B.Tech. (BIO TECHNOLOGY) PROGRAMME
Regulations and Syllabi
(Effective from 2008)

1. Eligibility:

(1) Candidates who passed Higher Secondary Examination with Mathematics, Biology, Physics and Chemistry or with Botany, Zoology, Physics, and Chemistry conducted by the Government of Tamil Nadu or any other equivalent examination thereto and who appeared for the entrance test conducted by the Government of Tamil Nadu or approved institutions wherever prescribed are eligible for admission to Four Year B.Tech.(Bio Technology) Programme.

Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects.

(2) Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to Second Year of Four Year B.Tech. (Bio-Technology Engineering) Programme.

2. Duration: Four Years comprising 8 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day.

3. Medium: English is the medium of instruction and examination.

4. Weightage for Continuous and End Assessment: The weightage for Continuous Assessment (CA) and End Assessment (EA) be 25:75 unless the ratio is specifically mentioned in the scheme of Examinations.

5. Credit System: Credit system be followed with 18 credits for each semester and each credit is equivalent to 25 hours of effective study provided in the Time Table.

6. Scheme of Examinations

I Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
108EHT01	Technical English – I	1	25	75	100
108MAT02	Mathematics – I	3	25	75	100
108PHT03	Engineering Physics – I	3	25	75	100
108CYT04	Engineering Chemistry – I	3	25	75	100
108EGT05	Engineering Graphics – I	3	25	75	100
108FCT06	Fundamentals of Computing – I	3	25	75	100
Practical					
108CLP01	Computer Practices Laboratory – I	1	25	75	100
108ELP02	Engineering Practices Laboratory – I	1	25	75	100
	Total	**18**	**200**	**600**	**800**

II Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
208EHT01	Technical English – II	2	25	75	100
208MAT02	Mathematics – II	3	25	75	100
208PHT03	Engineering Physics – II	2	25	75	100
208CYT04	Engineering Chemistry – II	2	25	75	100
208EMT05	Engineering Mechanics	3	25	75	100
208EET06	Basic Electrical & Electronics Engineering	3	25	75	100
Practical					
208CLP01	Computer Practices Laboratory – II	1	25	75	100
208PCP02	Physics & Chemistry Laboratory – II	1	25	75	100
208DMP03	Computer Aided Drafting and Modelling Laboratory	1	25	75	100
	Total	**18**	**225**	**675**	**900**

III Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
308BTT01	Transforms and Partial Differential Equation	3	25	75	100
308BTT02	Principles of Chemical Engineering	2	25	75	100
308BTT03	Environmental science and Engineering	2	25	75	100
308BTT04	Cell Biology	3	25	75	100
308BTT05	Bioorganic Chemistry	2	25	75	100
308BTT06	Biochemistry – I	3	25	75	100
Practical					
308BTP01	Bio Chemistry Lab	1	25	75	100
308BTP02	Bioorganic Chemistry Lab	1	25	75	100
308BTP03	Cell Biology Lab	1	25	75	100
	Total	**18**	**225**	**675**	**900**

IV Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
408BTT01	Basic Industrial Biotechnology	2	25	75	100
408BTT02	Probability and Statistics	3	25	75	100
408BTT03	Unit Operations	3	25	75	100
408BTT04	Chemical Thermodynamics and Bio Thermodynamics	3	25	75	100
408BTT05	Instrumental Methods of Analysis	2	25	75	100
408BTT06	Microbiology	2	25	75	100
Practical					
408BTP01	Microbiology Lab	1	25	75	100
408BTP02	Instrumentation Methods of Analysis Lab	1	25	75	100
408BTP03	Chemical Engineering Lab	1	25	75	100
	Total	**18**	**225**	**675**	**900**

V Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
508BTT01	Professional Ethics In Engineering	2	25	75	100
508BTT02	Bioinformatics - I	2	25	75	100
508BTT03	Biochemistry II	3	25	75	100
508BTT04	Bioprocess Principles	3	25	75	100
508BTT05	Mass Transfer operations	3	25	75	100
508BTT06	Molecular Biology	3	25	75	100
Practical					
508BTP01	Molecular Biology Lab	1	25	75	100
508BTP02	Bioinformatics Lab	1	25	75	100
	Total	**18**	**200**	**600**	**800**

VI Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
608BTT01	Bio informatics - II	3	25	75	100
608BTT02	Chemical Reaction Engineering	2	25	75	100
608BTT03	Bioprocess Engineering	3	25	75	100
608BTT04	Immunology	3	25	75	100
608BTT05	Genetic Engineering	3	25	75	100
608BTT08	Molecular Pathogenesis (Elective – I)	2	25	75	100
Practical					
608BTP01	Genetic Engg. Lab	1	25	75	100
608BTP02	Bioprocess Lab	1	25	75	100
	Total	**18**	**200**	**600**	**800**

VII Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
708BTT01	Downstream processing	3	25	75	100
708BTT02	Protein Engineering	3	25	75	100
708BTT05	Cancer Biology (Elective – II)	3	25	75	100
708BTT06	Plant Biotechnology (Elective – III)	3	25	75	100
708BTT10	Animal Biotechnology (Elective – IV)	2	25	75	100
708BTT15	Nanobiotechnology (Elective – V)	2	25	75	100
Practical					
708BTP01	Downstream processing Lab	1	25	75	100
708BTP02	Immunology Lab	1	25	75	100
	Total	**18**	**200**	**600**	**800**

VIII Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
808BTT01	Total Quality Management	3	25	75	100
808BTT04	Neurobiology & Cognitive Sciences (Elective VI)	3	25	75	100
Project					
808BTP01	Project Work	12	25	65	100
	Viva voce			10	
	Total	18	75	225	300

LIST OF ELECTIVE COURSES

Code No.	Course Title
Elective – I	
608BTT06	Marine Biotechnology
608BTT07	Process Instrumentation Dynamics & Control
608BTT08	Molecular Pathogenesis
608BTT09	Recombinant DNA Technology
Elective – II	
708BTT03	Principles of Food Processing
708BTT04	Bio Conjugate Technology
708BTT05	Cancer Biology
Elective – III	
708BTT06	Plant Biotechnology
708BTT07	Biophysics
708BTT08	Biological Spectroscopy
Elective – IV	
708BTT09	Bioethics
708BTT10	Animal Biotechnology
708BTT11	Process Equipments & Plant Design
Elective – V	
708BTT12	Bio pharmaceutical Technology
708BTT13	Molecular Modeling & Drug Design
708BTT14	Metabolic Engineering
708BTT15	Nanobiotechnology
708BTT16	Bioreactor Technology
Elective – VI	
808BTT02	Stem Cell Technology
808BTT03	Immunotechnology
808BTT04	Neurobiology & Cognitive Sciences
808BTT05	Bioprocess Economics & Plant Design

7. Passing Requirements: The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in Continuous Assessment (CA) be prescribed unless it its specifically mentioned in the scheme of Examination.

