B. TECH

CURRICULUM AND SYLLABUS

Semester I

Code	Subject	L	T	P	C
HSS101	English for Technical Communication I	2	0	0	2
MAT101	Mathematics I	3	0	0	3
PHY101	Physics I	3	0	0	3
CHY106	Chemistry	3	0	0	3
CSE102	Programming Languages	2	0	0	2
EEE101	Basic Electrical and Electronics Engineering	4	0	0	4
PHY181	Physics Laboratory	0	0	3	1
CSE181	Programming Language Laboratory	0	0	3	1
	Total	17	0	6	19

Semester II

Code	Subject	L	T	P	C
HSS102	English for Technical Communication II	2	0	0	2
MAT102	Mathematics II	3	0	0	3
PHY102	Physics II	3	0	0	3
CIV101	Basic Civil and Mechanical Engineering	4	0	0	4
CHY101	Environmental Sciences	2	0	0	2
MEC101	Engineering Drawing	1	0	3	2
BIT101	Biochemistry	3	0	0	3
MEC181	Workshop	0	0	3	1

CHY181	Chemistry Laboratory	0	0	3	1
	Total	18	0	9	21

Semester III

Code	Subject	L	T	P	C
MAT201	Mathematics III	3	0	0	3
BIT201	Bioorganic Chemistry	3	0	0	3
BIT202	Cell Biology	3	0	0	3
CHE251	Principles of Chemical Engineering	3	0	0	3
BIT203	Bioenergetics and Metabolism	3	1	0	4
BIT204	Microbiology	3	0	0	3
BIT281	Biochemistry Laboratory	0	0	3	2
BIT282	Cell Biology Laboratory	0	0	3	2
BIT283	Microbiology Laboratory	0	0	3	2
	Total	18	1	9	25

Semester IV

Code	Subject	L	T	P	C
HSSXXX	Humanities Elective I	3	0	0	3
CHE252	Unit Operations	3	0	0	3
BIT205	Industrial Biotechnology	3	0	0	3
BIT206	Genetics	3	0	0	3

BIT207	Enzyme Engineering and Technology	3	0	0	3
BIT208	Instrumental Methods of Analysis	3	0	0	3
BIT209	Molecular Biology	3	0	0	3
BIT284	Instrumental Methods of Analysis Laboratory	0	0	4	2
BIT285	Molecular Biology Laboratory	0	0	6	2
CHE291	Chemical Engineering Laboratory	0	0	4	2
	Total	21	0	14	27

Semester V

Code	Subject	L	T	P	C
BITXXX	Major Elective I	3	0	0	3
	Minor Elective I	3	0	0	3
BIT301	Bioinformatics and Computational Biology	3	0	0	3
BIT302	Protein Engineering	3	0	0	3
BIT303	Bioprocess Principles	3	1	0	4
BIT304	Genetic Engineering	3	1	0	4
CHE351	Bioprocess Calculations	3	0	0	3
BIT387	Bioprocess Laboratory	0	0	6	2
BIT388	Genetic Engineering Laboratory	0	0	6	2
	Total	21	2	12	27

Semester VI

Code	Subject	L	T	P	C
BITXXX	Major Elective II	3	0	0	3
HSSXXX	Humanities - Elective II	3	0	0	3
	Free Elective I	3	0	0	3
	Minor Elective II	3	0	0	3
BIT305	Biochemical Engineering	3	1	0	4
BIT306	Immunology	3	1	0	4
BIT389	Immunology Laboratory	0	0	6	2
BIT390	Biochemical Engineering Laboratory	0	0	6	2
	Total	18	2	12	24

Semester VII

Code	Subject	L	T	P	C
HSSXXX	Humanities - Elective III	3	0	0	3
	Free Elective II	3	0	0	3
BITXXX	Major Elective III	3	0	0	3
BITXXX	Major Elective IV	3	0	0	3
BIT401	Animal Biotechnology	3	0	0	3
BIT402	Plant Biotechnology	3	0	0	3
BIT403	Downstream Processing	3	0	0	3
BIT491	Downstream Processing Laboratory	0	0	6	2
	Total	21	0	6	23

Semester VIII

Code	Subject	L	T	P	C
BITXXX	Self study Elective	3	0	0	3
BIT499	Project Work	0	0	26	10
	Total	3	0	26	13

Total Credit (from 1st semester to 8th semester = 179)

MAJOR ELECTIVES FOR III YEAR

Code	Subject	L	T	P	C
BIT307	Environmental Biotechnology	3	0	0	3
BIT308	Spectroscopic Methods for Structure Determination	3	0	0	3
BIT309	Food Processing and Technology	3	0	0	3
BIT310	Pharmaceutical Biotechnology	3	0	0	3
BIT311	Health Care Biotechnology	3	0	0	3
CHE352	Bioprocess Instrumentation and control	3	0	0	3
BIT312	Biophysics	3	0	0	3
CHE353	Transport Phenomena in Bioprocesses	3	0	0	3
BIT313	Metabolic Engineering	3	0	0	3
BIT314	Drug Design and Development	3	0	0	3

MAJOR ELECTIVES FOR IV YEAR

Code No.	Subject	L	T	P	C
BIT404	Diagnostic Techniques	3	0	0	3
BIT405	Nanobiotechnology	3	0	0	3
BIT406	IPR in Biotechnology	3	0	0	3
BIT407	Bioreactor Design and Analysis	3	0	0	3
BIT408	Genomics and Proteomics	3	0	0	3
BIT409	Cancer Biology	3	0	0	3
BIT410	Biomedical Engineering	3	0	0	3
BIT411	Bioresource Technology	3	0	0	3
BIT412	RNAi Technology	3	0	0	3

MINOR ELECTIVES

Code No.	Subject	L	T	P	C
CHE354	Mass Transfer	3	0	0	3
CHE355	Bioprocess Plant Design and Economics	3	0	0	3
CHE356	Chemical and Bio-Thermodynamics	3	0	0	3
CHE314	Colloids and Surface Science	3	0	0	3
CIV369	Environmental Impact Assessment	3	0	0	3
CIV463	Solid Waste Management	3	0	0	3

CIV464	Industrial Wastewater Management	3	0	0	3
CSE255	Data Structures	3	0	0	3
EIE409	Bio-Medical Instrumentation	3	0	0	3

HUMANITIES ELECTIVES

Code No.	Subject	L	T	P	C
HSS001	Total Quality Management	3	0	0	3
HSS002	Engineering Management	3	0	0	3
HSS003	Indian Economic Development	3	0	0	3
HSS004	Industrial Psychology	3	0	0	3
HSS005	Consumer Psychology	3	0	0	3
HSS006	Professional Ethics	3	0	0	3
HSS007	Operations Management	3	0	0	3
HSS010	International Trade and Finance	3	0	0	3
HSS011	Information Systems for Managerial Decision Making	3	0	0	3
HSS014	Marketing Management	3	0	0	3
HSS015	Management Concepts and Techniques	3	0	0	3
HSS016	Organizational Psychology	3	0	0	3
HSS017	International Economics	3	0	0	3
HSS018	Communication Skills	3	0	0	3
HSS020	Human Resource Management	3	0	0	3
HSS023	Entrepreneurship Development	3	0	0	3

SEMESTER I

		L	T	P	C
HSS101	**ENGLISH FOR TECHNICAL COMMUNICATION I** (Common to all branches)	2	0	0	2

FOCUS ON LANGUAGE

Parts of speech - Nominal compounds, noun phrases - Relative pronoun - Adjective - numerical, comparison and contrast, collocation and word combinations - Verb - Preposition and relative – Conjunction - connectives, expressions of purpose and function, cause and effect - Articles - Adjectives - Sentence pattern - Tenses - Voice - Rewriting the sentences in impersonal and abbreviated passive grammatical structures - Concord - sentence level verb noun agreement - Gerund - rewriting infinitive into gerund - Imperative - rewriting imperative into recommendation using should - Word formation - varied grammatical function of the same word - Affixes - prefix and suffix, number prefix, negative prefix - Reported speech - Editing strategies - Conditional structures - Real, unreal, no possibility, zero condition - Writing formal definition - Abbreviation and acronym - Idioms and phrases - Varieties of English - British versus American

LISTENING SKILLS

Comprehension practice - Vocabulary development - Familiarity to varied types of spoken english and accents - Developing ability to understand audio and video media - Aiming at overcoming barriers to listening - Listening to documentaries, radio news broadcasts, TV news telecasts - Active listening in discussions and to lectures - Taking notes while listening - Extracting information from listening

SPEAKING SKILLS

Oral practice - Role play - Interplay - Seminar - Transcoding visual into oral - Participating in short and longer conversation - Voice record, replay, correction of intonation, pronunciation and flow of

speech - Phonemes - vowels, consonants, stress, rhythm, intonation - Group discussion - Participative learning - Acquiring proficiency, fluency, accuracy in oral communication - Speaking practice - Developing confidence - Extempore speech - Learning professional and conversational etiquette

READING SKILLS

Vocabulary extension - Improving vocabulary - Intensive reading - Reading Strategies - Identifying topic sentence - guessing meaning from content - picking out specific information - Professional reading - Reading practice - Predicting the content, critical and analytical reading - Reading articles in english newspapers, sports magazines, encyclopedias - Reading aloud, use of stress and intonation - Reading and comprehending technical materials - Close reading

WRITING SKILLS

Discourse cohesion - Improving writing skills, avoiding common grammatical errors in academic writing - Extending the hints - Writing shorter sentences - Punctuation - Dialogue writing - Paragraph writing, problems and solutions, achieving coherence, transition words, sequence words - Essays of descriptive and argumentative - Writing instructions, use of imperatives - Jumbled sentences into sequential paragraph using linguistic clues - Report writing - technical reports, industry visit reports, events reports - Writing recommendations - Letter writing - Formal and informal letters - Job application and resume, permission for in-plant training, business correspondence letters, calling for quotation, placing order, lodging complaint, persuasive letters - Assignment writing - Mini-project - Transcoding - Transferring of information from text to pictorial and graphical representation and vice versa

TEXT BOOK

1. Rizvi M Ashraf, Effective Technical Communication, Tata McGraw-Hill, 2005

REFERENCES

1. Daniel Jones, English Pronouncing Dictionary, Universal Book Stall, New Delhi, 17th Edition, 2000
2. Geoffrey Leech, Fan Svartvik, A Communicative Grammar of English, Pearson Education Asia, 1994
3. Hornby, AS, Oxford Advanced Learner's Dictionary of Current English, OUP, 7th Edition, 2005
4. Manivannan G, English for Engineers - A Book on Scientific and Technical Writing, Govi Publications, 2005
5. Martin Cutts, Plain English Guide - How to Write Clearly and Communicate Better, Oxford University Press, 1999

		L	T	P	C
MAT101	**MATHEMATICS I** (Common to all Branches)	3	0	0	3

MATRICES

Review of linear algebra - Matrix operations - Addition, scalar multiplication, multiplication, transpose, adjoint and their properties - Special types of matrices - Null, identity, diagonal, triangular, symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, orthogonal, unitary, normal - Rank - Consistency of a system of linear equations - Solution of the matrix equation Ax = b – Row - Reduced echelon form

EIGEN VALUE PROBLEMS

Eigen value and eigen vector of real matrix - properties of eigen values and eigen vectors - Cayley - Hamilton theorem - Orthogonal transformation of a real symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by orthogonal transformation - Index, signature and nature of quadratic form

DIFFERENTIAL CALCULUS

Review of limits - Continuity and differentiability - Curvature - Cartesian and Parametric co-ordinates - Centre and radius of

curvature - Circle of curvature - Evolutes - Involutes - Envelopes - Partial differentiation - Euler's theorem for homogeneous functions - Total differential - Taylor's expansion (two variables) - Maxima and Minima for functions of two variables - Method of Lagrangian multiplier - Jacobians

THREE DIMENSIONAL ANALYTICAL GEOMETRY

Direction cosines and ratios - Angle between two lines - Equations of a plane - Equations of straight line - Coplanar lines - Shortest distance between two skew lines - Sphere - Tangent plane - Plane section of a sphere - Orthogonal spheres

ORDINARY DIFFERENTIAL EQUATIONS

Solutions of second and higher order linear ODE with constant coefficients - Cauchy's and Legendre's linear equations - Simultaneous first order linear equations with constant coefficients - Method of variation of parameters

TEXT BOOKS

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore , 8th Edn., 2001
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume I, Scitech Publications (India) Pvt. Ltd., Chennai, 2nd Edn., Reprint 2000, 1999

REFERENCES

1. Grewal , B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edition., 5th Reprint 2004, 2003
2. Venkataraman, M. K., Engineering Mathematics First Year, The National Publishing Company, Chennai, 2nd Edition., Reprint 2001, 2000

		L	P	T	C
PHY 101	**PHYSICS I** (Common to all Branches)	3	0	0	3

ACOUSTICS AND STRUCTURE OF SOLIDS

Classification of sound - Reverberation, Sabine's formula - Common acoustical defects and remedie - Classification of solids - Crystal structures, X-ray diffraction, crystal growth, crystal defects

LASER AND FIBRE OPTICS

Interaction of radiation with matter - Quantum mechanical view, three and four level laser system, engineering and medical applications - Introduction of fibre optics - Classification of fibre - Engineering and medical applications

QUANTUM PHYSICS

Inadequacy of classical mechanics - Black body radiation, Planck's law, photoelectric effect, Compton effect, Einstein's photoelectric equation, Schrödinger wave equation - Particle in one, three dimensional box

NON DESTRUCTIVE TESTING, NEW ENGINEERING MATERIALS

Ultrasonics, ultrasonics flaw detectors, X-ray photography, fluoroscopy, thermography, gamma ray spectroscopy, characterization technique nanophase materials, biomaterials, non linear materials, polymer materials

DIGITAL ELECTRONICS

Introduction, analog to digital circuits, conversion of numbers one's complement, 2's complement, logic gates, Boolean algebra, DeMorgan's theorem, Karnaugh's maps

TEXT BOOK

1. Gaur, R. K. and Gupta S. L., Engineering Physics, Dhanpat Rai Publishers, New Delhi, 2001

REFERENCES

1. Murthy, V.S.R., Jena, A.K., Gupta, K.P. and Murthy, G.S., Structures and Properties of Engineering Materials, Tata McGraw Hill Publishing company Limited, New Delhi, 2003
2. Ali Omar, M., Elementary Solid State Physics, Pearson Education (Singapore), IndianBranch, New Delhi, First Edition, 2006
3. William, F. Smith., Foundations of materials science and Engineering, McGraw-Hill, New York, 3rd Edition , 2003
4. Mathews, P.M., Venkatesan. K., Text Book of Quantum Mechanics, Tata McGraw Hill Company, Delhi, 2003
5. Gupta,S.L., Kumar.V., Hand book of Electronics, Pragati Prakashan, Meerut,28th Edition, 2001

CHY106	CHEMISTRY	L	T	P	C
		3	0	0	3

WATER

Water quality parameter (Industry and Drinking Water) - Hardness, Definition, Classifications, Expressions, Units of Hardness of Water with respect to $CaCO_3$, Problems -Estimation of Hardness by EDTA Method (Theory Only) - Definition of Alkalinity (Theory Only) - Boiler feed water - Requirements, Disadvantages of using hard water in boilers, Removal of boiler scales and sludges - Water Softening - Zeolite Process, Demineralization (Ion – Exchange Process), Desalination

CORROSION SCIENCE AND CONTROL ENGINEERING

Corrosion - definitions, electrode potential - Principles of Dry and Wet Corrosion, Factors Influencing rate of corrosion, Types of

Corrosion - Corrosion Control – Impressed Current Cathodic Protection and Sacrificial Anodic Protection Method - Corrosion Inhibitors – Protective Coatings, Surface conversion coatings, organic coatings (paints)

POLYMERS

Introduction, Classification, Difference Between Thermoplastic and Thermosetting Plastics - Properties of Plastic - Degree of Polymerization – Types of Polymerization (Mechanism) - Phenol Formaldehyde Resin, Epoxy Resin, polyurethanes, Teflon -Amino Resins (Urea Formaldehyde, Nylon.11, Nylon.66 and Nylon 6), PET, PVC – Composites - Definition, characteristics, Constituent. Types- Fibre reinforced plastics (FRP), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMMC), Properties and Applications

INSTRUMENTAL METHODS OF ANALYSIS

Electro Magnetic Radiation - Absorption of Radiation , Beer - Lambert's Law – UV-Visible spectroscopy – IR Spectroscopy - Principle and Instrumentation (Black Diagram Only) Estimation of Iron by Colorimetry – Flame Photometry, Principle and Instrumentation (Block Diagram Only), Estimation of Na by Flame Photometry - Atomic Absorption Spectroscopy, Principle and Instrumentation (Block Diagram Only), Quantitative Estimation of Nickel by Atomic Absorption Spectroscopy

BIOMOLECULES AND NANOTECHNOLOGY

Carbohydrates - Classification, Synthesis, Structure and Properties of Glucose and Sucrose – Polysaccharides, Starch and Cellulose - Amino Acids - Polypeptide linkages, Structure and Properties of DNA and RNA - Enzyme Catalysis - Kinetics and Mechanism – Nanotechnology - Introduction, Preparation, Characterization and Application

TEXT BOOKS

1. Jain, P.C., Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing company (P) Ltd., New Delhi, 14th Edition, 2002
2. Sharma, B.K., Industrial Chemistry, Goel Publishing House, Meerut, 12th Edition, 2001

REFERENCES

1. Puri, B.R., Sharma, L.R., Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., Jalandhar, 40th Edition, 2003
2. Vogel, A.I., A text book of Quantitative Inorganic Analysis, ELBS, London, 3rd Edition, 2000
3. Mick Wilson and Kamali Kannangara, Nanotechnology: Basic science and emerging Technology, Overseas India Pvt. Ltd. Press, New Delhi, Ist Edition, 2005
4. Bandyopadhyay, A.K., Nano Materials, New Age International Publishers, New Delhi, 1st Edition, 2007

		L	T	P	C
CSE102	**PROGRAMMING LANGUAGES** (Common to all Branches)	2	0	0	2

BASIC ELEMENTS OF C AND CONTROL STATEMENTS

Introduction to C- Structure of C language – Lexical elements of C- Operators and Expressions-Operator precedence and associativity of operators -Input and Output Functions-Library Functions –Header Files-Simple Computational problems. Decision Making: if statement - if-else statement - else-if ladder - switch statement – Looping Control Structure - the break statement - ? : operator - Continue statement - goto statement – Problems using Control Structures.

FUNCTIONS, PROGRAM STRUCTURES AND ARRAYS

Prototypes and Functions – Declaring, defining and accessing Functions- Parameter passing methods-Recursion - Storage Classes -

Automatic Variables -External Variables – Static and Register Variables – Programs using functions. Defining and Processing an Array - Passing Arrays to Functions - Multidimensional Arrays - Arrays and Strings - Enumerated data types-Programs using sorting, searching and merging of arrays.

POINTERS, STRUCTURES AND UNIONS

Pointer Fundaments - Pointer Declarations - Passing Pointers to Functions - Arrays and Pointers - Pointers and One-Dimensional Arrays - Pointers and Multidimensional Arrays - Operations on Pointers - Pointers and Structures - Dynamic Memory Allocation – Command Line Arguments – Programs using Pointers with Functions, Arrays and Structures. Defining a Structure - Processing a Structure - User-Defined Data Types – Union – Nested structure - Structures and Pointers - Passing Structures to Functions - Self Referential Structures.

DATA FILES AND DATA STRUCTURES

Opening and Closing a Data File - Creating a Data File - High Level File Operations - Processing and Updation of Data Files - Unformatted Data Files - Low Level Programming – File Handling Programs. Linked List – Creation, Insertion and Deletion of elements - Stack and Queue implementation using Linked List.

UNIX BASICS AND SHELL PROGRAMMING

Shell Fundamentals - Shell Commands - Shell Decisions and Repetitions - Command line usage - Wildcard expansion - Redirection of I/O, pipes and filters. Shell Programming - Simple scripts - Specifying the interpreter - Shell variables - The Environment - Control flow; test, if, for, while, case - Command substitution - Signal catching - Shell functions - Aliases - Reading from the Standard I/P - Startup Files - basename and dirname - Expression evaluation.

TEXT BOOKS

1. Byron S. Gottfried, Theory and Problems of Programming with

C, Tata McGraw Hill, Second Edition, 1996.
2. Lowell Jay Arthur and Ted Burns, UNIX Shell Programming, John Wiley and Sons Canada, Ltd, Fourth Edition, 1997.
3. Deshpande P.S, Kakde O.G, C and Data Structures , Dreamtech Press, First edition, 2004

REFERENCES

1. Brian Kerninghan W, Dennis Richie M, The C Programming language, Pearson Education,2005.
2. Johnsonbaugh R.and Kalin M, Applications Programming in ANSI C, Pearson Education, Third Edition ,2003.
3. Behrouz A.Forouzan and Richard Gilberg F, A Structured Programming Approach Using C, Brooks-Cole Thompson Learning Publications, Second Edition, 2001.
4. Bruce Molay, Understanding UNIX/LINUX Programming: A Guide to Theory and Practice, Prentice Hall, First Edition, 2002.
5. Glass, G., Ables, K. UNIX for Programmers and Users, Prentice Hall, 1999.
6. Stephen Kochan and Patrick Wood, UNIX Shell Programming, Pearson Education, Third Edition, 2003.

