseases- Gram positive and negative bacteria causing human infections, Staphylococcal infections, Streptococcal infections, Vibrio cholera infections, Klebsiella infections, Salmonella infections, Shigella infections, Neisseria infections, Fungal diseases-cutaneous, sub-cutaneous and systemic infections. Histoplasma infections, Candida infections, Cryptococcus infections. Advantages and disadvantages of DNA-based diagnostic methods, Confocal Microscopy.

References

1. S. Jeffery, J. Booth, S. Myint; Molecular Diagnosis
2. Finbarr E. Cotter; Molecular Diagnosis of Cancer
3. Gregory J. Tsongalis, William B. Colema; Molecular Diagnostics: A Training and Study Guide
4. Jochen Decker, Udo Reischl; Molecular Diagnosis of Infectious Diseases
5. Rob Elles and Roger Mountford; Molecular Diagnosis of Genetic Diseases: Second Edition

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 2003 MOLECULAR HUMAN GENETICS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the human genome structure and function to treat genetic disorders.

Course Outcome

Students will understand the human genetics and different recombinant technologies.

MODULE 1

Introduction to Human Genetics, Basic laws of inheritance mono-hybrid, dihybrid and tri-hybrid ratios, Modification of Mendel's ratios due to gene interaction. Multiple factors of inheritance. Genes and environment. Organization of genetic material in Eukaryotes. Euchromatin and Heterochromatin.

MODULE II

Different banding techniques, Sex Determination, Sex differentiation and developments in humans, Dosage compensation, The human karyotype, Human chromosomal abnormalities, Human allelic disorders -recessive and dominant. Sex-linked traits, diagnosis of human genetic diseases.

MODULE III

Symbols used in pedigree analysis. Pedigree analysis of important genetic diseases like Haemophilia and Color blindness. Pharmacogenetics – definition, gene loci influencing drug metabolism and pharmacogenetic interactions. Eugenics, Eutheics, Euphenics and Genetic councelling. DNA Fingerprinting. Human Genome project and its importance in Molecular Medicine.

References

1. Milo Keynes, A.W.F. Edwards and Robert Peel; A Century of Mendelism in Human Genetics (Frontiers)

2. Redei and George P.; Encyclopedia of Genetics, Genomics, Proteomics, and Informatics
3. Bertrand Jordan; Travelling Around the Human Genome: An in Situ Investigation
4. Reginald Ruggles Gates; Human Genetics
5. M. Jackson, T. Strachan, and G. Dover; Human Genome Evolution (Human Molecular Genetics)

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS2004 IMMUNOTECHNOLOGY 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the components and function of the immune system, techniques for diagnosis and detection of pathogens, immune system disorders and vaccine development.

Course Outcome

The course will enable the students to understand the immune responses of the human body caused by applications of bio-incompatible materials and health care products

MODULE 1

Introduction to Immunology, cells and organs involved in immune system, Antigens- structure and properties, Antibodies - Fine structure, heterogeneity, mechanism of heterogeneity; types and subtypes and their properties, Antibody engineering, Major histocompatibility complex, Complement system - structure, components, properties and functions of complement. Role of cytokines and hormones in immunomodulation.

MODULE II

Immuno diagnostic techniques: agglutination, precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA (Indirect, Sandwich, Competitive, Chemiluminiscence, ELISPOT assay), radioimmunoassay, western blotting, flowcytometry, immuno electron microscopy.

MODULE III

Different types of hypersensitivity reactions, Immunohaematology - blood groups- ABO and Rh, blood group incompatibilities, Tissue typing methods for organ and tissue transplantations in humans, mechanisms of graft versus host reaction and rejection; Immunology of HIV infection and immune evasion. Common immunizations- active and

passive methods; immunological preparations-toxoids, antisera, polyclonal and monoclonal antibodies; vaccines- conventional and modern types of vaccines.

References

1. Kuby, J.; Immunology
2. Abdul, K. Abbas, Andrew K. Lightman, Jordan S. Pober.; Cellular and Molecular Immunology
3. Goding, J.V.; Monoclonal antibodies: Principles and Practice
4. Sringer, T.A.; Hybridoma technology in the Biosciences and Medicine
5. Stites, D.P., Stobo,J.D., Fudenberg, H.H. and Wells, J.V.; Basic and clinical Immunology
6. Ivan Roitt, Jonathan Brostoff and David Male; Immunology
7. Paul W.E.; Fundamentals of Immunology
8. Harlow and David Lane; Antibodies: A laboratory Manual

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 2005 MOLECULAR ENDOCRINOLOGY 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the human endocrine system, the hormones –basic structure and function, the diseases related to molecular errors in the endocrine pathways.