8. Grading System: Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

CONVERSION TABLE

(1 mark = 0.1 Grade Point on a 10 Point Scale)

Range of Marks	Grade Point	Letter Grade	Classification
90 to 100	9.0 to 10.0	O	First Class
80 to 89	8.0 to 8.9	A	First Class
70 to 79	7.0 to 7.9	B	First Class
60 to 69	6.0 to 6.9	C	First Class
50 to 59	5.0 to 5.9	D	Second Class
0 to 49	0 to 4.9	**F**	**Reappearance**

Procedure for Calculation

Cumulative Grade Point Average (CGPA) = $\frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$

$= \frac{\sum (CA+EA)\, C}{\sum C}$

Where Weighted Grade Points in each Course = Grade Points (CA+EA) multiplied by Credits

$= (CA+EA)C$

Weighted Cumulative Percentage of Marks(WCPM) = CGPAx10

C- Credit, CA-Continuous Assessment, EA- End Assessment

9. Pattern of the Question Paper: The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

Part B: 5 question with either or type (with equal distribution to all units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

Registrar

10. Syllabus

108EHT01 - TECHNICAL ENGLISH – I

AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I
General Vocabulary - changing words from one form to another - Adjectives, comparative adjectives – Adverbs - Active and passive voice – Tenses - simple present, present continuous - Adverb forms – Nouns – compound nouns - Skimming and scanning - Listening and transfer of information – bar chart, flowchart - Paragraph writing, description – Discussing as a group and making an oral report on the points discussed, conversation techniques - convincing others.

Suggested activities:
1. Matching words & meanings - Using words in context – Making sentences.
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form – bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises
   Any other related relevant classroom activity

UNIT II
Vocabulary – prefixes & suffixes – simple past tense - Spelling and punctuation – 'wh' Question forms - Scanning, inference - Listening & note-taking - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:
1. a. Vocabulary actiivities using prefixes and suffixes.
   b. Exercises using questions – asking & answering questions.
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings
   and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas.
   Any other related relevant classroom activity

UNIT III
Tenses - simple past, simple future and past perfect - Reading in Context -Listening & note-taking – single line – Definitions – sequencing of sentences – instruction - Persuasive speaking.

Suggested activities:

1. a. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
   (b) Identifying the discourse links and sequencing jumbled sentences / writing instructions.
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive strategies

   Any other related relevant classroom activity

UNIT IV

Modal verbs and Probability – Concord subject verb agreement – Correction of errors - Cause and effect expressions – Extended Definition - Speaking about the future plans.

Suggested activities:

1. a. Making sentences using modal verbs to express probability
   b. Gap filling using relevant grammatical form of words.
2. 2. Writing extended definitions
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.

   Any other related relevant classroom activity

UNIT V

'If' conditionals – Gerunds - Intensive reading - Speaking – Presentation of problems & solutions - Itinerary – planning for an industrial visit - Formal Letter writing – Letter to the editor, invititation letter, accepting, declining letter and permission letter.

Suggested activities:

1. a) Sentence completion exercises using 'If' conditionals.
   b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing
   a. problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the
   a. editor in formal/official contexts.

   Any other related relevant classroom activity

TEXT BOOK:

1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 – 4 (Resources, Energy, Computer, Transport)

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers', Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. A.P.J.Abdul Kalam with Arun Tiwari, 'Wings of Fire' An Autobiography, University Press (India) Pvt. Ltd.,1999, 30th Impression 2007.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

108MAT02 - MATHEMATICS – I

UNIT I MATRICES

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

108PHT03 - ENGINEERING PHYSICS – I

UNIT I ULTRASONICS

Introduction – Production – magnetostriction effect - magnetostriction generator- piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications - Sonograms

UNIT II LASERS

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coeffcients - derivation. Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) Qualitative Industrial Applications - Lasers in welding, heat treatment, cutting – Medical applications - Holography (construction & reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Splicing, Loss in optical fibre – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature & displacement - Endoscope.

UNIT IV QUANTUM PHYSICS

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT V CRYSTAL PHYSICS

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy - Crystal defects – point, line and surface defects- Burger vector.

TEXT BOOKS:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.

REFERENCES:

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007)
2. Rajendran, V and Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd, III Edition, New Delhi, (2004).
3. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).
4. Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).
5. Chitra Shadrach and Sivakumar Vadivelu, 'Engineering Physics', Pearson Education, New Delhi, (2007).

108CYT04 - ENGINEERING CHEMISTRY – I

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.
- Principles of polymer chemistry and engineering applications of polymers
- Industrial applications of surface chemistry
- Conventional and non-conventional energy sources and energy storage devices and Chemistry of engineering materials

UNIT I WATER TECHNOLOGY

Characteristics – alkalinity – types of alkalinity and determination – hardness – types and estimation by EDTA method (problems); Domestic water treatment – disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis.

UNIT II POLYMERS AND COMPOSITES

Polymers-definition – polymerization – types – addition and condensation polymerization – free radical polymerization mechanism – Plastics, classification – preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET- Rubber -vulcanization of rubber, synthetic rubbers – buty1 rubber, SBR, Composites – definition, types polymer matrix composites – FRP only.

UNIT III SURFACE CHEMISTRY

Adsorption – types – adsorption of gases on solids – adsorption isotherms – Frendlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

UNIT IV NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES

Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only) – breeder reactor – solar energy conversion – solar cells – wind energy – fuel cells – hydrogen – oxygen fuel cell – batteries – alkaline batteries – lead–acid, nickel–cadmium and lithium batteries.

UNIT V ENGINEERING MATERIALS

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks, Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrication, liquid lubricants, - properties – viscosity index, flash and fire points, cloud and pour points, oilyness) – solid lubricants – graphite and molybdenum sulphide. Nanomaterials – introduction to nanochemistry – carbon nanotubes and their applications

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

108EGT05 - ENGINEERING GRAPHICS

AIM
To develop graphic skills in students.

OBJECTIVES
To develop in students graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

Concepts and conventions (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING

Curves used in engineering practices:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:
Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, (2003).

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

108FCT06 - FUNDAMENTALS OF COMPUTING AND PROGRAMMING

AIM :

To provide an awareness to Computing and Programming

OBJECTIVES :

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode -Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TEXT BOOKS:

1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press. (2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

108CLP01 - COMPUTER PRACTICE LABORATORY – I

LIST OF EXERCISES

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

Simple C Programming

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

* For programming exercises Flow chart and pseudocode are essential

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

☐LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
☐Printers – 3 Nos.

Software

☐OS – Windows / UNIX Clone
☐Application Package – Office suite
☐Compiler – C

108ELP02 - ENGINEERING PRACTICES LABORATORY

OBJECTIVES

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

REFERENCES:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, (2006)
3. H.S. Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", Scitech Publications, (1999).