EEE101	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** (Common to all Branches)	L	T	P	C
		4	0	0	4

ELECTRICAL CIRCUITS

Introduction to electric circuits – laws of electric circuits– Ohm's Law, Kirchoff's Laws– analysis of DC circuits–mesh, nodal – introduction to AC circuits– average Value, RMS value, power and power factor–analysis of 3 phase AC circuits – balanced and unbalanced circuits

ELECTRICAL MACHINES

DC Machines –principle of operation–DC generators–emf equation, characteristics, types– DC motors–shunt, series, compound– single

phase transformer – principle of operation, emf equation, phasor diagram –induction motors–single phase, three phase–alternators– principle of operation, emf equation , characteristics

ELECTRICAL MEASUREMENTS

Moving coil –ammeter, voltmeter – moving iron instruments – ammeter, voltmeter – dynamometer – wattmeter, energy meter

BASIC ELECTRONICS

Semiconductor devices – introduction, construction, types – pn junction diode –working principle, characteristics– zener diode– working principle, characteristics uni–junction transistor– operation, characteristics –field effect transistor– operation, characteristics– bipolar junction transistor– operation, characteristics–applications– half wave and full wave rectifiers

DIGITAL ELECTRONICS

Introduction to binary number system–logic gates –AND, OR, NOT, NAND, NOR, exclusive OR–boolean algebra– combinational circuits – half adder, full adder, half subtractor, full subtractor

INTEGRATED CIRCUITS

Operational amplifier–introduction, DC characteristics, AC characteristics–types of operational amplifier–inverting, non–inverting– applications– scalar, adder, Subtractor, differentiator, and integrator

TEXT BOOKS

1. Edward Hughes., Electrical and Electronics Technology, Pearson Education ltd, 9th edition, 2005.
2. Kothari.D.P.,and.Nagrath.I.J.,Basic Electrical Engineering, Tata McGraw Hill,2nd Edition.

REFERENCES

1. Malvino,A P., Electronic Principles, TataMcGraw Hill International, 1998.

2. Vincent Del tora.,Electrical Engineering fundamentals, Prentice hall of India , 2nd edition 2003.
3. Muraleedharan.K.A., Muthusubramanian .R., and Salivahanan .S., Basic Electrical and Electronics and Computer Engineering, Tata McGraw Hill, 1997.

PHY181	PHYSICS LABORATORY (Common to all Branches)	L	P	T	C
		0	0	3	1

1. To determine the acceleration due to gravity using Compound Pendulum
2. To determine the Rigidity Modulus of wire using Torsional Pendulum
3. To find thickness of the given two glass plates using single optic lever
4. To determine the thermal conductivity of a bad conductor – Lee's disc method.
5. To determine the refractive index of the material of the prism
6. To find the prominent wave length of mercury spectrum using grating
7. To determine the particle size using Laser
8. To determine the coefficient of viscosity of the liquid by Poiseuille's method
9. To determine the young's modulus of given material using Uniform Bending
10. To Determine the thickness of a given material using Air wedge method
11. To determine the focal length of a biconvex lens using Newton's Rings method
12. To determine the velocity of ultrasonic waves in the liquid using ultrasonic Interferometer

CSE181	PROGRAMMING LANGUAGES LABORATORY (Common to all Branches)	L	T	P	C
		0	0	3	1

WORD PROCESSING, SPREADSHEET, POWERPOINT

1. To create an advertisement in Word.
2. To illustrate the concept of mail merging in word.
3. To create a spread sheet to analyze the marks of the students of a class and also to create appropriate charts.
4. To create the presentation for the department using Power Point.

C PROGRAMMING

5. To write a simple menu driven calculator program using switch statement
6. To write a program to print Pascal's triangle.
7. To write a program for electricity bill preparation.
8. To write a program to print the sine and cosine series.
9. To print Fibonacci series up to N numbers.

ARRAYS AND FUNCTIONS

10. To write a program to perform Matrix multiplication.
11. To write a program to sort a given set of numbers.
12. To write a program to perform string manipulation manipulations function like string concatenations, comparison, find the length and string copy without using library functions.
13. To write a program to arrange names in alphabetical order.
14. To write a C program to check whether a number is palindrome or not using functions.
15. To write a program to calculate the factorial of the given number using functions.

POINTERS, STRUCTURES AND FILES

16. To print the mark sheet of n students using structures.
17. To write a program using pointers to access the elements of an array

and count the number of occurrences of the given number in the array.

18. To write a program for find the average of numbers using files.
19. To write a program to merge the given two files arguments using command line arguments.

UNIX PROGRAMMING

20. Study of Basic UNIX Commands.
21. Implement ls Command.
22. Write a shell script to determine the properties of a given file.
23. Implement grep function.
24. Write a shell script to find the factorial of given number.
25. Write a shell script to evaluate the given expression using switch-case.

SEMESTER II

		L	T	P	C
HSS102	**ENGLISH FOR TECHNICAL COMMUNICATION II** (Common to all Branches)	2	0	0	2

GRAMMAR AND VOCABULARY

Grammar and Vocabulary - introduction to grammatical models - proper use of tenses, concord, voice, articles, punctuation, and modal auxiliaries

RECEPTION SKILLS

Listening and Language Development - Improving listening skills - comprehension practice - Comprehend classroom lectures, simple technically oriented passages - Listening to news bulletins, pre-recorded talks, different speech styles, comprehending the essential meaning - Physical and psychological barriers to listening - Steps to overcome the barriers - Practice in note-taking while listening

SPEAKING TECHNIQUES

Speaking practice - Improving conversing skills - Improving self-expression - Developing confidence and fluency in oral communication - Physical and psychological barriers to speaking - Steps to overcome the barriers - Formal and public speaking practice - Extemporary talk practice - Speech process - fluency and accuracy in speech - Developing persuasive speaking skills - Conversation in a given milieu, social and cultural surroundings - Practice in giving small talks on local topics for a minute or two - Goal oriented group discussion - Participating in seminars - Independent and effective communication

READING STRATEGIES

Reading comprehension - Vocabulary extension methods - Speed reading practice - technical and non-technical materials - Practice in

various reading techniques - skimming, scanning, eye reading - Looking for specific information - Comprehending the given passages, technical information

WRITTEN COMMUNICATION

Basic grammatical structures - Alphabet of other languages - Paragraph writing - Expressing the idea in writing - Avoiding and correcting common errors - Effective writing techniques - brevity, clarity, objectivity and simplicity - Discourse writing - definition, description, instruction - Note-making - Proof reading - Mechanics of writing - Writing formal, informal letters, Technical reports - Reference skills - using dictionary better

TEXT BOOKS

1. Rizvi, M.A., Effective Technical Communication, Tata McGraw-Hill, 2005
2. Rutherford Andrea, J., Basic Communication Skills for Technology, Pearson Education, 2002

REFERENCES

1. Deborah, C.A., Margaret, D.B, Technical Writing - Principles and Forms, Macmillan, 1978
2. Manivannan, G., English for Engineers - A Book on Scientific and Technical Writing, Govi Publications, 2005
3. Sarah Freeman, Written Communication in English, Orient Longman, 2000
4. Thomson, A J., Martinet, A.V., A Practical English Grammar, OUP, 4th Edition, 1986
5. Tom Hutchinson, Alan Waters, English for Specific Purpose, Cambridge University Press, 1987

		L	T	P	C
MAT102	**MATHEMATICS II** (Common to all Branches)	3	0	0	3

SEQUENCES AND SERIES

Convergence and divergence of infinite series – series of positive terms – comparison, D'Alembert's ratio, Raabe's and Cauchy's root tests – Convergence of alternating series – Leibnitz's test (proof of theorems and tests not included) – elementary notions of absolute and conditional convergence - Power series – Taylor's theorem(one variable)

ANALYTIC FUNCTION AND CONFORMAL MAPPING

Function of a complex variable – Analytic function – Necessary conditions – Cauchy – Riemann equations – Sufficient conditions (excluding proof) – Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping - w = z+a, az, 1/z, e^z, sin z, cos z and bilinear transformation – fixed points – cross ratio

COMPLEX INTEGRATION

Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem - Contour integration over unit circle and semicircular contours (excluding poles on boundaries)- evaluation of real integrals using contour integration

MULTIPLE INTEGRALS

Review of Riemann integrals - Double integration – Cartesian and polar coordinates – change of order of integration – change of variable between Cartesian and polar – Area as double integral – Triple integration in Cartesian, cylindrical and spherical polar coordinates – volume as triple integral

VECTOR CALCULUS

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proof) – Simple applications

TEXT BOOKS

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore, 8th Edition, 2001
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume II, Scitech Publications (India) Pvt. Ltd., Chennai, 1st Edition., Reprint 2000, 1999

REFERENCES

1. Grewal , B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edition., 5th Reprint 2004, 2003
2. Venkataraman, M. K., Engineering Mathematics First Year, The National Publishing Company, Chennai, 2nd Edition., Reprint 2001, 2000
3. Venkataraman, M. K., Engineering Mathematics –III A, The National Publishing Company, Chennai, 11th Edition., Reprint 2002, 1998

		L	P	T	C
PHY102	**PHYSICS II** (Common to Biotechnology and Chemical Engineering)	3	0	0	3

CONDUCTING MATERIALS

Electron theory of solids - classical free electron theory, quantum free electron theory, Band theory of solids

SEMI CONDUCTING AND SUPER CONDUCTING MATERIALS

Introduction semi conducting materials, Types of semi conducting materials, carrier concentration - Hall Effect –Determination of Hall coefficient - Superconducting Phenomena - Properties of superconductors, Type I and Type II superconductors, High T_c Superconductors, Application of super conductors

MAGNETIC MATERIALS

Classical theory of magnetism, Quantum theory of paramagnetism, Ferromagnetism, Ferrites, Applications of magnetic materials

NEW ENGINEERING MATERIALS

Metallic glasses as transformer core material, Nanophase materials, shape memory alloys, Bio materials (metals and alloys, ceramics), Fibre reinforced plastics (FRP) and fiber reinforce metals (FRM) Properties – Thermal, mechanical electrical and chemical ceramic fibres

MEDICAL PHYSICS

Medical application in Ultrasound, Ultrasonic scanning device, source of radioactivity for nuclear Medicine, clinical applications, Nuclear medicine imaging devices

TEXT BOOK

1. Avadhanulu, M.N., Kshirsagar P.G., A Text Book of Engineering Physics, S.Chand and Co. Ltd., New Delhi, 6th Edition, 2003

REFERENCES

1. Srivastava, C.M., Srinivasan, C., Science of Engineering Materials, New Age International (P) Ltd., Pub. New Delhi, 2nd Edition, 1997
2. Wahab, M.A., Solid State Physics, Narosa Publishing House, New Delhi, 1999
3. Arumugam, M., Materials Science, Anuradha Agencies, Kumbakonam, 3rd Edition, 2003

4. Pillai, S.O., Solid State Physics, New Age International Publication, New Delhi, 5th Edition ,2003
5. Ali Omar, M., Elementary Solid State Physics, Pearson Education (Singapore)
Pvt. Ltd., Indian Branch, New Delhi, 2002

		L	T	P	C
CIV101	**BASIC CIVIL AND MECHANICAL ENGINEERING** (Common to all branches)	4	0	0	4

CIVIL ENGINEERING

BUILDINGS

Characteristics of good building materials such as stones, bricks, plywood and ceramic tiles, timber, cement, aggregates and concrete - Basic functions of buildings – Major components of buildings – Foundations - Purpose of a foundation – Bearing capacity of soils – types of foundations. Proper methods of construction of Brick masonry – Stone masonry – Hollow Block masonry. Beams – Lintels – Columns – Flooring – Damp proof course – surface finishes – Doors and windows – Roofing.

TRANSPORTATION ENGINEERING

Principles and Classification of surveying, Chain surveying, Compass surveying and leveling - Importance of roads – Classification of Highways –water bound macadam, bituminous and cement concrete roads –. Railways - Importance of railways – Gauges – Components of a permanent way. Bridges - Components of Culverts – Causeways, Slab Bridge, T-beam and slab bridge, Suspension bridge

MECHANICAL ENGINEERING

BOILERS AND TURBINES

Boilers - boiler mountings and accessories – Cochran boiler, Locomotive boiler, Babcock and Wilcox boiler, fire and water tube

boilers - Steam turbine - single stage impulse turbine, Parson's reaction turbine, difference between impulse and reaction turbines.

POWER PLANTS AND INTERNAL COMBUSTION (IC) ENGINE

Classification of power plants – steam, nuclear, diesel and hydro power plants - Alternate sources of energy - solar, wind, tidal, geothermal, ocean thermal energy conversion. – IC engine - components, working of four and two stroke petrol and diesel engines.

PRODUCTION TECHNOLOGY

Metal casting and forming process –patterns, moulding, melting of cast iron, casting – forging – rolling – extrusion – drawing - Metal joining process - welding – arc welding, gas welding, brazing and soldering - Metal machining – lathe, drilling machine, milling machine, shaping machine, planing machine, introduction to Computer Numerical Control machining.

TEXT BOOK

1. Shanmugam, G,, and Palanichamy, M.S., Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 1996.

REFERENCES

1. Khanna, K., Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi, 1997.
3. Venugopal K., Basic Mechanical Engineering, Anuradha Publications, Kumbakonam, 2000.
4. Shanmugam G., Basic Mechanical Engineering, Tata McGraw Hill Publishing Co.,New Delhi, 2001.

CHY101	ENVIRONMENTAL SCIENCES (Common to all Branches)	L	T	P	C
		2	0	0	2

NATURAL RESOURCES

Definitions – Scope of Environmental Sciences - Forest Resource – Food Resource – Land Resource – Water – Mineral resources - Utilization of Natural Resource, Impact on Environment – Conservation of Natural Resources

ECOSYSTEM AND BIODIVERSITY

Concept – Structure and Function – Energy Flow in Ecosystem – Ecological Succession – Food Chain – Food Web, Ecological Pyramids – Biodiversity, Definition, Values, Threats to Biodiversity, Conservation of Biodiversity

ENVIRONMENTAL POLLUTION

Definition, Causes, Effects and Control Measures of Air, Water and Soil Pollution – Thermal and Nuclear Pollution

MANAGEMENT OF ENVIRONMENTAL POLLUTION

Solid Waste Management – Treatment Methods adopted for Municipal Sewage and Industrial Effluent – Hazardous and Biomedical Waste Management

TOOLS FOR ENVIRONMENTAL MANAGEMENT

Environment Impact Assessment – Precautionary and Polluter Pay Principle - Constitutional Provision – (Air, Water and Forest) - Waste Minimization Techniques, Cleaner Technology Options, Bioremediation

TEXT BOOK

1. Dhameja, S.K., Environmental engineering and Management, S. K. Kataria and Sons, New Delhi, 1st Edition, 2004

REFERENCES

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 1st Edition, 2001.
2. Miller, T.G. Jr., Environmental Science, Wadsworth Publishing Co. USA, 2nd Edition, 2004
3. Trivedi, R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media., New Delhi, 2nd Edition, 2004
4. Masters, G. M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 2nd Edition, 1997
5. Henry, J. G., and Heike, G. W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersey, 1st Edition, 2005

MEC101	**ENGINEERING DRAWING** (Common to all branches)	L	T	P	C
		1	0	3	2

INTRODUCTION

Importance of graphics – use of drafting instruments – BIS conventions and specifications – size, layout and folding of drawing sheets – lettering dimensioning and scales - Orthographic principles - free hand sketching in first angle projection from pictorial views.

PROJECTION OF POINTS, STRAIGHT LINES AND PLANES

Projection of points, located in all quadrants - projection of straight lines located in the first quadrant, determination of true lengths and true inclinations, location of traces - projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes.

PROJECTION AND SECTION OF SOLIDS

Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position

method. Section of above solids in simple vertical position by cutting planes inclined to any one of the reference planes, obtaining true shape of section.

DEVELOPMENT OF SURFACES

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones - development of lateral surfaces of combined solids – prism and cylinder, cylinder and cylinder with axes at right angles with no offset.

ISOMETRIC AND PERSPECTIVE PROJECTION

Principles of isometric projection – isometric view and projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.

TEXT BOOK

1. Bhatt, N.D., Engineering Drawing, Charotar publishing House, New Delhi, 46th Edition, 2003.

REFERENCES

1. Nataraajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2006.
2. Shah, M.B., and Rana, B.C., Engineering Drawing, Pearson Education, New Delhi, 2005.
3. Gopalakrishnana, K.R., Engineering Drawing (Vol. I and II), Subhas Publications, 1998.
4. Luzadder and Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt Ltd, New Delhi, XI Edition, 2001.
5. Venugopal, K., Engineering Graphics, New Age International (P) Limited, 2002.

BIT101	BIOCHEMISTRY	L	T	P	C
		3	0	0	3

CARBOHYDRATES

Classification, structure, sources, and reactions of monosaccharide (glucose, fructose, galactose) – Disaccharides (sucrose, lactose, maltose) and Polysaccharides – Structural polysaccharide (cellulose, chitin, pectin), Storage polysaccharide (starch, glycogen, insulin) – Homopolysaccharide, Hetero-polysaccharides (Glycoso-amino-glycan), Chemistry and biological role of carbohydrates

AMINO ACIDS AND PROTEINS

Classification, structure and characteristics of amino acids-Essential and Non essential amino acids-Acid-base properties and general reactions of amino acids- Nonprotein or unusual amino acids-Peptide bond stability and formation-Polypeptides-Methods for determining Molecular weight, Amino- and -Carboxyl termini-Structural organization of proteins – primary, secondary, tertiary, quaternary and subunit structure of protein, Conformation of proteins globular and fibrous proteins- Ramachandran's plot- Denaturation and Renaturation, Classification of proteins

NUCLEIC ACIDS

Structure of Purines, Pyrimidine, nucleosides and nucleotides-Stability and formation of phosphodiester bond- Watson and Crick model of DNA, Different forms of DNA- Circular DNA and Super coiling- Types of RNA- Structure of tRNA- Denaturation and renaturation of DNA - Melting Curves- Calculation of Tm for oligonuclotides and DNA-Chemical and Enzymatic susceptibility of Nucleic acids

LIPIDS AND PORPHYRINS

Structure, properties and classification of lipids, fatty acids, waxes, phospholipids, cerebrosides, lipoproteins and gangliosides-Prostaglandins - prostacyclins, leukotrienes, thromboxanes and

physiological implications- Steroids and bile acids- Structure / function of heme and chlorophyll

VITAMINS

Source of vitamins, classification of vitamins, Fat soluble vitamins, water soluble vitamins, structure of vitamins, properties of vitamins, function of Fat soluble vitamins, water soluble vitamins, vitamins as cofactor

TEXT BOOK

1. Voet, D., and Voet, G., Biochemistry, John Wiley and Sons, Singapore, 3rd Edition, 2001

REFERENCES

1. Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, Worth
2. Publishers, London, 3rd Edition, 2000
3. Stryer, J.M., Tymoezko, J.L., Biochemistry, W.H. Freeman and Co., New York, 5th Edition, 2002
4. Zubay, G., Biochemistry, McGraw-Hill Publishers, New Delhi, 4th Edition, 1999

MEC181	WORK SHOP	L	T	P	C
		0	0	3	1

CARPENTRY

Carpentry tools - practice in marking, sawing, planing and chiseling – making simple joints: lap joint, T-joint, dovetail joint, mortise and tenon joint.

FITTING

Fitting tools - practice in marking, filing, punching, hacksawing - fitting to size and drilling - making of simple mating profiles: V, square, dovetail, half round joints.

SHEET METAL

Study of press, die and tools - sheet metal layout - development of lateral surfaces -simple exercises: blanking, forming, bending and flanging.

DRILLING

Drilling and tapping in drilling machines

Demonstration on:

i) Welding operations like butt joint and lap joints in Arc welding
ii) Foundry operations like mould preparation for split pattern
iii) Smithy operations like the production of hexagonal bolt
iv) Preparation of plumbing line sketches – basic pipe connections involving the fittings like valves, taps, couplings, unions, reducers, elbows and other components used in household fittings.