Outcome of paper

Students will understand the molecular mechanisms of hormonal action and the diseases associated with hormonal action.

MODULE 1

Introduction to endocrinology; chemical classes of hormones, amino hormones, peptide hormones and steroid hormones. Molecular mechanism of hormonal action; membrane receptors, nuclear hormone receptors, receptor-ligand interactions, co-activators and co-repressors.

MODULE II

Recent advances in endocrinology; receptor regulation and degradation. Steroid hormone receptors in health and disease. Molecular basis of endocrinopathies. Diseases associated with hormone regulation.

MODULE III

Prostate and breast cancer. Ligand-independent transcriptional activation of steroid hormone receptors. Selective steroid receptor modulators and endocrine disruptors.

References

1. De Groot; Endocrinology, Elsevier Publications
2. Bruce D. Weintraub; Molecular Endocrinology: Basic Concepts and Clinical Correlations
3. Gill Rumsby and Sheelagh M. Farrow; Molecular Endocrinology: Genetic Analysis of Hormones and Their Receptors

4. Brian E. Henderson, Bruce A. J. Ponder, Ronald K. Ross; Hormones, Genes, and Cancer
5. Anthony R. Means, Bert W. Malley; Current Topics in Molecular Endocrinology

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 2006 NANOBIOTECHNOLOGY 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

The course aims to introduce different nanomaterials and their biomedical applications to students which will be beneficial for the development of many site directed therapy devoid of side effects.

Course Outcome

Students will be familiar with different approaches in the synthesis of nanomaterials and the development of nanobased diagnostic and therapeutic tools.

MODULE 1

Introduction to Nanotechnology and Nanomedicine, Visualization and Manipulation on Nanoscale. Unique properties of nanomaterials; magnetic, electrical, thermal and mechanical properties. Approaches for the synthesis of nanomaterials; bottom up approaches and top-down approaches, tools for the characterization of nanomaterials; Atomic Force Microscopy (AFM), Magnetic Resonance Force Microscopy, Scanning Probe Microscopy, Scanning Electron Microscopy, TEM, scanning tunneling microscopy (STM), XRD.

MODULE II

Different types of nanomaterials and their biomedical applications. Nanomolecular diagnostics; nanoparticles for molecular diagnostics, gold nanoparticles, quantum dots, magnetic nanoparticles, nanobarcode technology. Nanobiosensors; cantilevers as biosensors for molecular diagnosis, carbon nanotubes, FRET based DNA nanosensors, viral nanosensors, PEBBLE nanosensors, optical nanosensors. Nanopharmaceuticals; drug delivery by using gold nanoparticles, QDs, dendrimers, fullerenes, liposomes, nanoshells, targeted drug delivery using nanoparticles. Nanoparticle based therapies; stem cell therapy, gene therapy, nanomachines for gene delivery, antisense therapy, RNA

interference; nanoparticle siRNA delivery, nanodevices for medicine and surgery. Fluorescent Nanoparticles, Bacterial Structures Relevant to Nanobiotechnology, Cubosomes, Dendrimers, DNA–Nanoparticle Conjugates, DNA Octahedron, Fullerenes, Nanoshells, CarbonNanotubes , Nanopores, Nanostructured Silicon and Molecular Motors.

MODULE III

Nanostructures for Tissue Engineering/Regenerative Medicine; nanobiomaterials for tissue engineering, replacement of diseased tissue, cell culture and in vitro tissue development, development of skn. Ethical, Safety, and Regulatory Issues of Nanomedicine; biocompatibility of nanomaterials.

References

1. Oded Shoseyov and Ilan Levy; .Nanobiotechnology: Bioinspired Devices and Materials of the Future, Humana Press; 1 edition (2007)
2. M. Reza Mozafari; Nanomaterials and Nanosystems for Biomedical Applications, Springer; 1 edition (2007)
3. Kewal K. Jain; The Handbook of Nanomedicine, Humana Press
4. Elisabeth S. Papazoglou, Aravind Parthasarathy; Bio Nanotechnology, Morgan & Claypool Publishers,
5. Kenneth E. Gonsalves, Craig R. Halberstadt, Cato T. Laurencin, Lakshmi S. Nair; Biomedical Nanostructures, Wiley & Sons Inc.
6. Rolando Barbucci; Integrated Biomaterials Science, Springer
7. Vijay K. Varadan, Linfing Chen, Jining Xie; Nanomedicine: Design and Applications of Magnetic Nanomaterials, Nanosensors and Nanosystems, Wiley

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMD 2001 ADVANCED FERMENTATION ENGINEERING 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the mechanism of cell growth kinetics, scale up of processes in industry and physic-chemical parameters that determine production.

