



GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

Regulations, Curriculum and Syllabi For Full Time B.Tech Industrial Biotechnology

2012

Regulations

**Office of The Controller of Examinations
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE - 641 013**

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**BACHELOR OF TECHNOLOGY
INDUSTRIAL BIOTECHNOLOGY
CURRICULUM**

(Full Time Candidates admitted during 2012 - 2013 and onwards)

FIRST SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B1Z1	Communication Skills in English - I	25	75	100	3	1	0	4
2	12B1Z2	Engineering Mathematics - I	25	75	100	3	1	0	4
3	12B103	Applied Physics	25	75	100	3	0	0	3
4	12B104	Human Anatomy & Physiology	25	75	100	3	0	0	3
5	12B105	Fundamentals of Electrical and Electronics Engineering	25	75	100	4	0	0	4
6	12B106	Programming in C	25	75	100	3	1	0	4
		PRACTICAL							
1	12B107	Physics Laboratory	25	75	100	0	0	3	2
2	12B108	Communication Skills and Technical Seminar	25	75	100	0	0	3	2
3	12B109	C Programming Laboratory	25	75	100	0	0	3	2
		TOTAL			900				28

SECOND SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B2Z1	Communication Skills in English - II	25	75	100	3	1	0	4
2	12B2Z2	Engineering Mathematics - II	25	75	100	3	1	0	4
3	12B203	Biochemistry - I	25	75	100	3	0	0	3
4	12B204	Materials Technology	25	75	100	3	0	0	3
5	12B205	Applied Chemistry for Biotechnology	25	75	100	3	0	0	3
6	12B206	Process Calculations	25	75	100	3	1	0	4
		PRACTICAL							
1	12B207	Workshop	25	75	100	0	0	3	2
2	12B208	Chemistry Laboratory	25	75	100	0	0	3	2
3	12B209	Biochemistry Laboratory	25	75	100	0	0	3	2
		TOTAL			900				27

THIRD SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B3Z1	Engineering Mathematics - III	25	75	100	3	1	0	4
2	12B302	Fluid Mechanics and Mechanical Operations	25	75	100	3	1	0	4
3	12B303	Basics of Industrial Biotechnology	25	75	100	3	0	0	3
4	12B304	Cell Biology	25	75	100	3	0	0	3
5	12B305	Bio - Organic Chemistry	25	75	100	3	0	0	3
6	12B306	Microbiology	25	75	100	3	0	0	3
		PRACTICAL							
1	12B307	Bio - Organic Chemistry Laboratory	25	75	100	0	0	3	2
2	12B308	Cell Biology Laboratory	25	75	100	0	0	3	2
3	12B309	Microbiology Laboratory	25	75	100	0	0	3	2
		TOTAL			900				26

FOURTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B401	Probability, Statistics and Random Processes	25	75	100	3	1	0	4
2	12B402	Environmental Science and Engineering	25	75	100	3	0	0	3
3	12B403	Chemical Engineering Thermodynamics	25	75	100	3	1	0	4
4	12B404	Unit Operations	25	75	100	3	1	0	4
5	12B405	Instrumental Methods of Analysis	25	75	100	3	0	0	3
6	12B406	Molecular Biology	25	75	100	3	0	0	3
		PRACTICAL							
1	12B407	Instrumental Methods of Analysis Laboratory	25	75	100	0	0	3	2
2	12B408	Molecular Biology Laboratory	25	75	100	0	0	3	2
3	12B409	Unit Operations Laboratory	25	75	100	0	0	3	2
		TOTAL			900				27

FIFTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B501	Bioinformatics	25	75	100	3	1	0	4
2	12B502	Enzyme Engineering & Technology	25	75	100	3	0	0	3
3	12B503	Biochemistry-II	25	75	100	3	0	0	4
4	12B504	Bioprocess Principles	25	75	100	3	1	0	4
5	12B505	Mass Transfer Operations	25	75	100	3	1	0	4
6	12B506	Genetic Engineering	25	75	100	3	0	0	3
		PRACTICAL							
1	12B507	Bioinformatics Laboratory	25	75	100	0	0	3	2
2	12B508	Bioprocess Laboratory I	25	75	100	0	0	3	2
3	12B509	Genetic Engineering Laboratory	25	75	100	0	0	3	2
		TOTAL			900				28

SIXTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B601	Immunology	25	75	100	3	0	0	3
2	12B602	Chemical Reaction Engineering	25	75	100	3	1	0	4
3	12B603	Protein Engineering	25	75	100	3	1	0	4
4	12B604	Plant Biotechnology	25	75	100	3	0	0	3
5	12B605	Animal Biotechnology	25	75	100	3	0	0	3
6		Elective-I	25	75	100	3	0	0	3
		PRACTICAL							
1	12B607	Immunology Laboratory	25	75	100	0	0	3	2
2	12B608	Plant Biotechnology Laboratory	25	75	100	0	0	3	2
3	12B609	Animal Biotechnology Laboratory	25	75	100	0	0	3	2
		TOTAL			900				26

SEVENTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1	12B701	Principles of Management	25	75	100	3	0	0	3
2	12B702	Bioprocess Engineering	25	75	100	3	0	0	4
3	12B703	Downstream processing	25	75	100	3	1	0	3
4	12B704	Metabolic Engineering	25	75	100	3	0	0	3
5		Elective - II	25	75	100	3	0	0	3
6		Elective - III	25	75	100	3	0	0	3
		PRACTICAL							
1	12B707	Mini project	25	75	100	0	0	3	2
2	12B708	Downstream processing Laboratory	25	75	100	0	0	3	2
3	12B709	Bioprocess Laboratory II	25	75	100	0	0	3	2
		TOTAL			900				25

EIGHTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
		THEORY							
1		Elective - IV	25	75	100	3	0	0	3
2		Elective - V	25	75	100	3	0	0	3
		PRACTICAL							
1	12B801	Project Work	50	150	200	0	0	12	6
		TOTAL			400				12

**LIST OF ELECTIVE SUBJECTS
BRANCH – INDUSTRIAL BIOTECHNOLOGY
(SIXTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
1	12B6E0	Food Technology	25	75	100	3	0	0	3
2	12B6E1	Genetics	25	75	100	3	0	0	3
3	12B6E2	Energy Engineering and Technology	25	75	100	3	0	0	3
4	12B6E3	Nano Biotechnology	25	75	100	3	0	0	3
5	12B6E4	Medical Biotechnology	25	75	100	3	0	0	3

**LIST OF ELECTIVE SUBJECTS
BRANCH – INDUSTRIAL BIOTECHNOLOGY
(SEVENTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
1	12B7E0	Environmental Biotechnology	25	75	100	3	0	0	3
2	12B7E1	Bioseparations	25	75	100	3	0	0	3
3	12B7E2	Bioprocess economics & Plant design	25	75	100	3	0	0	3
4	12B7E3	Molecular modeling & Drug design	25	75	100	3	0	0	3
5	12B7E4	Genomics & Proteomics	25	75	100	3	0	0	3
6	12B7E5	Biological Spectroscopy	25	75	100	3	0	0	3
7	12B7E6	Biomedical instrumentation	25	75	100	3	0	0	3
8	12B7E7	Neurobiology & Cognitive Sciences	25	75	100	3	0	0	3
9	12B7E8	Molecular pathogenesis	25	75	100	3	0	0	3
10	12B7E9	Virology	25	75	100	3	0	0	3

**LIST OF ELECTIVE SUBJECTS
BRANCH – INDUSTRIAL BIOTECHNOLOGY
(EIGHTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	L	T	P	C
1	12B8E0	Biosafety, Ethics and IPR	25	75	100	3	0	0	3
2	12B8E1	Biopharmaceutical Technology	25	75	100	3	0	0	3
3	12B8E2	Cancer Biology	25	75	100	3	0	0	3
4	12B8E3	Immuno Technology	25	75	100	3	0	0	3
5	12B8E4	Biophysics	25	75	100	3	0	0	3
6	12B8E5	Bioconjugate Technology	25	75	100	3	0	0	3
7	12B8E6	Process Instrumentation Dynamics & Control	25	75	100	3	0	0	3
8	12B8E7	Bioreactor Design and Drawing	25	75	100	3	0	0	3
9	12B8E8	Developmental Biology	25	75	100	3	0	0	3
10	12B8E9	Chemical Process Engineering	25	75	100	3	0	0	3

12B1Z1 Communication Skills in English- I

Common to all branches of Engineering and Technology

L T P C

3 1 0 4

UNIT-I

(9)

Tenses - Word formation- Vocabulary (Synonyms & Antonyms)- Listening and transfer of information-Pronunciation Practice- Word Stress-Sentence Stress-Intonation-Introducing oneself-Role play activities based on real life situations- Non-Verbal Communication -Reading Comprehension (Skimming and Scanning)- An introduction to Letter Writing – E-Tender Notices

UNIT-II

(9)

Technical Vocabulary-Abbreviations & Acronyms- Commonly Confused Words- Active Voice to Passive Voice-Impersonal Passive- Listening at Specific Contexts such as Airport, Railway Station, Bus Stand, Sea Port/Shipboard etc - Debates on Chosen Topics -Reading For Identifying Stylistic Features- Recommendations-Letter to the Editor of a News Paper

UNIT-III

(9)

Subject-Verb Agreement (Concord) - Preposition-Listening to News in English- Mini Oral Presentation on the assumption of a historian, celebrity, famous Personality etc.- Reading and Note-making- - Notice-Agenda- Memo-Advertisement and Slogan Writing

UNIT-IV

(9)

Common Errors in English-Conditional Statements -Use of Modal Auxiliaries- Definition-Listening to a Discussion at a Business Meeting- Group Discussion on chosen topics-Reading for interpreting tables, charts etc. - Writing E-mails-Graphic Description

UNIT-V

(9)

Extensive Reading- APJ Abdul Kalam's "Wings of Fire"- An Abridged Special Edition for Students.

LECTURE : 45 TUTORIAL : 15 TOTAL: 60 HOURS

Reference Books:

1. Meenakshi Raman, Sangeetha Sharma, "**Technical Communication: English Skills for Engineers**" Oxford University Press: New Delhi, 2008
2. Rizvi Ashrav.M, "**Effective Technical Communication**" Tata McGraw Hill'New Delhi, 2005
3. Herbert, A.J, "**Structure of Technical English**": the English Language Society.
4. Authentic NET Resources

12B1Z2 – ENGINEERING MATHEMATICS – I

Common To All Branches

L T P C

3 1 0 4

UNIT – I MATRICES

(9)

Characteristic equation – Eigen values and Eigen vectors of a real matrix - Properties of Eigen values – Cayley-Hamilton Theorem (statement only) and applications- Diagonalisation by similarity transformation - Reduction of quadratic form to canonical form.

UNIT – II HYPERBOLIC FUNCTIONS AND SOLID GEOMETRY

(9)

Hyperbolic functions and Inverse Hyperbolic functions – Identities – Real and imaginary parts – solving problems using hyperbolic functions.

Sphere- tangent plane – Orthogonal spheres – Cone – right circular cone – Cylinder – right circular cylinder.

UNIT – III APPLICATIONS OF DIFFERENTIAL CALCULUS

(9)

Curvature - Cartesian and Polar Coordinates – centre and radius of curvature - Circle of curvature -Evolutes - Envelopes - Evolutes as envelope of normal.

UNIT – IV FUNCTION OF SEVERAL VARIABLES

(9)

Function of two variables - Taylor’s theorem (statement only) and expansions - maxima and minima - constrained maxima and minima by Lagrangian multiplier method - Jacobians - differentiation under integral sign.

UNIT – V INTEGRAL CALCULUS

(9)

Gamma and Beta functions - Double integration - Cartesian and Polar Coordinates – change of order of integration - Area as double integral –Triple integration –Volume as a triple integral - Transformation of Cylindrical and Spherical coordinates.

LECTURE : 45 TUTORIAL :15 TOTAL HRS : 60

Text Books:

1. Veerarajan.T., “**Engineering Mathematics**” for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.
2. Dr. Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy. K., “**Engineering Mathematics**” for First Year B.E/B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

Reference Books :

1. N.P.Bali., Dr. Manish Goyal., “**A text book of Engineering Mathematics**” vol. I, University science Press, New Delhi, 2010.
2. H.C.Taneja., “**Advanced Engineering Mathematics**” vol. I, I.K.International Pub.House Pvt.Ltd., New Delhi, 2007.
3. Baburam., “**Engineering Mathematics**” vol. I, Pearson, New Delhi, 2010.
4. B.V.Ramana., “**Higher Engineering Mathematics**” Tata McGraw Hill Publishing Co., New Delhi, 2007.
5. Grewal B.S., “**Higher Engineering Mathematics**”(40th Edition) Khanna Publishers, New Delhi., 2007

12B103 - APPLIED PHYSICS*(Common to Civil, Mechanical, Production and Industrial Biotechnology)***L T P C****3 0 0 3****UNIT – I LASERS**

(9)

Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein’s coefficients - population inversion – methods of achieving population inversion -Types of pumping –Optical Resonator - Types of Lasers – Principle, construction and working of different types of laser- CO₂, Nd-YAG, Semiconductor laser and Dye laser- applications of laser -Lasers in microelectronics, welding, heat treatment, cutting – holography – construction and reconstruction of a hologram – applications of holography.

UNIT – II FIBER OPTICS AND APPLICATIONS

(9)

Introduction – Basics Principles involved in fiber optics- Total internal reflection – Structure of optical fiber –Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change - Preparation of optical fiber- Crucible and Crucible technique - Classification of optical fiber based on materials, refractive index profile and Modes - Splicing-fusion and multiple splices - Light sources for fiber optics.- LED- Detectors- Principle of photo detection - PIN Photodiode, - Fiber optical communication links-Fiber optic sensors-Temperature, displacement

UNIT – III QUANTUM PHYSICS AND APPLICATIONS

(9)

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy, and temperature –Heisenberg’s Uncertainty principle – verification - Schrödinger’s Time independent and Time dependent wave equations – physical significance of a wavefunction - Particle in a one dimensional deep potential well– microscope – basic definitions of microscope - Electron microscope-Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).

UNIT – IV ULTRASONICS

(9)

Introduction – properties of ultrasonic waves – production of ultrasonic waves Magnetostriction effect- Magnetostriction generator- Piezoelectric crystals - Piezoelectric effect- Piezoelectric generator- Detection of ultrasonic wave – kundt’s tube method – sensitive flame method – thermal detector method – piezo electric detector method- cavitation - industrial applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing- Pulse echo system, through transmission and resonance system.

UNIT – V VACUUM SCIENCE

(9)

Introduction - Importance of vacuum in industries - Properties of Design procedure of a vacuum Pump - Schematic diagram of a vacuum system - Pumping speed and throughput - Types of pumps-Rotary vane type Vacuum pump(oil sealed), Diffusion Pump and Turbo Molecular Pump - Measurement of High Vacuum-McLeod Gauge-Pirani Gauge-Penning Gauge.

Total: 45 Hours**Text books :**

1. Ganesan S. Iyandurai N, “*Applied Physics*”, KKS Publishers, Chennai, 2007

Reference books :

1. Gaur R K and Gupta S L-"**Engineering Physics**", Dhanpat Raj and sons, 2002
2. Avadhanulu M N and Kshirsagar P G,"**A textbook of Engineering Physics**"S.Chand and Company Ltd, New Delhi, 2005
3. Arumugam M- "**Engineering Physics**", Anuadha Publishers, 2002
4. Jayakumar S, "**Engineering Physics**", RK Publishers, Coimbatore, 2003

12B104 HUMAN ANATOMY AND PHYSIOLOGY

L	T	P	C
3	0	0	3

UNIT – I HUMAN ANATOMY (9)

Basics of human anatomy, tissues of the human body: epithelial, connective, muscular and nervous tissues, their sub types and characteristics. Skeletal system- Structure, composition, classification of joint. Skeletal muscles-anatomy.

UNIT – II CIRCULATORY SYSTEM (9)

Circulatory system- Blood ,lymph composition and function. Basic anatomy of the heart. Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

UNIT – III DIGESTIVE AND ENDOCRINE SYSTEM (9)

Digestive System: Anatomy of the gastro intestinal tract, functions of its different parts: liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Endocrine system: anatomy and functions of pituitary gland, adrenal gland, parathyroid gland. pancreas, testes and ovary.

UNIT – IV RESPIRATORY, URINARY AND REPRODUCTIVE SYSTEM (9)

Respiratory System-Anatomy of respiratory organs. Functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity. Urinary System: Various parts, structures and functions of the kidney and urinary tract. Reproductive system- Anatomy and physiology of various parts of male and female reproductive systems.

UNIT – V NERVOUS SYSTEM (9)

Central Nervous System: Functions of different parts of brain and spinal cord. Neuro-chemical transmission in central nervous system, reflex action, cranial nerves and their functions. Autonomic Nervous System: Physiology and functions of autonomic nervous system-mechanism of neurohumoral transmission in A.N.S.

LECTURE: 45 TOTAL : 45 Hours**Text Books :**

1. Tortora, G.J and Anagnodokas, *Principles of Anatomy and Physiology*, N.P Harper & Row Publishers N.Y
2. C.C.Chatterjee, *Human Physiology*, 11th Edition, Vol I and II, Medical allied agency, 2004
3. H.D.Singh, *Hand book of Basic Human Physiology* s.chand & company

Reference Books:

1. Guyton, *Textbook of Medical Physiology*, AC Guyton WB Sannders Company, 1995.
2. K. Sembulingam, *Prema Sembulingam, Essentials of Medical Physiology*, 3rd Edition, Jaypee Bros., New Delhi
3. Marieb, Elaine N. and Katja Hoehn, *Human Anatomy & Physiology*, 7th Ed., Pearson - Benjamin Cummings, 2007

12B105 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P C
4 0 0 4

UNIT – I ELECTRICAL CIRCUITS & MEASUREMENTS (12)

Ohm's Law – Kirchoff's Laws- Steady state solution of DC Circuits- Introduction to AC Circuits- Waveforms and RMS Value- Power and Power factor- Single Phase and Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and energy meters,

UNIT – II ELECTRICAL MACHINES (12)

Construction, Principle of Operation, Basic Equations, Types, characteristics and applications of DC Generators, DC Motors, single Phase Transformer, Induction Motors and Stepper Motors.