		L	T	P	C
CHY181	**CHEMISTRY LABORATORY** (Common to all branches)	0	0	3	1

1. Preparation of standard and buffer solutions
2. Estimation of hardness of water sample by EDTA method
3. Determination of dissolved oxygen in a sample of water
4. Estimation of chloride and fluoride ion in water sample
5. Determination of alkalinity of water sample
6. Estimation of hydrochloric acid by pH titration
7. Estimation of ferrous ion by potentiometric titration
8. Estimation of mixture of acid by conductometric titration
9. Estimation of iron by spectrophotometric method
10. Flame photometry – Determination of Na and K

SEMESTER III

		L	T	P	C
MAT201	**MATHEMATICS III** (Common to Biotechnology, Chemical Engineering, Civil Engineering, CSE, EEE, EIE and Mechanical Engineering)	3	0	0	3

LAPLACE TRANSFORM

Definition of Laplace transform - Linearity property - condition for existence of Laplace transform - First and second shifting properties - Laplace transform of derivatives and integrals - Unit step functions - Dirac delta-function - Differentiation and integration of transforms - Convolution theorem - Inversion - Periodic functions - Evaluation of integrals by Laplace transform - Solution of boundary value problems

PARTIAL DIFFERENTIAL EQUATIONS

Formation of PDE - Solution of std types of first order PDE - Lagrange's linear equation - Linear PDE of second and higher order with constant coefficients

FOURIER SERIES

Dirichlet's conditions - General Fourier series - odd and even functions - Half range sine and cosine series - complex form of Fourier series - Parseval's identity - Harmonic analysis

Z – TRANSFORM

Z-transform - elementary properties - Inverse Z-transform - Convolution theorem - formation of difference equation - Solution of difference equation using Z-transform.

FOURIER TRANSFORM

Fourier Integral formula - Fourier Transform - Fourier sine and cosine transforms - Linearity, Scaling, frequency shifting and time

shifting properties - Self reciprocity of Fourier Transform - Convolution theorem - Application to boundary value problems

TEXT BOOKS

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore, 8th Edition., 2001
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume II, Scitech Publications (India) Pvt. Ltd., Chennai, 1st Edn., Reprint 2000, 1999

REFERENCES

1. Grewal, B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edition, 5th Reprint 2004, 2003
2. Venkataraman, M. K., Engineering Mathematics –III A, The National Publishing Company, Chennai, 11th Edition., Reprint 2002, 1998
3. Venkataraman, M. K., Engineering Mathematics - III B, The National Publishing Company, Chennai, 13th Edition., Reprint 1999, 1998

BIT201	BIOORGANIC CHEMISTRY	L	T	P	C
		3	0	0	3

INTRODUCTION TO BIOORGANIC CHEMISTRY

Stereochemistry - R, S notation - Re, si faces - E, Z isomerism - Conformers - Ethane - Mechanisms of SN1, SN2 reactions - E1, E2 reactions - Ester formation and hydrolysis, Reaction rates - Hammond's postulate

CHEMISTRY OF BIOLOGICAL COMPOUNDS

Chemistry of living cells - Analogy between organic reactions and biochemical transformations - Structure, preparation and reactions of biologically important compounds based on modern concepts of organic chemistry - Carbohydrate structure and reactivity -

Chemistry of the peptide bond, synthesis of amino acids - Synthesis of nucleotides and phosphate esters

INTRODUCTION TO CATALYSIS

Introduction to catalysis - Enzyme catalysis - Acid-base catalysis - Covalent catalysis - Metal ion catalysis - Electrostatic catalysis - Proximity and orientation effects - Preferential binding of the transition state complex

METAL IONS IN BIOLOGICAL SYSTEMS

Metal ions in biological molecules - Carboxypeptidase and role of zinc - Iron and oxygen transport - Biomodels for photosynthesis and energy transfer - Cobalt and vitamin B12 actions - Oxidation and reduction reactions

STEREOCHEMISTRY OF ENZYMATIC REACTIONS

Stereospecific enzymatic reactions - Fumarase catalyzed reactions - NAD dependant oxidation and reduction reactions - Stereochemistry of nucleophilic reactions - Chiral methyl group - Chiral phosphate

TEXT BOOKS

1. Fersht, A.R., Structure and Mechanism in Protein Science, A Guide to Enzyme Catalysis and Protein Folding, W.H. Freeman, New York, 4th Revised Edition, 1999
2. Dugas, H., Bioorganic Chemistry, Springer Verlag, London, 3rd Edition, 1999

REFERENCES

1. David, L., Nelson and Michael, M., Cox., Lehninger's - Principles of Biochemistry, Macmillan worth Publisher, USA, 3rd Edition, 2000
2. Voet, D., Voet, G., Biochemistry, John Wiley and Sons, Singapore, 3rdEdition, 2001

BIT202	CELL BIOLOGY	L	T	P	C
		3	0	0	3

STRUCTURE AND FUNCTION OF THE CELL AND CELLULAR ORGANELLES

Eukaryotic and prokaryotic cells - Plasma membrane, cytoplasmic matrix, chloroplast, mitochondria, endoplasmic reticulum, nucleus, chromosomes, principles of membrane organization - Membrane proteins, cytoskeletal proteins - Types of cell division- Mitosis and meiosis - Extra cellular matrix - Cell cycle and molecules that control cell cycle

CELL DIFFERENTIATION

Factors influencing differentiation - Differentiation in unicellular organism, differentiation in multicellular organism, effect of environment in differentiation, levels of differentiation, mechanism of differentiation and cytoplasmic factors in differentiation - Ageing at cellular level, theories of ageing, ageing and immunological surveillance, ageing of connective tissue and mental aspects of ageing

RECEPTORS AND CELL SIGNALLING

Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine models of action, quantization and characterization of receptors -Signaling molecules, signal amplification, and cyclic AMP

TRANSPORT ACROSS CELL MEMBRANES AND SIGNAL TRANSDUCTION

Passive and active transport - Permeases, sodium potassium pump, Ca^{2+} ATPase pumps, lysosomal and vacuolar membrane, ATP dependent proton pumps, co-transport, symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis - Role of inositol phosphates as messengers, biosynthesis of inositol tri phosphates - Cyclic GMP and G proteins - Phosphorylation of protein kinases

ORGANELLE BIOGENESIS AND PROTEIN SECRETION

Synthesis and targeting of mitochondrial and chloroplast proteins - Overview of the secretory pathway - Translocation of secretory protein across the ER membrane

TEXT BOOK

1. Darnell,J., Lodish,H.Baltimore D.,Molecular Cell Biology, W.H.Freeman Publication, New York, 4 th Edition, 1995

REFERENCES

1. Gerald Karp and Nancy, L .Puritt., Cell and Molecular Biology, Concepts and experiments, John Wiley and Sons Inc, Singapore, 4th Edition,2004
2. De Robertis, E.D.P and De Robertis, E.M.F., Cell and Molecular Biology, Saunders College, Philadelphia, 6th Edition, 1990

CHE251	PRINCIPLES OF CHEMICAL ENGINEERING	L	T	P	C
		3	0	0	3

INTRODUCTION

Basic concepts - Units and dimensions - Steady state and dynamic processes - Lumped and distributed processes - Single and multiphase systems - Types of variables - Intensive and extensive variables - Specific properties - State variables - Types of equation - Mass and energy conservation - Equilibrium relations - Rate laws, constitutive equations for material behavior - Correlations for physical and transport properties

FUNDAMENTAL OF FLUID MECHANICS AND APPLICATIONS

Properties of fluids - Fluid statics, pressure measurement, forces on submerged bodies - Equation of continuity and motion - Bernoulli's equation and its applications - Newtonian and non-Newtonian fluids - Laminar and turbulent flows - Pressure drop calculation and friction factor - Measuring and control of flowing fluids, principles

and operation of variable head meter and variable area meter - Fluid moving machineries such as pumps, blowers, compressors, vacuum system - Application and selection of valves

PRINCIPLES OF HEAT TRANSFER

Principles of heat transfer, conduction, convection, radiation - Free and forced convection - Heat transfer coefficients - Heat exchangers

PRINCIPLES OF MASS TRANSFER

Diffusion mass transfer, molecular diffusion in fluids - Definition of mass transfer coefficients, theories of diffusion in turbulent flow - Mass, heat and momentum transfer analogies - Interface mass transfer - Diffusion in solids - Humidification, general theory, definition of absolute humidity, humid volume, humid heat, total enthalpy - Adiabatic saturation temperature

DISTILLATION AND ABSORPTION

Distillation, types - Mc Cabe Thiele method, applications - Absorption, conditions of equilibrium between liquid and gas, mechanism of absorption and desorption between phases, liquid and gas side resistance - Membrane filtration - Crystallization - Drying

TEXT BOOK

1. McCabe, W. L., Smith, J. C., and Harriott, P., Unit Operations of Chemical Engineering, McGraw Hill, New York, 6th Edition, 2004

REFERENCES

1. David, M. Himmelblau, Basic Principles and Calculations in Chemical Engineering, Prentice-Hall of India, New Delhi, 7th Edition, 2004
2. Coulson, J.M., Richardson, J.F, Backhurst J.R. and Harker J.M., Coulson and Richardson's Chemical Engineering, Volume I, Butter worth Heinemann, Oxford, 5th New York, Edition, 2002

BIT203	BIOENERGETICS AND METABOLISM	L	T	P	C
		3	1	0	4

BIOENERGETICS

Law of thermodynamics - Biological oxidation - Oxidation and reduction concepts - Gibbs energy and free energy changes - Redox potential and phosphate potential - High energy compounds - Thermodynamic considerations - Photosynthesis - Photo systems, light and dark phases, C3 and C4 pathways

CARBOHYDRATE METABOLISM

Glycolysis, TCA cycle and glyoxylate cycle - Mitochondrial shuttles - Pentose phosphate pathway, gluconeogenesis oxidative phosphorylation, electron transport chain, gluconeogenesis - Glycogenolysis

PROTEIN METABOLISM

Urea cycle, amino acid degradative pathways - Biosynthetic pathway of amino acids - Different levels of regulation - Protein synthesis and degradation - Allosteric regulation - Reversible covalent modification, proteolytic processing - Requirements of ATP for synthesis and degradation cycle

LIPID METABOLISM

Fatty acids metabolism - β-oxidation pathway - Ketone bodies - Biosynthesis of fatty acids - Control of metabolism - Biosynthetic and catabolic perspectives

NUCLEIC ACID METABOLISM

Biosynthesis of purine - Nucleotides (adenine, guanine) - Biosynthesis of pyrimidine - Nucleotides (cytosine, thymine, and uracil) - Catabolism of adenine, guanine, cytosine, thymine, and uracil - Metabolic disorders associated with purine metabolism - Metabolic disorders associated with pyrimidine metabolism

TEXT BOOK

1. Voet, D and Voet, G., Biochemistry, John Wiley and Sons, Singapore, 3rd Edition, 2001

REFERENCES

1. Stryer, L.Berg., J.M.Tymoezko., J.L., Biochemistry, W.H. Freeman Co., New York, 5th Edition, 2002
2. Zubay, G., Biochemistry, McGraw Hill Publishers, New Delhi, 4th Edition, 1999
3. Lehninger's, A.L. Nelson., D.L., Cox, M.M., Principles of Biochemistry, Worth Publishers, London,4th Edition, 2000

BIT204	MICROBIOLOGY	L	T	P	C
		3	0	0	3

MICROBIAL TAXONOMY

Characteristics - Classification and importance of microorganisms - Codes of bacterial nomenclature and taxonomy - Types of cultures for classification - Numerical taxonomy, chemotaxonomy - Light and electron microscope

STRUCTURE AND FUNCTION OF PROKARYOTES

Structure and reproduction - Important groups of prokaryotes - Eubacteria (*E.coli*), rickettsiae, actinomycetes, mycoplasma, L-forms bacteria , spirochetes , cyanobacteria , acetic acid bacteria, budding and appendages bacteria, spirilla, gliding and sheathed bacteria - Endospore forming rods and cocci - Fission and conjugation, - Domain archaea - Overview of bacterial viruses, animal viruses, plant Viruses

STRUCTURE AND FUNCTION OF EUKARYOTES

Structure and reproduction in protozoa, yeast, filamentous fungi and algae - Economical importance of algae, yeast, fungi

MICROBIAL ECOLOGY

Effect of environment factors such as temperature pH, water availability and oxygen on growth - Rhizosphere and phylloplane microflora - Mycorrhiza - Air microflora, water microflora - Microbial interaction in animal and plant - Microbes and environment

FOOD MICROBIOLOGY

Definition - Important fermented foods and beverages (curd, yogurt, cheese, bread, idly, pickles, beer, wine) - Factors affecting spoilage of food and food preservation methods - Methods to study food quality

TEXT BOOK

1. Pelczar, Jr. Chan, M.J. Krieg, E.C.S., Microbiology, N.R Tata McGraw Hill Publishers, New Delhi, 5th Edition, 2003

REFERENCES

1. Prescott, L.M., Harley, J.P., and Klein., Microbiology, D.A.McGraw Hill Publishers, New Delhi, USA, 5th Edition, 2003
2. Talaro, K.Talaro, A. Casida, Reid., Foundations in Microbiology, W.C.Brown Publishers, New York, 9th Edition 2005
3. Adam, M.R, Moss, Food Microbiology, Panima Publishers, New Delhi, 2nd Edition, 2003

BIT281	BIOCHEMISTRY LABORATORY	L	T	P	C
		0	0	3	2

1. Preparation of buffers (acidic, basic, neutral, biological)
2. Titration curves for amino acid, determination of pKa and pI
3. Qualitative analysis of lipids, carbohydrates and amino acids
4. Determination of glycine (Sorensen formal titration), amino acid by ninhydrin method

5. Estimation of protein (Biuret, Lowry and Kjeldhal Method)
6. Estimation of total sugars by Anthrone
7. Estimation of total sugars by DNS
8. Estimation of aldose and ketose sugars
9. Determination of acid value, saponification value and iodine number of oils and fats
10. Separation of lipids by TLC

BIT282	CELL BIOLOGY LABORATORY	L	T	P	C
		0	0	3	2

1. Identification of given plant, animal and bacterial cells and their components by microscopy
2. Leishman staining
3. Giemsa staining
4. Separation of peripheral blood mononuclear cells from blood
5. Osmosis and tonicity
6. Tryphan blue assay
7. Staining for different stages of mitosis in *Allium cepa* (Onion)
8. Identification of algal cell
9. Identification of giant chromosome from chyronomous larvae
10. Identification of protozoa

BIT283	MICROBIOLOGY LABORATORY	L	T	P	C
		0	0	3	2

1.Sterilization techniques and handling method of glass wares and instruments
2. Microscopy and micrometry
3. Staining techniques - simple, Gram's, and spore staining
4. Motility test by hanging drop technique
5. Pure culture technique - serial dilution, plating and streaking
6. Biochemical test - IMViC test, catalase, oxidase, starch hydrolysis
7. Effects of temperature, pH on growth of microorganisms
8. Anti microbial assay. (Kirby Bauer method)

SEMESTER IV

CHE252	UNIT OPERATIONS	L	T	P	C
		3	0	0	3

MIXING AND AGITATION

Dimensional analysis - Power for agitation, agitation of liquids - Gas-liquid systems - Gas-solid suspensions - Agitator scale up

FILTRATION

Constant pressure, constant volume batch filtration, continuous filtration - Industrial filters - Settling and sedimentation, batch settling test - Centrifugation

MECHANISM OF HEAT TRANSFER

Steady state conduction - Combined resistances - Unsteady state conduction - Lumped heat capacity - Extended surfaces - Combined conduction and convection - Two dimensional shape factors

CONVECTION HEAT TRANSFER

Dimensional analysis - Forced and natural convection - Convection in flow over surfaces through pipes - Boiling and condensation

HEAT EXCHANGERS

Equipments - Overall heat transfer coefficients - Design of heat exchangers, NTU concept - Evaporators, single and multiple effects - Mass and enthalpy balances

TEXT BOOK

1. Mccabe, W.L., Smith, J. C., Harriott, P., Unit Operations of Chemical Engineering, McGraw Hill, New York, 6th Edition, 2004

REFERENCES

1. Geankoplis, C. J., Transport Processes and Separation Process Principles (Includes Unit Operations), Prentice Hall of India, New Delhi, 4th Edition, 2003
2. Incropera, F. P.,Dewitt, D. P., Bergman, T. L., Lavine, A. S., Introduction to Heat Transfer, John Wiley and Sons, Singapore, 5th Edition, 2006
3. Coulson, J.M., Richardson, J.F., Backhurst, J.R. and Harker, J.M., Coulson and Richardson's Chemical Engineering, Volume I, Butter worth Heinemann, Oxford, 5th Edition, 2002

BIT205	INDUSTRIAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO INDUSTRIAL BIOPROCESS

Introduction to fermentation process - definition, scope, history, microorganisms and industrial products - Screening for microbes of industrial importance - Isolation and preservation of industrial microorganisms - Primary screening (screening for amylase, organic acid, antibiotic, aminoacid and vitamin producing microorganisms) and secondary screening - Further evaluation of primary isolates - Detection and assay of fermentation products - Physico chemical methods and biological assays - Role of a bioprocess engineer in the biotechnology industry - Outline of the various unit operations involved in an integrated bioprocess - Process flow sheeting

STRAIN IMPROVEMENT AND MEDIA PREPARATION

Environmental factors and genetic factors for improvement - Immobilization methods - Adsorption, covalent linkage, entrapment and cross linkage - Types of carriers - Advantages and disadvantages - Inoculum media and inoculum preparation - Medium requirements for fermentation process - Carbon, nitrogen, minerals, vitamins and other nutrients - Examples of simple and complex media, raw materials, saccharides, starchy and cellulosic materials

FERMENTATION PROCESS

Types of fermentation processes - Solid state, surface and submerged fermentations - batch, fed batch, continuous fermentations - Direct-dual or multiple fermentations - Scale up of fermentations

PRODUCTION OF PRIMARY AND SECONDARY METABOLITES

Fermentative production of industrial alcohol, beer - Principles of wine making -Fermentative production of citric acid, vitamin B12, glutamic acid - Antibiotics, commercial production of benzyl penicillin and tetracyclines

PRODUCTION OF MODERN BIOTECHNOLOGICAL PRODUCTS

Production and application of microbial enzymes - Amylases, lipases and proteases - Steroid transformations - Microbial biopesticides and biofertilizers - Principles of vaccine production and types of vaccines - Microbial products from genetically modified (cloned) organisms

TEXT BOOKS

1. Casida, J.R., L.E., Industrial Microbiology, Willey Eastern Ltd, New Delhi,1st Edition, 2006
2. Wulf Cruger and Anneliese Cruger., Biotechnoloogy, (A text book of industrial Microbiology), Panima Publishers, New Delhi, 2nd edition, 2003

REFERENCES

1. Prescott and Dunn, Industrial Microbiology, CBS Publishers, New Delhi, 4th Edition, 1987
2. Young, M.Y., Comprehensive Biotechnology Vol. 1-4, Pergamon Press, Oxford, 1st Edition, 1985
3. Stanbury, P.F., and Whitaker, A., Principles of Fermentation Technology, 2nd Edition, Pergamon Press, Oxford, 2005

BIT206	GENETICS	L	T	P	C
		3	0	0	3

CHEMISTRY OF GENETICS

Mendelian view of the world - Importance of weak chemical interactions - Importance of high energy bonds - Weak and strong bonds determine macromolecular structure

GENETIC MATERIAL AND GENOME REPLICATION

DNA as genetic material - Experiments of Griffith, Avery and Hershey and Chase, RNA as genetic material - TMV- Enzymes involved in the replication of DNA and their features replication of DNA, semi conservative replication, Meselson and Stahl's experiment ,replication of circular and linear DNA - Regulation of eukaryotic genome replication

DNA DAMAGE AND REPAIR

Spontaneous and induced mutations -Physical and chemical mutagenesis - Molecular mechanisms of mutagenesis - Transition, transversion, frame shifts, missense and nonsense mutations - Photoreactivation - Excision repair, mismatch repair, post-replication repair, SOS repair

RECOMBINATION IN BACTERIA AND VIRUSES

Transformation - competence factors, mechanism of transformation, mapping genes by transformation - Conjugation - structure of F plasmid, mechanism of transfer of F plasmid, Hfr, mechanism of integration of F plasmid into bacterial chromosome, circularization of chromosome, conjugation mapping - Transduction , generalized transduction, lysogeny and lytic cycle, specialized transduction - Structure of ג phage, mechanism of integration of ג d gal - Gene mapping by transduction

GENOME REARRANGEMENTS AND RECOMBINATION

Complete and segmental duplication of genomes, insertion, deletion and translocation of sequences, process of rearrangement - Homologous recombination - rec pathways, site specific

recombination, and non-homologous, - End joining transposon and repeats mediated rearrangements - Molecular mechanisms of gene conversion

TEXT BOOKS

1. Watson, J.D., Hopkins, N.H., Robertis, J.W, Steitz A. and Weiner, A.M., Molecular Biology of the Gene, Benjamin Cummings Publication, California, 5th Edition, 1988
2. Benjamin Lewin, Genes VII. Oxford Univ. Press, Oxford, New York, 7th Edition, 2000

REFERENCES

1. Lodish, H., Baltimore, D., Fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. Molecular Cell Biology, American Scientific Books. W.H. Freeman, NewYork, 4th Edition, 2000
2. Freifelder, D., Microbial Genetics, Narosa Publishing house, New York, Delhi, 8th Edition, 2001