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory

List of equipment and components (For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
(a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

PHYSICS LABORATORY – I

LIST OF EXPERIMENTS

1. (a) Particle size determination using Diode Laser
   (b) Determination of Laser parameters – Wavelength, and angle of divergence.
   (c) Determination of acceptance angle in an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

CHEMISTRY LABORATORY – I

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Determination of DO in water (Winkler's method)
4. Estimation of Chloride in Water sample (Argentometric)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight and degree of polymerization using viscometry.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

208EHT01 - TECHNICAL ENGLISH II

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TEXT BOOK:

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma**, '**The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

208MAT02 - MATHEMATICS – II

UNIT I ORDINARY DIFFERENTIAL EQUATIONS

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II 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 stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III ANALYTIC FUNCTIONS Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

208PHT03 - ENGINEERING PHYSICS – II

UNIT I CONDUCTING MATERIALS

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.

Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.

Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TEXT BOOKS:

1. Charles Kittel ' Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Owen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES:

1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

208CYT04 - ENGINEERING CHEMISTRY – II

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^{+} vs CI^{-} titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III FUELS AND COMBUSTION

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

208EMT05 - ENGINEERING MECHANICS

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

208CCT05 - CIRCUIT THEORY
(Common to EEE, EIE and ICE Branches)

UNIT I BASIC CIRCUITS ANALYSIS

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS:

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES:

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003)

208EDT05 - ELECTRIC CIRCUITS AND ELECTRON DEVICES
(For ECE, CSE, IT and Biomedical Engg. Branches)

UNIT I CIRCUIT ANALYSIS TECHNIQUES

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV TRANSISTORS

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES
(Qualitative Treatment only)

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TEXT BOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES:

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

208EET06 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to branches under Civil, Mechanical and Technology faculty)

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TEXT BOOKS:

1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003)

208CMT06 - BASIC CIVIL & MECHANICAL ENGINEERING
(Common to branches under Electrical and I & C Faculty)

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

REFERENCES:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering",Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

208CLP01 - COMPUTER PRACTICE LABORATORY – II

LIST OF EXPERIMENTS

1. UNIX COMMANDS

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation-Pointers-Functions-File Handling

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

☐1 UNIX Clone Server
☐33 Nodes (thin client or PCs)
☐Printer – 3 Nos.

Software

☐OS – UNIX Clone (33 user license or License free Linux)
☐Compiler - C

208PCP02 - PHYSICS LABORATORY – II

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using $BaCl_2$ vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

208DMP03 COMPUTER AIDED DRAFTING AND MODELING LABORATORY

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility - 30 No.
2. Licensed software for Drafting and Modeling. - 30 Licenses
3. Laser Printer or Plotter to print / plot drawings - 2 No.

208ELP03 - ELECTRICAL CIRCUIT LABORATORY
(Common to EEE, EIE and ICE)

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

208CDP03 CIRCUITS AND DEVICES LABORATORY

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

308BTT01 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all branches of BE / B.Tech Programmes)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I FOURIER SERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.

TEXT BOOKS

1. Grewal, B.S, "*Higher Engineering Mathematic",* 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1. Bali.N.P and Manish Goyal, "*A Textbook of Engineering Mathematic"*, 7th Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V., "*Higher Engineering Mathematics",* Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, "*Advanced Modern Engineering Mathematics"*, 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig, "*Advanced Engineering Mathematics",* 8th edition, Wiley India (2007).

308BTT02 - PRINCIPLES OF CHEMICAL ENGINEERING

PRE-REQUISITE:

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of the Students in the area of Chemical Engineering with emphasis in Thermodynamics fluid mechanics. This will be necessary for certain other course offered in the subsequent semesters and will serve as a prerequisite

MAIN TOPICS OF STUDY

UNIT I OVERVIEW OF PROCESS INDUSTRY

Mass and energy conservation; process automation; environment; SI units; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration.

UNIT II MATERIAL BALANCES

Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations.

UNIT III FIRST AND SECOND LAWS OF THERMODYNAMICS

Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.

UNIT IV FLUID MECHANICS

Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts; multiphase flow concepts.

UNIT V FLOW THROUGH PACKED COLUMNS

Fluidisation; centrifugal and piston pumps; characteristics; compressors; work.

TEXTS PRESCRIBED:

1. Bhatt B.I., Vora S.M. Stoichiometry. 3rd Edition. Tata McGraw-Hill, 1977.
2. McCabe W.L., Smith J.C, Harriot P. "Unit Operations In Chemical Engineering", 5th Edition. McGraw-Hill Inc., 1993.

308BTT03 - ENVIRONMENTAL SCIENCE AND ENGINEERING
(Common to EEE, EIE, ICE, Biotech, Chemical, Fashion, Plastic, Polymer & Textile)

OBJECTIVES

- To create an awareness on the various environmental pollution aspects and issues.
- To give a comprehensive insight into natural resources, ecosystem and biodiversity.
- To educate the ways and means to protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.

1. INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

2. ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

3. ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – urban / rural / industrial / agricultural

4. SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness.

5. HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TEXT BOOKS

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell Science.
3. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno-Science Publications.
4. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
5. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
6. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.

308BTT04 - CELL BIOLOGY

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of the Students in the area of Cell Biology and Cell Signalling pathways. This will be necessary for studies in course like Microbiology, Molecular course is also a prerequisite for other Biology, etc., This courses offered in the subsequent semesters.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES

Eukaryotic and prokaryotic cells, principles of membrane organisation, membrane proteins, cytoskeletal proteins, types of cell division, mitosis & meiosis, extra cellular matrix, cell cycle and molecules that control cell cycle.

UNIT II TRANSPORT ACROSS CELL MEMBRANES

Passive & active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, co transport symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis. Entry of viruses and toxins into cells.

UNIT III RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALLING

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

UNIT IV SIGNAL TRANSDUCTION

Signal amplification, different models of signal amplifications, cyclic amp, role of inositol phosphates as messengers, biosynthesis of inositol tri phosphates, cyclic GMP and g proteins, role in signal transduction, calcium ion flux and its role in cell signaling, current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families.

UNIT V CELL CULTURE

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

TEXTS PRESCRIBED:

1. Darnell J, Lodish H, Baltimore D, "Molecular Cell Biology", W.H.Freeman;
2. Kimball T.W., "Cell Biology", Wesley Publishers;

REFERENCES:

1. De Robertis & De Robertis, "Cell Biology".
2. James D.Watson, "Molecular Biology of the Cell".

308BTT05 - BIOORGANIC CHEMISTRY

PRE-REQUISITE:

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology. This will be a prerequisite to courses like Molecular Modelling, Bioseparations etc.