Course Outcome

The aims of the course are to review fundamentals and provide an up-to-date account of current knowledge in biological and biochemical technology. The lectures will emphasize and place perspectives on biological systems with industrial practices.

MODULE 1

Introduction to fermentation processes- classification – aerobic and anaerobic fermentation, submerged and solid state fermentation - Cell kinetics-batch growth, balanced growth-effect of substrate concentration-Monod equation.-growth kinetics with plasmid instability-production kinetics-structured and unstructured models.

MODULE II

Design equations for ideal reactors-batch fermenter, chemostat, fed-batch fermenter, chemostat with cell recycle, plug flow reactor for cell culture. Sterilization reactors- batch and continuous, Immobilized cell bioreactor, packed bed, bubble column reactors, fluidized bed bioreactor, trickle bed reactor.

MODULE III

Selection criteria for fermentation air filters-air sterilization, principle and design-scale-up of stirred tank fermenters, Convective mass transfer, gas- liquid mass transfer-rates of metabolic oxygen utilization-oxygen transfer in fermenters, determination of oxygen transfer rates, measurement of KLa, factors affecting KLa, estimation of power requirement for sparged and agitated vessels. Chemical and physical factors affecting mass transfer.

References

1. James E. Bailey and David F. Olis, Biochemical Engineering Fundamentals (2nd Edition) , Mc Graw Hill International Series
2. Paulin M Doran,Bioprocess Engineering Principles - Academy Press
3. Michael L shuler,Fikert kargi,.Bioprocess Engineering,peason education international services
4. StanburryP F, Stefan J Hall and A Whitaker, Principles of Frmentation Technology
5. Muo – Young ,Comprehensive Biotechnology –(ed) Pergamon Press

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMD2002 MODELLING AND SIMULATION OF PROCESS PLANTS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment : 40 marks

End semester examination: 60 marks

Objectives

To understand the fundamentals and basic modeling techniques in different systems.

Course Outcome

This subject will lead to the analysis and understanding of observed phenomena and testing of hypotheses and theories.

MODULE 1

Basic modeling principles – uses of mathematical modeling- classification of modeling techniques- fundamental laws- energy equations – continuity equation – equations of Cmotion- transport equations- equations of state- equilibrium states and chemical kinetics – examples.

MODULE II

Mathematical models for chemical engineering systems – continuous flow tanks-enclosed – enclosed vessel- mixing vessel- mixing vessel- mixing with reaction-reversible reaction – steam jacketed vessel- boiling of single component liquid – open and closed vessel – continuous boiling system- batch distillation.

MODULE III

Gas flow systems – hydraulic transients between two reservoirs-reaction kinetics-general modeling scheme-liquid phase CSTR-batch reactor-ideal binary distillation column-distributed systems-jacketed tubular reactor-laminar flow in a pipe-counter current heat exchanger. Digital simulation-numerical integration-Euler and fourth order Runge Kutta methods-simulation of gravity flow tank-CSTR in series- non isothermal CSTR- binary distillation column-batch reactor.

References

1. Luyben W.L., Process Modelling Simulation and Control for Chemical Engineers, McGraw Hill.
2. Franks R.G.E., Mathematical Modelling in Chemical Engineering, John Wiley
3. JohnIngham et.al.,Chemical Engineering Dynamics- Modelling with PC Simulation,VCH publishers.
4. Biquette W.B.,Process Dynamics- Modelling Analysis and Simulation, Prentice Hall.

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered

BMD2003 PROCESS CONTROL AND INSTRUMENTATION FOR BIOPROCESSES 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To understand the fundamentals of process control as applied to bioprocesses in the industry.

Course Outcome

Small changes in a process can have a large impact on the end result. Variations in proportions, temperature, flow, turbulence, and many other factors must be carefully and consistently controlled to produce the desired end product with a minimum of raw materials and energy. Process control technology is the tool that enables manufacturers to keep their operations running within specified limits and to set more precise limits to maximize profitability, ensure quality and safety.

MODULE 1

Monitoring of bioprocess: different types of fermentation-common measurements and control systems, additional sensers, redox, airflow, weight, pressure.Online data analysis for measurement of important physico-chemical and biochemical parameters.