BIT207	ENZYME ENGINEERING AND TECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO ENZYMES

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 - Types of enzymes - constitutive enzyme, induced enzymes - Intracellular and extracellular enzymes - Application of enzymes in food, pharmaceutical and other industries - Enzymes for analytical and diagnostic applications

KINETICS OF ENZYME ACTION

Kinetics of single substrate reactions - Estimation of Michaelis - Menten parameters, multisubstrate reactions - Mechanisms and

kinetics - Turnover number - Types of inhibition, Kinetic models - Substrate and product inhibition - Allosteric regulation of enzymes - Monod Changeux Wyman model, pH and temperature effect on enzymes and deactivation kinetics

ENZYME IMMOBILIZATION

Physical and chemical techniques for enzyme immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding with example - Advantages and disadvantages of different immobilization techniques - Overview of applications of immobilized enzyme systems

PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES

Production and purification of crude enzyme extracts from plant, animal and microbial sources - Methods of characterization of enzymes - Development of enzymatic assays

ENZYME BIOSENSORS

Application of enzymes in analysis - Design of enzyme electrodes and their application as biosensors in industry - Healthcare and environment

TEXT BOOKS

1. James Lee, M., Biochemical Engineering, PHI, USA, e-Book Version 2.1,2002
2. Bailey, J.E., Ollis, D.F., Biochemical Engineering Fundamentals, McGraw Hill Publishers, New Delhi, 2nd Edition, 1986

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1. Zubay, G., Biochemistry, McGraw Hill Publishers, New Delhi, 4th Edition, 1999

BIT208	INSTRUMENTAL METHODS OF ANALYSIS	L	T	P	C
		3	0	0	3

BASICS OF MEASUREMENT AND OPTICAL METHODS

Classification of methods - Calibration of instrumental methods - Electrical components and circuits - Signal to noise ratio - Signal - Noise enhancement - General design - Sources of radiation - Wavelength selectors - Sample containers - Radiation transducers - Types of optical instruments - Fourier transform measurements

MOLECULAR SPECTROSCOPY

Measurement of transmittance and absorbance - Beer's law - Spectrophotometer analysis - Qualitative and quantitative absorption measurements - Types of spectrophotometers – UV- Visible - IR - Raman spectroscopy - Principle, instrumentation and applications

ELECTRONS AND ION SPECTROSCOPY

X-ray photoelectron spectroscopy (XPS) - Ultraviolet photo electron spectroscopy (UPS) - Electron impact spectroscopy and auger electron spectroscopy - Instrumentation radiation sources - Energy analysis - Detectors and auxiliary systems

THERMAL METHODS

Thermo gravimetric methods - thermo balance, derivative thermo gravimetric analysis - Differential thermal analysis - Differential scanning calorimetry

SEPARATION METHODS

Introduction to chromatography - models , ideal separation , retention parameters Van - Deemter equation - Gas chromatography, stationary phases, detectors - Kovats indices - HPLC - pumps , columns , detectors - Ion exchange chromatography - Size exclusion chromatography - Supercritical chromatography - Capillary electrophoresis

TEXT BOOKS

1. Willard, H., Merrit, L., Instrumental Methods and Analysis, CBS Publishers and Distributors, New Delhi, 7th Edition,2004
2. Skoog, Holler and Nieman., Principles of Instrumental Analysis, Thomson Asia Pvt Ltd., Singapore, 5th edition, (Reprint) 2003

REFERENCES

1. Chatwal, R.G., Anand, K.S., Instrumental Method of Chemical Analysis, Himalaya Publishing House, Mumbai, 5th Edition (Reprint), 2006
2. Ewing, G.W., Instrumental Methods of Chemical Analysis, McGraw Hill Company, NewDelhi, 5th Edition, 1989

BIT209	MOLECULAR BIOLOGY	L	T	P	C
		3	0	0	3

MENDELIAN GENETICS

Mendelian genetics - Linkage, crossing over - Classical experiments, Hershey and chase, Avery McLeod and McCarty - Bacterial conjugation - Transduction - Transformation

REPLICATION OF DNA AND RNA

Conformation of DNA and RNA - Replication in prokaryotes - D-loop, rolling circle mode of replication, replication of linear viral DNA - Organization of eukaryotic chromosome, replication of telomeres in eukaryotes

GENES AND CHROMOSOMES

Molecular structure of genes and chromosomes - Transposons - Protein secretion - Organelle biogenesis

TRANSCRIPTION

Prokaryotes and eukaryotes - Features of promoters and enhancers - Transcription factors, nuclear RNA splicing, ribozyme - Lac and trp operon - Mutation and repair of DNA

TECHNINIQUES IN MOLECULAR BIOLOGY

Techniques in molecular biology - Hybridization techniques - Blotting techniques, RAPD, RFLP, DNA sequencing - Micro array - DNA fingerprinting and PCR

TEXT BOOK

1. David Friefelder., Molecular Biology, Narosa Publication House, New Delhi, 2nd Edition, 1999

REFERENCES

1. Benjamin Lewin., Genes VII, Prentice Hall, New Delhi, 7th Edition, 2004
2. Watson, J.D., Hopkins, W.H., Roberts, J.W., Steitz, J.A., Weiner, A.M., Molecular Biology of the Gene, Scientific American Book, New York, 3rd Edition, 1987

BIT284	INSTRUMENTAL METHODS OF ANALYSIS LABORATORY	L	T	P	C
		0	0	4	2

1. Precision and validity in an experiment using absorption spectroscopy
2. Validating Lambert-Beer's law using $KMnO_4$
3. Finding the molar absorbtivity and stoichiometry of the Fe (1, 10 phenanthroline) 3 using absorption spectrometry
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy
5. UV spectra of nucleic acids
6. Chemical actinometry using potassium ferrioxolate
7. Estimation of SO^{-4} by nephelometry
8. Estimation of Al^{3+} by flourimetry

9. Limits of detection using aluminium alizarin complex
10. Chromatography analysis using TLC
11. Chromatography analysis using column chromatography

BIT285	MOLECULAR BIOLOGY LABORATORY	L	T	P	C
		0	0	6	2

1. Isolation of genomic DNA from bacteria
2. Isolation of plasmid DNA from bacteria
3. Isolation of genomic DNA from plant and animal cell
4. Agarose gel electrophoresis
5. Restriction enzyme digestion
6. Purification of digested DNA
7. Preparation of competent cell and transformation
8. SDS PAGE
9. Phage titration
10. Phage lysis of liquid culture
11. UV mutation

CHE291	CHEMICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

1. Flow measurement - Variable head and variable area meters (Venturi, orifice, rotameter) - Calibration curve and determination of discharge coefficient
2. Pressure drop in straight pipes
3. Pressure drop in annular pipes
4. Pressure drop in packed columns - verification of Ergun equation
5. Fluidization - Calculation of minimum fluidization velocity
6. Filtration - plate and frame Filter, leaf filter and rotary vacuum filter
7. Heat exchanger - shell and tube, double pipe heat exchanger, calculation of effectiveness and efficiency
8. Simple distillation

9. Steam distillation
10. Distillation in packed column
11. Liquid-liquid equilibria in extraction
12. Adsorption equilibrium
13. Transient heat conduction
14. Free and forced convection heat transfer
15. Batch sedimentation Test

SEMESTER V

BIT301	BIOINFORMATICS AND COMPUTATIONAL BIOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO BIOINFORMATICS

Scope of bioinformatics - Protocols - FTP - Telnet - HTTP - Hardware - Topology - Information theory - Search engine and Search Algorithm

DATABASES AND THEIR USE

Introduction to databases - Data management - Data life cycle - Interfaces and Implementation - Algorithm issues in database search - Biological databases and their uses

PATTERN MATCHING AND PHLYOGENY

Pair wise sequence alignment - Local vs global alignment - Multiple sequence alignment - Substitution matrices (PAM BLOSSUM) - Dynamic programming - BLAST- FASTA - Perfect phylogeny - Ultrasonic Trees - Tree Construction - Parsimony - Mutation as a measure of time - Distance - Phylogenetic alignment in connection with multiple alignment

COMPUTATIONAL BIOLOGY

Methods and algorithms for biological data analysis and interpretation - Algorithms for genome analysis and gene finding - Markov models - Theoretical models for sequence comparisons of nucleic acids and proteins

ADVANCED TOPICS IN BIOINFORMATICS

Microarray analysis - DNA mapping and sequencing - Sequence assembly - Gene predictions - System biology

TEXT BOOKS

1. Bryan Bergeron, M.D., Bioinformatics Computing, Eastern Economy Edition, Prentice Hall, NewYork, 2nd Edition, 2003

2. Dan Gusfield., Algorithm on Strings Trees and Sequences, Cambridge University Press, USA, 1st Edition, 1997

REFERENCES

1. Baldi, P., Brunak, S., Bioinformatics, A Machine Learning Approach, MIT press, USA, 2nd Edition, 1998
2. Attwood, T.K., Perry smith, D.J., Introduction to Bioinformatics, Longman, Essex, 1st Edition, 1999

BIT302	PROTEIN ENGINEERING	L	T	P	C
		3	0	0	3

STRUCTURE OF PROTEINS

Primary structure - Peptide mapping, peptide sequencing, automated Edman method and mass spec - high throughput protein sequencing setup - Secondary structure - alpha, beta and loop structures, alpha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down and TIM barrel structures, nucleotide binding folds, prediction of substrate binding sites - Tertiary structure - Domains, folding, denaturation and renaturation - Overview of methods to determine 3D structures - Quaternary structure - Modular nature, formation of complexes

STRUCTURE-FUNCTION RELATIONSHIP

DNA binding proteins - Prokaryotic transcription factors, helix-turn-helix motif in DNA binding, Trp repressor, eukaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, leucine zippers - Membrane proteins - General characteristics, trans-membrane segments, prediction - Bacteriorhodopsin and photosynthetic reaction center- Immunoglobulin - IgG light chain and heavy chain architecture - Abzymes and enzymes- serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate - Assisted catalysis other commercial applications

METHODS OF PROTEIN ENGINEERING

Protein engineering - Proteins design and engineering - Random site directed mutagenesis - Strategies to alter catalytic efficiency - Structure prediction and modeling proteins - Molecular graphics in protein engineering - Dynamics and mechanics - Drug-protein interactions and design

DATA ANALYSIS METHODS

Methods in protein data base analysis - theory, interactive graphics programme, perturbation

PROTEIN ENGINEERING IN INDUSTRIAL BIOTECHNOLOGY

Stabilization of industrial enzymes - Design of biotechnology applicable yeast carboxypeptidase, Y mutants, ß-glycoside hydrolases - Specificity and stability in glucoamylase - Engineering proteins for degradation of recalcitrant compounds and biosensors

TEXT BOOKS

1. Branden, C., Tooze, R., Introduction of Protein structure, Garland, 1st Edition, 1993.
2. Lilia Alberghina., Protein Engineering in Industrial Biotechnology, Harwood
   Academic publishers, Netherland, Reprint, 2003

REFERENCES

1. Creighton, T.E., Proteins, WH Freeman, New York, 2nd Edition, 1993
2. Voet,D., and Voet, G., Biochemistry, John Wiley and Sons, Singapore, 3rd Edition, 2001

BIT303	BIOPROCESS PRINCIPLES	L	T	P	C
		3	1	0	4

OVERVIEW OF FERMENTATION PROCESS AN BIOPROCESS

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 - Role of bioprocess engineer in the biotechnology industry - Concept of bioprocess outline of an integrated bioprocess and the various unit operations involved in bioprocesses - Generalized process flow sheets - Modern applications of biotechnological processes

RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS

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 - Design of various commercial media for industrial fermentations - Medium optimization methods

STERILIZATION KINETICS

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

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 and heat evolution in aerobic cultures, thermodynamic efficiency of growth

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

Modes of operation - Batch, fed batch and continuous cultivation - Chemostat -Turbidostat - Introduction to structured models for growth and product formation - 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

TEXT BOOKS

1. Bailey, J.E., Ollis, D.F., Biochemical Engineering Fundamentals, McGraw Hill Publishers, New Delhi, 2nd Edition, 1986
2. Shuler, M.L., Fikret Kargi, Bioprocess Engineering-Basic Concepts, Prentice Hall Pvt. Ltd., New Delhi, 2nd Edition, 2004

REFERENCES

1. Doran, P.M., Bioprocess Engineering Principles, Academic Press(An Imprint Of Elsevier), New Delhi, 2nd Edition, 2005
2. Peter, F., Stanbury, Stephen, J., Hall and A. Whitaker., Principles of Fermentation Technology, Elsevier, Science and Technology Books, New Delhi, 2nd Edition, 2005
3. James Lee, M., Biochemical Engineering, PHI, USA, e-Book Version 2.1,2002

BIT304	GENETIC ENGINEERING	L	T	P	C
		3	1	0	4

BASICS OF RECOMBINANT DNA TECHNOLOGY

Role of genes within cells - Genetic elements that control gene expression - Restriction and modifying enzymes - Safety guidelines of recombinant DNA research

CREATION OF RECOMBINANT MOLECULES

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

Construction of cDNA and genomic libraries - Screening of libraries with DNA probes and antisera

POLYMERASE CHAIN REACTION

Inverse PCR, nested PCR, Taqman assay, molecular beacons, RACE PCR, RAPD -Site directed mutagenesis - Methods of nucleic acid sequencing - Sangers method, (Kunkel's method)

APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

Cloning in plants - Ti plasmid - Transgenic and knockout animals - DNA microarrays, FACS

TEXT BOOK

1. Old, R.W., Primrose, S.B., Principles of Gene Manipulation, An Introduction to Genetic Engineering, Blackwell Science Publications, Oxdford,5th Edition,1993

REFERENCES

1. Watson, J.D., Hopkins, W.H., Roberts, J.W., Steitz, J.A., Weiner, A.M., Molecular Biology of the Gene, Scientific American Book, New York, 3rd Edition, 1987

2. Brown, T.A., Gene Cloning and DNA analysis-An Introduction, Blackwell Science Ltd, Oxford, 2nd Edition, 2001

CHE351	BIOPROCESS CALCULATIONS	L	T	P	C
		3	0	0	3

UNITS AND DIMENSIONS

Buckingham Pi-theorem - Dimensionless groups - Conversion of equations - Solution of simultaneous equations - Use of log-log and semi-log graph paper - Triangular diagram, Graphical differentiation and graphical integration - Treatment and interpretation of data - Error analysis in connection with computation

MATERIAL BALANCE

Introductory concepts - Simplification of the general mass balance equation for steady and unsteady state processes - Material balance without chemical reactions - Humidification such as continuous filtration - Batch mixing, crystallizer, distillation column - Material balance with chemical reaction - Stoichiometry of growth and product formation - Growth stoichiometry and elemental balances - Material balance with recycle, bypass and purge streams

ENERGY BALANCE

General energy balance equation for steady and unsteady state processes - Without chemical reaction, with chemical reaction - Enthalpy calculation procedures, special cases e.g., spray dryer, distillation column, enthalpy change due to reaction - Heat of combustion, heat of reaction for processes with biomass production - Energy-balance equation for cell culture for fermentation processes

COMBINED MATERIAL AND ENERGY BALANCES

Simultaneous material and energy balances - Selected industrial process calculations for bioprocesses

THERMOCHEMISTRY

Standard heat of reaction, heat of formation - Hess law - Heat of combustion, and calculation of various heats of reactions - Enthalpy changes in reactions with different temperatures and energy balances - Material and energy balances for typical processes

TEXT BOOK

1. Bhatt, B.I., Vora, S.M., Stoichiometry, Tata McGraw-Hill Publishing Company, New Delhi, 4th Edition, 2004

REFERENCES

1. David, M. Himmelblau., Basic Principles and Calculations in Chemical Engineering, Prentice-Hall of India, New Delhi, 7th Edition, 2004
2. Hougen,O.A., Watson, K.M., and R.A. Ragatz., Chemical Process Principles, part-I, CBS Publishers and Distributors, New Delhi, 2nd Edition, 1995

BIT387	BIOPROCESS LABORATORY	L	T	P	C
		0	0	6	2

1. Growth of bacteria - estimation of biomass, calculation of specific growth rate, yield coefficient, utilization and product formation kinetics in shake flask culture
2. Growth of yeast - estimation of biomass, calculation of specific growth rate, yield coefficient, utilization and product formation kinetics in shake flask culture
3. Medium optimization - Plackett Burman design
4. Medium optimization - Response surface methodology
5. Enzyme kinetics - Michaelis Menton parameters
6. Enzyme activity - effect of temperature and pH
7. Enzyme inhibition kinetics
8. Enzyme immobilization - gel entrapment, cross linking, column packing, whole Cell immobilization
9. Kinetics of immobilized enzyme reactions

10. Bioconversion studies with immobilized enzyme packed - bed reactors.
11. Performance of bioreactor - utilities for bioreactor operation

BIT388	GENETIC ENGINEERING LABORATORY	L	T	P	C
		0	0	6	2

1. Isolation of chromosomal DNA from bacteria, fungi, plants and animal
2. Restriction digestion and ligation
3. Isolation of RNA
4. Transformation and screening of recombinants
5. Conjugation
6. Cloning of genes and its expression
7. Polymerase chain reaction
8. Southern blotting
9. Northern blotting
10. Western blotting
11. Colony hybridization
12. Single strand conformation polymorphism
13. Invitro mutagenesis

SEMESTER VI

		L	T	P	C
BIT305	**BIOCHEMICAL ENGINEERING**	3	1	0	4

DESIGN AND ANALYSIS OF BIOREACTORS

Modeling of non-ideal behavior in bioreactors - Tanks-in-series and dispersion models - Application to design of continuous sterilizers - Design and operation of novel bioreactors - Air-lift loop reactors - Packed bed reactor, bubble column reactors and fluidized - bed bioreactors - Stability analysis of bioreactors

BIOREACTOR SCALE – UP

Regime analysis of bioreactor processes - Oxygen mass transfer in bioreactors - Microbial oxygen demands - Methods for the determination of mass transfer coefficients mass transfer correlations - Scale up criteria for bioreactors based on oxygen transfer - Power consumption and impeller tip speed

MODELLING AND SIMULATION OF BIOPROCESSES

Study of structured models for analysis of various bioprocesses - Compartmental models, cybernetic models - Models of cellular energetic and metabolism - Single cell models, plasmid replication and plasmid stability model - Dynamic simulation of batch, fed batch, steady and transient culture metabolism - Model simulation using MATLAB-SIMULINK and ISIM software packages

MODERN BIOTECHNOLOGICAL PROCESSES

Recombinant cell culture processes - Guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture - Limits to over expression - Modeling of recombinant bacterial cultures - Bioreactor strategies for maximizing product formation - Bioprocess design considerations for plant and animal cell cultures

BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions - Formulation of dimensionless groups and calculation of effectiveness factors - Design of immobilized enzyme reactors – Packed bed, fluidized bed and membrane reactors

TEXT BOOKS

1. Bailey, J.E., Ollis, D.F., Biochemical Engineering Fundamentals, McGraw Hill Publishers, New Delhi, 2nd Edition, 1986
2. Peter, F., Stanbury, Stephen, J., Hall and Whitaker, A., Principles of Fermentation Technology, Elsevier, Science and Technology Books, New Delhi, 2nd Edition, 2005

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1. Shuler, M.L., Fikret Kargi., Bioprocess Engineering-Basic Concepts, Prentice Hall Pvt. Ltd., New Delhi, 2nd Edition, 2004
2. Doran, P.M., Bioprocess Engineering Principles, Academic Press (An Imprint Of Elsevier), New Delhi, 2nd Edition, 2005
3. James Lee, M., Biochemical Engineering, PHI, USA, E-Book Version 2.1,2002

BIT306	IMMUNOLOGY	L	T	P	C
		3	1	0	4

THE IMMUNE SYSTEM

Introduction - Lymphocytes, their origin and differentiation - Antigens, their structure and classification - Complement and their biological functions -Types of immune responses, anatomy of immune response

HUMORAL IMMUNITY

B-Lymphocytes and their activation - Structure and function of immunoglobulin, immunoglobulin classes and subclasses, genetic

control of antibody production - Hybridoma technology and diagnosis - Idiotope and antibodies - Major histocompatibility complex

CELLULLAR IMMUNOLOGY

Thymus derived lymphocytes (T Cells), their classification - Antigen presenting cells (APC), macrophages, langerhans cells, their origin and function - Mechanisms of phagocytosis, identification - Cell types of immune System, immunosuppression, and immune tolerance

IMMUNITY TO INFECTION

Hypersensitivity reactions - Mechanisms of T cell activation - Cytokines and their role in immune response - Macrophage activation and granuloma formation

TRANSPLANTATION AND AUTOIMMUNITY

Graft rejection - evidence and mechanisms of graft rejection - Prevention of graft rejection - Immunosuppressive drugs - HLA and disease - Mechanisms of immunity to tumour antigens-Autoantibody in humans - Pathogenic mechanisms - Experimental models of autoimmune disease - Treatment of auto immune disorders