MAIN TOPICS OF STUDY

UNIT I 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; Stereochemistry – R,S notation – re-si faces – e,z isomerism- conformers- ethane – cyclopean - reactivates- mechanisms of sn1 sn2 reactions, e1 e2 reactions – ester formation and hydrolysis, reaction rates - hammond's postulate – h/d effects. Catalysis – general acid – base and covalent catalysis.

UNIT II KINETICS OF ENZYME ACTION

Allosteric regulation of enzymes, Monod changeux wyman model, ph and temperature effect on enzymes & deactivation kinetics - Stereospecific enzymatic reactions –Stereochemistry of nucleophilic reactions – chiral methyl group – chiral phosphate.

UNIT III ENZYME IMMOBILIZATION & CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Case studies include dehydrogenases, proteases – - lysozyme- stability of proteins

UNIT IV KINETICS OF PROTEIN FOLDING

Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multi substrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate, product - folding of peptides.

UNIT V FOLDING PATHWAYS & ENERGY LANDSCAPES

Folding of ci2 – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones. Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays .

TEXTS PRESCRIBED:

1. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Dekker, Inc.
2. James M. Lee, "Biochemical Engineering", PHI, USA.

REFERENCES:

1. Structure and Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.
2. Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.
3. James. E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill.
4. Wiseman, "Enzyme Biotechnology", Ellis Horwood Pub.

308BTT06 - BIOCHEMISTRY - I

Aim : To enable students learn the basic fundamental of biochemical Processes.

Objectives:

(i) To ensure students have a strong grounding in structures and reactions of biomolecules.
(ii) To introduce them to metabolic pathway of the major bimolecular and relevance to clinical conductors.
(iii) To correlate biochemical processes with biotechnology applications.

UNIT I INTRODUCTION TO BIOMOLECULES

Basic principles of organic chemistry, types of functional groups, biomolecules, chemical nature, water, pH and biological buffers.

UNIT II

Structure and properties of Important Biomolecules.

Carbohydrates (mono, di, oligo & polysaccharides) Proteoglycans, glucosaminoglycans. mutarotation, glycosidic bond, reactions of monosaccharides, reducing sugars .

Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglandins.

Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. Determine of primary structure.

Nucleic acids: purines, pyrimidines, nucleoside, nucleotide, RNA, DNA ,reactions, properties, measurement, nucleoprotein complexes

UNIT III METABOLISM CONCEPTS

Functions of Proteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites.

UNIT IV INTERMEDIARY METABOLISM AND REGULATION

Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, glyoxalate shunt, fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, interconnection of pathways and metabolic regulation. Case study on overproduction of glutamic acid, threonine , lysine, methionine, isoleucine and ethanol.

UNIT V BIOENERGETICS

High energy compounds, electronegative potential of compounds, respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

TEXT BOOK:

1. Nelson, D.L. and M.M. Cox, "Lehninger's Principles of Biochemsitry", 4th Edition, W.H. Freemen & Co., 2005.
2. Stryer, L., "Biochemsitry", 4th Edition, W.H. Freeman & Co., 2000.
3. Voet, D. and Voet, J.G., "Biochemistry", 3rd Edition, John Wiley & Sons Inc., 2004.
4. Murray, R.K., etal "Harper's Biochemistry", 23rd Edition, Prentice Hall International, 1993.

308BTP01 - BIO CHEMISTRY LAB

MAIN TOPICS OF STUDY

1. Demonstration of use of volume and weight measurements devices.
2. Titration of weak acid-weak base.
3. Quantitative Test for carbohydrates
4. Distinguish reducing and nontraducing sugars.
5. Using ninhydrin for distinguishing Imino and amino acids
6. Protein estimation by Biuret and Lowry's methods.
7. Protein estimation by Bradfrd colorometric methods.
8. Extraction of lipids and analysis by TLC.
9. Estimation of nucleus ends by absorbance at 260mm and hyper chromicity.
10. Enzymatic assay of phosphates.
11. Hydrolysis of starch by an enzyme

REFERENCES:

1. Wilson and Walker "Principles and Techniques of Practical Biochemistry" 4 Edn., Cambridge Knew pros 1997.
2. Plummer DT "An Introduction to Practical Biochemistry" III Edn., Tata McGrawhill.

LIST OF EQUIPMENTS

1. Heating Mantles (5) / Water Baths (5) / Bunsen Buners (10)
2. TLC Plates – Required Numbers
3. Colorimeter – 2 Nos.
4. Consumables and Reagents.

308BTP02 - BIOORGANIC CHEMISTRY LAB

MAIN AIM(S) OF THE COURSE

The course aims is offering hands on training in the area of Bio Organic Chemistry. This will be a prerequisite for certain lab courses offered in the subsequent semesters and also for the project work.

LIST OF EXPERIMENTS

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid.
4. Preparation of oleic acid
5. Preparation of alpha D- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha D glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of L-proline
9. Preparation of L-cysteine from hair
10. Preparation of S-ethyl hydroxybutonate from ethyl acetoacetate using yeast
11. Resolution of S-ethyl hydroxybutonate using 3,5 dinitrobenzoate.
12. Preparation of 5,10,15,20-tetrakisphenyl porphyrin.

REFERENCES:

1. Fummis B.S., Hannaford A.J., Smith P.W.G., "Text Book of Practical Organic Chemistry", Longman Edition, 1995.

EQUIPMENTS / APPARATUS REQUIREMENTS

1. Heating Mantles (Nos. 5) / Water baths (Nos. 5) / Bunsen Burners (Nos. 15)
2. Round bottom flasks of various volumes (100ml, 500 ml, 250 ml – Nos.5) condensers (Nos. 5), Distillation units (Nos. 2).
3. Reagents and consumables.

308BTP03 - CELL BIOLOGY LAB

MAIN AIM(S) OF THE COURSE

The course aims is offering hands on training in the area of Cell culture and Cell identification. This will serve as a prerequisite for post graduate and specialized studies & research.

EXPERIMENTS

1. **TOTAL : 60** Introduction to principles of sterile techniques and cell propagation.
2. Principles of microscopy, phase contrast and fluorescent microscopy.
3. Identification of given plant, animal and bacterial cells and their components by microscopy,
4. GRAM'S Staining,
5. Leishman Staining,
6. Thin Layer Chromatography,
7. Giemsa Staining,
8. Separation of Peripheral Blood Mononuclear Cells from blood,
9. Osmosis and Tonicity,
10. Tryphan Blue Assay,
11. Staining for different stages of mitosis in AlliumCepa (Onion).

REFERENCE :

1. Laboratory Investigations in Cell and Molecular Biology, Allen Bregman Wiley, 2001.

EQUIPMENTS / APPARATUS

1. Microbiological Hood for sterilization with UV lighting (One).
2. Bunsen Burners – 10 Nos.
3. Orbital Shaker and Incubator – 2 Nos.
4. Refrigerator – 1 No.
5. Reagents and consumables – Required amount.