MODULE II

Methods of on-line and off-line biomass estimation. Flow injection analysis for measurement of substrates, products, and other metabolites-state and parameter estimation techniques for biochemical processes-biosensors in bioprocess monitoring, biosensors based on thermal effects, optical effects, potentiometric biosensors, amperometric biosensors, enzyme electrodes, transducers, electrochemical probes.

MODULE III

Control of fermentation; requirement of control, nature of control, control loop strategy, typical fermentation sensors, control action, types of control, feedback and feed forward

control loop, different types of controllers,P,PI,PD and PID.controller characteristics and tuning, ultimate gain method, fermentation control system objectives-fermenter control specification, control of incubation, specification for incubation control, advanced incubation control-fermentation profile, event tracking control, Boolean control and rule generation-other advanced fermentation control

References

1. A.E.G. Cass; Biosensors: A practical Approach, Oxford University Press
2. Donald R. Coughanowr, Lowell B. Koppel; Process system analysis and control
3. Ernest F. Johnson; Automatic process control

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMD 2004 TRANSPORT PHENOMENON IN BIOPROCESS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objectives

The objective of this course it to provide a fundamental understanding of the convection and diffusion processes in fluids, and how these determine the rates of transport of mass, heat and momentum. Principles are developed and illustrated here for the rational design of engineering equipments.

Course Outcome

Transport phenomena actually encompass all agents of physical change in the universe. Moreover, it is considered to be fundamental building block which developed the universe, and which is responsible for the success of all life on earth. Process control in a bioreactor depends on the transport phenomena involved in the reactor and the students will learn this from this subject.

MODULE 1

Momentum Transport: Velocity distribution in laminar flow: Shell momentum balances: boundary conditions, flow of a falling film, flow through a circular tube, flow through an annulus, Mechanism of momentum transport: Newton's Law of Viscosity, Non- Newtonian fluids different models for Non-Newtonian flow, rheological properties of fermentation broth, factors affecting broth viscosity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Bubbles and drops - bubble formation, break-up and coalescence; bubble rise velocities; interfacial area and hold-up in agitated and non-agitated systems; General transport equation for momentum, derivation of continuity equation, Analysis of equation of motion in rectangular coordinates (derivation not desired), Navier Stoke's equation and Euler equation with significance of each terms.

MODULE II

Mass Transport: Shell mass balances: Boundary conditions, diffusion through a stagnant gas film, diffusion with heterogeneous chemical reaction, diffusion with homogeneous chemical reaction, diffusion into a falling liquid film, diffusion and chemical reaction inside a porous catalyst: the effectiveness factor. Molecular diffusion, diffusion theory, Analogy between mass heat and momentum transfer, film theory. Scaling of mass transfer equipment.

MODULE III

Convective mass transfer, gas- liquid mass transfer-rates of metabolic oxygen utilization-oxygen transfer in fermenters, determination of oxygen transfer rates, measurement of K_La, factors affecting K_La, estimation of power requirement for sparged and agitated vessels, transport bottlenecks in bioprocesses, Chemical and physical factors affecting mass transfer, heat transfer in biological systems.

References

1. James E. Bailey and David F. Olis; Biochemical Engineering Fundamentals (2^{nd} Edition) Mc Graw Hill International Series
2. Pauline M. Doran; Academy Press- Bioprocess Engineering Principles
3. Shuchi Aiba, Aruther E. Humphrey, Wancy F Millis; Biochemical Engineering, Academy Press
4. Muo Young; Comprehensive Biotechnology –(ed) Pergamon Press
5. Bird R. B., Stewart W. E. and Lightfoot R. N.; Transport Phenomena, John Wiley and Sons.
6. John C Slattery; Momentum, Energy and Mass transfer in continua, McGraw Hill, Co.

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC 2101 ADVANCED BIOCHEMICAL ENGINEERING LAB 0-0-3-3

Structure of the course

Lab: 3 h/week Credits: 1

Internal continuous assessment: 100 marks

1. HPLC for qualitative analysis of
a. Drug components (min 2 components)
b. Phytochemicals (min 3 chemicals)
2. Affinity Chromatography for purification of Horse radish peroxidase using concanavalin agarose columns
3. Gel Chromatography for separation of plant pigments and qualitative analysis of the plant pigments.
4. Ion Exchange Chromatography for purification of lysozyme using CM cellulose column
5. Protein purification using ammonium sulphate precipitation and Desalting by dialysis
6. Quantification of biomolecules using UV Spectrophotometer
7. Thin Layer Chromatography for separation of amino acids

FERMENTATION EXPERIMENTS

1. Kinetics of growth in a batch reactor.
2. Kinetic study of ICR (Immobilized cell reactor) and comparison with CSTR
3. Estimation of Monod Kinetics and yield coefficient calculation using:
1. Submerged fermentation
2. Immobilized cell reactor
3. Solid state fermentation
4. Volumetric oxygen transfer coefficient calculation in the fermenter and comparison with different media.
5. Power/ mixing time calculation for CSTR/ fermenter
6. Adsorption experiment using biological molecules and HETP calculation/ column design.