TEXT BOOKS

1. Roitt, I., Essential Immunology, Blackwell Scientific Publications, Oxford, 11th Edition 2006
2. Benjamin, E., Leskowitz, S., Immunology –A Short Course, Wiley Liss, New York, 3rd revised Edition, 1996

REFERENCES

1. Jeneway, C. A Jr. and Travers, P.T., Immunobiology, Blackwell Scientific Publishers, Oxford, 6th Edition 2004
2. Janes Kuby., Immunology, WH Freeman and Company, Newyork, 5th Edition, 2002

BIT389	IMMUNOLOGY LABORATORY	L	T	P	C
		0	0	6	2

1. Identification of blood group
2. Handling of animals and bleeding techniques
3. Testing for typhoid antigens by Widal test
4. Immunoelectrophoresis
5. Rocket Immunoelectrophoresis
6. Outcherlony double diffusion
7. Radial Immunodiffusion
8. Affinity chromatography for antibody purification
9. ELISA-DOT and plate ELISA
10. Sandwich ELISA
11. Quantitative precipitation Assay
12. Latex agglutination Test

BIT390	BIOCHEMICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	6	2

1. Thermal death kinetics for microorganisms
2. Batch sterilization design
3. Batch cultivation, estimation of K_La – Dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing
4. Fed batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
5. Total cell retention cultivation, exhaust gas analysis – carbon balancing, gas balancing
6. Estimation of K_La – Sulphite oxidation method
7. Estimation of K_La – Power correlation method
8. Residence time distribution analysis
9. Estimation of overall heat transfer coefficient
10. Continuous cultivation – x-d diagram, pulse and shift method, exhaust gas analysis – carbon balancing, gas balancing

11. Computer based data acquisition, monitoring and control-LABVIEW software
12. Model simulation using MATLAB-SIMULINK and ISIM software packages

SEMESTER VII

BIT401	ANIMAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

TOOLS AND CLONING OF ANIMAL BIOTECHNOLOGY

Biology of viral vectors - SV40, adenovirus, retrovirus, vaccinia virus, herpes virus, and adeno associated virus, baculo virus - Construction of animal viral vectors for gene transfer into cell lines - Embryo preservation - Micro manipulation and cloning -Somatic cell cloning

EXPRESSION OF PROTEINS

Animal biotechnology for production of regulatory proteins, blood products, vaccines and hormones and other therapeutic proteins - Gene therapy- Prospects and problems - Biotechnological applications for HIV diagnostics and therapy - Oncogenes and antioncogenes - Phage display technology - Signal transduction - Transgenic animal production and application in expression of therapeutic proteins - Baculovirus in biocontrol-Baculo virus for expression of foreign genes

TRANSGENIC ANIMAL

Transgenic animal production, physiological and metabolic phenotype of transgenic animals - Developmental, nutritional, endocrinological and genetic influences on physiological systems - Metabolism and gene expression - Cell and molecular biology of animal cell

TECHNIQUES IN ANIMAL TISSUE CULTURE

Media for culturing cells and tissues - Natural and defined media - Preparation of various tissue culture media, sterilization and storage - Sterilization of various equipments and apparatus - Short-term lymphocyte culture (suspension cultures) - Fibroblast cultures from neonatal rat skin - Development and maintenance of cell lines - Demonstration of cell hybridization - Hybridoma and monoclonal

antibody production- *invitro* culture of oocytes and embryos – Cell and embryo cryopreservation - Stem cell isolation and culture

BIOTECHNOLOGY FOR ANIMAL IMPROVEMENT

Super ovulation - Oestrus synchronization embryo collection, evaluation and transfer-*Invitro* maturation of oocytes - *Invitro* fertilization and embryo culture - Gene knock out and mice model for human genetic disorder - Nucleic acid based detection of human disease genes - Mapping of human genome - Human genome project

TEXT BOOKS

1. Debra Davis., Animal Biotechnology, National Academic Press, Washington, 1st Edition,2002
2. Allan Holland and Andrew Johnson., Animal Biotechnology and Ethics, Springer Verlag, New York, 1st Edition, 1998

REFERENCES

1. Masters, J.R.W., Animal Cell Culture: Practical Approach, Oxford University Press, New York, 3rd Edition, 2000
2. Bernard, R., Glick and Jack J., Pasternak., Molecular Biotechnology, Asm Press, Washington, 2nd Edition ,2003

BIT402	PLANT BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

PLANT CELL AND ITS GROWTH

Special features and organization of plant cells - Totipotency, regeneration of plants - Plant products of industrial importance - Biochemistry of major metabolic pathways and products - Autotrophic and heterotrophic growth

CELL CULTURE

Organogenesis, induction of differentiation root cultures, cell suspension cultures, micropropagation with shoot apex cultures - Somatic embryogenesis - Biochemical and molecular characterization of morphogenetic events *invitro* - Isolation,

purification and culture of protoplasts - Protoplast fusion and somatic hybridization - Selection systems for somatic hybrids and cybrids - Anther and pollen cultures - Storage of plant genetic resources, induction of mutation - Somaclonal variation

PLANT MOLECULAR BIOLOGY

Factors influencing the development of plant form including genes - Phytohormones and environmental stimuli - Flowering, branching and other key developmental plant processes - Plant genomes and genes - Fundamental tools for gene isolation and expression analysis, plant transformation - Agrobacterium mediated gene transfer - Applications to the genetic manipulation of plants - Molecular cloning methods, plant transformation, molecular markers

PLANT GROWTH REGULATORS AND PLANT METABOLITES

Plant growth regulators and elicitors - Cell suspension culture development - methodology, kinetics of growth and production formation, nutrient optimization - Production of secondary metabolites by suspension cultures with a few case studies - Biological and technological barriers - Hydrodynamic shear and its quantification, mixing and impeller design aspects - Plant cell reactors, comparison of reactor performances

PLANT TISSUE CULTURE TECHNIQUES

Immobilized plant cell and cell-retention reactors - Hairy root cultures and their cultivation in laboratory - Development of callus and suspension cultures of plant cells, shear sensitivity, growth and product formation kinetics in suspension cultures

TEXT BOOKS

1. Adrian Slater., Nigel, W., Scott, and Mark R Fowler., Plant biotechnology The Genetic Manipulation of Plants, Oxford University Press, London, 1st Edition, 2003

2. Kirsi Majra., Oksman., Caldentey., Plant Biotechnology and Transgenic Plants, Marcel Dekker, New York, 1st Edition 2002

REFERENCES

1. Chawla, H. S., Introduction to Plant Biotechnology, Science Publisher, USA, 2nd Edition, 2002
2. Jenny Anitken., Christie., Toyoki Kozai., Mary Ann Lila Smith., Automation and Environmental Control in Plant Tissue Culture, Springer Verlag, London,1st Edition, 1995

BIT403	DOWNSTREAM PROCESSING	L	T	P	C
		3	0	0	3

INTRODUCTION TO DOWNSTREAM PROCESSING

Basic principles of down stream process- Importance of downstream processing in biotechnology, problems - Requirement of purification - Characteristics of biological molecules, classes of bio-products

PHYSICAL METHODS OF SEPARATION

Physicochemical basis of separation - Physical separation processes - Solid and liquid system, flocculation - Centrifugation, precipitation, filtration, settling - Membrane separation process

ISOLATION OF PRODUCTS

Cell disruption - Chemical, mechanical and enzymatic methods - Extraction, absorption, leaching, membrane separation process - Separation of intracellular, extra cellular - Heat and photosensitive materials - Case study with design aspect

CHROMATOGRAPHIC METHODS

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

FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS

Crystallization - Drying and lyophilization in final product formulation

TEXT BOOKS

1. Belter, P.A., Cussler, E.L. and Wei-Houhu., Bioseparations, Downstream Processing For Biotechnology, Wiley Interscience Publication, Singapore, 1st Edition, 1988
2. Jenkins, R.O., Product Recovery in Bioprocess Technology, Biotechnology by Open Learning Series, Butterworth-Heinemann, London, 2nd Edition, 1992

REFERENCES

1. Janson, J.C., Ryden, L., Protein Purification- Principles, High Resolution Methods and Applications, VCH Publication, New York 2nd Edition, 1989
2. Scopes, R.K., Protein Purification – Principles and Practice, Narosa Publication, New Delhi, 4th Edition, 1994

BIT491	DOWNSTREAM PROCESSING LABORATORY	L	T	P	C
		0	0	6	2

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruptions techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dyno mill – batch and continuous
4. Precipitation – Ammonium sulphate Method
5. Ultra filtration separation
6. Aqueous two phase extraction of fermentation Broth
7. High resolution purification – Affinity chromatography
8. High resolution purification – Ion exchange chromatography
9. Product polishing – Gel filtration chromatography

10. Product Polishing – Spray drying, freeze drying
11. High resolution purification – Hydrophobic interaction chromatography.

MAJOR ELECTIVES FOR THIRD YEAR

BIT307	ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION

Introduction to ecosystem - Microbial flora of soil - Interaction among Soil microorganisms – Bio geochemical cycle - Role of soil microorganisms

DEGRADATION OF XENOBIOTICS

Xenobiotics - Simple aromatics, chlorinated polyaromatic compounds, petroleum products, pesticides and surfactants - Mechanism of detoxification, oxidation, dehalogenation - Degradation of metals - Biotransformation of metals - Bioremediation

MICROBIAL TECHNOLOGY FOR WASTE WATER TREATMENT

Waste water characteristics - Biological waste water treatment - Unit operation - Design and modeling of activated sludge process - Anaerobic digested dynamics

TREATMENT OF INDUSTRIAL WASTES

Dairy, pulp, dye, leather and pharmaceuticals - Solid waste management

MICROBIAL LEACHING

Extraction of metals from ores, recovery of metals from solutions - Microbes in petroleum extraction - Microbial desulphurization of coal - Degradative plasmids and genetically engineered microbes in environment

TEXT BOOKS

1. Karnely, Chakrabarty, D., Omen, G.S., Biotechnology and Biodegradation, Advances in Applied Biotechnology Series, Vol I, Gulf Publications Company, London, 1st Edition, 1989
2. Foster, C.F., John Ware, D.A., Environmental Biotechnology, Ellis Harwood Ltd,1st Edition, 1987

REFERENCES

1. Young, M.Y., Comprehensive Biotechnology (Vol. 1-4),Pergamon Press, Oxford, 1st Edition, 1985
2. Wanwright, M., An Introduction to Environmental Biotechnology, Springer Verlag, London, 1st Edition, 1999

BIT308	SPECTROSCOPIC METHODS FOR STRUCTURE DETERMINATION	L	T	P	C
		3	0	0	3

ELECTROMAGNETIC AND QUANTUM THEORY OF RADIATION

Wave - Particle duality – Photons - Yukovs theory for nature of forces - Interaction of light with matter - Transition dipole moment - Group theory - Jablonsky diagram

SPECTROSCOPY OF BIOMOLECULES

UV-Visible Absorption Spectroscopy- Beer-Lambert's law, applications of UV-Visible difference spectroscopy , circular dichroism in protein analysis - Fluorescence Spectroscopy -Quantum yield , static and dynamic quenching of fluorescence ,energy transfer, polarization , anisotropy time , resolved fluorescence

VIBRATIONAL SPECTROSCOPY

IR,FTIR and Raman spectroscopy of biomolecules - Nuclear magnetic resonance spectroscopy - Chemical shifts, coupling constants, ring currents, paramagnetic shifts, spin-spin and spin - lattice relaxation times, NOE, chemical exchange - Applications to biomolecular structure and dynamics

ELECTRON SPIN RESONANCE SPECTROSCOPY

Hyperfine splitting - Zero field splitting - Spin labels - Mass spectrometry of biomolecules

X-RAY DIFFRACTION

Crystal systems and space groups - Miller indices and space lattices - Diffraction of x-rays and Braggs law - Structure determination of biomolecules - Refinement and accuracy of the x-ray crystallographic structures - Scanning tunneling microscopy - Atomic force microscopy - Electron microscopy of biomolecules

TEXT BOOK

1. Cantor, C.R., Schimmel, P.R., Biophysical Chemistry, Part-2, W.H.Freeman Company, New York, 1st Edition, 1980

REFERENCES

1. Lalcowicz, J.R., Principles of Fluorescence Spectroscopy, Plenum Press, Philadelphia, 3rd Edition ,2006
2. Atkins, P.W., Physical Chemistry, ELBS/Oxford University Press, New York, 3rd Edition, 1987
3. Willard, H., Merritt, L., Dean J.A., and Settle, F.A., Instrumental methods of analysis, CBS publishers, New Delhi, 6th Edition, 1986
4. Skoog, D.A. and West, D.M., Fundamentals of Analytical Chemistry, Saunders-college Publishing, Philadelphia, 2nd Edition, 1982

BIT309	FOOD PROCESSING AND TECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO FOOD PROCESSING

Biotechnology in relation to the food industry - Nutritive value of food - Types of microorganisms associated with food, its sources - Recent trends in food biotechnology

FOOD PRESERVATION

Principles involved in the use of sterilization, pasteurization and blanching - Thermal death curves of microorganisms – Canning - Frozen storage - Freezing characteristics of foods - Microbial activity at low temperatures - Bioprocessing of meat, fisheries ,vegetables, diary product - Enzymes and chemicals used in food processing - Biochemical engineering for flavor and food production - Factors affecting quality of foods in frozen storage -Irradiation preservation of foods

FERMENTED FOOD PRODUCTS

Dairy product – Meat - Fishery - Non beverage plant product - Beverages and related products of baking

FOOD SPOILAGE

Food borne illness - Quality control - Case studies on biotechnology in the evolution of food quality - HFCS (High Fructose Corn Syrup) and mycoproteins

FOOD MICROBIOLOGY

Utilization of microorganisms in food industries - Genetic manipulations - Food borne illness

TEXT BOOKS

1. Lidsay., Willis Biotechnology, Challenges for the flavour and food industries, Elsevier Applied Science, New Delhi, 1st Edition, 1988
2. Roger, A., Gordan, B., and John, T., Food Biotechnology, Cambridge University Press, USA, 1st Edition, 1989

REFERENCES

1. George, J. B., Basic Food Microbiology, Springer Verlag, London, 2nd Edition, 1995
2. James, M. J., Modern Food Microbiology, Springer Verlag, London, 7th Edition, 2006

3. Frazier, W.C., Westhoff, D.C., Food Microbiology, McGraw-Hill Book Co, New York, 4th Edition, 1988
4. Coultate, T.P., Food – The Chemistry of Its Components, Royal Society, London, 2nd Edition, 1992

BIT310	PHARMACEUTICAL BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION

Development of drug and pharmaceutical industry – Therapeutic agents, their use and economics - Regulatory aspects

DRUG METABOLISM AND PHARMACOKINETICS

Drug metabolism - Physico chemical principles - Radio activity - Pharma kinetic action of drugs on human bodies

IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS

Bulk drug manufacturers - Type of reactions in bulk drug manufacture and processes - Special requirement for bulk drug manufacture

MANUFACTURING PRINCIPLES

Compressed tablets, wet granulation - Dry granulation or slugging - Direct compression - Tablet presses, coating of tablets, capsules, sustained action dosage forms -Parental solution - Oral liquids – Injections – Ointment - Topical applications – Preservation - Analytical methods and test for various drug and pharmaceuticals - Packing techniques -Standard of hygiene and GMP

PHARMACEUTICAL PRODUCT AND THEIR CONTROL

Therapeutic categories - Vitamins, laxatives, analgesics, non-steroidal contraceptives - External antiseptics - Antacids and others, antibiotics, biological hormones - Quality management and control

TEXT BOOKS

1. Leon Lachman., Theory and Practice of Industrial Pharmacy, Lea and Febiger, USA, 3rd Edition, 1986
2. Remington., Pharmaceutical Science, Mark Publishing and Company, 2nd Edition, 1990

REFERENCE

1. Katzung, B.G., Basic and Clinical Pharmacology, Prentice Hall, New Delhi, 10th Edition, 2006

BIT311	HEALTH CARE BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

SIMPLE PROTEINS AND THERAPEUTIC AGENTS

Proteins as therapeutic agents - Choice of expression systems and optimizing gene expression - Applications, delivery and targeting of therapeutic proteins - Engineering human interferons and human growth hormones - Regulatory aspects of therapeutic proteins - Enzymes as therapeutic agents - Use of genetically engineered DNase I and alginate lyase for treatment of Cystic Fibrosis

MONOCLONAL ANTIBODIES AS THERAPEUTIC AGENTS

Production of monoclonal antibodies - Human monoclonal antibodies, its scope and limitations - Hybrid human - Mouse antibodies - Production of antibodies in *E. coli* -Approaches for producing HIV therapeutic agents

HUMAN DISEASES

Viral and bacterial diseases - Diseases caused by protozoan and parasitic worms (helminths) - Emerging infectious diseases - Active and passive immunity – Autoimmunity- Rational of immunization - Diseases controllable by vaccination – Vaccines, designing vaccines adjuvants - Whole organisms vaccines - Attenuated viruses and bacteria - Inactivation of pathogenic organisms by heat and chemical treatment

VACCINES

Bacterial polysaccharides, proteins and toxins as vaccines - Recombinant vaccines- subunit, attenuated and vector vaccines - Multivalent vaccine development against AIDS - Commercial and regulatory aspects of vaccine production and its distribution

APPLICATION OF GENETIC ENGINEERING IN HEALTH CARE

Production of Recombinant Proteins having therapeutic and diagnostic applications, recombinant vaccine

TEXT BOOK

1. Glick, B. R., Pasternak, J. J., Molecular Biotechnology, Principles and Application of Recombinant DNA, ASM press, Washington, 2nd Edition, 1998

REFERENCES

1. Ratledge, C., Kristiansen, B., Basic Biotechnology, Cambridge University Press, USA, 2nd Edition, 2001
2. David, E., Technology and Future of health care, Preparing for the Next 30 years, Jhon Wiley, Singapore, 2nd Edition, 2000

CHE352	BIOPROCESS INSTRUMENTATION AND CONTROL	L	T	P	C
		3	0	0	3

FIRST ORDER SYSTEMS

Linear open loop systems - First order and linearized first order systems - Response to various disturbances

HIGHER ORDER SYSTEMS

First order in series - Higher order systems - Response to various disturbances

BLOCK DIAGRAM

Controls - Block diagram - Closed loop transfer function - Transient response - Simple alarm modes of control and controller characteristics- Servo and regulatory problems

STABILITY ANALYSIS

Stability - Routh analysis - Frequency response - Control system design - Controller tuning

SPECIAL CONTROLS

Cascade - Feed forward and ratio control - Dead time compensation - Internal Model Control - Control valves - Process identification.- 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, humidity of gases - Composition by physical and chemical properties and spectroscopy

TEXT BOOKS

1. Coughnowr, D. P., Process Systems Analysis and Control, McGraw Hill, New York, 2nd Edition, 1991
2. Smith, C. A. and Corripio, A. B., Principles and Practice of Automatic Process Control, Wiley, New York, 2nd Edition, 1997

REFERENCE

1. Harriot, P., Process Control, Tata McGraw Hill, New Delhi, 4th Edition, 2005

BIT312	BIOPHYSICS	L	T	P	C
		3	0	0	3

MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS

Intermolecular 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

Primary structure –Bases, sugars , 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 - Thermodynamics of DNA denaturation - Changes in nucleic acid structures during biochemical processes

CONFORMATION OF PROTEINS

Conformation of the peptide bond – Secondary structures – Ramachandran's plots – Use of potential functions – Tertiary structure – Dynamics of protein folding – Hydration of proteins – Hydropathy index - Effect of amino acids on the structure of proteins - Energy status of a protein molecule - Helix coil transformation of proteins

CELLULAR PERMEABILITY AND ION – TRANSPORT

Ionic conductivity – Transport across ion channels – Mechanism - Ion pumps - Proton transfer – Nerve conduction – Techniques of studying ion transport and models

ENERGETICS AND DYNAMICS OF BIOLOGICAL SYSTEMS

Concepts in thermodynamics – Force and motion – Entropy and stability – Analyses of fluxes – Diffusion potential – Basic properties of fluids and biomaterials – Laminar and turbulent flows

TEXTBOOK

1. Cantor, C.R. and Schimmel, P.R., Biophysical Chemistry, W.H Freeman and Company, Press, New York, 4th Edition, 1999

REFERENCE

1. Glaser, R., Biophysics, Springer Verlag ,London,2nd Edition, 2004

CHE353	TRANSPORT PHENOMENA IN BIOPROCESSES	L	T	P	C
		3	0	0	3

BIOREACTORS

Introduction to bioreactor systems - Principles and practices of fermentation -Fermentation organisms - Basic bioreactor design

FLUID RHEOLOGY

Rheology - Review of fluid rheology - Experimental viscometry of biofluids- Effects of cell morphology on broth rheology

BUBBLES AND DROPS

Bubbles and drops - Bubble formation, break-up and coalescence - Bubble rise velocities - Interfacial area and hold-up in agitated and non-agitated systems - Behaviour of bubbles in beverages - Drop dispersion

SCALE UP OF BIOREACTORS

Aeration and Agitation - Achieving mixing and mass transfer in bioreactors - Specification of equipment - Flow regimes - Power requirements - Oxygen mass transfer in bioreactors - Microbial oxygen demands - Methods for the determination of mass transfer coefficients - Mass transfer correlations - Scale-up of stirred tank bioreactors - Principle of similarity - Criteria for scale-up in biological systems

HEAT TRANSFER

Heat generation and heat transfer in bioreactors - Sources of heat generation - Heat removal - Specification of heating and cooling systems - Heat transfer coefficients in agitated systems.