UNIT – III SEMICONDUCTOR DEVICES AND APPLICATIONS (12)

Characteristics of PN Junction Diode- Zener Effect- Zener Diode and its characteristics- Half wave and Full wave Rectifiers- Voltage Regulation. Bipolar junction Transistor- CB, CE, CC configurations and characteristics- working, Principle and characteristics of Field Effect Transistor -JFET- MOSFET. Characteristics and Simple applications of SCR, DIAC, TRIAC and UJT.

UNIT – IV DIGITAL ELECTRONICS (12)

Binary Number system- Logic Gates- Boolean Algebra – Half and full Adders – Flip – Flops- Registers and counters – A/D and D/A Conversions.

UNIT – V FUNDAMENTALS OF COMMUNICATION ENGINEERING (12)

Types of signals-Analog and digital signals- Modulation and Demodulation-Principles of Amplitude and Frequency Modulations. Communication system-Radio, TV, Microwave, Satellite, Radar and Optical Fibre (Block diagram Approach only)

LECTURE: 60 Hours TOTAL: 60 Hours.

Text Books:

1. Muthusubramaniam , Salivahanan S and Muraleedharan K A, “Basic Electrical , Electronic and computer Engineering” TMH, Second Edition, 2006.
2. Nagasarkar T K and sukhija M S, “Basics of electrical engineering “ Oxford press 2005.

Reference Books:

1. Meththa V K , “Principle of Electronics “, S. Chand & Company Ltd, 1994.
2. Mahmood Nahvi and Joseph A Edminister, “Electric Circuits”” Schaum’ Outline series, McGraw Hill, 2002.
3. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

12B106 PROGRAMMING IN C*[Common to CIVIL,EEE,ECE,EIE,CSE,IT]***L T P C****3 1 0 4****UNIT – I BASICS OF COMPUTER, PROGRAMMING AND INFORMATION TECHNOLOGY (9)**

Digital Computer Fundamentals–Block diagram of a computer–Components of a computer system–Applications of Computers–Hardware and Software definitions–Categories of Software–Booting–Installing and uninstalling Software–Software piracy–Software terminologies-Information Technology Basics–History of Internet–Internet Tools. Problem solving Techniques–Program–Program development cycle–Algorithm – Flow chart – Pseudo Code – Program control structures – Types and generation of programming languages – Development of algorithms for simple problems.

UNIT – II BASIC ELEMENTS OF C (9)

Introduction to C – C declaration – Operators and expressions — Input and Output Functions – Decision statements: If, nested if, If-else-if ladder – Loop control: for, nested for, while, do-while - Arrays: Initialization, characteristics, types and operations;

UNIT – III POINTERS AND FUNCTIONS (9)

Strings and Standard functions: formats, standard, conversion and memory functions, applications; Pointer concept–Declaration–Accessing variable through pointer–Initializing pointer variable–Pointers and Functions–Pointers and Arrays–Pointers and Structures–Example programs using pointers with function, arrays and structures–Operations on pointers. Functions: declaration and definitions, Parameter passing methods, recursion, applications.

UNIT – IV STORAGE CLASSES, STRUCTURE AND UNION (9)

Storage classes: Auto, extern, static, register; Structures–Preprocessor directives - User defined data types, Nested structure, passing structures to functions - Self referential structures – typedef - bitfields – Enumerated datatypes – Union – BIOS and DOS services – Union of Structures.

UNIT – V FILES, GRAPHICS AND DYNAMIC MEMORY ALLOCATION (9)

File pointer–High level File operations–Opening and closing of file–Creating, Processing and Updation on files–Simple file handling programs-Low level Programming – Command line arguments – Environmental variables; Graphics: Initialization, functions, library functions, text, patterns and styles, mouse programming, drawing non common figures – Dynamic memory allocation.

LECTURE: 45 TUTORIAL : 15 TOTAL : 60**Text Books:**

1. IITL Education Solutions Limited, **“Introduction to Information Technology”**, Pearson Education (India), 2005. (Unit I) (Chapters: 1, 7, 9, 10, 15, 16)
2. Ashok N. Kamthane, **“Programming in C”**, Pearson Education, Second edition, 2012.

Reference Books:

1. Byron Gottfried, **“Programming with C”**, II Edition, (Indian Adapted Edition), TMH publications, 2006.
2. Brian W. Kernighan and Dennis M. Ritchie, **“The C Programming Language”**, Pearson Education Inc. (2005)
3. E. Balagurusamy, **“Programming in ANSI C”**, 5 E, Tata McGraw – Hill Education, 2011.

12B107 - PHYSICS LABORATORY
(Common to all Branches of Engineering and Technology)

(Any Eight experiments)

L T P C
0 0 3 2

1. Spectrometer - diffraction grating
Normal incidence method
2. Air wedge
3. Young's modulus – cantilever bending
Koenig's method
4. Particle size determination
5. Thermal conductivity of the bad conductor
Lee's disc method
6. Ammeter and voltmeter calibration – low range
7. Resistance of the given coil of wire – Carey
Foster's bridge
8. Torsional pendulum
9. Young's modulus - non uniform bending
10. Transistor characteristics

12B108 - COMMUNICATION SKILLS AND TECHNICAL SEMINAR

L T P C

0 0 3 2

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. Three periods per week are to be allotted and 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

This will enable them to gain confidence in facing the placement interviews.

12B109 C PROGRAMMING LABORATORY

[Common to CIVIL,EEE,ECE,EIE,CSE,IT]

L T P C

0 0 3 2

Exercises illustrating the following concepts:

1. Operators, Expressions and IO Formatting
2. Decision Making and Looping
3. Arrays and String
4. Functions and Recursion
5. Pointers
6. Dynamic Memory Allocation
7. Structures
8. Unions
9. Files
10. Command line arguments.
11. Graphics
12. Mini Project

TOTAL - 45 Hrs

12B2Z1 - COMMUNICATION SKILLS IN ENGLISH – II

Common to all branches of Engineering and Technology

L T P C

3 1 0 4

UNIT-I

(9)

Use of Relative Clauses-Noun Phrases- Listening to Conversations- Telephonic Conversational Skills Paralinguistic Communication (Articulation, Stress and Pause) – Cloze Reading-Reading to practice stress, pause etc. -Process Description-Transcoding

UNIT-II

(9)

Cause and Effect Expressions-Time and Contracted Time Statements- Listening to Narration/Speech – Extemporaneous - Instructions with Imperatives- Reading for inferring meaning: Lexical and Contextual - Understanding the organisation of the Texts -Writing Articles (Technical & General)

UNIT-III

(9)

Phrasal Verbs -American and British Vocabulary- Video Listening: Listening to Authentic Clippings in English (Movie/ Play)-Making Speeches (Introducing a Chief Guest, Delivering Welcome Address, Proposing Vote of Thanks)-Reading for understanding discourse cohesion-Logical Connectives- Minutes of the Meeting

UNIT-IV

(9)

Idiomatic Expressions -Numerical Expressions- Listening to authentic songs in English-Mock Interviews-Reading for identifying the topic sentence in each paragraph-An Introduction to Different kinds of Report-Report on an Industrial Visit-Report on an accident

UNIT-V

(9)

Abstract – foot notes-bibliography-plagiarism- Technical Style- Presentation of a **Mini Project Report** of 25 to 30 pages on one of the topics from the First Year B.E Syllabus or similar topics.

Lecture: 45 Tutorial: 15 Total Hrs: 60

Reference Books:

1. Meenakshi Raman, Sangeetha Sharma, “**Technical Communication: English Skills for Engineers**” Oxford University Press: New Delhi, 2008
2. Rizvi Ashrav.M, “**Effective Technical Communication**” Tata McGraw Hill:New Delhi, 2005
3. Herbert, A.J, “**Structure of Technical English**”: the English Language Society
4. *Authentic NET Resources*

12B2Z2 - ENGINEERING MATHEMATICS – II

[COMMON TO ALL BRANCHES]

L T P C

3 1 0 4

UNIT I: VECTOR CALCULUS

(9)

Gradient , Divergence , Curl – Directional derivative – Irrotational and Solenoidal fields- Vector identities - Line, Surface and Volume Integrals – Green’s Theorem in a Plane , Gauss Divergence and Stoke’s Theorems (Statements only) – Verifications and Applications.

UNIT II: ORDINARY DIFFERENTIAL EQUATIONS

(9)

Linear equations of Second and Higher order with constant coefficients-Simultaneous first order Linear equations with constant coefficients - Linear equations of Second and higher order with variable coefficients - Legendre types – Method of variation of parameters – method of reduction of order.

UNIT III: COMPLEX DIFFERENTIATION

(9)

Functions of a Complex variable-Analytic functions- Cauchy Riemann equations and sufficient conditions(excluding proof)–Harmonic and orthogonal properties of analytic functions –Construction of analytic functions-Conformal mappings : $w = z + a$, az , $1/z$, z^2 , e^z , $\cos z$, $\sin z$ and Bilinear Transformation.

UNIT IV : COMPLEX INTEGRATION

(9)

Cauchy’s integral theorem, Cauchy’s integral formula -Taylor’s and Laurent’s theorems (Statements only) and expansions – Poles and Residues – Cauchy’s Residue theorem – Contour integration – Circular and semi circular contours.

UNIT V: LAPLACE TRANSFORMATIONS

(9)

Laplace transforms- Properties and standard transforms-Transforms of unit step, unit Impulse and error functions –Transforms of periodic functions- Inverse Laplace transforms- Initial and Final value theorems- Convolution theorem (Statement only) and applications - Applications to Solution of Linear differential equations of second order with constant coefficients.

Lecture: 45 Tutorial: 15 Total Hrs: 60

Text Books :

1. Veerarajan.T., “**Engineering Mathematics**” for Semesters I and II , Tata McGraw Hill Publishing Co., New Delhi., 2010.
2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., “**Engineering Mathematics**” for First Year B.E/ B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

Reference Books:

1. N.P.Bali., Dr. Manish Goyal., “**A text book of Engineering Mathematics**” vol. II , University science Press, New Delhi, 2010.
2. H.C.Taneja., “**Advanced Engineering Mathematics**” vol.II, I.K.International Pub.House Pvt.Ltd., New Delhi, 2007.
3. Baburam., “ **Engineering Mathematics**”, Pearson, New Delhi, 2010.
4. B.V.Ramana., “**Higher Engineering Mathematics**” Tata McGraw Hill Publishing Co., New Delhi, 2007.
5. Grewal B.S., “**Higher Engineering Mathematics**”(40th Edition) Khanna Publishers, New Delhi., 2007.

12B203 - BIOCHEMISTRY – I

L T P C
3 0 0 3

UNIT – I CARBOHYDRATES

(10)

Introduction to Biochemistry, Classification, Structure and Properties of Carbohydrates (Mono, Di, Oligo) - forms of Isomerism, Physiological importance of homo and hetero Polysaccharides – muco polysaccharides- sialic acids-bacterial cell wall polysaccharides-conjugated carbohydrates.

UNIT – II PROTEINS

(10)

Classification of Amino acids, Structure and Properties of Amino acids-peptide bond- Classification of Proteins-Primary-Secondary- Tertiary and Quaternary structure of proteins – denaturation and renaturation –fibrous and globular proteins-Myoglobin & Hemoglobin, conjugated proteins.

UNIT – III NUCLEIC ACIDS

(7)

Nucleic Acids – Structure of Purines – Pyrimidines – Nucleosides - Nucleotides - Ribonucleic acids - Deoxyribonucleic acids - Nucleoprotein complexes.

UNIT – IV LIPIDS

(10)

Structure and properties of Lipids – Classification, (Fatty acids, Glycerolipids, Phospholipids, Glycolipids, Sphingolipids, Steroids) - Physiological importance, prostaglandins - Significance of Cholesterol

UNIT – V STRUCTURAL PROTEINS AND CYTOSKELETON

(8)

Contractile proteins, Actin, actin polymerization, myosin, acto-myosin complexes, mechanism of myosin ATPase activity, excitation- contraction coupling and relaxation, microtubules, microfilaments and their role in organelle movements.

LECTURE: 45 TOTAL : 45 hours

Textbooks :

1. Lehninger's "**Principles of Biochemistry**" by David L. Nelson and Michael M. Cox, Macmillan Worth publisher.
2. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell, V.W., "**Harper's Biochemistry**" Prentice Hall International

Reference Books :

1. Lubert Stryer, "**Biochemistry, 4th Edition,**" WH. Freeman and co., 2000.
2. Voet and Voet, "**Biochemistry 2nd Edition,**" John Wiley and Sons Inc., 1995

12B204 - MATERIALS TECHNOLOGY*(Common to Civil, Mechanical, Production and IBT)***L T P C****3 0 0 3****UNIT – I CONDUCTING MATERIALS****(9)**

Introduction to Conductors – classical free electron theory of metals – Draw backs of classical theory – quantum theory - Electrical and Thermal conductivity of Metals – Derivation for Wiedemann – Franz law – Lorentz number — Fermi distribution function - effect of temperature – density of energy states – calculation of Fermi energy- carrier concentration in metals

UNIT – II SEMICONDUCTING MATERIALS**(9)**

Introduction – Properties – elemental and compound semiconductors - Intrinsic and extrinsic semiconductors – properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature and carrier concentration - Electrical Conductivity – band gap determination - extrinsic semiconductors - Carrier concentration in P- type and N- type semiconductors – variation of Fermi level with temperature and impurity concentration.

UNIT – III SUPERCONDUCTING MATERIALS**(9)**

Introduction – Superconducting state – magnetic properties of superconductors – Current flow and magnetic fields in superconductors – High current , High field superconductors - Types of superconductors - BCS theory of superconductivity (qualitative) – characteristics of superconductors - Applications of superconductors- High T_c superconductors - SQUID, Cryotron, Magnetic levitation.

UNIT – IV DIELECTRIC MATERIALS**(9)**

Introduction to dielectric materials – polar and nonpolar molecules-Variou polarization mechanisms in dielectrics - electronic, ionic, orientational and space charge polarization – frequency and temperature dependent of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – Ferro electricity and applications.

UNIT – V MODERN ENGINEERING MATERIALS**(9)**

Metallic glasses- preparation of metallic glasses- properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gels – ball Milling – properties of nanoparticles and applications of nanoparticles - Carbon Nanotubes(CNT) –structure – properties – applications of the CNTs.

Total : 45**Text books:**

1. Ganesan S. Iyandurai N, **“Engineering Physics II”**, Gems Publishers, Coimbatore 2009.

Reference books:

1. Jayakumar S, **“Materials Science”**, RK Publishers, Coimbatore, 2004

2. William D Callister Jr, **“Materials Science and Engineering – An Introduction”**, John Wiley and Sons Inc., 6th edition, New York, 2003

3. James F Shackelford, S **“Introduction to materials Science for Engineers”**, 6th Macmillan Publishing Company, New York, 2004

12B205 -APPLIED CHEMISTRY FOR BIOTECHNOLOGY

L P T C

3 0 0 3

UNIT-I REACTION MECHANISMS

(9)

Factors influencing a reaction - addition reaction, addition of halogens and halogen acids to olefin, Markwonikoff's rule, nucleophilic addition – substitution reactions – electrophilic - SN_1 and SN_2 - Elimination reaction, E_1 and E_2 , steric effects. Reagents and reactions – Grignard reagent, NBS, Osmium tetroxide, sodium borohydride.

UNIT-II STEREOISOMERISM

(9)

Geometrical isomers- examples- R and S notations, optical isomerism, optical activity, chirality, optical isomerism in compounds containing one chiral carbon, optical isomerism in compounds containing more than one chiral carbon, Compounds containing no asymmetric carbon- diastereoisomers, racemisation, asymmetric synthesis, Walden inversion. Confirmations of cyclo alkane, boat form and chair form, Amino acid synthesis, properties of amino acids, peptides, N&C terminal amino acid residue, properties of proteins, preparation properties and uses of xanthenes, caffeine, furan, pyrrole, pyridine, purine, quinoline, isoquinoline.

UNIT-III POLYMERS

(9)

Monomers-functionality, Degree of polymerization–Coordination polymerization -Zeigler-Natta catalyst, Polymers, structure , properties and their end uses of Polycarbonate, PVC, Poly carbonate, Polyamide, PET, Polyester, Teflon, Epoxy resin, Polyurethane, PMMA. Compounding of plastics, materials and functions, Fabrication-compression molding-Injection moulding-blow moulding & Extrusion moulding, conducting polymers, poly acetylene, mechanism of conduction-natural rubber-vulcanization of rubber- Biodegradable polymers-poly lactide, cellulose, and starch.

UNIT-IV BIOCHEMISTRY AND ADSORPTION

(9)

Enzymes-cofactors, temperature pH relationship, Biochemistry of carbohydrates, proteins, fats and oils, general biochemical pathways, novel bio-transformations, hydrolysis , reduction and oxidation, Adsorption, types of adsorption, adsorption of gases on solids, adsorption from solution, Freundlich adsorption isotherm, Langmuir adsorption isotherm, catalysis, types, acid base catalysis, enzyme catalysis, mechanism of catalysis, Michaelis-Menton equation.

UNIT-V INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

(9)

Instrumental methods of chemical analysis, Laws of light, Lambert Beer's law, deviations of law, UV-Visible spectroscopy, electronic transition, estimation of iron and nickel by spectrophotometer, Infrared spectroscopy – principle and instrumentation - Flame emission spectroscopy, estimation of sodium and potassium by flame photometer, chromatography, paper, Thin layer chromatography, column and gas chromatography.