7. Media optimization/ Media engineering/ Plackett Burman Techniques

Marks: Continuous evaluation: 100 (Attendance - 10, Record – 20, Test- I and viva- voce – (20+15) 35 marks, Test- II and viva- voce- (20 +15) 35 marks)

Reference

1. Scragg A.H.; Bioreactors in Biotechnology , ellis Horwood Ltd , England
2. Resnick; Process analysis and design for Chemical Engineers
3. Sadavisam and Manickam, 2008. Biochemical methods, New age international publishers.
4. John M Walker, 2002. The protein protocol handbook, Humana press
5. Ghasem D. Najafpour; Biochemical Engineering and Biotechnology
6. Juan A. Asenjo; Separation Processes in Biotechnology
7. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, Demetri Petrides; Bioseparations Science and Engineering

BMC2103 THESIS PRELIMINARY: PART-I

Structure of the Course

Thesis: 2 hrs/week Credits : 2

Internal Continuous Assessment: 100 Marks

For the Thesis-Preliminary part I the student is expected to start the preliminary background studies towards the Thesis by conducting a literature survey in the relevant field. He/she should broadly identify the area of the Thesis work, familiarize with the design and analysis tools required for the Thesis work and plan the experimental platform, if any, required for Thesis work. The student will submit a detailed report of these activities at the end of the semester.

Distribution of marks

Internal assessment of work by the Guide: 50 marks

Internal evaluation by the Committee: 50 Marks

BMC2103 SEMINAR

Structure of the Course

Duration: 2 hrs/week Credits: 2

Continuous Assessment: 100 Marks

The student is expected to present a seminar in one of the current topics in the stream of specialization. The student will undertake a detailed study based on current published papers, journals, books on the chosen subject, present the seminar and submit seminar report at the end of the semester.

Distribution of marks

Seminar Report Evaluation - 40 marks

Seminar Presentation - 60 marks

SEMESTER-III

BMS 3001 MOLECULAR CARCINOGENESIS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To familiarize the students on various aspects of carcinogenesis, molecular basis of carcinogenesis, its detection and treatment.

Course outcome : The students will have more in-depth understanding of the process of carcinogenesis, helping them in pursuing further research in the field.

MODULE I

Regulation of Cell cycle-factors controlling entry into various phases, proteins required for cell division, cell cycle control, mutations that cause changes in signal molecules, effects on receptor, modulation of cell cycle in cancer. Different forms of cancers, Diet and cancer. Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, oncogenic activation of signaling molecules, Growth factors related to transformations, tumour suppressor genes-Retinoblastoma gene, Ras gene, inhibitors of Ras, p53 and p19.

MODULE II

Chemical Carcinogenesis-genotoxic, non-genotoxic, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis-three stages of radiation carcinogenesis-physical stage, chemical stage, cellular and tissue stage, transformation of a normal cell to a cancerous cell- properties of normal cells and cancerous cells, Neoplastic cells, tumour angiogenesis, reasons for metastasis.

MODULE III

Detection of cancers, prediction of aggressiveness of cancer, genomic approaches in cancer biology, tumour markers, advances in cancer detection. different forms of therapy,

chemotherapy, chemo-sensitisation, radiation therapy and Immunotherapy: advantages and limitations.

references:

1. Virology a practical approach, Maly B.W.J.
2. Introduction to modern Virology, Dunmock N.J and Primrose.S.B.
3. An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical publications
4. Molecular Mechanisms of Cancer, George F. Weber
5. A Practical Guide to Human Cancer Genetics, Shirley Hodgson, William Foulkes, CharisEng and Eamonn Maher
6. Introduction to the cellular and molecular biology of cancer. 3rd ed., LM Franks and NM Teich, Oxford University press
7. Hormones, Genes and Cancer. 2003. Brian E Henderson et al. Oxofrd University Press
8. Cancer Systems Biology. 2010. Edwin Klang. CRC press

Question Paper:

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 3002 NEUROBIOLOGY 3-0-0-3

structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

objective

The course creates awareness about the structural and functional organization of the nervous system at cellular and molecular level, as well as, the relevance of neuronal development, genetics and cognitive science in understanding the complex nature of brain.

course outcome:

The developments in the field of neurobiology will be put in the right perspective for the keen minds.