TEXT BOOKS

1. Van Den Akker, H.E.A., Heijnen, J.J.C., Leach, K., Mudde, R.F., Bioprocess Technology, Modelling and Transport Phenomena (Biotol Series), 1st Edition, 1990
2. Byron, R.Bird., Warren, E. Stewart., and Edwin, N. Lightfoot., Transport Phenomena, John Wiley and Sons, New York, 1st Edition ,2000

REFERENCES

1. Sissom, L.E. and Pitts, D.R., Elements of Transport Phenomena, McGraw Hill, New York, 2nd Edition, 1972
2. Brodkey, R.S. and Hershey, H.C., Transport Phenomena – A United Approach, McGraw Hill, New York, 1st Edition, 1987

BIT313	METABOLIC ENGINEERING	L	T	P	C
		3	0	0	3

INTRODUCTION

Induction-Jacob-Monod model, catabolite regulation, glucose effect, cAMP deficiency - 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 - Energy charge, regulation - Permeability control passive diffusion, active transport group transportation

SYNTHESIS OF PRIMARY METABOLITES

Alteration of feed back regulation - Limiting accumulation of end products -Feedback, resistant mutants - Alteration of permeability - Metabolites

BIOSYNTHESIS OF SECONDARY METABOLITES

Precursor effects - Prophase, idiophase relationship - Enzyme induction -Feedback regulation - Catabolite regulation by passing control of secondary metabolism -Producers of secondary metabolites

BIOCONVERSIONS

Advantages of bioconversions - Specificity, yields, factors important to bioconversion - Regulation of enzyme synthesis - Mutation, permeability - Co-metabolism - Avoidance of product inhibition - Mixed or sequential bioconversions - Conversion of insoluble substances

REGULATION OF ENZYME PRODUCTION

Strain selection - Improving fermentation - Recognizing growth cycle peak –Induction - Feed back repression, catabolite repression, mutants resistant to repression - Gene dosage

TEXT BOOKS

1. Wang, D.I.C., Cooney, C.L., Demain, A.L., Dunnil, P., Humphery A.E.,Lilly, M.D., Fermentation and Enzyme Technology, John Wiley and Sons, Singapore, 1st Edition, 1980
2. Peter, F. Stanbury., Stephen, J. Hall and Whitaker, A., Principles of Fermentation Technology, Elsevier, Science and Technology Books, New Delhi, 2nd Edition,2005

REFERENCE

1. Zubay, G., Biochemistry, McGraw Hill Publishers, New Delhi, 4th Edition, 1999

BIT314	DRUG DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

DRUG DISCOVERY AND DEVELOPMENT

Organized drug discovery and development – Pharmacology - Microbial, recombinant - Biochemical and molecular level screening systems and their construction strategies - Alternative strategies in lead identification - Lead optimization

DRUG DESIGNING

Rational basis of drug designing, criteria for synthesizing drugs - Drug designing approaches - Pharmacophore based drug design - Lead and target tissues - Lead finding and lead optimization - Action and reaction, structure based drug design process of structure based design - Receptor based design - Drug designing using known receptor structure - Design of energy inhibitors

COMPUTATION FOR DRUG DESIGNING

Overview of computer based tools for drug designing - Ludi, Ludi/CAP, auto dock, GRAMM, CAMD tools - Scoring and Docking mode-QSAR principles and methods in drug designing - Current research in drug designing , a case study - Drug design by receptor site fit, active site simulations using PDB structure data and homology modeling - Concept of perturbation free energy and its practical applications - Rational design of enzyme inhibitors - Enzyme catalytic principles - Recapitulation affinity labels - Illustrative examples -Principle of suicide inactivation - Design strategies - Scope and limitations

MIIMICING IN DRUG DESIGNING

Principles and practice of transition state mimicry - Illustrative examples - ACE, renin and HIV protease inhibitors - Collected substrate analog inhibitors and design strategies , illustrative examples - Combinatorial approach to compound libraries

CURRENT STATUS AND FUTURE PROSPECTS

Synthetic peptide libraries - Peptide libraries through phage display - Applications in epitope and agretope mapping, synthetic vaccine design - Artificial combinatorial - Peptides, bezodiazepines and other current examples - Selection strategies and screening methodologies - Perspectives in gene therapy

TEXT BOOK

1. Walsh, G., Biopharmaceuticals-Biochemistry and Biotechnology, Wiley, Singapore, 2nd Edition,2003

REFERENCE

1. Perun, T. J. and Propst, C. L., Computer Aided Drug Design, Dekker, 1st Edition, 1989
2. Scolnick, J., Drug Discovery and Design, Academic Press, London, 1st Edition, 2001

MAJOR ELECTIVES FOR FOURTH YEAR

BIT404	DIAGNOSTIC TECHNIQUES	L	T	P	C
		3	0	0	3

INTRODUCTION

Comparison of the methods to diagnose bacterial and parasitic infections

IMMUNOLOGICAL DIAGNOSTIC PROCEDURES

Antigen-antibody reactions - Signal amplification systems - Isolation and characterization of antibodies - Immuno assay systems - Assay development, evaluation and validation - Reagent formulation and their shelf life evaluation – Enzyme Linked Immunosorbent Assay (ELISA) system - Applications in clinical diagnosis and prognosis of various diseases - Membrane based rapid immuno assays - Monoclonal antibodies- Formation and selection of hybrid cells - Screening for specific antibodies producing hybrid cell lines

APPLICATIONS OF MONOCLONAL ANTIBODIES

Detection of polypeptide hormones - Tumor markers and cytokines - Diagnosis of infectious diseases and drug monitoring - Detection of miscellaneous targets e.g. Thyroxin, Vit. B12, Ferritin degradation products, Tau protein etc

DNA DIAGNOSTICS

Nucleic acid hybridization assay systems - Basic considerations - Production of various types of hybridization probes-Diagnosis of *Plasmodium faliciparum, Mycobacterium tuberculosis, Trypanosoma cruzi* and sickle cell by DNA hybridization - Non - radioactive hybridization procedures - Use of chromogenic or chemiluminesent substrates and specific enzymes for detecting signal amplification - DNA Fingerprinting and RAPD as diagnostic tools

MOLECULAR DIAGNOSIS OF GENETIC DISEASES:

Significance in prenatal diagnosis - Diagnosis before onset of symptoms and identification of carriers of hereditary disorders - PCR/OLA procedures - Diagnosis of hereditary diseases caused by mutations not affecting restriction endonuclease sites - Genotyping with fluorescence labeled PCR primers - Detection of mutations at different sites within one gene

TEXT BOOK

1. Shimeld Lissa Anne., Rodgers Anne, T., Essentials of Diagnostic Microbiology, Delmar Learning, New York, 1st Edition, 1998

REFERENCES

1. Watson James, D., Gilman Michael., Recombinant DNA, W.H Freeman and Company, New York, 2nd Edition, 2001
2. Kwapinski, G., Bannatyne., Methodology of Immunochemical and Immunological Research, Willey inter Science, New York, 1st Edition, 1972

BIT405	NANOBIOTECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION - TECHNOLOGICAL IMPACT OF NANOSCALE SYSTEMS

Micro and nano systems and technologies - Overview of nanodevices and techniques

SYNTHESIS AND CHARACTERIZATIONS OF NANOSCALE MATERIALS

Strategies for nano architecture (top down and bottom up approaches) - Fabrication technologies and characterizations - Self-assembly systems, some aspects of nanofluidics- Surfactants, polymers, emulsions and colloids

INORGANIC NANOSCALE SYSTEMS FOR BIOSYSTEMS

Nano-structured materials, fullerenes - Properties and characteristics, carbon nanotubes - Characteristics and applications quantum dots and wires, gold nanoparticles and nanopores

APPLICATIONS OF NANO-MOLECULES IN BIOSYSTEMS

Molecules of life - Proteins, lipids, RNA and DNA - Nanoscale elements for delivery of materials into cells, peptides coupled nanoparticles - DNA based artificial nanostructure proteins as components in nanodevices

APPLICATION OF NANO-BIOTECHNOLOGY IN DRUG DELIVERY

Nanoscale devices for drug discovery Micelles for drug delivery protein targeting - Small molecule - Protein interactions, microarray and genome chips

TEXT BOOKS

1. Mick Wilson, Kamali Kannangra, Geoff Smith., Nanotechnology, Oversees Press India Private Ltd, NewDelhi,2nd Edition, 2005
2. Jain, K.K., Nanobiomolecular Diagnostics: Current Techniques and Application, Taylor and Fransis Publishers, New York, 1st Edition, 2006

REFERENCE

1. Kimball Nill., Glossary of Biotech and Nanobioterms, CRC Publisher, California, 4th Edition, 2005

BIT406	IPR IN BIOTECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO IPR

Invention and creativity - Intellectual Property (IP), importance - Protection of IPR - Basic types of property (i.e. movable property, immovable property and intellectual property)

PATENTS IN IPR

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, PBR. IPR for bioprocess and bioproducts

INTERNATIONAL CONVENTION RELATING TO INTELLECTUAL PROPERTY

Establishment of WIPO - Mission and activities - History - General agreement on Trade and tariff (GATT). WIPO copyright treaty (WCT)

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

Case studies on - Patents (basmati rice, turmeric, neem, etc.) - Copyright and related rights - Trade marks - Industrial design and integrated circuits - Geographic indications - Protection against unfair competition

IPR TRANSACTIONS AND TECHNOLOGY TRANSFER CONTRACT

Various types of contracts - Assignment, lease and license, conditionality, drafting of technology transfer contract and global sharing of technology - Confidentiality and proper use, further innovation and invention - Ever-greening chain

TEXT BOOKS

1. Carlos,C.,Trade Related aspects of IPR, a Commentary on TRIPS agreement, Oxford
   University Press, USA, 1st Edition, 2007

2. Cornish, W.R., Intellectual Property- Patent, Copyright Trademarks and Allied rights,
Sweet and Maxwell, USA, 5th Revised Edition, 2003

REFERENCES

1. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
2. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794

BIT407	BIOREACTOR DESIGN AND ANALYSIS	L	T	P	C
		3	0	0	3

REACTION KINETICS

Definitions of rate constant, reaction order - Elementary and non-elementary reactions - Mechanisms and kinetics - Reactions with constant volume and variable volume-Conversion yield - Kinetics of chemical reactions - Elementary and non - elementary reactions, nth-order kinetics - Rate equations with multiple rate constants, shifting - Order kinetics, interpretation of batch reactor data for simple and complex reactions, dependence of reaction rate on environmental conditions – Arrheniu's equation

IDEAL REACTORS

Introduction to ideal reactors - Performance equations for ideal reactors and non-isothermal reactors - Rate data analysis - Multiple reactors and multiple reactions -Polymerization reactions, enzymatic reactions, microbial growth and bioreactors

NON-IDEALITY IN REACTORS

RTD studies - Dispersion effects, models for non-ideal reactors – Non isothermal reactors - External diffusion effects on heterogeneous reactions - Diffusion and reaction in porous catalysts

BIOREACTOR

Definition of bioreactor, basic principles of bioreactor - Interaction of heat and mass transfer in the microbial processes - Classification of bioreactors and their configurations - Analysis of batch, continuous, fed batch and semi-continuous bioreactors, non-ideal effects, mechanical design of bioreactors and its components

BIOREACTOR SCALE – UP

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - Microbial oxygen demands, methods for the determination of mass transfer coefficients, mass transfer correlations - Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed

TEXT BOOKS

1. Levenspiel, O., Chemical Reaction Engineering, Wiley Easter Ltd, New York, 5th Edition, 1999
2. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice Hall Pvt Ltd, 4th Edition, 2006

REFERENCE

1. Smith, J.M., Van Ness, H.C., Abbott, M. M., Introduction to Chemical Engineering Thermodynamics , McGraw Hill, New York, 6th Edition, 2001
2.

BIT408	GENOMICS AND PROTEOMICS	L	T	P	C
		3	0	0	3

OUTLINE ABOUT GENOME

Genome organization (prokaryotes and Eukaryotes) - Physical mapping of genome - Whole genome sequencing - Various strategies of sequencing - Mass spectroscopy – Shotgun - Automation in sequencing finding genes and mutations - Genome sequence annotation

FUNCTIONAL GENOMICS

Construction and screening of cDNA libraries, PCR, yeast two hybrid systems - Serial analysis of gene expression (SAGE) - SAGE adaptation fro down sized extracts (SADE) – Pharmacogenomics

PROTEOME

Introduction - Methods exists to tackle the proteome complexity - Imaging mass spectroscopy - Protein chip array - Methods for protein interaction analysis - Multi dimensional chromatography

PROTEIN STRUCTURAL GENOMICS

Determining gene function by sequence comparison - Determining gene function through conserved protein structure - Approaches to protein structural genomics

ADVANCE TOPICS

Proteomics in vaccine discovery from genome sequence to vaccine discovery, the case study, omics approaches of discovery

TEXT BOOKS

1. Saccone, C., Pesole, G., Hand book of Comparative Genomics – Principles and Methodology, John Wiley and Sons Publication, New Jersey, 1st Edition, 2003
2. Lesk, A.M., Introduction to Protein Science. Architecture, Function and Genomics, Oxford University press, New York, 2nd Edition, 2004

REFERENCES

1. Creighton, T.E., Protein Structure – A Practical Approach, Oxford University Press, New York, 4th Edition, 2004
2. Brown, T.A., Genomes III, Garland Science, Taylore and Francis Group, New York, 3rd Edition, 2007

B1T409	CANCER BIOLOGY	L	T	P	C
		3	0	0	3

FUNDAMENTALS OF CANCER BIOLOGY

Regulation of cell cycle, mutations that cause changes in signal molecules - Effects on receptor, signal switches, tumour suppressor genes - Modulation of cell cycle in cancer, different forms of cancers, diet and cancer - Cancer screening and early detection, detection using biochemical assays, tumor markers - Molecular tools for early diagnosis of cancer

PRINCIPLES OF CARCINOGENESIS

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

Signal targets and cancer, activation of kinases - Oncogenes, identification of oncogenes, retroviruses and oncogenes - Detection of oncogenes, oncogenes and proto oncogene activity - Growth factors related to transformation - Telomerases

PRINCIPLES OF CANCER METASTASIS

Clinical significances of invasion, heterogeneity of metastatic phenotype - Metastatic cascade, basement membrane disruption - Three step theory of invasion, proteinases and tumour cell invasion

NEW MOLECULES FOR CANCER THERAPY

Different forms of therapy - Chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection, use of signal targets towards therapy of cancer - Gene therapy

TEXT BOOK

1. Dimmock, N., Keith., Introduction to Modern Virology, Blackwell Scientific Publications, Oxford, 6th Edition,2007

REFERENCE

1. Maly, B.W.J., Virology a Practical Approach, IRL Press, Oxford, 2nd Edition, 1995

BIT410	BIOMEDICAL ENGINEERING	L	T	P	C
		3	0	0	3

INTRODUCTION

Introduction to cell structure and components, protein structure, cell membranes, chromosomes, cytoskeleton, actin filaments, microtubules, cell signaling and ECM, biomembrane and action potentials - Transducers and electrodes, types of transducers and their selection for biomedical applications - Biosensors based on electrochemical transducers

CARDIAC SYSTEMS AND ITS FUNCTION

Cardiovascular systems, the heart and other cardiac systems, circulation and blood flow, blood pressure, cardiac output, cardiac rate, cardiac shock and response to exercise, magnet cardiography, cardiac pacemaker, computer applications - Measurement of electrical activities in muscles and brain - Electromyography, electro encephalographs and their interpretation

BIOSYSTEM MODELING

Electrical impedance encephalography, biotelemetry, Biosignal analyzer, biosystem modeling

BIOMEDICAL TESTS

Biomedical tests - measurement of sugar, pH, sodium potassium ions, haemoglobin, oxygen and carbondioxide concentration in blood, medical imaging, ultrasound imaging, radiography, biophysics of signal transmission and reception of biological signals, telemedicine

ULTRASOUND IN DIAGNOSIS

Ultrasound in diagnosis, limb prosthetics and Orthotics, sensory aids for the blinds, assisting the heart and kidney, ECG, EEB, physiological equipments

TEXT BOOK

1. Atilla Hincal, A., Suheylakas, H., Biomedical Science and Technology, Plenum Press, New York, 1st Edition, 2001

REFERENCES

1. Khandpur, R.S., Handbook of biomedical Instrumentation, McGraw Hill, USA,
   1st Edition, 2004
2. Manz and Becker., Microsystem technology in Chemistry and Life Sciences, Springer Verlag, London, 1st Edition, 1999

BIT411	BIORESOURCE TECHNOLOGY	L	T	P	C
		3	0	0	3

RENEWABLE ENERGY SOURCE

Hydropower, geothermal power, solar power, wind power – Biofuel - Biomass - Feed stocks (agricultural crops, bioenergy crops, agricultural waste residues, wood residues, waste stream)

FUEL TECHNOLOGY AND BIOCONVERSION

History - Definition of biofuel, applications of biofuel (transport, direct electricity generation, home use and energy content of biofuel) - Bioconversion of lignocellulosics, cellulose saccharification, pretreatment technologies (air separation process, mechanical size reduction, autohydrolysis) - Pulping and bleaching - Enzymatic deinking

BIOGAS

Biogas plant, feed stock materials, biogas production, factors affecting methane formation - Role of methanogens - Biohydrogen production - Oxygen sensitivity problems in hydrogenenases

BIO ETHANOL AND BUTANOL

Advantages of ethanol over fossil fuels, production of ethanol from cellulosic materials, ethanol recovery - Biobutanol production, energy content and effects on fuel economy - Octane rating, air fuel ratio, specific energy, viscosity, heat of vaporization -Butanol fuel mixtures

BIODIESEL

Production of biodiesel, oil extraction from algae by chemical solvents, enzymatic, expeller press - Osmotic shock and ultrasonic assisted extraction - Applications of biodiesel, environmental benefits and concerns

TEXT BOOK

1. Baker, K. H., Herson, S.D., Bioremediation (Advanced Science and Technology), MGH, New York, 1st Edition, 1993

REFERENCES

1. Waites, M.J., Organ, N.L.M., Rokeyand, J.S., Higton, G., Industrial Microbiology – An introduction, Blackwell Science. Indian edition. New Delhi, 1st Edition, 2002
2. Larroche,C., Pandey,A., Dussap, C.G., Current topics on Bioprocess in food Industry, Asiatech publishers Inc,New Delhi,1st Edition, 2006

BIT412	RNAi TECHNOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION TO RNAi TECHNOLOGY

Gene silencing - RNA silencing - Biochemistry of RNAi - Role of sense-co suppression in animals and plants

REGULATION OF GENOME BY DOUBLE STRAND DNA

RNA directed DNA methylation - Mechanism of R_DDM - Signaling of Methylation

TECHNIQUES IN RNAi TECHNOLOGY

Particle bombardment method - Stable transformation, agro infiltration, VIGS methodology, transfect ion of Si RNA Duplexes - Protein knock down detection by western blotting and immunofluorescence, selection of Si RNA sequence

RNA INTERFERENCE

Mechanism of RNA interference in mammalian and plant cells - Analysis of gene function - Analysis of axonal path finding

APPLICATION OF RNAi TECHNOLOGY

Application of RNAi Technology in microbes, plant and animal cells

TEXT BOOK

1. Gregory, J., Hannon., RNAi- A Guide to Gene Silencing, Cold spring harbour laboratory Press New York, 1st Edition, 2003

REFERENCES

1. Mart Latterich., RNAi Advanced Methods, Taylor and Francis, New York, 1st Edition, 2007
2. Dmitry, S., Mark, K., RNAi in Discovery and Development, CRC Publishers, USA, 1st Edition, 2007

MINOR ELECTIVES

CHE354	MASS TRANSFER	L	T	P	C
		3	0	0	3

DIFFUSION

Diffusion, equation of continuity - Unimolecular diffusion and equimolar counter diffusion applied to both gases and liquids - Diffusion in solids, Knudsen diffusion, measurement of diffusivity of liquids and gases - Empirical relations for measurement of diffusivity of gases and liquids

MASS TRANSFER COEFFICIENT

Mass transfer coefficients (k type and f-type), overall and local mass transfer coefficients, Lewis Whitman two phase theory, estimation of mass transfer coefficients, analogy between transport processes - Theories of mass transfer - Gas liquid contacting devices - Convective mass transfer