Total: 45 Hours

Text books:

1. B.S Bahl & Arun Bahl, *Advanced Organic chemistry*, 2nd Edn S.Chand & Co.Ltd, New Delhi (1985).
2. Ramadevi A. & Siva Shankari C. *Chemistry for Biotechnology* 1st Edn, Gem publishers, Coimbatore (2011).

Reference books:

1. Clair N. Sawyer, Perry L. McCarty, Gene F.Prlom, *Chemistry for Environmental Engineering*, 4th Edition (1994).
2. Morrison and Boyd, *Organic Chemistry*, 4th Edn, Universal book stall, New Delhi (1985).

12B206 - PROCESS CALCULATIONS

L P T C
3 0 0 3

UNIT – I OVERVIEW OF PROCESS INDUSTRY**(7)**

Systems of units - fundamental and derived quantities, unit conversion, composition conversion-atomic weight, molecular weight, equivalent weight, molar concept, mole percent, weight percent, volume percent, molarity, molality, normality etc., Basics of unit operations and unit processes involved in biotechnology industries and its applications

UNIT – II BEHAVIOUR OF IDEAL GAS**(7)**

Ideal and real gas law – gas constant – calculation of pressure, volume and temperature using ideal gas law – use of partial pressure and pure component volume in gas calculations – applications of real gas relationship in gas calculations.

UNIT – III MATERIAL BALANCE**(12)**

Stoichiometric principles – applications of material balance to unit operations, material balance with chemical reactions and without chemical reactions – limiting reactant and excess reactant – conversion and yield – recycle, bypassing and purging.

UNIT – IV ENERGY BALANCE**(12)**

Fundamentals of energy balance calculations – concepts of heat capacity, latent heat, sensible heat, vapor pressure and internal energy – energy balance with chemical reactions and without chemical reactions.

UNIT – V FUELS AND COMBUSTION**(7)**

Types of fuels-solid, liquid & gaseous fuels-ultimate and proximate analysis. Determination of composition by orsat analysis of products of combustion of solid, liquid and gas fuels – calculations of excess air from orsat techniques – problems on combustion process.

LECTURE: 45 TUTORIAL: 15 TOTAL : 60 hours

Text Books:

1. *Bhatt B.I and Vora S.M. "Stoichiometry" Fourth Edition. Tata McGraw-Hill, New Delhi, 2004.*
2. *Himmelblau MD., and JamesB.Riggs, "Basic principles and calculations in Chemical Engineering" Prentice Hall PTR, 2004.*
3. *Williams and Johnson, "Stoichiometry for Chemical Engineers" McGraw-Hill, 1986.*

Reference Books:

1. *Perry's W H., "Chemical Engineering Handbook", McGraw-Hill company, 2008.*
2. *McCabe Smith and Harriott, "Unit Operations of Chemical Engineering" McGraw-Hill company, 2005.*
3. *K.V. Narayanan, B.Lakshmikutty, "Stoichiometry and Process calculations", Prentice hall of India,2006.*

12B207 WORKSHOP

(Common to all Branches)

L T P C

0 0 3 2

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap joint and Dovetail joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal

TOTAL : 45 Hrs

12B208 - CHEMISTRY LABORATORY

(Common to all branches)

L T P C
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1. Estimation of hardness by EDTA method
2. Estimation of chloride by argentometric method
3. Determination Dissolved oxygen by Winkler's method
4. Estimation of available chlorine in bleaching powder
5. Estimation of copper and zinc in brass sample
6. Estimation of manganese in steel sample.
7. Surface area of activated carbon by adsorption technique using acetic acid
8. Estimation of calcium and magnesium in magnesite ore
9. Estimation of manganese in pyrolusite ore
10. Conduct metric titration of mixture of strong and weak acids using strong base
11. Potentiometric titration (Ferrous iron versus potassium dichromate)
12. Estimation of sodium or potassium using flame photometer
13. Estimation nickel using spectrophotometer
14. Estimation of iron by spectrophotometer.

(Any twelve experiments only)

Reference books :

1. A.O.Thomas, **Practical Chemistry**, 6th Edn, Scientific book centre, Kannanore (1995)
2. Arthur I. Vogel, **Quantitative Inorganic Analysis**, 3rd Edn, ELBS (1970)

12B209 - BIOCHEMISTRY LABORATORY

L T P C

0 0 3 2

- 1) Units, Volume/Weight measurements, concentrations, pH measurements, Preparation of buffers, Sensitivity, Specificity, precision and Accuracy.
- 2) Qualitative tests for carbohydrates.
- 3) Quantitative tests for reducing sugars by Benedict's method.
- 4) Qualitative tests for Amino Acids.
- 5) Protein estimation - Biuret, Folin's Spectrophotometry and Bradford Assay
- 6) Acid hydrolysis of proteins and estimation of Amino acids by Ninhydrin, OPA, PTH
- 7) Extraction of lipids and Saponification of Fats.
- 8) Phospholipids: Ashing and estimation of phosphate.
- 9) Estimation of cholesterol.
- 10) Estimation of Nucleic Acids, Precipitation by sodium sulphate, Test for ribose and deoxyribose.
- 11) Enzyme assays: Phosphatase from potato, Amylase from sweet potato, Trypsin digestion of proteins.

Textbooks

1. David. T. Plummer, "***An Introduction to Practical Biochemistry***", Tata McGraw – Hill Publishers, 3rd edition, 2006.

12B3Z1 ENGINEERING MATHEMATICS – III*[COMMON TO ALL BRANCHES]***L T P C****3 1 0 4****UNIT I: PARTIAL DIFFERENTIAL EQUATIONS**

(9)

Formation of PDE by elimination arbitrary constants and functions – Solutions of standard first order partial differential equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients-homogeneous and non homogeneous types.

UNIT II: FOURIER SERIES

(9)

Dirichlet's Conditions – General Fourier Series – Odd and even functions- Half range Sine and Cosine series – Parseval's Identity – Harmonic Analysis.

UNIT III: FOURIER TRANSFORMS

(9)

Statement of Fourier integral Theorem – Fourier transform pair– Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions- Convolution Theorem – Parseval's Identity-Finite Fourier transforms

UNIT IV: BOUNDARY VALUE PROBLEMS

(9)

Method of separation of variables – One dimensional wave equation – One dimensional heat equation – Unsteady and Steady state conditions – Fourier series solution.

UNIT V: Z TRANSFORMS

(9)

Z-transforms - Elementary properties-Inverse Z-transform - Initial and Final value theorems - Convolution theorem - Formation of difference equations - Solution to difference equations of second order with constant coefficients using Z -transform.

Lecture: 45 Tutorial: 15 Total : 60**Text Books :**

1. Veerarajan.T., *“Transforms and partial Differential equations”*, Tata McGraw Hill Publishing Co., New Delhi. 2010.

Reference Books :

1. N.P.Bali., Dr. Manish Goyal., *“Transforms and partial Differential equations”*, University science Press, New Delhi, 2010.

2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., *“Engineering Mathematics”* for Third Semester B.E/ B.Tech, S. Chand & Co., Ram Nagar, New Delhi, 2010.

3. B.V.Ramana., *“Higher Engineering Mathematics”* Tata McGraw Hill Publishing Co., New Delhi, 2007.

4. Grewal B.S., *“Higher Engineering Mathematics”* (40th Edition) Khanna Publishers, New Delhi., 2007.

5. Glyn James, *“Advanced Modern Engineering Mathematics”* (8th Edition) Wiley India , New Delhi., 2007.

12B302 FLUID MECHANICS AND MECHANICAL OPERATIONS

L T P C

3 1 0 4

INTRODUCTION

(8)

Properties of fluids, fluid statics, concept of shear stress, Newton's law of viscosity – Fluid behavior under shear, Newtonian and non-Newtonian fluids, Types of flow – laminar, turbulent, steady, unsteady, non uniform and uniform flows – compressible and incompressible fluids.

FLUID DYNAMICS

(10)

Continuity equation, Bernoulli's equation, boundary layer condition, form drag, skin drag, drag coefficient – laminar and turbulent flow through closed conduit velocity profiles, pipes, tubes, fittings, valves, friction factor for smooth and rough pipes, head losses due to friction in pipes and fittings.

FLUID FLOW MEASUREMENT AND EQUIPMENTS

(10)

Orifice meter, Venturimeter, Pitot tube, Rota meter, weirs and notches, hot wire anemometer, displacement meter, current meter, magnetic flow meter, pressure measurement by manometers, U-tube, differential and inclined manometers, Pumps – types, selection and specifications, positive displacement pumps, reciprocating pump, rotary pumps, centrifugal pumps - characteristics curve of pumps – fans, blowers and compressors.

FLUIDIZATION AND PACKED BEDS

(8)

Mechanisms, types – fluidized beds, properties of fluidized beds, continuous fluidization and application, packed beds – pressure drop, flooding and loading.

MECHANICAL OPERATIONS

(9)

Size reduction equipments – operations and their classification, Energy and power requirements, Laws of crushing, open and closed circuit operations - techniques of size analysis – different methods for storage of solids, conveyors and elevators.

LECTURE: 45 TUTORIAL : 15 TOTAL : 60 Hours

Text Books :

1. *McCabe Smith and Harriott, "Unit Operations of Chemical Engineering" McGraw-Hill company., 1993*
2. *Geankoplis C.J. Transport Processes and Unit Operations. 3rd edition, Prentice Hall of India, 2002.*

Reference Books :

1. *Coulson and Richardson's Chemical Engineering. Vol I & II, Asian Books Pvt Ltd, 1998.*
2. *Bansal R K "Fluid mechanics and Hydraulic machines" 5th edition, Lakshmi publications (P)Ltd, New Delhi, 1997.*

12B303 - BASICS OF INDUSTRIAL BIOTECHNOLOGY**L T P C****3 0 0 3****INTRODUCTION TO BIOTECHNOLOGY AND INDUSTRIAL BIOPROCESS (9)**

Biotechnology: Scope and importance, Commercial potential of Biotechnology in India. Historical overview of industrial fermentation process -traditional and modern Biotechnology. Industrial Fermentation- microorganisms, mode of operation, fermentation processes-pictorial representation

PRODUCTION OF PRIMARY METABOLITES (9)

A brief outline of processes for the production of some commercially important organic acids (citric acid, lactic acid & acetic acid); amino acids (glutamic acid & tryptophan) and alcohols (ethanol & butanol)

PRODUCTION OF SECONDARY METABOLITES (9)

Study of production processes for various classes of secondary metabolites: antibiotics: (penicillin streptomycin & erythromycin), vitamins (vit B₁₂ and vit B₂) and steroid biotransformation

PRODUCTION OF ENZYMES AND OTHER PRODUCTS (9)

Production of industrial enzymes (proteases & amylases), Production of biopesticide, Biofertilizers, biopreservative (Nisin), biopolymers (xanthan gum & PHB), cheese, SCP

PRODUCTION OF MODERN BIOTECHNOLOGY PRODUCTS (9)

Production of recombinant proteins having therapeutic and diagnostic applications (insulin, human growth hormone & interferon), Production of recombinant vaccines (hepatitis B vaccine, cholera vaccine & vaccinia vector vaccine), production of monoclonal antibodies

LECTURE : 45 TOTAL: 45 Hours**Textbooks:**

1. Wulf Cruger and Anneliese Cruger, **"A Textbook of Industrial Microbiology"**, Panima Publishing Corporation.
2. Michael J. Waites, Neil L. Morgan, John S. Rockey and Grey Higton, **"Industrial Microbiology": An Introduction**, Blackwell science publishing house.

Reference Books:

1. Casida Jr, L. E., **"Industrial Microbiology"**, New Age International(p) Ltd
2. Prescott. Dunn, **"Industrial Microbiology"**, Agrobios (India).

12B304 - CELL BIOLOGY

L T P C
3 0 0 3

CELL STRUCTURE AND FUNCTION OF THE ORGANELLES

(10)

Structure of Prokaryotic and Eukaryotic cells and brief on their organelles, principles of membrane organization, membrane proteins, extra cellular matrix, cytoskeleton structures, cell junction and cell adhesions, types of cell division, mitosis & meiosis, cell cycle and molecules that control cell cycle.

TRANSPORT ACROSS BIO MEMBRANES

(10)

Osmosis, Passive & active transport, permeases, sodium potassium pump, Ca²⁺ ATPase pumps, gated channels, lysosomal and vacuolar membrane ATP dependent proton pumps, Co- transport - symport, antiport, active group transportation , endocytosis and exocytosis. Entry of virus and toxins into cells.

RECEPTORS AND MODES OF CELL SIGNALLING

(7)

Cytosolic, nuclear and membrane bound receptors with examples, autocrine, paracrine and endocrine modes of action, quantitation and characterisation of receptors.

SIGNAL TRANSDUCTION

(9)

Signal amplification, different models of signal amplifications, role of secondary messengers- cyclic AMP, inositol tri phosphates and cyclic GMP; G proteins - role in signal transduction, calcium ion flux and its role in cell signaling, current models of signal amplification, role of protein kinases - serine –threonine kinases, tumor necrosis factor receptor families.

BASICS OF CELL CULTURE

(9)

Techniques for propagation of eukaryotic and prokaryotic cells. Cell line, generation of cell lines, maintenance of stock cells, characterization of cells, morphological analysis techniques in cell culture, primary cultures, contamination, differentiation, three dimensional cultures, role of matrix in cell growth.

LECTURE: 45 TOTAL : 45 Hours

Textbooks :

1. Darnell J, Lodish H, Baltimore D, “*Molecular Cell Biology*,” W.H.Freeman; Fourth edition,1999
2. De Robertis & De Robertis, “*Cell Biology; Fourth edition,2007*”.

Reference Books :

1. Kimball T.W., “*Cell Biology*,” Wesley Publishers; Third edition,1984
2. James D. Watson, “*Molecular Biology of The Cell*”. Third edition, 2004

12B305 - BIOORGANIC CHEMISTRY

L T P C
3 0 0 3

CONCEPTS IN ORGANIC CHEMISTRY**(9)**

Chemical bondings – Overview- five membered and six membered hetero aromatic rings and fused ring systems, major aliphatic and aromatic functional groups. Stereochemistry – R,S notation – re-si faces – e,z isomerism- conformers- ethane – cyclohexane - reactives- mechanisms of $sn1$ $sn2$ reactions, $e1$ $e2$ reactions – ester formation and hydrolysis, reaction rates - hammond's postulate.

CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM**(9)**

Biocatalysis – Enzymes and their classification - dehydrogenases –proteases – ribonucleases – lysozyme- stability of proteins, stability – activity tradeoff.

STEREOCHEMISTRY OF ENZYMATIC REACTIONS**(9)**

Catalysis – general acid – base and covalent catalysis. Stereospecific enzymatic reactions – fumarase catalysed reactions – NAD dependent oxidation and reduction reactions - stereochemistry of nucleophilic reactions – chiral methyl group – chiral phosphate.

KINETICS OF PROTEIN FOLDING**(9)**

Basic principles of protein folding – two state kinetics – multistate kinetics – transition states in protein folding – 1h/2h exchange methods – folding of peptides.

FOLDING PATHWAYS & ENERGY LANDSCAPES**(9)**

Folding of $ci2$ – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones.

LECTURE : 45 TOTAL : 45 Hours

Textbooks :

1. A. R Fersht, W.H. Freeman, “**Structure and Mechanism in Protein Science**” : A Guide to Enzyme Catalysis and Protein Folding, 1999

Reference Books :

1. H. Dugas, “**Bioorganic Chemistry**”, Springer Verlag, 1999.
2. Robert Thornton Morrison and Robert Neilson Boyd, “**Organic chemistry**” ; 6th edition

12B306 - MICROBIOLOGY

L T P C

3 0 0 3

INTRODUCTION

(8)

History of microbiology, Microbial existence-Soil, Water and Air; classification and nomenclature of microorganism, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast staining, capsular staining, flagella staining, Spore staining.

MICROBES-STRUCTURE AND MULTIPLICATION

(10)

Structural organization and multiplication of bacteria, viruses, algae and fungi with a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage.

MICROBIAL NUTRITION, GROWTH AND METABOLISM

(10)

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve and different methods to quantify the bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

CONTROL OF MICROORGANISMS

(8)

Host-microbe interactions, clinically important microorganisms; Physical and chemical control of microorganisms; anti-bacterial, anti-fungal and anti-viral agents, mode of action of antibiotics and its resistance.

INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

(9)

Primary metabolites; secondary metabolites and their applications-preservation of food; Microorganism used for the production of penicillin, alcohol, vit.B-12; biogas; bioremediation; leaching of ores by microorganisms; mycorrhiza; Biological Nitrogen fixation, microorganisms and pollution control; biosensors.

LECTURE: 45

TOTAL : 45 Hours

Textbooks :

1. Pelczar MJ, Chan ECS and Krein NR, "**Microbiology**", Tata McGraw Hill Edition, New Delhi,

Reference Books :

1. Talaron K, Talaron A, Casita, Pelczar And Reid. "**Foundations In Microbiology**", W.C.Brown Publishers, 1993.
2. Prescott LM, Harley JP, Klein DA, "**Microbiology**", 3rd Edition, Wm. C. Brown Publishers, 1996.

12B307 - BIOORGANIC CHEMISTRY LABORATORY

L T P C
0 0 3 2

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid from tartaric acid
4. Preparation of oleic acid from tartaric acid
5. Preparation of alpha d- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha d glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of l-proline
9. Preparation of l-cysteine from hair
10. Preparation of s-ethyl hydroxybutonate from ethyl acetoacetate using yeast
11. Resolution of s-ethyl hydroxybutonate using 3, 5 dinitrobenzoate.
12. Preparation of 5, 10,15, 20-tetrakisphenyl porphyrin.
13. Isolation of casein from milk.
14. Isolation of starch from potato tubers.
15. Isolation of caffeine from tea leaves.