408BTT01 - BASIC INDUSTRIAL BIOTECHNOLOGY

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of the Students in area of Basic Industrial Biotechnology. This will be very effect in understanding courses like Bioprocess technology, genetic engineering. Etc.,

MAIN TOPICS OF STUDY

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS

A historical overview of industrial fermentation process – traditional and modern biotechnology. A brief survey of organisms, processes, products relating to modern biotechnology. Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES

A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.,); amino acids (glutamic acid, phenyalanine, aspartic acid etc.,) and alcohols (ethanol, butanol etc.,)

UNIT III PRODUCTION OF SECONDARY METABOLITES

Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.,) macrolides (erythromycin), vitamins and steroids.

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS

Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB etc.,), single cell protein.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS

Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture

TEXTS PRESCRIBED:

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

REFERENCES:

1. Wulf Cruger and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", Panima Publishing Corporation.
2. Murrey Moo & Young, "Comprehensive Biotechnology", Pergamon

408BTT02 - PROBABILITY AND STATISTICS
(Common to Biotech, Chemical, Fashion, Petroleum, Polymer, Plastic)

OBJECTIVES

At the end of the course, the students would

- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
- Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

1. RANDOM VARIABLES

Discrete and continuous random variables - Properties- Moments - Moment generating functions and their properties. Binomial, Poisson ,Geometric, Negative binomial, Uniform, Exponential, Gamma, and Weibull distributions.

2. TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

3. TESTING OF HYPOTHESIS

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

4. DESIGN OF EXPERIMENTS

Analysis of variance – One way classification – CRD - Two – way classification – RBD - Latin square.

5. RELIABILTY AND QUALITY CONTROL

Concepts of reliability-hazard functions-Reliability of series and parallel systems- control charts for measurements (x and R charts) – control charts for attributes (p, c and np charts)

Note : Use of approved statistical table is permitted in the examination.

TEXT BOOKS

1. J. S. Milton and J.C. Arnold, " Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2)
2. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
2. Navidi, W, "Statistics for Engineers and Scientists", Special Indian Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi,2008.
3. Spiegel, M.R, Schiller, J and Alu Srinivasan, R, "Schaum's Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi ,2007.

408BTT03 - UNIT OPERATIONS

PRE-REQUISITE:

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of the Students in area of unit operations. This course will be a prerequisite for certain engineering subjects offered in the subsequent semesters.

MAIN TOPICS OF STUDY

UNIT I MIXING AND AGITATION

Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gas-solid suspensions; agitator scale up.

UNIT II FILTRATION

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

UNIT III MECHANISM OF HEAT TRANSFER

Steady state conduction; combined resistances; unsteady state conduction; lumped heat capacity; extended surfaces; combined conduction and convection.

UNIT IV CONVECTION HEAT TRANSFER

Dimensional analysis; forced and natural convection; convection in flow over surfaces through pipes boiling and condensation.

UNIT V HEAT EXCHANGERS

Equipments; overall heat transfer coefficients; design of heat exchangers; NTU concept; evaporators; single and multiple effects; mass and enthalpy balances.

TEXTS PRESCRIBED:

1. Geankoplis C.J. Transport Processes And Unit Operations. Prentice Hall India.2002. McCabe W.L., Smith J.C. Unit Operations In Chemical Engineering.5th Edition.Mcgrawhill.1993.

REFERENCES:

1. Incropera F.P. Fundamentals Of Heat And Mass Transfer. John Wiley.1998

408BTT04 - CHEMICAL THERMODYNAMICS AND BIO THERMODYNAMICS

MAIN AIM(S) OF THE COURSE

The course aims to expose the students to the area of chemical thermodynamics. This will serve as a prerequisite for courses like enzyme engineering, Mass transfer, etc

UNIT I THERMODYNAMIC PROPERTIES OF FLUIDS

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

UNIT II SOLUTION THERMODYNAMICS

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

UNIT III PHASE EQUILIBRIA

Criteria for phase equilibria; v-l-e calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA

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

UNIT V THERMODYNAMIC ANALYSIS OF PROCESSES

Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction.

TEXTS PRESCRIBED:

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

REFERENCES:

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

408BTT05 - INSTRUMENTAL METHODS OF ANALYSIS

MAIN AIM(S) OF THE COURSE

The course aims to develop the skills of the students in the area of Instrumentation in Biotechnology. This will be prerequisite for understanding specialized courses & project work that will be offered in the subsequent semesters.

UNIT I BASICS OF MEASUREMENT

Classification of methods – calibration of instrumental methods – electrical components and circuits – signal to noise ratio – signal – noise enhancement.

UNIT II OPTICAL METHODS

General design – sources of radiation – wavelength selectors – sample containers – radiation transducers – types of optical instruments – Fourier transform measurements.

UNIT III MOLECULAR SPECTROSCOPY

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

UNIT IV THERMAL METHODS

Thermo-gravimetric methods – differential thermal analysis – differential scanning calorimetry.

UNIT V 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

TEXTS PRESCRIBED:

1. Instrumental Methods of Analysis; Willard and .H. Merrit, Phi, 1999.
2. Instrumental Methods of Analysis, D. Skoog, 2000.

408BTT06 - MICROBIOLOGY

MAIN AIM(S) OF THE COURSE

The course aims to develop skills of the Students in the area of Microbiology particularly to identify microbes, their structure, their metabolism and their industrial applications. This will be a prerequisite for all courses offered in Bioprocess Technology.

UNIT I INTRODUCTION

Basic of microbial existence; history of microbiology, classification and nomenclature of microorganism, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES-STRUCTURE AND MULTIPLICATION

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

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM

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

UNIT - IV CONTROL OF MICROORGANISMS

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

UNIT - V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vit.b-12; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides; microorganisms and pollution control; biosensors

TEXTS PRESCRIBED:

1. Talaron K, Talaron A, Casita, Pelczar And Reid. Foundations In Microbiology, W.C.Brown Publishers, 1993.
2. Pelczar MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw-Hill Edition, New Delhi, India.
3. Prescott LM, Harley JP, Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996.

408BTP01 - MICROBIOLOGY LAB

MAIN AIM(S) OF THE COURSE

The course aims to develop the skills of students in area of microbiology. Here hands on training is offered for the students to study microbes, their identifications & characterization and their practical uses.

EXPERIMENTS

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

REFERENCES :

1. Micro Biology : Laboratory Theory and applications, M.J. Heboffee aw BE Pierce Morten Publishing House, 2006.

EQUIPMENTS / APPARATUS

1. Microbiological Hood for sterilization with UV lighting (One).
2. Bunsen Burners – 15 Nos.
3. Orbital Shaker and incubator – 2 Nos.
4. Refrigerator – 1 No.
5. Reagents and consumables – Required amount.