MODULE I

Concept of neurobiology; Levels of neuronal organization; Central and Peripheral nervous systems- structural & functional aspects; Ventricular system & cerebrospinal fluid; Neurons and glial cells- types, structure & function; Axonal transport; Conduction of impulse by neurons: Neuronal signaling & Membrane potentials; Action potential, Synapse & synaptic transmission, Neurotransmitters & its receptors. Channels & Transporters: Voltage-gated & ion-gated channels, Molecular structure & function of channels, Channelopathies, ATPase pump & ion exchangers, Na/K pump electrogenic activity.

MODULE II

Correlation of sensory functions: Vision, Audition, Vestibular sense, Chemosensation by olfaction, gustation & trigeminal, Somatic sensory system, Nociception. Molecular and cellular basis of neuronal differentiation: Primitive layers, Neurulation, Inductive signals, Brain subdivision development, Neuronal & glial differentiation, Neurogenesis, Neuronal birthday, Generation of neuronal diversity, Neuronal migration, Axonal growth and synapse formation

MODULE III

Genetics as tool in Neurobiology: genetic causes for defects in neuronal development, channelopathy, triplet repeat disorders and apoptotic neuronal death defects; Molecular basis of degenerative diseases- Parkinson disease and Alzheimer's disease. Cognitive neuroscience: Learning & memory, Communication & speech, Emotions. Techniques in Neurobiology: Electrophysiology including extracellular & intracellular recording and patch clamp techniques; Visualization of nervous system structure by in situ hybridization and immunohistochemistry; Visualization of nervous system function- imaging voltage, calcium and synaptic transmission

.

References:

1. Neuroscience. Dale Purves, George J Augustine, David Fitzpatrick
2. The Nervous System: How it works. F Fay Evans Martin
3. Neuroscience- Instant notes. A Longstaff
4. Neurobiology. G.M Shepherd
5. Principles of Neural science. Eric R Kandel et al
6. Neuroinformatics, ChiquitoJoaqiumCrasto
7. Neuroengineering, Daniel J. DiLorenzo and Joseph D. Bronzino
8. The Human Nervous System: Structure and Function. Charles R. Noback, Norman L. Strominger, Robert J. Demarest and David A. Ruggiero
9. Alzheimer's Disease: A Century of Scientific and Clinical Research, George Perry, Jesús Avila, June Kinoshita and Mark A. Smith.
10. Hand Book of Parkinson's Disease, Rajesh Pahwa and Kelly E. Lyons
11. Guide to research techniques in neuroscience, Matt Carter and Jennifer C Shieh, Elsevier Academic Press

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 3003 INTELLECTUAL PROPERTY RIGHTS 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objectives

To impart knowledge on bioethics and intellectual property rights and to study the various ethical issues occurring in biotechnology

Course outcome: The awareness about the practical aspects of intellectual property rights will be instilled in the students.

MODULE I

Biotechnology and Bioethics. (Animal Rights, Environmental Ethics, Decision Making) – Ethical Aspects of Designer Babies, genetic screening and prenatal testing – issues of ethics in biomedicine. Transgenic plants.The debates on GM foods.Terminator technology, Ethical, issues of the Human Genome Project.Ethical issues in pharmaceutical drug research.Orphan drugs.

Intellectual Property Rights – Development and need for IPR in knowledge based industries. Various types of intellectual Property Rights with examples (Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels) – Objectives of the patent system – Basic principles and general requirements of Patents (Novelty, Utility Non obviousness. Etc) and tenets of patent law – Product and Process Patents)

MODULE II

The patenting process in India – Exercising and enforcing of Intellectual Property Rights.Rights of IPR owner Brief overview of patent filing in India.Criteria for patent infringement – Various Amendments to Patent Law in India.Comparison of Patent Law in India and the US. International conventions and treaties: International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities - General Agreement on Trade and Tariff (GATT),TRIPS. Evolution and present status.WIPO and its functioning.CBD Treaty.Paris and

Berne Conventions Enforcement and Dispute Settlement in WTO – Patent Cooperation Treaty IPR and WTO regime.

MODULE III

Biotechnological inventions and patent law – patentable subjects and protection in biotechnology.The patentability of microorganisms -Traditional knowledge Systems (TKS) – Options for protection of Traditional Knowledge Systems.Need for Sui Generis Systems.TKS and the National and International Arena.