Reference Books

1. Fummi B.S., Hannaford A.J., Smith P.W.G., “*Text Book Of Practical Organic Chemistry*“, Longman Edition, 1995.

12B308 - CELL BIOLOGY LABORATORY

L T P C
0 0 3 2

1. Introduction to principles of sterile techniques and cell propagation.
2. Principles of microscopy, phase contrast and fluorescent microscopy.
3. Identification of given plant, animal and bacterial cells and their components by Microscopy
4. Leishman Staining.
5. Haematoxylin Eosine staining.
6. Giemsa Staining.
7. Separation and Identification of Peripheral Blood Mononuclear Cells from blood.
8. Osmosis and Tonicity.
9. Tryphan Blue Assay.
10. Staining for different stages of mitosis in *Allium cepa* (Onion).
11. Identification of meiosis cell division in Grass hopper testis.

Textbooks :

De Robertis & De Robertis, "Cell Biology"; Fourth edition 2007

12B309 - MICROBIOLOGY LABORATORY

L T P C
0 0 3 2

1. Laboratory safety and sterilization techniques
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. Culturing of microorganisms – in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures)
5. Staining techniques – grams' and differential
6. Quantification of microorganisms.
7. Effect of disinfectants on microbial flora
8. Isolation and identification of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria and yeast.
11. Effect of different parameters on bacterial growth (pH, temperature & UV irradiation)

Textbook

1. James G. cappuccino & Natalie, “*Microbiology, A Laboratory manual*”, Pearson Education publishers, 6th edition, 2004.

12B401 - PROBABILITY, STATISTICS AND RANDOM PROCESSES

(Common To Industrial Biotechnology)

L T P C

3 1 0 4

UNIT I PROBABILITY AND RANDOM VARIABLES (9)

Axioms of probability – conditional probability – Total probability – Baye’s theorem - Random variables- Discrete and continuous random variables- Moments - Moment Generating Functions and their properties.

UNIT II STANDARD DISTRIBUTIONS (9)

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a Random variable.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES (9)

Joint distributions – Marginal Distributions – Conditional Distributions –Covariance –Correlation and Regression – Transformation of random variables – Central Limit theorem.

UNIT IV RANDOM PROCESSES (9)

Definition and examples – first order, second order, strictly stationary, wide – sense stationery and ergodic processes – Markov process – Binomial, Poisson and Normal processes – Sine wave process – Random telegraph process.

UNIT V CORRELATION AND SPECTRAL DENSITIES (9)

Autocorrelation – Cross Correlation – properties – Power spectral density – Cross spectral density – properties – Wiener – Khintchine relation – Relation between cross power spectrum and cross correlation function.

Lecture: 45 Tutorial: 15 Total: 60

Text Books

1. T. Veerarajan, “**Probability Statistics and Random Process**”, Tata McGraw Hill Publishing Company Ltd., New Delhi – 2007.

Reference Books

1. S. P. Gupta, “**Statistical Methods**”, Sultan Chand & Sons, New Delhi – 2004.
2. K. S. Trivedi, “**Probability and Statistics with Reliability, Queuing and Computer Science Applications**”, Prentice Hall of India Ltd., New Delhi.
3. P. Kandasamy, K.Thilagavathy and K.Gunavathy, “**Probability and Random Process**”, S.Chand & Co. Ltd., New Delhi - 2003
4. S.C. Gupta and V. K. Kapoor, “**Fundamentals of Mathematical Statistics**”, Sultan Chand & Sons, New Delhi – Latest Edition 2009.
5. G.Haribaskaran, “**Probability, Queueing theory and Reliability Engineering**”, Lakshmi Publishers(P) Ltd(University science Press), New Delhi, 2006.

12B402 - ENVIRONMENTAL SCIENCE AND ENGINEERING*(Common to MECH, EEE, ECE, PROD, EIE, CSE, IT and IBT.)***L T P C**
3 0 0 3**UNIT-I ENVIRONMENTAL RESOURCES****(9)**

Earth structure, Internal and external earth processes, plate tectonics, erosion, weathering, deforestation, anomalous properties of water, hydrological cycle, effect of modern agriculture, fertilizers, pesticides, eutrophication, biomagnifications, land degradation, minerals, rocks, rock cycle, mining, types of mining, desertification, soil erosion, methods of conservation of soil erosion, renewable energy resources, wind, solar, geothermal, tidal, OTEC.

UNIT-II ECO SYSTEM AND BIODIVERSITY**(9)**

Weather and climate, ocean current, upwelling, EL Nino, Ecology, ecosystem, biomes, physical and chemical components of ecosystem, biological components of ecosystem, forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle, carbon dioxide cycle, phosphorous cycle, food pyramid, Ecological succession, types, biodiversity, need for biodiversity, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity insitu-exitu conservation.

UNIT-III ENVIRONMENTAL POLLUTION**(9)**

Air pollution, classification of air pollutants gaseous particulars, sources effects and control of gaseous pollutants SO₂, NO₂, H₂S, CO, CO₂ and particulates, control methods, cyclone separator, electrostatic precipitator, catalytic combustion- water pollution-classification of water pollutants, inorganic pollutants, sources, effects and control of heavy metals, organic pollutants, oxygen demanding wastes, aerobic and anaerobic decomposition, soil pollution, Noise pollution, sources, effects, decibel scale.

UNIT- IV ENVIRONMENTAL THREATS**(9)**

Acid rain, green house effect, global warming, disaster management, flood, drought, earthquake, tsunami, threats to biodiversity, destruction of habitat, habit fragmentation- hunting, over exploitation – man- wildlife conflicts, The IUCN red list categories, status of threatened species.

UNIT-V SOCIAL ISSUES AND ENVIRONMENT**(9)**

Sustainable development- sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Air act, Wild life protection act, forest conservation act, population growth, exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, Role of information technology in human and health, HIV/AIDS, effects and preventive measures.

Text Books:

1. Sharma J.P., '*Environmental Studies*', 3rd Edn, University Science Press, New Delhi (2009)
2. Anubha Kaushik and C.P.Kaushik, '*Environmental Science and Engineering*', 3rd Edn New age International Publishers, New Delhi (2008)

Reference Books :

1. R.K.Trivedi, '*Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards*', Vol.I &II, Environ Media.(2006)
2. G.Tyler Miller,J_R '*Environmental Science*', Tenth Edition, Thomson BROOKS/COLE (2004)
3. Gilbert M.Masters, '*Introduction to Environmental Engineering and Science*', 2nd Edition Pearson Education (2004).

12B403 - CHEMICAL ENGINEERING THERMODYNAMICS

L T P C
3 1 0 4

BASIC CONCEPTS IN ENGINEERING THERMODYNAMICS (9)

First and second law of thermodynamics, calculation of work, energy and property changes in reversible processes, thermodynamics of flow processes, power cycles and refrigeration cycle.

THERMODYNAMIC PROPERTIES OF FLUIDS (9)

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications.

SOLUTION THERMODYNAMICS (9)

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

PHASE EQUILIBRIA (9)

Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

CHEMICAL REACTION EQUILIBRIA (9)

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

LECTURE: 45 TUTORIAL: 15 TOTAL : 60 Hours

Textbooks :

1. Smith J.M., Van Ness H.C., Abbot M.M., "Chemical Engineering Thermodynamics", 6th Edition. McGraw-Hill, 2001.
2. Narayanan K.V. A "Text Book of Chemical Engineering Thermodynamics". Prentice Hall India, 2001.

Reference Books :

1. Sandler S.I. "Chemical and Engineering Thermodynamics". John Wiley, 1989.

12B404 UNIT OPERATIONS

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MIXING AND AGITATION**(8)**

Dimensional analysis – Rayleigh’s method and pi- theorem ; power for agitation; agitation of liquids; gas-liquid systems; gas-solid suspensions; agitator scale up.

FILTRATION**(8)**

Constant pressure, constant volume batch filtration; continuous filtration; industrial filtration equipments; settling and sedimentation; centrifugation.

MECHANISM OF HEAT TRANSFER**(10)**

Steady state conduction – flat plates, hollow cylinder and hollow sphere; conduction through series resistances; lumped heat capacity; extended surfaces; combined conduction, convection and heat transfer coefficients, concepts of radiation.

CONVECTION HEAT TRANSFER**(9)**

Dimensional analysis for forced and natural convection; forced convection in pipes and other geometries; mechanisms of boiling and condensation.

HEAT EXCHANGERS AND EVAPORATORS**(10)**

Parallel and counter flow heat exchangers, LMTD, single and multi-pass heat exchangers - overall heat transfer coefficients; design of heat exchangers; Evaporators – types of evaporators, single and multiple effects evaporators, capacity and economy of evaporator; mass and enthalpy balances.

LECTURE: 45 TOTAL: 45 Hours***Text Books***

1. Geankoplis C.J. “*Transport Processes and Unit Operations*”. Prentice Hall India.2002.
2. McCabe W.L., Smith J.C. “*Unit Operations in Chemical Engineering*”. 5th Edition.Mcgrawhill.1993.

Reference Books

1. Incropera F.P. “*Fundamentals of Heat and Mass Transfer*”. John Wiley, 1998.

12B405 - INSTRUMENTAL METHODS OF ANALYSIS

L T P C
3 0 0 3

BASICS OF MEASUREMENT

(8)

Classification of methods – calibration of instrumental methods – electrical components and circuits -signal to noise ratio – signal – noise enhancement, introduction to fluorescent spectroscopy.

OPTICAL METHODS

(9)

General design – sources of radiation – wavelength selectors – sample containers – radiation transducers – types of optical instruments – Fourier transform measurements, X- Ray Crystallography, Nuclear Magnetic Resonance.

MOLECULAR SPECTROSCOPY

(10)

Measurement of transmittance and absorbance – Lambert-Beer's law – Colorimeter -spectrophotometer analysis – qualitative and quantitative absorption measurements - types of spectrometers – UV – visible – IR – Raman spectroscopy – instrumentation – theory.

THERMAL METHODS

(8)

Different thermal analysis techniques. Differential scanning calorimetry - instrumentation & application. Differential thermal analysis - instrumentation & application, DTA curve. Thermogravimetry – instrumentation & application, TG curve.

CHROMATOGRAPHIC SEPARATION METHODS

(10)

Introduction to chromatography – Types – ideal separation – retention parameters – van – deemter equation – gas chromatography – stationary phases – detectors – kovats indices – HPLC – pumps – columns – detectors – ion exchange chromatography – size exclusion chromatography.

LECTURE: 45 TOTAL : 45 Hours

Text Books

1. Chatwal & Anand "*Instrumental Methods of Chemical Analysis*", Himalaya Publishing House, 1999.
2. Willard and H. Merrit, Prentice hall of india, "*Instrumental Methods of Analysis*", CBS Publishers and Distributors, 1999.

Reference Books

1. D. Skoog, "*Instrumental Methods of Analysis*", 2000.

12B406 - MOLECULAR BIOLOGY

L T P C
3 0 0 3

CLASSICAL & MOLECULAR GENETICS

(8)

Linkage, crossing over, classical experiments – Hershey and Chase; Avery McLeod & McCarty. Conformation of DNA and RNA, classes of RNA. Organisation of eukaryotic chromosome – c_0t value, Bacterial conjugation, transduction and transformation- sexduction.

DNA REPLICATION

(10)

Rules of replication in all nucleic acid, enzymology, replication – continuous, discontinuous. Replication in prokaryotes - D-loop and rolling circle mode of replication, replication of linear viral DNA. Replication of telomeres in eukaryotes

TRANSCRIPTION

(10)

RNA polymerase, RNA replicase (Virus), Transcription in prokaryotes and eukaryotes, Inhibitors, features of promoters and enhancers, transcription factors, nuclear RNA splicing mechanisms – tRNA, rRNA, mRNA, ribozymes, RNA editing.

TRANSLATION

(10)

Elucidation of genetic code, Salient features of genetic code - Wobble hypothesis, ribosomes – prokaryotic & eukaryotic, protein synthesis, post translational processing, Protein targeting.

MUTATION – REPAIR AND REGULATION OF GENE EXPRESSION

(7)

Regulation of genes – replication, transcription & translation factors, *Lac* and *trp* operon. Mutation – transition, transversion, artificial & natural mutation, suppressor mutation. repair of DNA.

LECTURE: 45 TOTAL : 45 Hours

Textbooks

1. David Friefelder, “***Molecular Biology***”, Narosa Publ. House. 1999

Reference Books

1. Benjamin Lewin, “***Gene VII***”, Oxford University Press. 2000

2. Watson JD, Hopkins WH, Roberts JW, Steitz JA, Weiner AM, “***Molecular Biology of the Gene***”. 1987

12B407 - INSTRUMENTAL METHODS OF ANALYSIS LABORATORY

L T P C

0 0 3 2

1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer's law using KMnO_4
3. Finding the concentration of polyphenol using colorimeter.
4. Finding the analytical wavelength of KMnO_4 using colorimeter
5. Finding the concentration of the Fe (1, 10 phenanthroline) using absorption spectrometry.
6. UV spectra of nucleic acids.
7. Chromatography analysis using TLC.
8. Finding the concentration of Na and Ca using flame photometer.
9. Finding the concentration of fluorescein using fluorimeter .
10. Finding the concentration of Na and Ca using atomic absorption spectrophotometer.
11. Nuclear magnetic resonance.
12. Infrared spectrophotometer.

Textbook :

1. Willard and H. Merrit, "**Instrumental Methods of Analysis**", CBS Publishers and Distributors, 1999.

12B408 - MOLECULAR BIOLOGY LABORATORY

L T P C

0 0 3 2

1. Agarose gel electrophoresis
2. Isolation of plasmid DNA
3. Isolation of plant cell DNA
4. Isolation of animal cell genomic DNA
5. Restriction enzyme digestion
6. Ligation
7. Competent cell preparation
8. Transformation of DNA into competent cells
9. Blue and white selection for recombinants
10. Isolation of RNA
11. Isolation of genomic DNA from bacteria

Textbook :

1. Maniatis T, Sambrook. J, "*Molecular Cloning: A laboratory manual*", 2nd edition, 1987

12B409 - UNIT OPERATIONS LABORATORY

L T P C

0 0 3 2

1. Calibration of Venturimeter.
2. Calibration of Orificemeter.
3. Calibration of Rotameter
4. Flow through Straight pipe.
5. Double pipe Heat exchanger.
6. Pressure drop studies in fluidized bed.
7. Study of characterization of filtration using leaf filter.
8. Study of characterization of filtration using plate and frame filter press.
9. Study of crushing strength of solid materials using jaw crusher.
10. Study of crushing strength of solid materials using roll crusher.
11. Study of crushing strength of solid materials using ball mill.

Textbook :

1. McCabe W.L., Smith J.C. *“Unit Operations in Chemical Engineering”* 5th Edition. Mcgrawhill. 1993

12B501 - BIOINFORMATICS**L T P C****3 1 0 4****INTRODUCTION****(12)**

Operating system - Basic UNIX commands — File , directory related commands – pipes and Filter – FAP; Perl – Introduction, Basic Operators and Control Structures, Scalars, Lists, Hashes, File manipulation ; Computer network – protocols & Topology

DATABASES**(9)**

Databases – introduction, concepts – Biological Databases – Primary databases – Nucleic acids – ncbi, ddbj, embl. Proteins – PIR, Swissprot; Secondary databases – Prosite, PRINTS, profile, Pfam; Structure classification databases – SCOPE, CATH. Model organisms.

PATTERN MATCHING & MACHINE LEARNING**(9)**

Pair wise sequence alignment ; local vs. global alignment – multiple sequence alignment – dot matrix analysis – substitution matrices – dynamic programming – Bayesian methods – tools – BLAST – FASTA- machine learning – neural networks – statistical methods – Hidden Markov models.

PHYLOGENY**(9)**

Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances.

ADVANCED TOPICS IN BIOINFORMATICS**(6)**

Biomolecular modeling - 3D Structure prediction – Homology modeling; Micro array analysis – systems biology.

LECTURE: 45 Tutorial: 15 TOTAL: 60 Hours***Textbooks***

1. B. Bergeron, **“Bioinformatics Computing”**, PHI, 2002.
2. **“PERL programming for bioinformatics”** : Harshawardhan P Bal; Tata Mc Graw hill publications 2003
3. S.Sundara rajan , R.Balaji : **“Introduction to Bioinformatics”** : Himalaya publishing house 2003

Reference Books

1. C. Gibas & P. Jambeck, **Developing Bioinformatics Skills**, O’Reilly, 1999.
2. David. W. Mount : **“Bioinformatics genome and sequence analysis”** CSHL publications.2004

12B502 - ENZYME ENGINEERING AND TECHNOLOGY

L T P C

3 0 0 3

INTRODUCTION TO ENZYMES

(9)

Classification of enzymes. mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis.

KINETICS OF ENZYME ACTION

(12)

Kinetics of single substrate reactions; estimation of Michaelis – Menten parameters, multisubstrate reactions- mechanisms and kinetics; turnover number; types of enzyme inhibitions, allosteric regulation of enzymes, Monod changeux wyman model, deactivation kinetics.

ENZYME IMMOBILIZATION

(8)

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages.

PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES

(8)

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes.

APPLICATIONS OF ENZYMES & BIOSENSORS

(8)

Application of enzymes in analysis, industry, healthcare and environment; Enzyme biosensor and its significance

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours

Textbooks

1. Trevor Palmer “**Enzymes**”, Affiliated East West Press Pvt Ltd, New Delhi, 2004
2. Harvey W. Blanch, Douglas S. Clark, “**Biochemical Engineering**”, Marcel Dekker Inc, 1996.