408BTP02 - INSTRUMENTAL METHODS OF ANALYSIS LAB

MAIN AIM(S) OF THE COURSE

To develop skills of students by providing hands on training in using various equipments used in biotechnology. This will be a pre-requisite for certain specialized project work that a student undertakes.

EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy and Validating Lambert-Beer's law using kMn O4
2. Finding the molar absorbtivity and stoichiometry of the Fe (1, 10 phenanthroline) 3 using absorption spectrometry.
3. Finding the pKa of 4-nirophenol using absorption spectroscopy.
4. UV spectra of nucleic acids.
5. Estimation of Sulphate by nephelometry.
6. Estimation of AL^{+++} by flourimetry.
7. Chromatography analysis using TLC and Column chromatography.
8. UV spectra of nucleic acids.
9. Limits of detection of colorimeter using aluminum alizam complex.
10. Chromotography using column chromatography.
11. . Job's plot for funding stochometer of iron salicylate complex.
12. UV – spectra of proteins.

REFERENCE:

1. Textbook of Quantitative Inorganic Analysis, AI Vogal, ELBS edition 1987.

LIST OF EQUIPMENTS

1. UV – VIS Spectro photometer, Fluorimeter (optional).
2. TLC chamber (common to biochemistry)
3. Reagents and consumables
4. Measuring cylinders, bathometric flasks of various volumes.

408BTP03 - CHEMICAL ENGINEERING LAB

1. Flow measurement
2. Pressure drop in pipes and packed columns
3. Fluidization
4. Filtration
5. Heat exchanger
6. Simple and steam distillation
7. Distillation in packed column
8. Liquid-liquid equilibria in extraction
9. Adsorption equilibrium

FIFTH SEMESTER
508BTT01 - PROFESSIONAL ETHICS IN ENGINEERING

UNIT I ENGINEERING ETHICS
Senses of 'Engineering 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 – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT IV RESPONSIBILITIES AND RIGHTS
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

508BTT02 - BIOINFORMATICS - I

AIM

This course aims to develop the skills of the students in Bioinformatics. This is a prerequisite for certain elective courses offered in the subsequent semesters & for project work.

OBJECTIVES

- At the end of this course, the students would have learnt about tools used in Bio informatics & how to use them. This will facilitate the students to undertake projects in the modern biology.

UNIT I INTRODUCTION

Basic UNIX commands – telnet – ftp – protocols – hardware – topology -search engines – search algorithms – Perl programming.

UNIT II DATABASES

Data management – data life cycle – database technology – interfaces and implementation – biological databases and their uses

UNIT III PATTERN MATCHING & MACHINE LEANING

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

UNIT IV PHYLOGENY

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

UNIT V ADVANCED TOPICS IN BIOINFORMATICS

Biomolecular and cellular computing – micro array analysis – systems biology.

TEXT BOOKS

1. B. Bergeron, Bioinformatics Computing, PHI, 2002.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., Instant Notes In Bioinformatics, BIOS Scientific Publishers, 2000.

REFERENCE

1. C. Gibas & P. Jambeck, Developing Bioinformatics Skills, O'Reilly, 1999.

508BTT03 - BIOCHEMISTRY-II

AIM

To develop skills of the students in Biochemistry with special emphasis on the metabolizing amino acids, nucleic acids, polysaccharide & lipids and an bio membranes. This may be a pre-requisite for certain-elective courses like Metabolic Engineering; Molecular Modelling & Drug Design etc.

OBJECTIVES

- At the end of the course, the student would have gained an extensive knowledge of Biochemistry particular various metabolic pathways & Bio membranes. This knowledge will be useful for project work.

UNIT I METABOLISM OF AMINO ACIDS

Nitrogen metabolism and urea cycle. Biosynthesis of Gly, Ser and Cys; Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and regulation of branched chain amino acids (concerted inhibition, allosteric regulation and enzyme multiplicity, sequential feedback) from oxaloacetate and pyruvate; Biosynthesis of aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc)

UNIT II PROTEIN TRANSPORT AND DEGRADATION

Protein targeting, signal sequence, secretion; Folding, Chaperons and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

UNIT III METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS

Biosynthesis of nucleotides, *denovo* and salvage pathways for purines and pyrimidines, regulatory mechanisms: Degradation of nucleic acid by exo and endo nucleases. Biosynthesis and degradation of starch and glycogen, Biosynthesis and degradation of Lipids: Fatty acid synthesis and oxidative degradation, Triacylglycerol and phospholipid biosynthesis and degradation; Cholesterol biosynthesis and regulation and targets and action of cholesterol lowering drugs. Vitamins (fat and water-soluble), Co-enzymes, hormones (steroids like corticoids, amino acids derived like adrenaline and noradrenaline and peptides like insulin and growth hormone).

UNIT IV STRUCTURAL PROTEINS AND CYTOSKELETON

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

UNIT V BIOMEMBRANE, TRANSPORT AND ELECTRICAL CONDUCTIVITY

Micelles, lipid bi-layer structure of membranes, membrane proteins, passive, careermediated and active transport, ion-selective channels, trans-membrane potential coupled ATP generation, receptors, acetylcholine receptor as a ligand gated ionchannel, Neuronal sodium channel as voltage-gated ion channel, neurotransmitters and their mechanism of action, action potential, depolarization and nerve conduction. Ionchannel agonists and antagonists as drugs. Ion channel defects (Cystic Fibrosis).

TEXT BOOKS

1. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher
2. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.

REFERENCES

1. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995.
2. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell. V.W., Harper's Biochemistry, Prentice Hall International.
3. Creighton. T.E., Proteins, Structure and Molecular Properties, 2nd Edition, W.H. Freeman and Co., 1993.
4. Salway, J.G., Metabolism at a Glance, 2nd Edition, Blackwell Science Ltd., 2000.

508BTT04 - BIOPROCESS PRINCIPLES

AIM

To develop skills of the students in the area of Bio process Technology with emphasis an Bioprocess principles. This is a pre-requisite for courses an Bioprocess technology offered in the subsequent semesters.

OBJECTIVES

- At the end of the course, the students would have learnt about fermentation processes, Metabolic stoichiometry, Energetics, Kinetics of microbial growth etc. This will serve as an effective course to understand certain specialized electives in Bioprocess related fields.

UNIT I OVERVIEW OF FERMENTATION PROCESSES

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.

UNIT II 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

UNIT III 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.

UNIT IV 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.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

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

TEXT BOOKS

1. Bailey and Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill (2nd Ed.), 1986.
2. Shule and Kargi, "Bioprocess Engineering", Prentice Hall, 1992.

REFERENCES

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

508BTT05 - MASS TRANSFER OPERATIONS

AIM

To develop skills of the students in the area of Mass Transfer operation. This will be a pre-requisite for courses offered in Engineering in the subsequent semesters.