References

1. *Ethical Issues in Biotechnology*. Edited by Richard Sherlock and John D.Morrey. 2002Publishers Lanham, Md: Rowman and Littlefield.
2. J.Rehm and G.Reed, *Biotechnology*, Second Edition, Multi Volume Treatise, Volume 12Legal Economic and Ethical Dimensions, VCHPublishers.
3. PrabuddhaGanguli*Intellectual Property Rights-Unleashing the Knowledge Economy*. TataMcGraw Hill Publishing Company Limited, New Delhi.
4. Beier, F.K, Crespi, R.S and Straus, T.*Biotechnology and Patent protection* – Oxford and IBH Publishing Co. New Delhi.
5. Sasson A, *Biotechnologies and Development*, UNESCO Publications.
6. Jeffrey M.Gimble, *Academia to Biotechnology*, Elsevier, Academic Press.
7. N.R. Subbaram," Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers andPublishers) Pvt. Ltd., 1998.
8. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
9. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 3004 STEM CELL BIOLOGY 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective:

The characterization, identification, maintenance and application of different stem cells will be imparted to the students.

Course outcome:

The students will get an in-depth knowledge of the origin of stem cells, differentiation patterns and how to use them in curing diseases due to cellular defects.

MODULE I

Stem Cells: Origin, Identification, Isolation, Characterization and maintenance of Embryonic stem cells, Adult stem cells, Epithelial stem cell –skin and intestinal stem cells, Induced pluripotent stem cells, Hematopoietic stem cells, Mesenchymal stem cells and Neural stem cells (NSC). Cancer stem cells.

MODULE II

Molecular bases of pluripotency, Stem cell niches within mammalian tissues– Mammalian testis, HSC, Epidermis hair follicle, Gut epithelium and Neural stem cells. Metaplasia and transdifferentiation – pancreas to liver, regeneration, experimental conversion of a cells phenotype.

MODULE III

Clinical translation of stem cells: Therapeutic cloning using stem cells, Cord blood transplantation & cord blood banking, Stem cells for clinical regeneration and repair, organ cloning, tissue engineering, Use of embryological stem cells in pharmacological and toxicological screens, Regulation and ethics of stem cell research and its applications.

References

1. Essentials of stem cell biology - Robert Lanza
2. Stem Cell Biology and Gene Therapy, Edited by Peter J. Quesenberry, Gary S. Stein, Bernard G. Forget, Sherman M. Weissman.
3. Embryonic Stem Cell Protocols, Volume 1: Isolation and Characterization Edited by KursadTurksen.
4. Stem Cell Repair and Regeneration, Edited by Nagy A Habib, NatasaLevicar, Myrtle Y Gordon, Long Jiao and Nicholas Fisk.
5. Stem Cells, Human Emryos and Ethics Edited by Lars Ostnor
6. Stem Cells: From *Hydra* to Man, Edited by Thomas C. G. Bosch.
7. Stem Cell Biology, Edited by Daniel R. Marshak , Richard L. Gardner and David Gottlieb.
8. www.isscr.org

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 3005 ADVANCED GENETIC ENGINEERING 3-0-0-3

Structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

Objective

To have an understanding of the basic molecular biology and the relevant tools for analyzing and manipulating at genetic level.

Course outcome:

The students will be adept in advanced genetic engineering techniques and the possibilities in genetic manipulations to treat incurable diseases.

MODULE I

Gene Regulation and Expression in Prokaryotes- Lactose, Arabinose and Tryptophan operons, Repressors and activator, Gene regulation in Eukaryotic system, Repetitive DNA, Promoters, enhancer elements, gene amplification. Transposons, Applications of transposons, Retrotransposons.

MODULE II

Vectors for Gene Transfers.Purification of genomic DNA from living cells, Manipulation of purified DNA; Construction of prototype vector (pBR 322), Different types of cloning vectors (plasmid – pUC 19, λ phage, Cosmid, M13, Phasmid, Phagemid, YAC and BAC). Enzymes involved in genetic engineering; cloning strategies, Introduction of DNA into living cells. Methods of Gene transfer, Restriction mapping. Expression of cloned genes in yeast &E.coli. Blot analysis - Southern, Northern & Western blot; dot and slot blot. Genomic and cDNA library construction and application.DNA sequencing. Molecular markers: RFLP, RAPD, AFLP, 16S rRNA typing, gene chip and micro array; applications in disease profile.

MODULE III

Introduction to Gene therapy (Ex vivo &In vivo), case study of ADA as an example. Advantages and limitations of Gene therapy.basic molecular mechanism of gene transfer, prerequisite of

human gene therapy, biological basis of gene therapy strategies, vehicles for gene transfer, clinical gene therapy studies, gene therapy for hereditary disease, gene therapy for cancer, gene therapy for HIV.