Reference Books

1. James M. Lee, “**Biochemical Engineering**”, PHI, USA, 1992.
2. James. E. Bailey & David F. Ollis, “**Biochemical Engineering Fundamentals**”, McGraw Hill, 1986

12B503 BIOCHEMISTRY – II

L T P C
4 0 0 4

METABOLISM OF CARBOHYDRATES**(15)**

Glycolysis, TCA cycle, Gluconeogenesis, Pentose phosphate shunt, Interconnection of pathways and regulations, Respiratory chain, TP cycle, energy rich compounds, Biosynthesis and degradation of starch and glycogen, glycogen storage disorders.

METABOLISM OF AMINO ACIDS & PROTEINS**(15)**

Nitrogen metabolism and urea cycle. Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc), Protein degradation.

METABOLISM OF NUCLEIC ACIDS**(10)**

Biosynthesis of nucleotides, *denovo* and salvage pathways for purines and pyrimidines, regulatory mechanisms: Metabolic disorders associated with nucleic acid metabolism.

METABOLISM OF LIPIDS**(10)**

Biosynthesis and degradation of Lipids: Fatty acid synthesis and oxidative degradation, Triacylglycerol, phospholipid biosynthesis and degradation; Cholesterol biosynthesis, regulation, targets and action of cholesterol lowering drugs, Steroid hormones

BIOMEMBRANE AND ELECTRICAL CONDUCTIVITY**(10)**

Biomembrane transport proteins, trans-membrane potential coupled ATP generation, acetylcholine receptor as a ligand gated ion-channel, Neuronal sodium channel as voltage-gated ion channel, neurotransmitters and their mechanism of action, action potential, depolarization and nerve conduction. Ion-channel agonists and antagonists as drugs. Ion channel defects (Cystic Fibrosis)

LECTURE : 60 TOTAL : 60 Hours

Text Books

1. *Lehninger's "Principles of Biochemistry"* by David L. Nelson and Michael M Cox, Macmillan Worth Publisher, IVth edition, 2004.
2. *Lubert Stryer, "Biochemistry, 5th Edition"*, WH Freeman & Co., 2002.
3. *Voet and Voet, "Biochemistry, 3rd Edition"*, John Wiley & Sons Inc., 2004.

Reference Books

1. *Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell. V.W., "Harper's Biochemistry"*, Prentice Hall International 27th edition, 2006.
2. *Salway, J.G., "Metabolism at a Glance"*, 2nd Edition, Blackwell Science Ltd., 2000.

12B504 BIOPROCESS PRINCIPLES

L T P C

3 1 0 4

OVERVIEW OF FERMENTATION PROCESSES

(6)

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS

(12)

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, medium optimization methods – Plackett and Burman and Response surface method.

STERILIZATION KINETICS

(6)

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

METABOLIC STOICHIOMETRY AND ENERGETICS

(12)

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption – steps involved in the transfer of oxygen to broth and heat evolution in aerobic cultures.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

(9)

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models, substrate and product inhibition on cell growth and product formation.

LECTURE: 45 TUTORIAL: 15 TOTAL : 60 Hours

Textbooks

1. Bailey and Ollis, “*Biochemical Engineering Fundamentals*”, McGraw Hill (2nd Ed.), 1986.
2. Shuler and Kargi, “*Bioprocess Engineering*“, Prentice Hall, 1992.

Reference Books

1. Pauline Doran, “*Bioprocess Engineering Calculation*”, Blackwell Scientific Publications, 1992
2. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, “*Principles of Fermentation Technology*”, Science & Technology Books, 1992
3. Harvey W. Blanch, Douglas S. Clark, “*Biochemical Engineering*”, Marcel Dekker, Inc. 1986.

12B505 MASS TRANSFER OPERATIONS**L T P C****3 1 0 4****DIFFUSION AND MASS TRANSFER****(9)**

Molecular diffusion in solids, liquids and gases; Inter-phase mass transfer; theories to determine mass transfer coefficients; Analogies in Transport phenomenon.

GAS - LIQUID OPERATIONS**(9)**

Principles of gas absorption; Single and Multi component absorption; Absorption with chemical reaction; Design principles of absorbers; Industrial absorption equipments; HTU, NTU concepts.

VAPOUR - LIQUID OPERATIONS**(9)**

Vapour-Liquid equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCabe-Thiele & enthalpy-concentration method; Industrial distillation equipments, HETP, HTU and NTU concepts.

EXTRACTION OPERATIONS**(9)**

Liquid-Liquid equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching principles, Equipments for extraction and leaching.

SOLID - FLUID OPERATIONS**(9)**

Adsorption equilibria – Types - Batch and fixed bed adsorption; Drying - Mechanism - Drying curves - Time of drying; Equipments for drying - Batch and continuous dryers.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 Hours**Textbooks**

1. Treybal R.E. *“Mass Transfer Operations.3rd edition”*. Mcgraw Hill, 1981.
2. Geankoplis C.J. *“Transport Processes and Unit Operations. 3rd edition”*, Prentice Hall of India, 2002.

Reference Book

1. Coulson and Richardson's *“Chemical Engineering”*. Vol I & II, Asian Books Pvt Ltd, 1998

12B506 GENETIC ENGINEERING

L T P C
3 0 0 3

BASICS OF RECOMBINANT DNA TECHNOLOGY

(8)

Role of genes within cells - genetic elements that control gene expression in prokaryotes and eukaryotes – Repressors and Promoters – Methods of creating recombinant molecules - Restriction and modifying enzymes - safety guidelines of recombinant DNA research.

CREATION OF RECOMBINANT MOLECULES AND VECTORS

(10)

Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors. Insect, Yeast and Mammalian vectors.

CONSTRUCTION OF LIBRARIES

(10)

Construction of cDNA and genomic libraries. Screening of libraries with DNA probes and antisera, Characterization of recombinant clones by southern, Northern, western and PCR analysis.

POLYMERASE CHAIN REACTION

(10)

DNA amplification, primer synthesis – Taq polymerase – Types of PCR -Inverse PCR, Nested PCR, RACE PCR, RAPD, Taqman assay, Molecular beacons, site directed mutagenesis (Kunkel's Method) - methods of nucleic acid sequencing- Sangers method.

APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

(7)

Applications of recombinant technology in agriculture, pharmaceutical industry and medicine – knockout animals, Production of novel products, Antisense technology - Transgenic animals – embryo transfer eg. Dolly.

LECTURE : 45 TOTAL : 45 Hours

Textbook

1. Old RW, Primrose SB, “*Principles Of Gene Manipulation, An Introduction To Genetic Engineering*“, Blackwell Science Publications, 1993.

Reference Books

1. Ansel FM, Brent R, Kingston RE, Moore DD, “*Current Protocols In Molecular Biology*“, Green Publishing Associates, NY, 1988.
2. Berger SI, Kimmer AR, “*Methods In Enzymology*“, Vol 152, Academic Press, 1987

12B507 BIOINFORMATICS LABORATORY

L T P C

0 0 3 2

1. Biological Databanks - Sequence Databases, Structure Databases, Specialized Databases; Data retrieval tools and methods; Database file formats.
2. Molecular visualization- Rasmol, Cn3D, Swiss PDB Viewer.
3. Database similarity searching and dynamic programming algorithm
 - Sequence similarity searching - NCBI BLAST, FASTA
 - Pair wise & Multiple sequence alignment (ClustalW)- Smith Waterman & Needleman –Wunsch algorithm.
4. Analysis of protein and nucleic acids sequences- Dot matrix, Substitution matrix.
5. Protein sequence analysis -ExpASy proteomics tools
6. Molecular phylogeny — Construction of Phylogenetic tree — Maximum Parsimony & Maximum Likelihood method —PHYLP program
7. Homology Modeling - Homology modeling using SPDBV Model structure refinement using SPDBV-Ramachandran plot. Model validation using what Check and Pro Check - Verify 3D.

Textbooks :

1. **“Bioinformatics Databases, Tools and Algorithms”** by Orpita Bosu, Simminder Kaur Thukral. Oxford University Press. 2007.
2. **“ Bioinformatics a Practical Approach”** by K. Mani and N. Vijayaraj, Aparna Publications, Coimbatore. 2004.

12B508 BIOPROCESS LABORATORY I

L T P C

0 0 3 2

1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
2. Growth of yeast – estimation of biomass, calculation of specific growth rate, yield coefficient
3. Medium optimization – Plackett Burman design
4. Enzyme kinetics – Michaelis Menten parameters
5. Enzyme activity – effect of temperature and pH
6. Enzyme inhibition kinetics
7. Enzyme immobilization – gel entrapment
8. Enzyme immobilization – cross linking
9. Preparation of bioreactor, utilities for bioreactor operation (Batch, Fed batch, continuous)
10. Sterilization Kinetics

12B509 GENETIC ENGINEERING LABORATORY

L T P C

0 0 3 2

1. Isolation and Quantification of plasmid DNA
2. Elution of DNA from agarose gels
3. Ligation of DNA into expression vectors
4. Transformation
5. Optimization of inducer concentration for recombinant protein expression
6. Optimization of time of inducer for recombinant protein expression
7. SDS-PAGE
8. Western blotting
9. Blotting techniques – Southern , Northern
10. Hybridization with anti-sera
11. PCR.
12. RFLP and RAPD

12B601 IMMUNOLOGY

L T P C
3 0 0 3

CELLS AND ORGANS OF THE IMMUNE SYSTEMS

(6)

Innate and acquired immunity; cells of immune system, primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

CELLULAR RESPONSES

(12)

Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

INFECTION AND IMMUNITY

(16)

Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; allergy and hypersensitivity; AIDS and Immunodeficiencies; resistance and immunisation; vaccines.

TRANSPLANTATION IMMUNOLOGY

(7)

Basis of Graft rejection, specificity and memory of graft rejection, Role of cell mediated response in graft rejection, Transplantation antigens, Mechanisms involved in Graft rejections.

AUTOIMMUNITY

(4)

Autoimmunity, Auto immune diseases and diagnosis, proposed mechanisms for induction of Autoimmunity, Treatment of Autoimmune diseases; current therapies, monoclonal antibody and diagnosis, treatment.

LECTURE:45 TOTAL : 45 Hours

Textbook

1. Roitt I, Male, Brostoff. **“Immunology”**, Mosby Publ., 2002.

Reference Books

1. Kuby J, **“Immunology”**, WH Freeman & Co., 2000.

2. Ashim K. Chakravarthy, **“Immunology”**, TataMcGraw-Hill, 1998.

12B602 CHEMICAL REACTION ENGINEERING**L T P C****3 1 0 4****KINETICS OF HOMOGENOUS REACTIONS****(9)**

Concentration and temperature dependent term of rate equation – searching for mechanism – predictability of reaction rate from theory; Interpretation of batch reactor data – constant volume and variable volume batch reactors – temperature and reaction rate - development of rate equations for different homogeneous reactions (up to second order reactions both reversible and irreversible reactions) .

REACTOR DESIGN**(9)**

Ideal batch reactors – steady state MFR & PFR – holding time for flow systems; Design for single reactions - performance equations for single reactors – size comparison of single reactors – MFR vs PFR for first and second order reactions – graphical comparison; multiple reactor systems – PFR in series/ parallel – equal size and different size Mixed reactors in series; reactors of different types in series. Design for Multiple reactions (first order reactions only)

NON IDEAL FLOW**(9)**

RTD of fluid in vessel – relationship between F,C & E curve – conversion from tracer information ; non-ideal flow models – Dispersion model and Tanks in series Model; Multiparameter models – models for fluidized beds.

DESIGN FOR HETEROGENOUS SYSTEMS**(9)**

Rate equations – contacting patterns for two phase systems; fluid particle reactions – unreacted core model for spherical particles of unchanging size – rate of reaction for shrinking spherical particles – determination of rate controlling step – application to design; reactions steps; resistances and rate equations; Fluid – Fluid reactions – rate equations.

SOLID CATALYSED REACTIONS**(9)**

Rate equation – rate controlling mechanisms – experimental methods for finding rates – product distribution in multiple reactions – application to design; Deactivating catalysts – mechanism – rate equation.

LECTURE: 45 TUTORIAL: 15 TOTAL : 60 Hours**Text books :**

1. Levenspiel O. “*Chemical Reaction Engineering. 3rd Edition*”. John Wiley.1999.
2. Fogler H.S. “*Elements of Chemical Reaction Engineering*”. Prentice Hall India.2002

Reference Book

1. Missen R.W., Mims C.A., Saville B.A. “*Introduction to Chemical Reaction Engineering and Kinetics*”. John Wiley.1999.

12B603 PROTEIN ENGINEERING

L T P C
3 0 0 3

BONDS AND ENERGIES IN PROTEIN MAKEUP

(5)

Covalent, Ionic, Hydrogen, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

AMINO ACIDS AND THEIR CHARACTERISTICS

(6)

Amino acids – structure with three and single letter codes- molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

PROTEIN ARCHITECTURE

(12)

Peptide mapping, peptide sequencing - automated Edman method & mass-spec. Methods to determine Super-secondary structure: Apha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites. overview of methods to determine 3D structures, Modular nature, formation of complexes.

STRUCTURE-FUNCTION RELATIONSHIP

(12)

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins and receptors bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase,

PROTEIN ENGINEERING

(10)

Advantages – protein data base analysis – methods to alter primary structure of proteins, examples of engineered proteins, thermal stability of T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *de novo* protein design – principles and examples.

LECTUTRE: 45 TUTORIAL: 15 TOTAL: 60 Hours

Text Books

1. Voet D. and Voet G, “**Biochemistry**”, Third edn. John Wiley and Sons, 2001.
2. Moody P.C.E. and Wilkinson A.J. “**Protein Engineering**”, IRL Press, Oxford, UK, 1990.

Reference Books

1. Branden C. and Tooze J., “**Introduction to Protein Structured**”, Second Edition, GarlandPublishing, NY, USA, 1999
2. Creighton T.E. “**Proteins**”, Freeman WH, Second Edition, 1993

12B604 PLANT BIOTECHNOLOGY**L T P C****3 0 0 3****PLANT GENOMES AND PLANT TISSUE CULTURE****(9)**

Introduction-gene structure and gene expression-regulation, implication for plant transformation,- heterologous promoters, genome size and organization, mitochondrial and chloroplast genome. Plant tissue culture-plasticity and totipotency, culture environment, growth regulators, media regulators, culture types, plant regeneration.

PLANT TRANSFORMATION TECHNIQUES**(9)**

Introduction- *Agrobacterium* mediated gene transfer –Ti-plasmid-process of T-DNA transfer and integration, transformation in plant, Direct gene transfer methods, Binary vectors- basic features of vectors-optimization, clean gene technology, viral vectors- Gemini virus - cauliflower mosaic virus

TRANSGENIC PLANTS-HERBICIDE AND PEST RESISTANCE**(9)**

Herbicide resistance-use of herbicide in modern agriculture-strategies for engineering herbicide-resistance. Environmental impact, pest resistance-nature and scale of insect / pest damage to crop-GM strategies-Bt approach to insect resistance-copy nature strategy-insect resistant crops and food safety.

PLANT DISEASE RESISTANCE AND STRESS TOLERANCE**(9)**

Introduction-plant-pathogen interactions-natural disease resistance pathways-biotechnological approaches to disease resistance. Plant viruses- types-entry and replication- transgenic approach-PDR Stress tolerance-abiotic stress-water deficit stress and various approaches for tolerance.

MOLECULAR FARMING AND GM CROPS FUTURE PROSPECTS**(9)**

Introduction-carbohydrates and lipids production-molecular farming of proteins-economic considerations for molecular farming.GM crops-current status-concerns about GM crops- regulations of GM crops and products-Greener genetic engineering.

Text Books

1. Adrian Slater, Nigel W.Scott and Mark R.Fowler, "**Plant Biotechnology-The genetic manipulation of plants**". Oxford university press, pg-341.
2. Ignacimuthu .S, "**Applied Plant Biotechnology**", Tata McGraw Hill,1996

Reference Book

1. Heldt HW. "**Plant Biochemistry & Molecular Biology**", Oxford University Press. 1997.

12B605 ANIMAL BIOTECHNOLOGY

L T P C

3 0 0 3

ANIMAL CELL CULTURE

(12)

Introduction to basic tissue culture techniques, equipments and instruments in ATC - chemically defined and serum free media - animal cell cultures - maintenance and preservation - various types of cultures; suspension cultures - continuous flow cultures - immobilized cultures - somatic cell fusion - organ cultures.

ANIMAL DISEASES AND THEIR DIAGNOSIS

(9)

Bacterial and viral diseases in animals - monoclonal antibodies – diagnosis - molecular diagnostic techniques; PCR - *in-situ* hybridization - northern -southern blotting - RFLP.

THERAPY OF ANIMAL DISEASES

(10)

Recombinant cytokines – therapeutic applications of monoclonal antibody, vaccines - DNA, sub unit, cocktail vaccines - gene therapy for animal diseases.

MICROMANIPULATION OF EMBRYO'S

(7)

Micromanipulation technology - equipments - enrichment of x and y bearing sperms from semen samples - artificial insemination - germ cell manipulations – *In vitro* fertilization -embryo transfer - micromanipulation technology and breeding of farm animals.

TRANSGENIC ANIMALS

(7)

Concepts of transgenic animal technology; strategies for the production of transgenic and knock out animals– significance in biotechnology - stem cell cultures in production of transgenic animals.

LECTURE: 45

TOTAL: 45Hours

Textbooks

1. Ranga M.M. “**Animal Biotechnology**”. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. “**Text Book Of Animal Biotechnology**”. Akshara Printers,1997.