OBJECTIVES

- At the end of the course, the student would have learnt about Mass Transfer, Gas-Liquid, Vapour – liquid & solid – third operations. This will be beneficial to for the study of specialized electives and project work.

UNIT I DIFFUSION AND MASS TRANSFER

Molecular diffusion in fluids and solids; Inter phase Mass Transfer; Mass Transfer coefficients; Analogies in Transport Phenomenon.

UNIT II GAS LIQUID OPERATIONS

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

UNIT III VAPOUR LIQUID OPERATIONS

V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCABETHIELE & PONCHON-SAVARIT Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

UNIT IV EXTRACTION OPERATIONS

L-L equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching Principles.

UNIT V SOLID FLUID OPERATIONS

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

TEXT BOOKS

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

REFERENCE

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

508BTT06 - MOLECULAR BIOLOGY

UNIT I CLASSICAL GENETICS

Mendelian genetics, linkage, crossing over, classical experiments – Hershey and Chase, Avery McLeod & McCarty. Bacterial conjugation, transduction and transformation.

UNIT II STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION

Conformation of DNA and RNA; replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Organisation of eukaryotic chromosome – cot value, replication of telomeres in eukaryotes

UNIT II I TRANSCRIPTION

In prokaryotes and eukaryotes, features of promoters and enhancers, transcription factors, nuclear RNA splicing, ribozyme.

UNIT IV TRANSLATION

Elucidation of genetic code, mechanism, codon usage, suppressor mutation.

UNIT V REGULATION OF GENE EXPRESSION

Lac and trp phage life cycle, mutation and repair of DNA.□operon ,

TEXT BOOKS

1. Friefelder David, "Molecular Biology", 2nd edition Narosa Publ. House. 1999
2. Lewin Benjamin," Gene VIII", Pearson Education,2004.
3. Watson JD., "Molecular Biology of the Gene", 5th edition,Pearson Education, 2004.

REFERENCE

1. Weaver , R.F ," Molecular Biology", 3rd edition , Mc Grraw Hill, 2005.

508BTP01 - MOLECULAR BIOLOGY LAB

AIM

To develop the skills of the students by providing hands on training practical training in Molecular Biology. This will facilitate the students to take up specialized project in Molecular biology and will be a pre-requisite for research work.

OBJECTIVES

- At the end of this course, the students would have learnt basic techniques used in Molecular Biology and its application. This will be strength for students to undertake research projects in the area of moderabiology.

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Competent cells preparation
6. Transformation and screening for recombinants
7. Agarose gel electrophoresis
8. Restriction enzyme digestion
9. Competent cells preparation
10. Blue and white selection for recombinants
11. Plating of O□phage
12. O□ phage lysis of liquid cultures

Requirement for a batch of 30 students

S.No.	Description of Equipment	Deficiency %
1.	Weighing balance Analytical	1
2.	Micro centrifuge (Non refrigerated)	2
3.	Refrigerated microfuge	2
4.	Micro oven	1
5.	DNA electrophoresis tank (complete set)	3
6.	Rock and Roll	2
7.	Gel Documentation System.	1
8.	UV-transilluminator.	1
9.	Laminar Hood.	1
10.	Spectrophotometer.	1
11.	Water bath shaker.	1
12.	Refrigerator.	1
13.	Incubator.	1

508BTP02 - BIOINFORMATICS LAB

1. Introduction to UNIX basic commands and UNIX Filters.

2. Perl programming and applications to Bioinformatics.

- Basic scripting.
- Regular expressions.
- File i/o & control statement.
- Subroutines & functions.
- Writing scripts for automation.

3. Types of Biological Databases and Using it.

- Genbank.
- Protein Data Bank.
- Uniprot.

4. Sequence Analysis Tools

- Use of BLAST, FASTA (Nucleic Acids & Protiens).
- Use of Clustal W.
- Use of EMBOSS.

5. Phylogenetic Analysis

- Use of Phyllip.

6. Molecular Modeling

- Homology Modeling – Swissmodeller.
- Any Open Source Software.

EQUIPMENT

One computer for every 2 students with the software indicated.

SIXTH SEMESTER
608BTT01 - BIO INFORMATICS – II

UNIT I INTRODUCTION
Overview of Genomes of Bacteria , Archae and Eukaryota.

UNIT II PHYSICAL MAPPING TECHNIQUES
Top down and bottom up approach; linking and jumping of clones; genome sequencing: placing small fragments on map: STS assembly; gap closure; pooling strategies; cytogenetic mapping techniques

UNIT III FUNCTIONAL GENOMICS
Gene finding; annotation; ORF and functional predication; Subtractive DNA library screening; differential display and representational difference analysis; SAGE; TOGA.

UNIT IV PROTEOMICS TECHNIQUES
Protein level estimation; Edman protein micro sequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels; pattern analysis; Mass spectrometry – principles of MALDI-TOF; tandem MS-MS; Peptide mass fingerprinting.

UNIT V STRUCTURE FUNCTION RELATIONSHIP OF PROTEINS
Post translation modification; protein –protein interactions; glycoprotein analysis; phosphoprotein analysis, NMR and Crystallography of protein of elucidate protein structure, protein structure by modally.

REFERENCES

1. Cantor,C.R and Smith, C.L "Geneomics", John Wiley & Sons,1999.
2. Pennington,S.R. and Dunn, M.J."Proteomics: from Protein Sequence to Function", viva books publishers, 2002.
3. Liebler, D.L. " Introduction to Proteomics : Tools for the new Biology", Humana press, 2002.
4. Hunt , S.P. and Livesey, F.L. " functional genomics ", oxford university Press ,2000.

608BTT02 - CHEMICAL REACTION ENGINEERING

AIM

This course aims to develop the skills of the students in the area of chemical reaction engineering. This is a pre-requisite for courses offered in Bioprocess Technology a few electives.

OBJECTIVES

- At the end of the course, the student would have learnt chemical kinetics, various types of reactors, and how they function. This will help the student to take up PG courses in Bioprocess, Biochemical Engg., and also the project work.

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING

Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II IDEAL REACTORS

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW

RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS

Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS

G/l reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TEXT BOOKS

1. Levenspiel O. "Chemical Reaction Engineering", 3rd Edition. John Wiley.1999.
2. Fogler H.S. "Elements Of Chemical Reaction Engineering", Prentice Hall India.2002

REFERENCE

1. Missen R.W., Mims C.A., Saville B.A. "Introduction To Chemical Reaction Engineering And Kinetics", John Wiley.1999.

608BTT03 - BIOPROCESS ENGINEERING

AIM

This course aims to develop the skills of the students in the area of Bioprocess Engineering. This will be a pre-requisite for a few elective courses and for project in Bioprocess Technology.