INTERPHASE MASS TRANSFER

Vapor liquid equilibria, T-x-y and P-x-y diagrams, steam distillation, flashing, differential distillation, design of continuous counter current distillation process - Ponchon Savarit and Mc Cabe Thiele method, (binary components only) - Packed column distillation, HTU, NTU and HETP concepts - Principles of gas absorption, single and multi component absorption, absorption with chemical reaction, design principles of absorbers, industrial absorbers, HTU, NTU concepts

ADSORPTION

Liquid - liquid equilibria, staged and continuous extraction - Solid-liquid Equilibria - Leaching principles - Adsorption equilibria - Batch and fixed bed adsorption - Ion exchange drying - Mechanism drying curves, time of drying, batch and continuous dryers

MEMBRANE SEPARATION PROCESSES

Membrane separation processes -Types liquid and gas - Membrane processes -Complete mixing - Cross flow and counter current flow models - Concentration polarization and membrane fouling, ultra filtration and micro filtration

TEXT BOOKS

1. Treybal, R.E., Mass Transfer Operations, McGraw Hill, New Delhi, 3rd Edition, 1981
2. Geankoplis, C.J., Transport Processes and Unit Operations, Prentice Hall of India, New Delhi, 3rd Edition, 2002

REFERENCE

1. Coulson, J.M., Richardson, J.F., Backhurst, J.R. and Harker, J.M., Coulson and Richardson's Chemical Engineering, Volume II, Butter worth Heinemann, Oxford, 5th Edition, 2002

CHE355	BIOPROCESS PLANT DESIGN AND ECONOMICS	L	T	P	C
		3	0	0	3

PROCESS ECONOMICS AND BUSINESS ORGANIZATIONS

Definition of bioprocess - Bioprocess economics - Importance of various M-inputs -Globalization concept - Competition by dumping and it's effect on plant size - Status of India with adjoining ASIAN countries (Singapore, Malaysia, Indonesia etc) - Project profile concept ,details - Structure and types of organizations - Simple management principles

PROJECT DESIGN AND DEVELOPMENT

Choosing a project - Market survey, importance of techno-economic - Viability studies - Sourcing of processes - Process alternatives - Fixing most economic processes technology – Scanning - Plant

location principles - Plant lay out - Process flow sheets, preparation of budgetary investment and production costs

COST ESTIMATION, PROFITABILITY AND ACCOUNTING

Capital investment - Concept of time -Value of money - Source sink concept of profitability, capital costs, depreciation, estimation of capital costs, manufacturing costs, working capital, profitability standards, project profitability evaluation - Alternative investments and replacements - Annual reports - Balance sheets - Performance analysis

PROCESS OPTIMIZATION TECHNIQUES

Optimum design - Design strategy, economic - Balance, different unit operations with single and multiple variables

QUALITY AND QUALITY CONTROL

Current good manufacturing practices, concepts of quality control in 20^{th} century, elements of quality control envisaged by ISI since 1947 - Emergence of statistical process control (SPC) - Simple SPC concept details - Fundamental concepts of ISO 9000 Quality System and the various requirements for ISO certification

TEXT BOOK

1. Peters, and Timmerhaus., Plant design and Economics for Chemical Engineers, McGraw Hill, New Delhi, 4th Edition, 1989

REFERENCE

1. Rudd, D.F., Watson., Strategy of Process Engineering, John Wiley, Singapore, 3^{rd} Edition, 1987

CHE356	CHEMICAL AND BIO-THERMODYNAMICS	L	T	P	C
		3	0	0	3

FIRST LAW OF THERMODYNAMICS

Thermodynamic state and state functions, enthalpy, reversible processes - Statements of first law for flow and non-flow systems - Heat effects in phase change, standard heat of reaction, formation and combustion - Effect of temperature on standard heat of reaction - Heat effects of industrial reactions

SECOND LAW OF THERMODYNAMICS

Entropy, entropy change - Thermodynamic properties of fluids - Various thermodynamic relations and application - Equations of state - Ideal gas law, cubic equations of state, Van der Waals equation, Redlich-Kwong, Soave-Redlich-Kwong, Peng-Robinson and Benedict-Web-Rubin equations

THERMODYNAMIC PROPERTIES OF MIXTURES AND SOLUTION

Partial molar properties and relation with total mixture property - Gibbs'-Duhem equation, chemical potential, mixing rules, departure functions for real gas mixtures, fugacity and fugacity coefficients of real gas mixtures.Ideal and non-ideal solutions - Dilute solutions, thermodynamic properties of solutions, Lewis-Randall rule, Raoult's Law and Henry's Law

PHASE EQUILIBRIA

Phase transitions and phase equilibria - Gibbs' phase rule, binary vapor-liquid equilibria (VLE),VLE at low and high pressures, modified Raoult's law, VLE for miscible, partially miscible and immiscible systems, VLE using equations of state, liquid-liquid equilibria (LLE), adsorption equilibria - Common adsorption isotherms

CHEMICAL REACTION EQUILIBRIA

Extent of reaction, equilibrium constant, effect of operating conditions on equilibrium conversion, determination of equilibrium compositions for homogeneous gas-phase reactions - Single and multiple reactions, liquid-phase reaction equilibria - Electrochemical equilibria and applications

TEXT BOOKS

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

REFERENCE

1. Nag,P.E., Engineering Thermodynamics, McGraw Hill, New Delhi, 2nd Edition,1995

CHE314	COLLOIDS AND SURFACE SCIENCE	L	T	P	C
		3	0	0	3

INTRODUCTION

Hamaker's analysis for interparticle attractive forces, experiments verifying Van der Waals interactions between surfaces, Lifshitz macroscopic theory for the Hamaker constant, Parsegian, Ninham's approximation to Lifshitz theory, Casimir and Polder's correction for relaxation effects - Example calculations of Hamaker constants for several specific metal, polymer, and ceramic systems - Influence of other types of interparticle forces

HIERARCHY OF SURFACE CHEMICAL MODELS

Hierarchy of surface chemical models for surface charging - Monoprotic surface charging systems lattices and organic acids, metallic and non,oxide systems - Role of surface oxygen in dictating surface charge for metal and non-oxide ceramic systems

ELECTRIC DOUBLE LAYER

Isolated electric double layer - Overlap of the double layer for interacting particles - Free NRGs of isolated and interacting double layers, repulsive NRG due to overlapping double layers - Derjaguin approximation for the interaction of spherical particles - Concept of the critical coagulation concentration, - Influence of salt concentration, ionic strength, and ionic size- Influence of surface charge for monoprotic surface charge systems - Role of surface charging in the dispersion of solids in non, aqueous systems

STABILIZATION OF PARTICLES WITH NON- IONIC POLYMERS

Criteria for stabilization of particles with non-ionic polymers - Role of polymer solubility in stabilization - Role of co, and ter, polymers in providing stabilization reconciling surface attachment with polymer extension from the surface - Impenetrable barrier model for polymeric stabilization - Compression model by Bagchi for polymeric dispersion - Interpenetration and compression model for polymeric dispersion - Other assumptions with respect to the relative contribution of the Hamaker constant toward stabilization with polymers - Selection criteria for polymeric dispersants for specific types of material systems - Polymeric dispersion of nanometer size particles

FEATURES OF POLYELECTROLYTE

Features of polyelectrolyte that contribute to their dispersing power - pKa, molecular size and distribution, type of polymer - Criteria for polyelectrolyte adsorption to charged surfaces - Role of pKa - Monitoring adsorption via solution depletion, EM scattering, and zeta potential measurements, polyelectrolyte conformation at charged surfaces - Combined electrostatic and impenetrable barrier model for dispersion of particles with polyelectrolytes - Some other concepts regarding nonionic dispersants in aqueous systems, interaction of polyelectrolyte with ionic species in solution

TEXT BOOKS

1. Hiemenz, P.C, Raj Rajagopalan., Principles of Colloids and Surface Chemistry, Marcel Dekker, New York, 3rd Edition ,1997
2. De Keizer., Johannes Lyklema., Hans Lyklema., Fundamentals of Interface and Colloid Science, Elsevier, New Delhi, 2nd Edition, 2000

REFERENCE

1. Milling,A.J.,Surface Characterization Methods Principles, Techniques and Applications, (Surfactant Science Series- V, 87), CRC, New York, 1st Edition, 1999

CIV 369	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

INTRODUCTION

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.

METHODOLOGIES

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies.

PREDICTION AND ASSESSMENT

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna, Mathematical models, public participation - Rapid EIA.

ENVIRONMENTAL MANAGEMENT PLAN

Plan for mitigation of adverse impact on environment - options for mitigation of impact on water, air and land, flora and fauna, addressing the issues related to the Project Affected People - ISO 14000

CASE STUDIES

EIA for infrastructure projects - Bridges - Stadium - Highways - Dams - Multi-storey Buildings - Water Supply and Drainage Projects

TEXT BOOKS

1. Canter,L., Environmental Impact Assessment, McGraw-Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., Concepts in Environmental Impact Analysis, Common Wealth Publishers, New Delhi, 1992.

REFERENCES

1. John G. Rau and David C Hooten (Ed)., Environmental Impact Analysis Handbook, McGraw-Hill Book Company, New York, 1990.
2. Environmental Assessment Source book, Vol. I, II and III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, 1999.

CIV463	SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES

Sources and types of solid wastes - Quantity - Factors affecting generation of solid wastes; characteristics - methods of sampling and characterization; Effects of improper disposal of solid wastes -

public health effects - Principle of solid waste management - social and economic aspects; Public awareness; Role of NGOs; Legislation

ON-SITE STORAGE AND PROCESSING

On-site storage methods - Materials used for containers - on-site segregation of solid wastes - public health and economic aspects of storage - options under Indian conditions - Critical Evaluation of Options

COLLECTION AND TRANSFER

Methods of Collection - types of vehicles - Manpower requirement - collection routes; transfer stations - selection of location, operation and maintenance; options under Indian conditions

OFF-SITE PROCESSING

Processing techniques and Equipment; Resource recovery from solid wastes - composting, incineration, Pyrolysis - options under Indian conditions

DISPOSAL

Dumping of solid waste; sanitary land fills - site selection, design and operation of sanitary landfills - Leachate collection and treatment

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil Integrated Solid Waste Management, McGraw-Hill Publishers, 1993
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”, Springer, 1994

REFERENCES

1. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
2. R.E.Landreth and P.A.Rebers, Municipal Solid Wastes - problems and Solutions, Lewis Publishers, 1997
3. Bhide A.D. and Sundaresan, B.B., Solid Waste Management in Developing Countries, INSDOC, 1993

		L	T	P	C
CIV 464	**INDUSTRIAL WASTE WATER MANAGEMENT**	3	0	0	3

INTRODUCTION

Industrial scenario in India- Industrial activity and Environment - Uses of Water by industry - Sources and types of industrial wastewater - Industrial wastewater and environmental impacts - Regulatory requirements for treatment of industrial wastewater - Industrial waste survey - Industrial wastewater generation rates, characterization and variables - Population equivalent - Toxicity of industrial effluents and Bioassay tests

INDUSTRIAL POLLUTION PREVENTION

Prevention Vs Control of Industrial Pollution - Benefits and Barriers - Source reduction techniques - Waste Audit - Evaluation of Pollution prevention options - Environmental statement as a tool for pollution prevention - Waste minimization Circles

INDUSTRIAL WASTEWATER TREATMENT

Equalisation - Neutralisation - Oil separation - Flotation - Precipitation - Heavy metal Removal - Refractory organics separation by adsorption - Aerobic and anaerobic biological treatment - Sequencing batch reactors - High Rate reactors -

Chemical oxidation - Ozonation - Photocatalysis - Wet Air Oxidation - Evaporation - Ion Exchange - Membrane Technologies - Nutrient removal

WASTEWATER REUSE AND RESIDUAL MANAGEMENT

Individual and Common Effluent Treatment Plants - Joint treatment of industrial wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse - Industrial reuse - Disposal on water and land - Residuals of industrial wastewater treatment - Quantification and characteristics of Sludge - Thickening, digestion, conditioning, dewatering and disposal of sludge - Management of RO rejects

CASE STUDIES

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles - Tanneries - Pulp and paper - metal finishing - Petroleum Refining - Pharmaceuticals - Sugar and Distilleries - Food Processing - fertilizers - Thermal Power Plants and Industrial Estates

REFERENCES

1. Eckenfelder, W.W., Industrial Water Pollution Control, McGraw-Hill, 1999
2. Arceivala, S.J., Wastewater Treatment for Pollution Control, Tata McGraw-Hill, 1998
3. Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001
4. World Bank Group Pollution Prevention and Abatement Handbook - Towards Cleaner Production, World Bank and UNEP, Washington D.C.1998
5. Paul L. Bishop Pollution Prevention: - Fundamentals and Practice, McGraw-Hill International, 2000

CSE 255	DATA STRUCTURES	L	T	P	C
		3	0	0	3

PROBLEM SOLVING

Problem solving - Top-down Design - Implementation - Verification - Efficiency - Analysis - Sample algorithms.

LISTS, STACKS AND QUEUES

Abstract Data Type (ADT) - The List ADT - The Stack ADT - The Queue ADT

TREES

Preliminaries - Binary Trees - The Search Tree ADT - Binary Search Trees - AVL Trees - Tree Traversals - Hashing - General Idea - Hash Function - Separate Chaining - Open Addressing - Linear Probing - Priority Queues (Heaps) - Model - Simple implementations - Binary Heap

SORTING

Preliminaries - Insertion Sort - Shellsort - Heapsort - Mergesort - Quicksort - External Sorting

GRAPHS

Definitions - Topological Sort - Shortest-Path Algorithms - Unweighted Shortest Paths - Dijkstra's Algorithm - Minimum Spanning Tree - Prim's Algorithm - Applications of Depth-First Search - Undirected Graphs - Biconnectivity - Introduction to NP-Completeness

TEXT BOOKS

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, Introduction to Algorithms, 2nd Edition, Prentice Hall India, 2002
2. Aho, J. E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms",Pearson Education Asia, 1983

REFERENCES:

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures using C', Pearson Education, 2004 / PHI
2. M. A. Weiss: Data Structure and Algorithm Analysis in C, Addison Wesley, 1997
3. E. Horowitz, S. Shani: Fundamentals of Data Structures, Pittman, 1977
4. D.E. Knuth: The Art of Computer Programming, Vols. 1 to 3, Addison-Wesley, Massachusetts, 1973
5. R.L. Kruse: Data Structures and Program Design, Prentice-Hall, Englewood Cliffs, 1984
6. J.P. Tremblay, P.G. Sorenson: An Introduction to Data Structures with Applications, Second Edition, McGraw-Hill, 1984
7. G. Brassard and P. Bratley: Fundamentals of Algorithms, Prentice Hall, 1996

EIE409	BIO-MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

ANATOMY, PHYSIOLOGY AND TRANSDUCERS

Brief review of human physiology - anatomy – cell structures – electrical activities - mechanical activities - chemical activities – action potential - resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers - electrodes – necessity for low noise pre-amplifiers – difference amplifiers – difference amplifiers – chopper amplifiers – electrical safety – grounding - isolation

MEASUREMENT OF BIOPOTENTIAL AND PHYSIOLOGICAL PARAMETERS

ECG – Phonocardiography – Neurophysiology – Central nervous system – EEG – Respiratory system – Muscular system - EMG, - Eye – ERG, Physiological Transducers - Measurement of Blood

pressure – Blood flow - Cardiac output measurement – heart rate – respiration rate – measurement of lung volume – Oximeters – Audiometer

THERAPEUTIC AND SURGICAL EQUIPMENTS

Electro Surgical unit – short wave - microwave diathermy – Laser surgical unit – Anesthesia machine – Pacemakers – Total artificial heart (TAH) – Dialyser – Heart lung machine – Defibrillators – Ventilators – Nerve stimulators – centralized and Bedside patient monitoring system – Nerve stimulators

BIOMEDICAL EQUIPMENTS AND ELECTRICAL SAFETY

-Flame photometer – spectrophotometer – chromatography – pH, pCO2, analysis – sterilizers – Electrical safety hazards in hospitals

IMAGING SYSTEMS AND TELEMETRY

Computerized Tomography (CT) – MRI instrumentation – Ultrasound scanner – X-ray machine – Fluroscopic techniques – angiography – Cardiac catherisation lab – Echo cardiograph – vector cardiograph – Biotelemetry

TEXT BOOKS

1. Kandpur, R.S., Handbook of Biomedical Instrumentation, TMH, 2003
2. Richard Aston, Principles of Biomedical Instrumentation and Measurement, Merrill publishing company, 1990

REFERENCES

1. Arumugam, M., Biomedical Instrumentation, Anuradha Agencies, Publishers, Kumbakonam, 1992
2. Geddes, L.A. and Baker, L.E.,:Principles of Applied Biomedical Instrumentation, John wiley and Sons, 1989

HUMANITIES ELECTIVES

HSS001	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

INTRODUCTION TO QUALITY MANAGEMENT

Definitions - TOM framework, benefits, awareness and obstacles - Quality - vision, mission and policy statements - Customer Focus - customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality

PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi, Shingeo and Walter Shewhart - Concepts of Quality circle, Japanese 5S principles and 8D methodology

STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) - construction of control charts for variables and attributed - Process capability - meaning, significance and measurement - Six sigma concepts of process capability - Reliability concepts - definitions, reliability in series and parallel, product life characteristics curve - Business process re-engineering (BPR) - principles, applications, reengineering process, benefits and limitations

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Quality functions development (QFD) - Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) - requirements

of reliability, failure rate, FMEA stages, design, process and documentation

TAGUCHI TECHNIQUES

Taguchi techniques - introduction, loss function, parameter and tolerance design, signal to noise ratio - Seven old (statistical) tools - Seven new management tools - Bench marking and POKA YOKE

REFERENCES

1. Dale H.Besterfield et al, Total Quality Management, Pearson
2. Education, Third edition, (First Indian Reprints 2004)
3. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition, 2002
4. William J.Kolarii, Creating quality, McGraw Hill, 1995
5. Poornima, M.Charantimath., Total quality management, Pearson Education,
6. First Indian Reprint, 2003

HSS002	ENGINEERING MANAGEMENT	L	T	P	C
		3	0	0	3

INTRODUCTION

Demand and Revenue Analysis - Demand Forecasting - Production Analysis - Cost and Supply Analysis, Price and output Determination - Investment Analysis - Plant Location - Economic Optimization

FORMS OF BUSINESS AND FUNCTIONS

Types of Business Organisation, Forms - Planning - Organizing - Designing effective organisations - Coordination

HUMAN RESOURCE DEVELOPMENT

Motivating individuals and workgroups - Leadership for Managerial Effectiveness - Team working and Creativity - Managerial Communication - Personal Management – Time Management - Stores Management - Career Planning

FINANCIAL MANAGEMENT

Product development - Management techniques in product development - Nature of controlling - Operations Management - Just-in-Time

GLOBAL ENVIRONMENT

Managing World Economic Change - The global environment - Multinational Strategies - Economic Cycles and Director Investment - Change and Organisation Development - Managerial Ethics and Social responsibilities

REFERENCES

1. Harold Koontzand Heinz Weihrich, Essentials of Management, Tata McGraw Hill publishing company Ltd
2. Koontz, Weihrichand Aryasri, Principles of Management, Tata McGraw Hill publishing company Ltd
3. Tripathiand Reddy, Principles of Management, Tata McGraw Hill publishing company Ltd
4. Hampton, Management, Tata McGraw Hill publishing company Ltd
5. L.M.Prasad, Principles of Management

HSS003	INDIAN ECONOMIC DEVELOPMENT	L	T	P	C
		3	0	0	3

INDIAN ECONOMIC SCENARIO

Indian economy before and after Independence - National income trends and compositions. Sources of capital formation and savings - Sectoral growth. Demographic trends in India and its effect on economic development - Occupational structure of the labour force

ECONOMIC PLANNING AND POLICY

Indian Economic Planning, fiscal policy, Monetary Policy, Unemployment in India and other economic policies

INDUSTRIAL DEVELOPMENT

Industry: Industrial development during the planning period - Industrial policies Industrial licensing policy – MRTP Act, FERA and FEMA - Growth and problems of small-scale industries - Role of Public sector enterprises in India's industrialization. Impact of economic reforms on Indian industrial sector after 1991

FOREIGN TRADE

External Sector - Role of foreign trade. Trends in exports and imports - Composition and direction of India's foreign trade - Balance of payments crisis and the New Economic Reforms – Export promotion measures and the new trade policies - Foreign capital – FDI, aid: Multinational corporations in India

ISSUES

Important Areas of Concern - Poverty and inequality. Unemployment. Rising prices. Industrial relations. Industrial structure and causes of industrial backwardness