Reference Book

1. Masters J.R.W. “**Animal Cell Culture: Practical Approach**”. Oxford University Press.2000

12B607 IMMUNOLOGY LABORATORY

L T P C
0 0 3 2

1. Handling and maintenance of experimental animals.
2. Routes of immunization.
3. Raising of antiserum.
4. Bleeding of Experimental animals.
5. Separation and preservation of serum from blood.
6. Identification of cells in a blood smear.
7. Agglutination reaction to determine blood group.
8. Immunodiffusion (Double diffusion, Ouchterlony method, radial immunodiffusion)
9. Immunoelectrophoresis
10. Enzyme Linked ImmunoSorbent Assay (ELISA)

12B608 PLANT BIOTECHNOLOGY LABORATORY

L T P C

0 0 3 2

- I. Preparation and Sterilization of Plant tissue culture media
 1. Sterilization and inoculation of leaf, cotyledon and nodal explants.
 2. Callus culture and maintenance
 3. Sub-culturing of callus
 4. Shoot and root induction.
 5. Protoplast isolation and protoplast fusion.
 6. Genetic transformation – *Agrobacterium mediated*, Gene-gun
 7. Isolation of Genomic DNA from transformed callus
 8. Screening of transformants through PCR
 9. GUS assay

12B609 ANIMAL BIOTECHNOLOGY LABORATORY

L T P C

0 0 3 2

1. Sterilization techniques – media, glass wares
2. Preparation of reagents and medium for animal tissue culture
3. Cryopreservation.
4. Separation of lymphocytes from blood using gradient medium
5. Culturing of lymphocytes
6. Tumour induction in mice
7. Culturing of B-cells from Spleen
8. Isolation of macrophage from tissue.
9. Macrophage culture and Phagocytosis assay
10. Tryphan blue assay
11. MTT assay
12. Isolation of DNA from Blood cells

12B701 PRINCIPLES OF MANAGEMENT

L T P C

3 0 0 3

BASICS OF MANAGEMENT THOUGHT

(9)

Evolution of management, definition. Levels, principles, differences with administration, roles of managers, social responsibility of business, external environment of business, management ethics, introduction to functions of management.

PLANNING

(9)

Nature, Purpose, types, steps, management by objectives, strategic planning process, decision making, types of decisions, approaches to decision making under uncertainty.

ORGANISING

(9)

Formal and informal organization – Span of management – Departmentation- line , staff authority, De-Centralization and Delegation of Authority – Effective organization and organization culture.

STAFFING & LEADING

(9)

Systems approach to staffing – performance appraisal process and career strategy formulation, Leadership theory, theories of Motivation Communication – Process , Barriers , Guidelines for effective Communication – Electronic media in Communication

CONTROLLING

(9)

Process, feedback loop of management control, requirements for effective control – control techniques – operations research for controlling , overall and preventive control.

LECTURE: 45 TOTAL: 45Hours

Text Books :

1. Harold Koontz & Heinz Weihrich “*Essentials of Management*”, Tata Mcgraw Hill,1998
2. Joseph L Massie “*Essentials of Management*”, Prentice Hall of India,(Pearson) Fourth Edition, 2003.

Reference Books :

1. Tripathy PC And Reddy PN, “ *Principles of Management*”, Tata Mcgraw Hill,1999.
2. Prasad,LM., “ *principles and practice of management*” , Sultan Chand and Sons, New Delhi, 2003.

12B702 BIOPROCESS ENGINEERING**L T P C****3 1 0 4****DESIGN AND ANALYSIS OF BIOREACTORS****(12)**

Design and operation of novel bioreactors-airlift, bubble column, packed bed and fluidized bed reactors, Stability analysis of bioreactors. Application to design of continuous sterilizers.

BIOREACTOR SCALE – UP**(8)**

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - microbial oxygen demands; Mass transfer coefficients ($K_L A$); mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

MONITORING OF BIOPROCESSES**(8)**

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, Product and other metabolites.

MODELLING AND SIMULATION OF BIOPROCESSES**(10)**

Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch and transient culture metabolism.

BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS**(7)**

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. kinetics of immobilized enzyme reactors – packed bed and fluidized bed.

LECTURE: 45 TUTORIAL:15 TOTAL: 60 Hours**Text Books :**

1. Anton Moser, *“Bioprocess Technology, Kinetics and Reactors”*, Springer Verlag.1998
2. James E. Bailey & David F. Ollis, *Biochemical Engineering Fundamentals*, McGraw Hill.1986 2nd edition.
3. Shuler and Kargi, *“Bioprocess Engineering “*, Prentice Hall, 1992.

Reference Books :

1. James M. Lee, *“Biochemical Engineering”*, PHI, USA.1991
2. Atkinson, *“Handbook of Bioreactors”*.1991
3. Harvey W. Blanch, Douglas S. Clark, *“Biochemical Engineering”*, Marcel Decker Inc.1991

12B703 DOWNSTREAM PROCESSING

L T P C

3 0 0 3

DOWNSTREAM PROCESSING

(8)

Introduction to downstream processing principles, characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilization of bioproducts.

PHYSICAL METHODS OF SEPERATION

(6)

Unit operations for solid-liquid separation - filtration and centrifugation, flocculation, precipitation and settling of particles.

ISOLATION OF PRODUCTS

(12)

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation -ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

PRODUCT PURIFICATION BY CHROMATOGRAPHY

(12)

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques.

FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS

(7)

Crystallization principles -Equipments, Drying principles-Equipments for drying and Lyophilization in final product formulation.

LECTURE: 45 TOTAL: 45 Hours

Text Books

1. P.A. Belter, E.L. Cussler and Wei-Houhu – “**Bioseparations – Downstream Processing For Biotechnology**”, Wiley Interscience Pun.1988
2. R.O. Jenkins, (Ed.) – “**Product Recovery in Bioprocess Technology**” – *Biotechnology By Open Learning Series*, Butterworth-Heinemann,1992

Reference Books

1. J.C. Janson and L. Ryden, (Ed.) – “**Protein Purification – Principles, High Resolution Methods and Applications**”, VCH Pub. 1989.
2. R.K. Scopes – “**Protein Purification – Principles and Practice**”, Narosa Pub. (1994).

12B704 METABOLIC ENGINEERING**L T P C****3 0 0 3****BASICS OF METABOLIC REGULATION****(9)**

Basic concepts of Metabolic Engineering – Overview of cellular metabolism – Different models for cellular reactions, induction – Jacob Monod model and its regulation, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, permeability control - passive diffusion, facilitated diffusion, active transport, group transportation.

METABOLIC ENGINEERING OF PRIMARY METABOLITES**(9)**

Alteration of feed back regulation for enhanced production of primary metabolites:glutamic acid.Mutants which do not produce feed back inhibitors or repressors-auxotrophs-lysine,isoleucine,arginine,purine nucleotides. Mutants that do not recognize inhibitors and repressors-resistant mutants-production of biotin,threonine,methionine

METABOLIC ENGINEERING OF SECONDARY METABOLITES**(9)**

Producers of secondary metabolites, Precursor effects, prophophase- idiophase relationship, applications of secondary metabolites, metabolic pathways and regulation for production of antibiotics (penicillin, cephalosporin,erythromycin,streptomycin),vitamins(Vit B₁₂,Vit B₂)

REGULATION OF ENZYME ACTIVITY**(9)**

Overview of enzyme kinetics-simple,reversible inhibition system,irreversible inhibition,un competitive,non-competitive inhibition, allosteric regulation,co-operativity-regulation of enzyme concentration-transcription initiation ,translation, regulation at whole cell level.

METABOLIC FLUX**(9)**

Integration of anabolism and catabolism, metabolic flux distribution analysis in bioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, Metabolic flux analysis and its applications-amino acid production by glutamic acid bacterium.

LECTURE: 45 TOTAL: 45 Hours**Textbooks**

1. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, *Principles of Fermentation technology*, Butterworth-Heinemann, An imprint of Elsevier India PVT Ltd., 2nd Edition, 2005.
2. G. Stephanopoulos, Aristos A. Aristidou, Jens Høirnis Nielson, *Metabolic Engineering : Principles and Methodologies*, Academic press, 1998.

Reference Books

1. Wang D. I. C., Cooney C. L., Demain A. L., Dunnill P., Humphrey A. E., Lilly M. D., *“Fermentation and Enzyme Technology”*, John Wiles and Sons., 1980.
2. W. Crueger and A. crueger, *“A text book of Industrial Microbiology”*, Panima Publishing Corporation, 2005.
3. Zubay G., *Biochemistry*, *“Macmillan Publishers”*, 1989.

12B707 MINI PROJECT

L T P C

0 0 3 2

- Students should do a separate mini project or part of their main project as mini project.
- Students can finalize their topic of specialization for their eighth semester project in seventh semester and do literature survey/related work as mini-project.
- At the end of the semester, a report has to be submitted

12B708 DOWNSTREAM PROCESSING LABORATORY

L T P C

0 0 3 2

1. Protein Purification by isoelectric point precipitation.
2. Ammonium Sulphate precipitation.
3. Liquid – Liquid extraction.
4. Solid – Liquid extraction.
5. Crystallization.
6. Adsorption studies.
7. Cell fractionation using centrifuge.
8. Drying of solid by heat source.
9. Extraction of Tyrosinase.
10. Dialysis
11. Purification of α – Amylase from *Bacillus*.
12. Solid recovery by centrifugation

Text Books

1. Roger G.Harrison, Paul Todd, Scott R.Rudge and Demetri P.Pterides – “**Bioseparations Science And Engineering**” – Oxford University Press – 2003
2. R.O. Jenkins, (Ed.) – “**Product Recovery In Bioprocess Technology – Biotechnology**” By Open Learning Series, Butterworth-Heinemann (1992).

12B709 BIOPROCESS LABORATORY II

L T P C

0 0 3 2

1. Thermal death kinetics
2. Batch reactor kinetics – estimation of reaction rate constant.
3. Fed batch reactor kinetics – estimation of rate constant.
4. Continuous reactor kinetics.
5. Estimation of $k_L a$ – dynamic gassing method in batch fermentor
6. Estimation of $k_L a$ – sulphite oxidation method
7. Estimation of $k_L a$ – power correlation method
8. Residence time distribution in CSTR.
9. Residence time distribution in PFR using immobilized enzyme system.
10. Estimation of overall heat transfer coefficient in batch fermentor

Text Books

1. Anton Moser, “**Bioprocess Technology, Kinetics and Reactors**”, Springer Verlag.1998.
2. James E. Bailey & David F. Ollis, “**Biochemical Engineering Fundamentals**”, McGraw Hill. 2nd edition, 1986.

12B801 PROJECT WORK

L T P C

0 0 12 6

The project should be done with the following criteria

1. Background of the study.
2. Hypothesis and rationale.
3. Plan of the study.
4. Designing of the experiment.
5. Validation.
6. Results and interpretation.
7. Discussion.
8. Conclusion and Significance of the study.
9. Outcome and Summary.
10. Report preparation and Presentation (PPT)

Students are encouraged to publish their original results in Journals.

12B6E0 FOOD TECHNOLOGY

L T P C

3 0 0 3

FOOD AND ENERGY

(5)

Constituents of Food- Carbohydrates, lipids, Proteins, Water, Vitamins and Minerals: Dietary sources.

FOOD MICROBIOLOGY

(9)

Types of micro-organism normally associated with food -mold, yeast, and bacteria. Micro-organisms in natural food products. Biochemical changes caused by micro-organisms. Food poisoning and microbial toxin. Spoilage of vegetables, fruit, meat, poultry , beverages and other food products. Food safety.

FERMENTATION PRODUCTS

(9)

Enzymes in foods and food industry, Nature and type of starters, Role of starters in Fermented foods, Fermentation of Milk products-Fermented soy and peanut milk , Idli, Fermented fish products, Pickles, Fermented Olives ; Production of distilled beverage alcohol ,wine, brandy, and beer. Mycoprotein production.

FOOD ADDITIVES

(9)

Chemical and physical methods of food analysis for determination of food composition; Pigments in food, food flavours, food additives and toxicants. Natural sweeteners and artificial sweeteners - role in controlling diseases.

FOOD PROCESSING & PRESERVATION

(13)

Basic principles, unit operations Involved in the food processing methods; Objectives, importance and functions of quality control. Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of micro organisms, canning, frozen storage characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

LECTURE: 45 TOTAL: 45 Hours

Text Books

1. Jay, J.M., "**Modern Food Microbiology**", CBS Publications, New Delhi, 1987.
2. William C.Frazier," **Food Microbiology**", fourth edition, Tata MC Graw hill.

Reference Books

1. Fennema, O.R. "**Principles of Food Science**": Part-I Food Chemistry. Marcel Dekker, New York. 1976.
2. Meyer, L.H. "**Food Chemistry**". East-West Press Pvt. Ltd., New Delhi. 1973.
3. B.Sivashankar – "**Food processing and preservation**", Prentice – Hall of India Pvt.Ltd.New Delhi 2002.

12B6E1 GENETICS

L T P C

3 0 0 3

(9)

MENDELIAN GENETICS

Mendel's experiments, principles of segregation – monohybrid cross – Independent Assortment, Gene interaction, multiple alleles.

CHROMOSOME STRUCTURE AND ORGANIZATION

(9)

Chromosome structure and organization in prokaryotes and eukaryotes, Giant chromosomes – polytene and lampbrush – sex determination and sex linkage.

LINKAGE AND CROSSING OVER

(9)

Linkage, Crossing over – cytological basis of crossing over, chromosome mapping – two and three factor cross– interference, somatic cell hybridization

VARIATION IN CHROMOSOME STRUCTURE AND NUMBER

(9)

Deficiencies – duplication –inversion- translocation – positive effects-human chromosome techniques. (karyotyping)- chromosome aberration in humans-classification of mutation- classification of ploidy -variation in chromosome number-extra chromosomal inheritance-cytogenetical abnormalities in humans

RECOMBINATION IN BACTERIA

(9)

Transformation, Transduction, Conjugation – mapping, fine structure mapping in merozygotes- plasmids and Episomes

LECTURE: 45 TOTAL: 45 Hours

Textbook

Gardner, Simmons, Snustad, "Principles of Genetics", 8th edition – John Wiley and Sons, Inc., 2003

12B6E2 ENERGY ENGINEERING AND TECHNOLOGY

L T P C

3 0 0 3

ENERGY

(9)

Introduction -Resources : Renewable and non-renewable resources (Water, Minerals, and Energy; Use and over-exploitation; Classification and Sources of Energy; Problems relating demand and supply of various energy sources; Coal, Petroleum etc.,

CONVENTIONAL AND NON- CONVENTIONAL ENERGY

(9)

Conventional fuels- firewood, plant and animal wastes, coal, gas, animal oils, their environmental impact.Modem fuels-methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugars to ethanol, the gasohol experiment, solar energy converters-hopes from the photosynthetic pigments, plant based petroleum industry, cellulose degradation for combustible fuels their environmental impacts.

BIOGAS PLANT AND ITS DESIGN

(9)

KVIC plants, process kinetics, digester design, sludge treatment, energy from wastes - development in energy routes.

CLEAN COAL TECHNOLOGY

(9)

Biotechnology and Microbiology of Coal Degradation – Aerobic and Anaerobic pathway of coal degradation- Characterisation/ identification of bioconversion substrates and products – Biosolubilization and bioliquefaction of coal- Biodesulfurisation of coal and oil- Mechanisms of coal biosolubilization- Enzymes that depolymerise coal – recent Advances in bioprocessing of coal.

GREEN TECHNOLOGY – MICROBIAL FUEL CELL

(9)

From Microbes to Megawatts – Microbial Fuel Cells - Types of Biological fuel cells – Working Principle - Applications of Biological Fuel cells.

LECTURE: 45 TOTAL: 45 Hours

Textbooks :

1. S.B Pandya, “*Conventional Energy Technology - Fuels and chemical Energy - TMH (1987)*”
2. S.P. Sharma and Chander Mohan, “*Fuels and Combustion*”, “TMH, 1984”
3. Kash Kori, C., “*Energy resources, demand and conservation with special reference to India*”, TMH, 1975.

Reference Books :

1. Gulp Jr., “*Principles of Energy Conservation*”, “MGK, 1979”
2. Chemtech I - “*Manual of Chemical Technology*”, “Vol.I. S. Chand and Co., New Delhi, 1985”
3. Pryde P.R., “*Non Conventional energy resources*” JW, 1983”
4. Connolly, T.J., “*Foundation of nuclear engineering*” JW, 1978”
5. Gray T.J. and Gashos G.K., “*Tidel Power,*” Plenum Press, 1972GGG”
6. Sarkar S. “*Fuels and Combustion*”, Orient Longmans, 1974”
7. Duffie T.R. and Beckman, W.A., “*Solar Energy Thermal Processes*” JW, 1974”

12B6E3 NANOBIO TECHNOLOGY**L T P C****3 0 0 3****INTRODUCTION****(9)**

Nano - definition, The Fundamental Science behind nanotechnology- electrons, atoms and ions, molecules, metals, biosystems. Nanobiotechnology –definition. Inorganic Nanoscale systems for Biosystems-Nano-structured materials - Fullerenes – Properties, Characteristics and applications, Carbon Nanotubes - Characteristics and Applications. Quantum Dots and Wires- Gold Nanoparticles- Nanopores - Applications of Nanomolecules in Biosystems

BIOLOGICAL METHODS OF SYNTHESIS**(9)**

Use of bacteria, fungi, Actinomycetes for nanoparticle synthesis, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation; Synthesis process and application, Role of plants in nanoparticle synthesis

NANOBIOMETRICS**(9)**

Introduction- Lipids as nanobricks and mortar, Self assembled monolayers, Nanoscale motors, Ion channel as sensors, DNA based Nano-cubes and nano-hinges, protein based Nanomotors-Bacteriorhodopsin

NANOANALYSIS**(9)**

Characterization of Nano particles using Instruments - AFM, SEM, TEM, STM, XRD, EDAX, FTIR – principle and applications

BIOMEDICAL APPLICATIONS OF NANOPARTICLES**(9)**

Biocompatible In organic devices (Implant coating, stems and seeds); Chips for molecular diagnostics –DNA microarrays, Protein microarrays, lab on a chip; Nanoparticles for drug delivery; Nanovectors for gene therapy; Nanobiosensors; In-vivo diagnostics in Molecular imaging; Nanoplatfoms for cancer therapy.