References:

1. Principles of Gene manipulation: An introduction to Genetic engineering, Old RW and Primrose SB
2. Gene Cloning, T.A. Brown.
3. Molecular Cell Biology – Gerald Carp.
4. Genes X, Benjamin Lewin

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMS 3006 MOLECULAR BASIS OF INFECTIOUS DISEASES 3-0-0-3

structure of the course

Lecture: 3 h/week Credits: 3

Internal continuous assessment: 40 marks

End semester examination: 60 marks

objective

To introduce the basic biology of the infectious organisms, antigenicity, genome organization, host pathogenicity and mechanism of infection.

course outcome:

The students will have better appreciation of the pathogenesis mechanism of various diseases, which is relevant in therapeutic strategies

MODULE I

Fungal, parasitic, bacterial and viral genetics; Morphology and antigenic determinants of bacteria, virus and fungus; bacteria- *Staphylococcus, Streptococcus, Vibrio cholera, Klebsiella pneumonia, Neisseria meningitides,Salmonella, Shigella.Viruses-Herpesvirus, Hepatitis virus, Pox virus, Adeno virus, Retrovirus.Fungus- Cryptococcus, Candida albicans, Histoplasma*.

MODULE II

The bacterial genome, gene organization (operons, cistrons), DNA replication, mutation & repair (types of mutations, mutagens, DNA repair processes); Gene transfer (transposons, extrachromosomal elements, mechanisms of DNA exchange, recombination, genetic engineering, etc.).Pathogenesis of bacterial infections

MODULE III

Host defense mechanisms against infections; Different stages of viral infections; Host defense and its control; Mechanisms of fungal pathogenesis its control, parasitic infections and its control;Bacterialadhesins, virulence factors.Protein and DNA secreting systems and pathogenicity island; Molecular approaches in clinical microbiology;Molecular mechanism for HIV infection and molecular approaches for its control, gene therapy.

References:

1. Molecular basis of Bacterial pathogenesis, Iglewski B.H. and Clark V.L.
2. Foundations in Microbiology, Talaro K. and Talaro A.
3. Essentials of Immunology, Roitt I.
4. Principles Cellular and Molecular Immunology, Austyn J.M. and Wood K.J.
5. General Microbiology. Hons. G.Schlege.
6. General Microbiology. Prescott and Dunn Biology of Disease, Nessar Ahmed, Maureen Dawson, Chris Smith and Ed Wood.

Question Paper

The end semester question paper totaling 60 marks shall have three questions of 10 marks each, from each of the three modules - out of which any two need to be answered. It shall have questions on problems/theory (50%) and applications (50%).

For continuous evaluation, a minimum of four assignments and two tests should be considered.

BMC3101 THESIS PRELIMINARY: PART II

Structure of the Course

Thesis: 14 hrs/week Credits: 5

Internal Continuous Assessment: 200 Marks

The Thesis Preliminary Part - II is an extension of Thesis Preliminary Part - I. Thesis Preliminary Part II comprises preliminary thesis work, two seminars and submission of Thesis - Preliminary report. The first seminar would highlight the topic, objectives and methodology and the second seminar will be a presentation of the work they have completed till the third semester and the scope of the work which is to be accomplished in the fourth semester, mentioning the expected results.

Distribution of marks

Internal assessment of work by the Guide: 100 Marks

Internal evaluation by the Committee: 100 marks

SEMESTER IV

EDC4101 THESIS

Structure of the Course

Thesis: 21 hrs/week Credits: 12

Internal Continuous Assessment: 300 Marks

End Semester Examination: 300 Marks

The student has to continue the thesis work done in second and third semesters. There would be an interim presentation at the first half of the semester to evaluate the progress of the work and at the end of the semester there would be a pre-Submission seminar before the Evaluation committee for assessing the quality and quantum of work. This would be the qualifying exercise for the students for getting approval from the Department Committee for the submission of Thesis. At least once technical paper is to be prepared for possible publication in Journals/Conferences. The final evaluation of the Thesis would be conducted by the board of examiners constituted by the University including the guide and the external examiner.

Distribution of marks

Internal evaluation of the Thesis work by the Guide: 150 Marks

Internal evaluation of the Thesis by the Evaluation Committee: 150 Marks

Final evaluation of the Thesis Work by the Internal and External Examiners:
[Evaluation of Thesis: 200 marks *+ Viva Voce: 100 marks (**5% of the marks is earmarked for publication in Journal/Conference*)] TOTAL – 300 Marks