REFERENCES

1. Agrawal, A.N. Indian Economy. Problems of Developmental Planning, Wiley Eastern Ltd., Calcutta, latest edition
2. Ahluwalia, I.J. and I.M.D. Little (eds.), India's Economic Reforms and Development, Essays in honour of Manmohan Singh, Oxford University Press, New Delhi, 1999
3. Alam, K., Agricultural Development in North East India: Constraints and Prospects, Deep and Deep Publications, New Delhi, 1993
4. Choudhuri, Pramit. Aspects of Indian Economic Development, Lord George Allen and Unwin Ltd., London, 1975
5. Dutt, R.C., The Economic History of India Under Early British Rule, Low Price Publications, Delhi, 1950
6. Dutt, Ruddar and K.P.M. Sundaram, Indian Economy, S. Chand and Co. Ltd., New Delhi, 2001

HSS004	INDUSTRIAL PSYCHOLOGY	L	T	P	C
		3	0	0	3

INTRODUCTION

The role of the psychologist in industry, the field of occupational Psychology - Study of behaviour in work situation and applications of Psychological principles to problems of selection, Placement, Counseling and training

DESIGN OF WORK ENVIRONMENTS,

Human engineering and physical environment techniques of job analysis, Social environment- Group dynamics in Industry Personal psychology - Selection, training, placement, promotion, counseling, job motivations, job satisfaction .Special Study of problem of fatigue, boredom and accidents

UNDERSTANDING CONSUMER BEHAVIOUR

Consumer behaviour; study of consumer preference, effects of advertising, Industrial morale - the nature and scope of engineering psychology, its application to industry

WORK METHODS

Efficiency at work, the concept of efficiency, the work curve, its characteristics - The work methods; hours of work, nature of work, fatigue and boredom, rest pauses. The personal factors; age abilities, interest, job satisfaction The working environment - noise, illumination, atmospheric conditions - Increasing efficiency at work; improving the work methods, Time and motion study, its contribution and failure resistance to time and motion studies, need for allowances in time and motion study

WORK AND EQUIPMENT DESIGN

Criteria in evaluation of job-related factor, job design, human factors, Engineering information, input processes, mediation processes, action processes, methods design, work space and its arrangement, human factors in job design. Accident and Safety - The

human and economic costs of accidents, accident record and statistics, the causes of accidents situational and individual factors related to accident reduction

REFERENCES

1. Tiffin,J and McCormic E.J., Industrial Psychology, Prentice Hall, 6th Edn., 1975
2. McCormic E.J., Human Factors engineering and design, McGraw Hill, 4th Edn.,1976 Mair, N.R.F., Principles of Human relations
3. Gilmer, Industrial Psychology
4. Ghiselli and Brown, Personnel and Industrial Psychology
5. Myer, Industrial Psychology
6. Dunnete, M.D., Handbook of Industrial and Organizational Psychology
7. Blum and Taylor, Industrial Psychology

HSS005	CONSUMER PSYCHOLOGY	L	T	P	C
		3	0	0	3

CONSUMER BEHAVIOUR

Introduction - Consumer behaviour - concepts - dimensions of consumer behaviours - application of consumer behaviour knowledge in marketing decisions - approaches to the study of consumer behaviour

LEAENING AND DECISION MAKING PROCESS

Motivation, ability and opportunity; exposure, attention and perception Categorizing and comprehending information Attitude formation and change - memory and retrieval Process of decision making – psychographics Consumer behaviour outcomes - consumer welfare

GROUP BEHAVIOUR

Group dynamics and consumer reference groups - Family - Social class cultural and sub-cultural aspects - cross cultural consumer behaviour

INFLUENCER BEHAVIOR

Personal influence and opinion leadership - diffusion of innovations - consumer decision - making process - models of consumer decision process - Nicosia- Howard Sheth and Engel-Kollat model- post purchase behaviour

CONSUMERISM

Consumer protection - difficulties and challenges in predicting consumer behaviour -online consumer behaviour - organizational and industrial buyer behaviour - consumer behaviour in Indian context - emerging issues

REFERENCES

1. David L.Loudon, Albert J Della Bitta, Consumer Behaviour, McGraw Hill, New Delhi, 2002
2. Jay D. Lindquist and M.Joseph sirgy, Shopper, buyer and consumer Behaviour, Theory and Marketing application, Biztantra Publication, New Delhi, 2005
3. Sheth Mittal, Consumer Behaviour A Managerial Perspective, Thomson Asia (P) Ltd., Singapore, 2003
4. K.K.Srivastava, Consumer Behaviour in Indian Context, Goal Gotia Publishing Co, New Delhi, 2002
5. S.L. Gupta and Sumitra Pal, Consumer Behaviour an Indian Perspective, Sultan Chand, New Delhi, 2001
6. Ms.Raju, Dominique Xavedel, Consumer behaviour, Concepts Applications and Cases, Vikas publishing house (P) Ltd., New Delhi, 2004

HSS006	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

ENGINEERING ETHICS

Functions of Being a Manager - Stock holder and stakeholder management - Ethical treatment of employees - ethical treatment of customers- supply chain management and other issues

ENGINEERING AS SOCIAL EXPERIMENTATION

Senses of Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Professions and Professionalism - Professional ideals and virtues - Theories about right action - Self-interest - Customs and religion - Use of Ethical Theories

ENGINEER RESPONSIBILTY FOR SAFETY

Corporate social responsibility - Collegiality and loyalty - Respect for Authority -Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Discrimination

RESPONSIBILITY AND RIGHTS

Moral imagination, stake holder theory and systems thinking - One approach to management Decision - making Leadership

GLOBAL ISSUES

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Sample code of conduct

REFERENCES

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996
2. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999

3. Laura Schlesinger, How Could You Do That: The Abdication of Character, Courage, and Conscience, Harper Collins, New York, 1996
4. Stephen Carter, Integrity, Basic Books, New York, 1996
5. Tom Rusk, The Power of Ethical Persuasion: From Conflict to Partnership at Work and in Private Life, Viking, New York, 1993

HSS007	OPERATIONS MANAGEMENT	L	T	P	C
		3	0	0	3

INTRODUCTION TO PRODUCTION AND OPERATION MANAGEMENT

Production and Operations Management (POM) - Need, History, System, Types, functions and communication in POM

MATERIAL AND INVENTORY MANAGEMENT

Material Management (MM) – Handling Technology (Robots, Automated storage and retrieval systems (ASRS) and methods (JIT, / Kanban, ABC Systems) - Independent Demand Inventory Models - Fixed order system, Basic EOQ, EBQ Models, Quantity discount models - Dependent Demand Inventory models - MRP and MRP II systems Introduction to ERP, e-business and e-operations strategies

PLANNING AND FORECASTING

Introduction to Strategic, Tactical, Operational, Aggregate and Capacity Planning - Planning Product design and development - Applications of CAD, CAM, Computer Integrated Manufacturing

FORECASTING AND SCHEDULING:

Forecasting - Types, Methods (Qualitative and Quantitative), Types of variation in data, Minimizing forecasting errors and selection of forecasting methods. Johnson's Algorithm for job sequencing (n job thro' 2 machines, n jobs thro' 3 machines, n jobs thro' m machines and 2 jobs thro' m machines) Use of Gantt charts, Queuing analysis and Critical Ratios as methods for job scheduling

FACILITY, LAYOUT LOCATION AND WORK MEASUREMENT

Facility Location Decisions (FLcD) – Facility Layout Decision (FlyD) - Types (Fixed Position, and Production, Process, Flexible), Methodologies (Distance Minimising, Computer software systems (CRAFT, CORELAP, ALDEP), Line Balancing and performance ratios, work measurement methods (WM) - Time study, methods-time measurement

REFERENCES

1. R.Paneer Selvam, Production and Operations Management, Prentice Hall of India, 2002
2. Sang M Lee and Marc J Schniederjans, Operation Management, All India Publishers and Distributors, First Indian edition, 1997
3. Robert H. Lowson, Strategic operations Management (The new competitive advantage), Vikas Publishing House, First Indian reprint, 2003

HSS010	INTERNATIONAL TRADE AND FINANCE	L	T	P	C
		3	0	0	3

INTERNATIONAL TRADE

International Trade - Meaning and Benefits - Basis of International Trade - Foreign Trade and Economic Growth - Balance of Trade - Balance of Payment - Current Trends in India – Barriers to International Trade - WTO - Indian EXIM Policy

EXPORT AND IMPORT FINANCE

Special need for Finance in International Trade - INCO Terms (FOB, CIF, etc.,) - Payment Terms - Letters of Credit - Pre Shipment and Post Shipment Finance - Forfeiting - Deferred Payment Terms - EXIM Bank - ECGC and its schemes - Import Licensing - Financing methods for import of Capital goods

FOREX MANAGEMENT

Foreign Exchange Markets - Spot Prices and Forward Prices - Factors influencing Exchange rates - The effects of Exchange rates in Foreign Trade - Tools for hedging against Exchange rate variations - Forward, Futures and Currency options - FEMA - Determination of Foreign Exchange rate and Forecasting

DOCUMENTATION IN INTERNATIONAL TRADE

Export Trade Documents - Financial Documents - Bill of Exchange- Type- Commercial Documents - Performa, Commercial, Consular, Customs, Legalized Invoice, Certification of Origin Certificate Value, Packing List, Weight Certificate, Certificate of Analysis and Quality, Certificate of Inspection, Health certificate. Transport Documents - Bill of Landing, Airway Bill, Postal Receipt, Multimodal Transport Document. Risk Covering Document: Insurance Policy, Insurance Cover Note. Official Document: Export Declaration Forms, GR Form, PP From, COD Form, Softer Forms, Export Certification, Certification of Origin, GSPS – UPCDC Norms

EXPORT PROMOTION SCHEMES

Government Organizations Promoting Exports - Export Incentives : Duty Exemption – IT Concession - Marketing Assistance - EPCG, DEPB - Advance License - Other efforts I Export Promotion - EPZ - EQU -SEZ and Export House

REFERENCES

1. Apte P.G., International Financial Management, Tata McGraw Hill
2. Larceny and Bhattacharya, International Marketing, Sultan Chand and Sons
3. B.M.Wali and AB Kalkumdrikas, Export Management, Sterling Publishers Pvt., Ltd
4. Websites of WTO, World Bank, IMF, Ministry of Commerce, ECGC and EXIM Bank

HSS011	INFORMATION SYSTEMS FOR MANAGERIAL DECISION MAKING	L	T	P	C
		3	0	0	3

INTRODUCTION

Information system - establishing the framework - business model - information system architecture - evolution of information systems

INFORMATION SYSTEM

Functional areas, Finance, marketing, production, personnel - levels, Concepts of DSS, EIS, ES - comparison, concepts and knowledge representation - managing international information system

SYSTEM DEVELOPMENT

Modern information system - system development life cycle - structured methodologies - designing computer based method, procedures control, designing structured programs

IMPLEMENTATION AND CONTROL

Testing security - coding techniques - detection of error - validation - cost benefits analysis – assessing the value and risk information systems

SOFTWARE ENGINEERING

Software engineering qualities - design, production, service, software specification, software metrics, and software quality assurance - software life cycle models - verification and validation

REFERENCES

1. Kenneth C. Laudon and Jane Price Laudon, Management Information systems Managing the digital firm, Pearson Education, Asia

2. Gordon B.Davis, Management Information system: Conceptual Foundations, Structure and Development, McGraw Hill, 1974
3. Joyce J. Elam, Case series for Management Information System, Silmon and Schuster, Custom Publishing, 1996
4. Steven Alter, Information system – A Management Perspective, AddisonWesley, 1999
5. James AN O' Brein, Management Information Systems, Tata McGraw Hill, New Delhi, 1999
6. Turban Mc Lean, Wetherbe, Information Technology Management making connection for strategic advantage, John Wiley, 1999
7. Ralph M.Stair and George W.Reynolds., Principles of Information Systems – A Managerial Approach Learning, 2001

HSS014	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

MARKETING

Meaning - concept - functions - marketing Planning and implementation marketing Programmes - Marketing environment - Market Segmentation and consumer behaviour - Influencing factors, Decision process - Marketing mix - Marketing department

PRODUCT

Meaning - Product planning - policies - positioning - New product development Product life cycle – BCG Matrix-branding. Packing, labeling

PRICING

Pricing objectives - Setting and modifying the price - Different pricing method Product line pricing and new product pricing

DISTRIBUTION

Nature of Marketing channels - Types of Channel flows - Channel functions - Channel co-operation, conflict and competition - Direct Marketing Telemarketing, Internet shopping

PROMOTION

Promotion Mix - Advertisement - Message - copy writing – Advertisement budgeting - Measuring advertisement effectiveness - Media strategy - sales promotion - Personal selling, publicity and direct marketing

REFERENCES

1. Philip Kotler, Marketing Management- Analysis Planning and Control, Prentice Hall of India, New Delhi
2. Cundiff, Still and Govoni., Fundamentals of Modern Marketing, Prentice Hall of India, New Delhi
3. Ramaswamy,V.S., and Namakumari, S., Marketing Management-Planning Implementation and Control, Macmillan Business Books, 2002
4. Jobber, Principles and Practice of Marketing, McGraw-Hill

HSS015	MANAGEMENT CONCEPTS AND TECHNIQUES	L	T	P	C
		3	0	0	3

DEVELOPMENT OF MANAGEMENT THOUGHT

Scientific Management Movement, Administrative Movement, Human- Relations Movement, Decision-Science Movement, Behavioral Movement, Systems Movement, Contingency Movement

ESSENTIALS OF PLANNING

Objectives, goals, Programmed Decisions and Un programmed Decisions; Decision-Making, Creativity in Decision-Making, Forecasting and Strategy to Formulation

EFFECTIVE ORGANIZING

Span of Control, Departmentation, Authority; Responsibility, Bureaucracy and Adhocracy; Group Dynamics

REALITIES OF ORGANIZATIONAL LIFE

Organizational Politics, Organizational Power, Organizational Conflict

COMMUNICATION and CONTROL

Communication Process Evaluation, Control Process, Qualities of a Good Control System, Management Audit, Human - Offset Accounting, Cost Benefit Analysis

REFERENCES

1. Harold Koontz and Heinz Weihrich, Essentials of Management, Tata McGraw Hill publishing company Ltd
2. Koontz, Weihrich and Aryasri, Principles of Management, Tata McGraw Hill publishing company Ltd
3. Tripathi and Reddy, Principles of Management, Tata McGraw Hill publishing company Ltd
4. Hampton, Management, Tata McGraw Hill publishing company Ltd
5. L.M.Prasad, Principles of Management

HSS016	ORGANIZATIONAL PSYCHOLOGY	L	T	P	C
		3	0	0	3

FOCUS AND PURPOSE

Definition, need and importance of organizational Behaviour - nature and scope - frame work

INDIVIDUAL BEHAVIOUR

Personality - types - factors influencing personality - theories - learning - types of learners - learning theories - organizational Behaviour modification. Attitudes - characteristics - components -

formation - measurement. Perceptions - importance - factors influencing perception - interpersonal perception

GROUP BEHAVIOUR

Organization structure - formation - groups in organizations - influence - group dynamics - emergence of informal leaders and working norms - group decision making techniques
- interpersonal relations N - communication – control

POWER

Leadership styles - theories - leaders Vs managers - sources of power - power centers - power and politics

DYNAMICS OF ORGANIZATIONAL BEHAVIOURS

Organizational climate - factors affecting organizational climate - importance. Job satisfaction - determinants - measurements - influence on behavior. Organizational change - importance - stability Vs change - proactive Vs reaction change - the change process - resistance to change - managing change. Organizational development -characteristics - objectives -team building. Organizational effectiveness - perspective - effectiveness Vs efficiency - approaches - the time dimension - achieving organizational effectiveness

REFERENCES

1. Stephen P.Robins, Organisational Behavior, Prentice Hall of India, 9th edition, 2001
2. Hellriegel, Slocum and Woodman, Organisational Behavior, South-Western, Thomson Learning, 9th edition, 2001
3. Schermerhorn, hunt and Osborn, Organisational behavior, John Wiley, 7th edition, 2001
4. Jit S.Chand, Organisational Behavior, Vikas publishing House Pvt. Ltd. 2nd edition, 2001
5. Fred Luthans, Organisational Behavior, McGraw Hill Book Co., 1998
6. New Strom and Davis, Organisational behaviour, McGraw Hill, 2001

7. Jaffa Harris and Sandra Hartman, Organisational Behaviour, Jaico, 2002

HSS017	INTERNATIONAL ECONOMICS	L	T	P	C
		3	0	0	3

INTRODUCTION

The Traditional Theory of International Trade, The Basic Trade Model, Heckscher- Ohlin-Samuelson Model, Effects of Tariffs and Quotas, Theory of Factor Movements - New Theories of International Trade and Industrial Policies

EXCHANGE RATE and BALANCE OF PAYMENT

The Balance of Payments and National Accounts, Determinants of Exchange Rates The Exchange-Rate Regime Choice and a Common Currency Area, International Debt and Currency Crise

INTERNATIONAL REGULATORY AUTHORITY

Political Economy of Trade Disputes, the FTA and the WTO - The role of the IMF and other International Financial Organizations

Reasons for Protection World Trade, International Movements of Capital - The Balance of Trade and Other Measures of International Transactions. Export and import policies

INTERNATIONAL MACROECONOMICS

European Monetary Unification and the Euro - Preferential Trading Arrangements and the NAFTA International Policies for Economic Development, Trade Outsourcing and Off shoring

REFERENCES

1. N. Bhagwati, A. Panagariya and T. N. Srinivasan, Lectures on International Trade, MIT Press, 2nd edition, 1998
2. M. Obstfeld and K. Rogoff, Foundation of International Macroeconomics, McGraw-Hill, 1996
3. Romer, D., Advanced Macroeconomics, McGraw Hill, 1996

HSS018	COMMUNICATION SKILLS	L	T	P	C
		3	0	0	3

COMMUNICATION IN BUSINESS

Systems approach, forms of business communication, management and communication, factors facilitating communication

COMMUNICATION PROCESS

Interpersonal perception, selective attention, feedback, variables, listening barriers to listening, persuasion, attending and conducting interviews, participating in discussions, debates and conferences, presentation skills, paralinguistic features, oral fluency development

BUSINESS CORRESPONDENCE

Business letter, Memos, minutes, agendas, enquiries, orders, sales letters, notice, tenders, letters of application, letter of complaints

TECHNICAL REPORTS

Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization

PROJECT REPORTS

Project proposal, project reports, and appraisal reports

REFERENCES

1. Sharan J.Genrson and Steven M.Gerson, Technical Writing - Process and Product, Pearson Education, 2000
2. Raymond V.Lesikar, John D. Pettit and Mary E.Flatley, Lesikass Basic Communication, Tata McGraw Will, 8th Edition, 1999
3. Stevel. E. Pauley, Daniel G.Riordan, Technical Report Writing Today, AITBS Publishing and Distributors, India 5th edition, 2000
4. Robert L.Shurter, Effective letters in business, Third Ed., 1983

5. McGraith, Basic Managerial Skills for all Prentice Hall of India, 6th Edition, 2002
6. Halliday, M.A.Ky R.Hasan, Cohesion in English, Longman, London, 1976

HSS020	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

INTRODUCTION

Functions of a human resources manager - recruitment and selection processes interview methods

HR- EVALUATION AND DEVELOPMENT

Performance appraisal, Training and development, disciplinary procedures, collective bargaining and employee welfare

TRENDS IN HRM

The recent methods and trends in HRM with a few case studies in the context of globalization

STRATEGIC ROLE OF HUMAN RESOURCE MANAGEMENT

Job analysis Personnel planning and recruiting Employee testing and selection, interviewing candidates, Appraising performance

CAREER AND COMPENSATION

Managing careers Compensation Benefits and services Labor relations and collective bargaining Employee safety and health

REFERENCES

1. Decenzo and Robbins, Human Resource Management, Wiley, 6th edition, 2001
2. Biswajeet Pattanayak, Human Resource Management, Prentice Hall of India, 2001
3. Eugene McKenna and Nic Beach, Human Resource Management, Pearson Education

4. Dessler, Human Resource Management, Pearson Education Limited, 2002
5. Mamoria C.B and Mamoria S., Personnel Management, Himalaya Publishing
6. Wayne Cascio, Managing Human Resources, McGraw-Hill, 1998
7. Ivancevich, Human Resource Management, McGraw-Hill, 2002

HSS023	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
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ENTREPRENEURIAL COMPETENCE

Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneur - Personality Characteristics of Successful. Entrepreneur - Knowledge and Skills Required for an Entrepreneur

ENTREPRENEURIAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business

BUSINESS PLAN PREPARATION

Sources of Product for Business – Pre-feasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria

LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching

MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units - Effective Management of small Business

REFERENCES

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001
2. Saravanavel, P., Entrepreneurial Development, Ess Pee kay Publishing House, Chennai,1997
3. .Khanka, S.S., Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001
4. Prasama Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, 1996
5. Jain, P.C., (ed.), Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi, 1999
6. Staff College for Technical Education, Manila and Centre for Research and Industrial Staff Performance, Bhopal, Entrepreneurship Development, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998