LECTURE: 45 TOTAL: 45 Hours**Textbooks:**

1. Christ of M.Niemeyer, Chad A.Mirkin, “**Nanobiotechnology: Concepts**”, Applications and Perspectives, (eds.), Wiley-VCH, Weinheim, (2004)
2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, “**Nanotechnology: basic science and emerging technologies**” , Overseas Press (2005).
3. B. Roszek,, W.H. de Jong, and R.E. Geertsma: “**Nanotechnology in medical applications**”: state-of-the-art in materials and devices (2005)

Reference Books:

1. Tuan Vo-Dinh, “**Nanotechnology in Biology and Medicine**”: Methods, devices and applications, ISBN no. 1249329494
2. Mark Ratner and Daniel Ratner, “**Nanotechnology - A Gentle Introduction to the Next Big idea**”, Pearson Education, Inc.2005
3. Handbook of “**Nanostructured Biomaterials and Their Applications in Nanobiotechnology**” - Hari Singh Nalwa

12B6E4 MEDICAL BIOTECHNOLOGY

L T P C

3 0 0 3

MEDICALLY IMPORTANT INFECTIOUS ORGANISMS (9)

Classifications of pathogenic microbes; Leptospira, Brucella, Bacillus anthracis, Medical Parasitology: Amoebiasis, Cryptosporidiosis, Giardiasis, Malaria; Toxoplasmosis, Medical Bacteriology: Staphylococcus, Streptococcus & Enterococcus, Pneumococcus, Mycobacterium, Bacillus, salmonella, Shigella, Pseudomonas & Non-fermenters, Vibrio.

MEDICAL VIROLOGY (8)

Adenoviruses, Pox viruses, Hepadnaviruses, Arboviruses, Retroviruses, Medical Mycology: Fungi, Mold, Yeast, Pathogenic fungi, Superficial Mycoses, Subcutaneous Mycoses, Systemic Mycoses.

HYBRIDOMA TECHNOLOGY (8)

Monoclonal Antibodies – Production, Target drug delivery using monoclonal antibodies; Human Gene Therapy, Detection and Therapy of Tuberculosis, Yellow Fever, Japanese encephalitis, Dengue fever, Acquired Immune Deficiency Syndrome (AIDS), Cholera, Malaria; Cancer.

STEM CELL (9)

Embryonic and adult stem cells, Totipotent, pluripotent and multipotent cells testing and generation of embryonic stem cells, testing of adult stem cells and differentiation, potential uses of stem cells – cell based therapies, Gene products in medicine – Humulin, erythropoietin, Growth hormone-somatostatin, TPA, Interferon; functional cloning-anti haemophilic factor positional cloning-Dystrophin.

PHARMACEUTICAL BIOTECHNOLOGY (11)

Vaccines- Preparation and testing, standardization and storage study. Diphtheria, tetanus toxoid, cholera, pertussis, plaque, BCG, rabies, polio, measles, typhoid, new generation of vaccines- hepatitis, AIDS, Malaria. Production of recombinant pharmaceutical products – Biotechnologically derived products (therapeutic proteins); Study of Haematopoietic growth factors, Interferons, interleukins, insulin, Growth Hormones. Recombinant coagulation factors and thrombolytic agents, somatostatin, somatotropin. Formulation of bioproducts- pharmacokinetics and pharmacodynamics of peptide and protein drugs.

LECTURE: 45 TOTAL: 45 Hours

Text Books

1. Berger S.L., ET AL., “*Methods in Enzymology*”, Academic press Inc., CA 1992
2. De Kalyan kumar, “*Plant tissue culture*”, 1st edition, 1997 New Central Book Agency (P) Ltd.
3. Freifelder David, “*Molecular Biology*”, 2nd Edition, 1998, Narosa Publishing.

12B7E0 ENVIRONMENTAL BIOTECHNOLOGY**L T P C****3 0 0 3****FUNDAMENTALS OF MICROORGANISMS****(8)**

Microbial flora of soil, growth and ecological adaptations of soil microorganisms, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

DEGRADATION OF XENOBIOTIC COMPOUNDS**(8)**

Aromatics – benzene, nitrobenzene, pentachlorophenol, hexachlorobenzene, Polyaromatic hydrocarbons(PAHs) – naphthalene, phenanthrene, Polychlorinated biphenyls(PCBs) –hexachlorobiphenyl , Pesticides - DDT and Surfactants – LAS

INDUSTRIAL WASTE WATER MANAGEMENT**(10)**

Wastewater characteristics – physical, chemical and biological, Biological processes - , unit operations, aerobic treatment processes, activated sludge process – characteristics of activated sludge and process configuration, anaerobic treatment by methanogenesis

TREATMENT OF INDUSTRIAL WASTES**(7)**

Dairy, pulp, dye, leather and pharamaceuticals

DEVELOPMENTS PERTAINING TO ENVIRONMENTAL BIOTECHNOLOGY**(12)**

Solid waste management, Role of biosensors in Environmental monitoring, Heavy metal pollution and their control strategies, Prevention of environmental damage with respect to nitrogen fixation, Bioremediation, Production of bioelectricity from microbial fuel cell (MFC), Improvement of water quality by denitrification, Role of biotechnology on agricultural chemical use

LECTURE: 45 TOTAL: 45 Hours**Textbooks :**

1. Bruce E. Rittmann and perry L. Mccarty., “*Environmental Biotechnology: Principle and Applications*” ,McGraw Hill publishing company Ltd,2001
2. Mecal and Eddy Inc, “*Wastewater Engineering : Treatment Disposal Reuse*” McGraHill publishing company Ltd, 1991
3. Des W. Connell,Basic concepts of “*Environmental chemistry*”, Lewis publishers,2005

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Reference Books :

1. Alan Scragg, “*Environmental Biotechnology*”, Oxford University press,2005
2. Prescott, Harley, Klein, “*Microbiology*”, WCB publishers,1996

12B7E1 BIOSEPARATIONS

L T P C

3 0 0 3

CELL DISRUPTION

(9)

Mechanical and enzymatic methods of cell disruption, importance of cell disruption in product release, homogenization, ultrasonication, extraction, absorption, adsorption.

CHROMATOGRAPHIC METHODS

(9)

Chromatographic methods, paper chromatography, thin layer chromatography, gas chromatography, GLC, HPLC, affinity chromatography, ion exchange chromatography, reverse phase chromatography

SEPARATION TECHNIQUES

(9)

Basic separation techniques: sedimentation, centrifugation, ultracentrifugation, gradient centrifugation, filtration, micro/ultra filtration, use of membranes (semi permeable) in purification, reverse osmosis. Separation of bioconversion products/ secondary metabolites e.g. Steroids and antibiotics.

PHYSICO - CHEMICAL SEPARATION

(9)

Importance of separation techniques in biotechnology, its scope from research to industry, chemical, physical and biochemical aspects of separation and isolation, purification of biomolecules. Behavior of biomolecules in body fluids

DOWNSTREAM PROCESSES

(9)

Leaching, crystallization, lyophilization, drying. Chemistry of extraction, selection of solvent, use of solvent extraction in antibiotic separation, affinity extraction/ chromatography. Industrial applications with examples.

LECTURE: 45 TOTAL: 45 Hours

Textbooks

1. *Belter, P.A. and Cussler, E.L., Hu, "Bioseparation: Downstream processing for Biotechnology", W.S. Wiley, New York.*
2. *"Bioseparation Engineering: Principles, practice and economics", Wiley, Interscience*

Reference Books

1. *McCabe, W.L., Smith, J.C. and Harritt, P., "Unit Operation of Chemical Engineering", McGraw Hill.*
2. *Seader, J.D, and Henley, "Separation Process Principles". E.J. Wiley*

12B7E2 BIOPROCESS ECONOMICS AND PLANT DESIGN

L T P C

3 0 0 3

PROCESS DEVELOPMENT

(9)

Introduction to Design – nature of design – Technical feasibility survey, process development – data acquisition – design data information of project - Organization of project – Project documentation – codes and standards.

DESIGN DEVELOPMENT

(9)

Equipment selection and specifications - materials of construction – flow sheeting – piping and instrumentation – process safety and loss prevention.

GENERAL SITE CONSIDERATION

(9)

Introduction – plant location and site selection – site layout- plant layout utilities – environmental considerations – waste management – visual impact – government regulations and other legal restrictions, community factors and other factors affecting investment and production costs – human resources.

COSTING AND PROJECT EVALUATION

(9)

Introduction – Accuracy and purpose of capital cost estimates – fixed and working capital operating costs – estimation of purchased costs – inflation – rapid and factorial method of cost estimation - plant overheads – Administration, safety and other auxiliary services, payroll overheads, warehouse and storage facilities etc.

ECONOMIC EVALUATION OF PROJECTS

(9)

Cash flow diagrams – tax depreciation – discounted cash flow – rate of return – payback time – allowing for inflation – sensitivity analysis – computer methods for costing and project evaluation – accounting for uncertainty and variations for future development – Optimization techniques.

LECTURE: 45 TOTAL: 45 Hours

Textbooks

1. Sinnott.R.K, Coulson & Richardson's "**Chemical Engg**" – Vol-6, Butterworth Heinemann III edition 2002.
2. Peters and Timmerhaus, "**Plant Design and Economics for Chemical Engineers**", Mc Graw
3. Hill 4th Edition, 1989.

Reference Book

1. Rudd and Watson , "**Stratergy of Process Engineering**", Wiley, 1987.

12B7E3 MOLECULAR MODELING & DRUG DESIGN

L T P C

3 0 0 3

MOLECULAR MODELLING

(9)

Introduction to concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, discussion of local and global energy minima

QUANTUM MECHANICS

(9)

Introduction to the computational quantum mechanics; one electron atom, poly electronic atoms and molecules, Hartree Fock equations; calculating molecular properties using ab initio and semi empirical methods.

MOLECULAR MECHANICS

(9)

Molecular mechanics; general features of molecular mechanics force field, bond stretching, angle bending, torsional terms, non – bonded interactions; force field parameterization and transferability; energy minimization; derivative and non – derivative methods, applications of energy minimization.

MOLECULAR DYNAMICS

(9)

Molecular dynamics simulation methods; molecular dynamics using simple models, molecular dynamics with continuous potential, setting up and running a molecular dynamic simulation, constraint dynamics; Monte Carlo simulation; Monte Carlo simulation of molecules.

MODELLING AND DRUG DESIGN

(9)

Macromolecular modeling, design of ligands for known macro molecular target sites, Drug- receptor interaction, classical SAR/QSAR studies and their implications to the 3 D modeler, 2-D and 3-D database searching, pharmacophore identification and novel drug design, molecular docking, Structure-based drug design for all classes of targets

LECTURE: 45 TOTAL: 45 Hours

Text Books

1. Andrew, R.. leach “*Molecular modeling : Principles and applications*” : prentice hall publications.
2. N. Claude Cohen. “*Guidebook on molecular modeling in drug design*”

Reference Books

1. Yvonne C. Martin. “*Designing Bioactive molecules three dimensional techniques and applications*”.
2. Matthew F. Schlecht. “*Molecular modeling on the PC*”.

12B7E4 GENOMICS AND PROTEOMICS**L T P C****3 0 0 3****OVERVIEW OF GENOMES OF BACTERIA, ARCHAE AND EUKARYOTA (9)**

Genome organization of prokaryotes and eukaryotes, gene structure of bacteria, archae bacterial and eukaryotes, Human genome project, Introduction to functional and comparative genomics.

PHYSICAL MAPPING TECHNIQUES (9)

Cytogenetic mapping, radiation hybrid mapping, Fish, STS mapping, SNP mapping optical mapping, Top down and bottom up approach, linking and jumping of clones, gap closure, pooling strategies, genome sequencing.

FUNCTIONAL GENOMICS (9)

Gene finding; annotation; ORF and functional prediction; Subtractive DNA library screening; differential display and representational difference analysis; SAGE.

PROTEOMICS TECHNIQUES (9)

Protein level estimation; Edman protein microsequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels. Mass spectrometry- principles of MALDI-TOF; Tandem MS-MS; Peptide mass fingerprinting.

PROTEIN PROFILING (9)

Post translational modification; protein-protein interactions; glycoprotein analysis; phosphoprotein analysis.

LECTURE: 45 TOTAL: 45 Hours***Textbooks :***

1. Cantor and Smith, "**Genomics**". John Wiley & Sons, 1999.
2. Pennington and Dunn, "**Proteomics**", BIOS Scientific Publishers, 2001
3. Genomics, T.A Brown.

Reference Books :

1. Liebler, "**Introduction to Proteomics**", Humana Press, 2002
2. Hunt and Livesey, "**Functional Genomics**", oxford University press, 2000
4. Primrose and Twyman, "**Principles of genome analysis and genomics**", Blackwell Publishing Co., 2003.

12B7E5 BIOLOGICAL SPECTROSCOPY

L T P C

3 0 0 3

SPECTROSCOPY

(9)

Interaction of radiation with matter, Definition frequency, Wave number, types of electromagnetic radiation, interparticle forces and energies, energy levels. Population of energy levels, Scattering, Absorption and Emission.

INFRARED SPECTROSCOPY

(9)

Measurement of Infrared spectrum-Physical basis of infrared spectra, Infrared of Polyatomic molecules, biological examples, infrared of oriented samples.

MASS SPECTROMETRY

(9)

Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

NUCLEAR MAGNETIC RESONANCE

(9)

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional NMR spectroscopy – determination of macromolecular structure by NMR – magnetic resonance imaging.

X-RAY DIFFRACTION

(9)

Scattering by x-rays-diffraction by a crystal – measuring diffraction pattern – Bragg reflection – unit cell – phase problem – anomalous diffraction – determination of crystal structure – electron and neutron diffraction.

LECTURE: 45 TOTAL: 45 Hours

Textbook

1. Campbell I.D and Dwek R.A., “*Biological Spectroscopy*”, Benjamin Cummins and Company, 1986.

Reference Book

1. Atkins P.W., “*Physical Chemistry*”, Oxford IV Edition, 1990.

12B7E6 BIOMEDICAL INSTRUMENTATION**L T P C****3 0 0 3****BASIC PHYSIOLOGY****(9)**

Cells and their structures-Transport of ions through cell membrane-Resting and action potential,Bioelectric potentials - Heart and Blood circulation - Respiratory system-Nervous system-Muscular system.

ELECTRODES AND TRANSDUCERS**(9)**

Basic electrode theory- Micro electrodes - Skin surface electrodes ,Needle electrodes,Equivalent circuit, Electrode materials ,Chemical electrodes ,Reference electrodes,The pH electrode,Blood gas electrode- Active transducers and passive transducers-Strain gauge-Thermistor- Biomedical applications.

BIO POTENTIAL RECORDERS**(9)**

Electrical and mechanical activities of the heart - Typical Electrocardiogram (ECG) ,Electrocardiograph Bipolar and unipolar leads ,Einthoven triangle - Electrical activities of the brain,Electroencephalogram - Various rhythms,EEG equipment - Muscle response - Electromyograph (EMG),Nerve Conduction velocity measurements.

BIOTELEMETRY AND PATIENT SAFETY**(9)**

Need for biotelemetry - Elements of telemetry system ,Radio telemetry system ,Physiological signals used in telemetry - TDM and FDM - Implantable units - Physiological effects of electrical current - Shock hazards from electrical equipments,Electrical accidents and their prevention.

COMPUTER APPLICATIONS**(9)**

Data acquisition systems -Analysis of ECG signals - Computerized Axial Tomography (CAT) Scanner Ultrasonic scanner, Magnetic resonance imaging-Computer based patient monitoring system - Introduction to expert system and hospital management.

LECTURE: 45 TOTAL: 45 Hours**Textbooks:**

1. Arumugam M, "**Biomedical Instrumentation**", Anuradha Agencies Publishers, Chennai, 2002.
2. Joseph J Carr and John M. Brown, "**Introduction to Biomedical Equipment Technology**", Pearson Education Asia, New Delhi, Fourth edition, 2003.
3. Leslie Cromwell, Fred J. Webber, Erich A. Pfeffer, "**Bio-medical Instrumentation and Measurements**", Prentice Hall of India, New Delhi, 2001.

Reference Books

1. Khandpur, "**Handbook on Biomedical Instrumentation**", Tata McGraw Hill Company, New Delhi, 2003.
2. John G Webster, Ed, "**Medical Instrumentation Application and Design**", Fourth edition, John Wiley & Sons, Singapore, 2007.

12B7E7 NEUROBIOLOGY AND COGNITIVE SCIENCES

L T P C

3 0 0 3

NEUROANATOMY

(9)

Central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

NEUROPHYSIOLOGY

(9)

Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

NEUROPHARMACOLOGY

(9)

Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function.

APPLIED NEUROBIOLOGY

(9)

Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

BEHAVIOUR SCIENCE

(9)

Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

LECTURE: 45 TOTAL: 45 Hours

Textbooks:

1. *Gordon M. Shepherd "Neurobiology", Oxford University Press, USA 3rd edition(1994)*

Reference Books

1. *Mathews G.G. "Neurobiology", 2nd edition, Blackwell Science, UK, 2000.*

2. *William Bechtel, George Graham "A Companion to Cognitive Science", Blackwell Publishers (1999)*

12B7E8 MOLECULAR PATHOGENESIS

L T P C
3 0 0 3

MICROBIOLOGY BASICS (7)

Historical perspective - Louis Pasteur's contributions - Robert Koch's postulates - early discoveries of microbial toxins – vaccines - antibiotics - pathogen types and modes of entry.

HOST-DEFENSE MACHANISMS AGAINST PATHOGENS AND PATHOGEN RESISTANCY (10)

Attributes & components of microbial pathogenesis, Host natural defense mechanism - humoral and cellular defense mechanisms – complements - inflammation process - general disease symptoms – Pathogen resistance to the defense machanisms.

MOLECULAR PATHOGENESIS (10)

Virulence factors - gene regulation in virulence of pathogens - labile & stable toxins; *Vibrio Cholerae* - Cholera toxin - *E.coli* pathogens: - ETEC – EPEC - EHEC - EIEC Hemolytic Uremic Syndrome - Shigella toxin - Plasmodium Life cycle - Antimalarials based on transport processes - Influenza virus - action of amantidine.

EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS (10)

Virulence assays; cytopathic - cytotoxic effects. Criteria and tests in identifying virulence factors - attenuated mutants - signal transduction and host responses.

MODERN APPROACHES TO CONTROL PATHOGENS (8)

Serotyping - Immuno and DNA based techniques - New therapeutic strategies based on life threatening pathogens - Vaccines - DNA, subunit and cocktail vaccines.

LECTURE: 45 TOTAL: 45 Hours

Textbooks:

1. Iglewski B.H and Clark V.L “**Molecular basis of Bacterial Pathogenesis**” , Academic Press, 1990.
2. Peter Williams, Julian Ketley & George Salmond, “**Methods in Microbiology : Bacterial Pathogenesis**”, Vol. 27, Academic Press, 1998.

Reference Books

1. Recent reviews in *Infect. Immun.*, *Mol. Microbiol.*, *Biochem. J.*, *EMBO etc*
2. Nester, Anderson, Roberts, Pearsall, Nester, “**Microbiology: A Human Perspective**”, Mc Graw Hill, 3rd Edition, 2001.
3. Eduardo A. Groisman, “**Principles of Bacterial Pathogenesis**”, Academic Press, 2001.

12B7E9 VIROLOGY

L T P C

3 0 0 3

GENERAL PROPERTIES OF VIRUSES

(9)

Early development of virology – properties of viruses: morphology, structure and shape – chemical properties – Resistance – viral agglutination – viral multiplication.

CULTIVATION OF VIRUSES & VIRAL GENETICS

(9)

Cultivation of viruses: Animal inoculation – cell culture – tissue culture types, detection of virus growth in cell cultures – Virus purification – viral assay – viral genetics –non genetic interactions. -Bacteriophages.

DNA AND RNA VIRUSES

(9)

DNA viruses: Morphology, properties and pathogenesis - pox viruses – herpes viruses – adenoviruses. RNA viruses – enteroviruses – poliovirus – influenza –rabies virus – hepatitis viruses.

VIRAL VACCINES AND ANTIVIRALS

(13)

Conventional vaccines -killed and attenuated, modern vaccines—recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines), vaccine delivery and adjuvants, Interferons, designing and screening for antivirals, mechanisms of action, antiviral libraries, antiretrovirals—mechanism of action and drug resistance.

MODERN APPROACHES OF VIRUS CONTROL

(5)

Anti-sense RNA, siRNA, ribozymes, in silico approaches for drug designing.

LECTURE: 45 TOTAL: 45 Hours

Textbooks:

1. Pierre Payment, Trudel ,Marcel “*Methods and Techniques in Virology*”. Dekker publisher
2. S. J. FlinV. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka “*Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Virus*”, American Society Microbiology,2003

Reference Books

1. Stephen K. Tyring. *Antiviral Agents, “Vaccines, and Immunotherapies”*. Marcel Dekker, 2004
2. Paul F. Torrence “*Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats*”, Wiley, John & Sons, Incorporate, 2005.
3. Stanley A. Plotkin, Walter A. Orenstein, “*Vaccines*”, Elsevier Health Sciences,2003

12B8E0 BIOSAFETY, ETHICS AND IPR

L T P C

3 0 0 3

BIOSAFETY

(8)

Biosafety – Biotechnology development in India, Safety issues concerning biotechnological products, governing biosafety, Cartagena protocol on biosafety, Conservation of Biodiversity.

INTELLECTUAL PROPERTY RIGHTS

(10)

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property). IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration -Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

IPR - POLICIES

(10)

International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities -History - General Agreement on Trade and Tariff (GATT). Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

CASE STUDIES

(10)

Case Studies on - Patents (Basumati rice, turmeric, Neem, etc.) - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

BIOETHICS

(7)

Bioethics – Disease prevention Vs right to privacy, patentability of DNA, preimplantation embryo diagnosis, Engineered organisms into environment, Genetic tests in diagnostics and therapy.

LECTURE: 45 TOTAL: 45 Hours

Textbooks

1. V.H Heywood.R.T Watson “*Global Biodiversity Assessment*”, Cambridge University Press, 1996.
2. Brody BA and Engelhardt, “*Bioethics : Readings and Cases*”, Prentice John- Wiley and Sons, Newyork, 2007.
3. Joshi. R, “*Biosafety and Bioethics*”, Isha Books, New Delhi, 2006.

Reference Books

1. Subbaram N.R. “*Handbook of Indian Patent Law and Practice*” , S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.
2. Sasson A, “*Biotechnologies and Development*” , UNESCO Publications, 1988.
3. Singh K, “*Intellectual property rights on Biotechnology*” , BCIL, New Delhi.

12B8E1 BIOPHARMACEUTICAL TECHNOLOGY

L T P C

3 0 0 3

INTRODUCTION

(7)

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses ; economics and regulatory aspects .

DRUG ACTION, METABOLISM AND PHARMACOKINETICS

(9)

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactive drugs; pharmacokinetics. (ADME)

MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS

(7)

Special requirements and reaction process for bulk drug manufacture - Aspirin, penicillin, streptomycin, laxative (any two), contraceptives (any two) and vitamins (any two)

PRINCIPLES OF DRUG MANUFACTURE

(13)

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

BIOPHARMACEUTICALS

(9)

Parenteral preparations: intravenous, intramuscular, intradermal, intraperitoneal, intracranial and subcutaneous. Preparation of various categories of biologicals: vaccines (attenuated and non attenuated) , monoclonal and polyclonal antibodies, growth hormones, cytokines (any two). .

LECTURE: 45 TOTAL: 45 Hours

Textbooks:

1. Leon Lachman et al, “*Theory and Practice of Industrial Pharmacy*”, 3 Edition, Lea and Febiger, 1986.
2. Remington’s “*Pharmaceutical Sciences*”, Mark publishing and Co.

ReferenceBooks

1. Gareth Thomas. “*Medicinal Chemistry*”. An introduction. John Wiley. 2000.
2. Katzung B.G. “*Basic and Clinical Pharmacology*”, Prentice Hall of Intl. 1995.

12B8E2 CANCER BIOLOGY**L T P C****3 0 0 3****FUNDAMENTALS OF CANCER BIOLOGY****(9)**

Epidemiology of cancer: environmental factors: tobacco, alcohol, diet, occupational exposure, hormones. Regulation of cell cycle, modulation of cell cycle in cancer. Different forms of cancers. Specific type of cancer hepato cellular, melanoma, breast, lung cancer. Genetic basis of cancer- DNA repair. mutations that cause changes in signal molecules, signal switches.

PRINCIPLES OF CARCINOGENESIS**(9)**

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER**(9)**

Signal targets and cancer, activation of kinases; tumor suppressor genes, Oncogenes, identification of oncogenes, Virus and cancers: DNA virus-retroviruses detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

PRINCIPLES OF CANCER METASTASIS**(9)**

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

CANCER THERAPY**(9)**

Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer. Advances in cancer detection. Different forms of therapy, chemotherapy, radiation therapy, immunotherapy, molecular therapy, use of signal targets towards therapy of cancer; Gene therapy.

LECTURE: 45 TOTAL: 45 Hours***Text Books***

1. Maly B.W.J, "***Virology A Practical Approach***", IRLI Press, Oxford, 1987.
2. Ian F.Tannock "***The Basic Science of Oncology***" 2nd edition, 1992, Richard P.Hill

Reference Books

1. Dunmock N.J and Primrose S.B., "***Introduction To Modern Virology***", Blackwell Scientific Publications, Oxford, 1988.
2. "***An Introducton Top Cellular and Molecular Biology of Cancer***", Oxford Medical Publications, 1991.

12B8E3 IMMUNOTECHNOLOGY

L T P C

3 0 0 3

ANTIGENS

(6)

Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

ANTIBODIES & IMMUNODIAGNOSIS

(9)

Monoclonal and polyclonal antibodies – their production and characterization, Western blot analysis, immunoelectrophoresis, SDS-PAGE - purification and synthesis of antigens, ELISA-principle and applications, radio immuno assay (RIA) - principles and applications, non isotopic methods of detection of antigens-enhanced chemiluminescence assay.

ASSESSMENT OF CELL MEDIATED IMMUNITY

(12)

Identification of lymphocytes and their subsets in blood. T cell activation parameters, estimation of cytokines, macrophage activation, macrophage microbicidal assays, in-vitro experimentation-application of the above technology to understand the pathogenesis of infectious diseases.

IMMUNOPATHOLOGY

(9)

Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cells, immunocytochemistry – immunofluorescence, immunoenzymatic and immunoferritin techniques, immuno electron microscopy.

MOLECULAR IMMUNOLOGY

(9)

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of anti idiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immunotherapy with genetically engineered antibodies – Tetramer, recombinant vaccines.

LECTURE: 45 TOTAL: 45 Hours

Textbooks :

1. Talwar G.P., and Gupta S.K., “A hand book of practical and clinical immunology”, vol. 1 & 2, CBS Publications, 1992.
2. Weir D.M., “Practical Immunology”, Blackwell Scientific Publications, Oxford, 1990.

Reference Books :

1. Austin J.M. and Wood K.J., “Principle of cellular and molecular immunology”, Oxford university press, 1993

12B8E4 BIOPHYSICS**L T P C****3 0 0 3****MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS (9)**

Intramolecular bonds – covalent – ionic and hydrogen bonds – biological structures -general features – water structure – hydration – interfacial phenomena and membranes – self assembly and molecular structure of membranes.

CONFORMATION OF NUCLEIC ACIDS (9)

Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – A, B and Z forms – properties of circular DNA – topology – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.

CONFORMATION OF PROTEINS (9)

Conformation of the peptide bond – secondary structures – ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.

ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS (9)

Kinetics of ligand interactions; Biochemical kinetics studies, uni-molecular reactions, simple bi molecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

APPLIED TECHNIQUES (9)

Techniques for the study of biological structure & function: Size and shape of macromolecules – methods of direct visualization macromolecules as hydrodynamic particles – macromolecules diffusion – ultra centrifugation – viscometry x-ray crystallography determination of molecular structures, X-ray fibre diffussion electron microscopy neutron scattering – light scattering.

LECTURE: 45 TOTAL: 45 Hours**Textbooks :**

1. R. Glase, *“Biophysics”*; Springer Verlag , 2000.
2. R. Duane, *“Biophysics: Molecules In Motion”*. Academic Press,1999.
3. Cantor And Schimmed, *“Biophysical chemistry part II Techniques for the study of biological structure and+ function.”* Freeman and company

12B8E5 BIOCONJUGATE TECHNOLOGY

L T P C

3 0 0 3

FUNCTIONAL TARGETS

(9)

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

CHEMISTRY OF ACTIVE GROUPS

(9)

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

BIOCONJUGATE REAGENTS

(9)

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION

(9)

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescence of DNA.

BIOCONJUGATE APPLICATIONS

(9)

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugation and derivatives- Colloidal – gold-labeled proteins – modification with synthetic polymers.

LECTURE: 45 TOTAL: 45 Hours

Textbook:

1. G.T. Hermanson, “*Bioconjugate Techniques*” , Academic Press, 1999

Reference Book

1. “*Recent Research Development in Bioconjugate Chemistry*” Vol-1, 2002

12B8E6 PROCESS INSTRUMENTATION DYNAMICS AND CONTROL**L T P C****3 0 0 3****INTRODUCTION****(9)**

Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.

CONTROL SYSTEMS**(9)**

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

CLOSED LOOP SYSTEMS**(9)**

Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.

CONTROL MECHANISM**(9)**

Controller mechanism, introduction to advanced control systems, cascade control, feed forward control, control of heat exchangers, introduction to microprocessors and computer control of chemical processes.

CONTROL INSTRUMENTS**(9)**

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity.

LECTURE: 45 TOTAL: 45 Hours**Textbooks :**

1. Coughnowr and Koppel, "**Process Systems Analysis and Control**", McGraw-Hill, New York, 1986.
2. George Stephanopolous, "**Chemical Process Control**", Prentice-Hall of India Pvt-Ltd., New Delhi, 1990.

Reference Books :

1. Emenule, S.Savas, "**Computer Control of Industrial Processes**", McGraw-Hill, London, 1965.
2. Eckman, D.P., "**Industrial Instrumentation**", Wiley, 1978.

12B8E7 BIOREACTOR DESIGN AND DRAWING

L T P C
2 0 3 4

ENGINEERING PROPERTIES AND STORAGE TANK

(5)

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

REACTOR DESIGN

(9)

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

HEAT TRANSFER EQUIPMENTS

(9)

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

MASS TRANSFER EQUIPMENTS

(10)

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

SEPERATION EQUIPMENTS

(12)

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson – walker crystallizer.

LECTURE : 15 PRACTICAL :45 TOTAL: 60

Textbooks:

1. Peter Max. S., Timmer haus Klaus. D and Ronald E West “Plant design and Economics for Chemical Engineer”, V Edition, Mc. Graw Hill Publication, 2003.
2. Indian Standard Codes
 - (a) IS: 2825 – 1969; Codes for unfired pressure vessels.
 - (b) IS: 4049 – 1979; Specification for formed ends for tanks and pressure vessel.
 - (c) IS: 4179 – 1967; Sizes of process vessel and their leading dimensions
 - (d) IS: 4864 to 4870 – 1968; Specification for shell flanges for vessel and equipments
 - (e) IS: 4503 – 1967; Specification for shell and tube heat exchangers.
 - (f) IS: 803 – 1962; Codes of practice for design , fabrication and creation of mild steel cylindrical welded oil storage tanks.

Reference books:

1. Perry R. H and Green D. W., “Chemical Engineer Hand book”, VII edition, Mc Graw Hill Publication, 2002.
2. Brownwell. L. E and Young E.H “Process equipment design” Wiley Eastern, New Delhi, 2002.

12B8E8 DEVELOPMENTAL BIOLOGY

L T P C

3 0 0 3

INTRODUCTION

(8)

Origins of developmental biology; Concepts in development – Developmental signals in cell division & differentiation; Role of gene expression in development; Identifying developmental genes, Cell commitment & differentiation; Determination & induction of cell fate, Concept of morphogen & positional information; Model vertebrate organisms: Mouse, Zebrafish, Model invertebrate organisms: *D. melanogaster*; *C. elegans*, Model plant: *A. thaliana*

GERM CELLS AND PATTERNING THE VERTEBRATE BODY PLAN

(9)

Genotypic & phenotypic sex-determination in mammals, *D. melanogaster* and *C. elegans*, Structure & Formation of germ cells, Fertilization; axes & germ layers; Setting up the body axes; the origin & specification of the germ layers.

DEVELOPMENT OF VERTEBRATES

(12)

Development of the *Drosophila*, Nematodes & Cellular Slime Molds: Body Plan; Specification of body axes & role of maternal genes; Polarization of body axes during oogenesis; Patterning, Segmentation- & role of pair-rule genes; cell differentiation and aggregation.

MORPHOGENESIS AND ORGANOGENESIS

(8)

Morphogenesis; Kinds of cleavage & blastulation; Types of tissue movement in gastrulation; Gastrulation in amphibians & mammals; Neural tube formation & neural crest migration; Cell Differentiation & Organogenesis; Models of cell differentiation; Insect imaginal disc & wing development; metamorphosis.

EMBRYOGENESIS

(8)

Plant development; Pattern development in early embryogenesis of angiosperms; floral development.

LECTURE: 45 TOTAL: 45 Hours

Textbooks:

1. Scott F. Gilbert, "Developmental Biology", Sinauer Associates, Inc, 1997
2. A. Arumugam, "Developmental Biology", Saras Publications. 1995

12B8E9 CHEMICAL PROCESS ENGINEERING

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MATERIAL BALANCE AND ENERGY BALANCE

(9)

Units, dimensions and dimensional analysis, material balance without chemical reactions and unit operations, material balance involving chemical reactions. Principles of thermodynamics, concept of first law of thermodynamics and concept of equilibrium, energy balance without chemical reaction and with chemical reaction.

FLUID FLOW

(9)

Fluid flow, concept of fluid, behaviour of Non-Newtonian fluids, types of fluid flow, applications of continuity and Bernoulli's equation, concept of friction factor piping system and its components, factors and selection of pipe size, good piping system, types of valves and fitting. Transportation devices, pumps and their working.

HEAT TRANSFER

(9)

Basic mechanisms of heat transfer, conduction, convection, radiation; conduction through slab, hollow and multi-cylinder, principles of free and forced convection, concept of heat transfer coefficient, heat exchange equipments (heat exchangers) principles and working and agitators.

MASS TRANSFER AND MECHANICAL SEPARATION

(9)

Introduction to Mass transfer, Fick's law of Diffusion – Diffusion in binary mixtures, Interphase mass transfer – Film theory of mass transfer. Principles of Cake filtration and membrane – based cross-flow filtration processes, Centrifugation – operational principles of different types of centrifuges.

PROCESS CONTROL

(9)

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, fugacity of gases, composition by physical and chemical properties and spectroscopy.

LECTURE : 45 TOTAL: 45 Hours

Reference Books

1. Badger and Banchero, *“Introduction to Chemical Engineering”*, Tata Mc Graw Hill Book Company, New Delhi.
2. Bhat and Vora, *“Stoichiometry”*, 4th Edition, Tata Mc Graw Hill Company, 2005
3. Christie J. Gaenokoplis, *“Transport Processes and Unit Operations”*, 3rd Edition Prentice Hall of India Limited, New Delhi.
4. Coughnowr and Koppel, *“Process System analysis and Control”*, Mc Graw Hill, New York, 1986