OBJECTIVES

- At the end of the course, the student would have learnt about stirred Tank reactors and configuration of various reaches, and how to model and similar a Bio process. This will help the student to undertake project in the area of Bio process Technology.

UNIT I ANALYSIS OF STR

Stirred tank reactor - non-ideality, RTD and stability analysis, tanks in series and dispersion models – application to design of continuous sterilizer.

UNIT II ANALYSIS OF OTHER CONFIGURATIONS

Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors – nonideality, RTD and stability analysis.

UNIT III 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.

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES

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

UNIT V 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. Anton Moser, "Bioprocess Technology", Kinetics and Reactors", Springer Verlag.
2. James E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill.
3. Shuler and Kargl,Bioprocess Engineering, Prentice Hall , 1992.

REFERENCES

1. James M. Lee, "Biochemical Engineering", PHI, USA.
2. EMT.EL-Mansi.CFA.Bryce, A.L.Demain, AR.Allman: Fermentation Microbiology and Biotechnology, Second Edition 2007.
3. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Decker Inc.

608BTT04 - IMMUNOLOGY

AIM

This course aims to develop the skills of the students in Immunotechnology, Proteomics and genomics etc.

OBJECTIVES

- At the end of the course would have learnt about the mechanisms by which a human body interacts with a pathogenic microbe & how it eliminates it. Students, also familiarize themselves with the pathogenesis of diseases like AIDS, Cancer, TB etc.

UNIT I INTRODUCTION

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

UNIT II CELLULAR RESPONSES

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

UNIT III INFECTION AND IMMUNITY

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

UNIT IV TRANSPLANTATION AND TUMOR IMMUNOLOGY

Transplantation: genetics of transplantation; laws of transplantation;; tumor immunology.

UNIT V AUTOIMMUNITY

Autoimmunity, Autoimmune disorders and diagnosis.

TEXT BOOKS

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., 2002.
2. Kuby J, Immunology, WH Freeman & Co., 2000.

REFERENCE

1. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 1998.

608BTT05 - GENETIC ENGINEERING

AIM

To develop skills of the students in the area of genetic Engineering. This will be a prerequisite for electives like genomics & proteomics, Immuno technology offered in the subsequent semesters.

OBJECTIVES

- At the end of the course, the student would learnt about various aspects of genetic engineering and its application This will be very useful for the student to undertake research /project work in Modern Biology.

UNIT I 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.

UNIT II 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.

UNIT III CONSTRUCTION OF LIBRARIES

Construction of DNA and genomic libraries. Screening of libraries with DNA probes and with antisera.

UNIT IV 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).

UNIT V APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

Cloning in plants, Ti plasmid, and transgenic and knockout animals.

TEXT BOOK

1. Old RW, Primrose SB, "Principles of Gene Manipulation, An Introduction To Genetic Engineering", Blackwell Science Publications, 1993.
2. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology", Greene Publishing Associates, NY, 1988.

REFERENCES

1. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol. 152, Academic Press, 1987.

ELECTIVE I

608BTT06 - MARINE BIOTECHNOLOGY

UNIT I INTRODUCTION TO MARINE ENVIRONMENT

World oceans and seas – ocean currents – physical and chemical properties of sea water – abiotic and biotic factors of the sea – ecological divisons of the sea – history of marine biology – biogeochemical cycles – food chain and food web**.**

UNIT II IMPORTANT MARINE ORGANISMS

Phytoplanktons – zooplanktons – nektons – benthos – marine mammals – marine algae – mangroves – coral reefs – deep sea animals and adaptation – fauna and flora of intertidal zone.

UNIT II MARINE ENVIRONMENTAL BIOTECHNOLOGY

Marine pollution – biological indicators (marine micro , algae) – biodegradation & bioremediation – marine fouling and corrosion.

UNIT IV MARINE PHARMACOLOGY

Medicinal compounds from marine flora and fauna – marine toxins , antiviral and antimicrobial agents.

UNIT V AQUACULTURE TECHNOLOGY

Importance of coastal aquaculture – marine fishery resources – common fishing crafts anjd gears – aquafarm design and construction.

TEXT BOOKS

1. Recent advances in marine biotechnology volume 3 – M.Fingerman , R . Nagabhushanam Mary – Frances Thomson.
2. Recent advances in marine biotechnology volume 2 – M.Fingerman , R . Nagabhushanam Mary – Frances Thomson.

608BTT07 - PROCESS INSTRUMENTATION DYNAMICS AND CONTROL

AIM

To introduce control equipments used to control the production process of a chemical factory and to introduce the control mechanism thro' automation and computers.

OBJECTIVES

- Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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 and Koppel, "Process Systems Analysis and Control", McGraw-Hill, New York, 1986.
2. George Stephanopolous, "Chemical Process Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 1990.
3. Patranabis.D, Principles of Process control, II edition, Tata McGraw-Hill Publishing Co. Ltd., 1981.
4. Peter Harriott, Processcontrol, Tata McGraw-Hill Publishing Co., Reprint 2004.

REFERENCES

1. Thomas, E.Marlin, Process Control, 2nd Edn, McGraw-Hills International Edn. 2000.
2. George Stephanopoulos, Chemical Process Control, Prentice Hall of India 2003.
3. Norman H.CEAGLSKE, Automatic process control for chemical engineers, John Wiley & Sons, Japan.
4. Emenule, S.Savas, "Computer Control of Industrial Processes", McGraw-Hill, London, 1965.
5. Eckman, D.P., "Industrial Instrumentation", Wiley, 1978.

608BTT08 - MOLECULAR PATHOGENESIS

AIM

To develop the skills of the students in the area of Molecular Pathogenesis.

OBJECTIVES

- At the end of the course, the students would have learnt about Host Parasite interactions, Host defense mechanisms and molecular mechanisms involved in Pathogenesis of diseases caused by E.Coli and Vibrio. Cholerae.

UNIT I OVERVIEW

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES)

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival *E.coli* pathogens: Enterotoxigenic *E.coli* (ETEC), labile & stable toxins, Entero- pathogenic *E.coli* (EPEC), type III secretion, cytoskeletal changes, intimate attachment; Enterohaemerrohogic *E.coli* (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, Enteroaggregative *E.coli* (EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TEXT BOOKS

1. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.
2. Tizard : Immunology; An introduction; 4th Edition, Thomson Publication.
3. Peter Williams, Julian Ketley & George Salmond, "Methods in Microbiology: Bacterial Pathogenesis, Vol. 27", Academic Press, 1998.
4. Bacterial Pathogenesis – A molecular Approach, Abigali A. Salyers and Dixie D.Whitt, Second Edition, 2002, ASM Press, Washington.

REFERENCES

1. Recent reviews in Infect. Immun., Mol. Microbiol, Biochem. J., EMBO etc.
2. Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective",McGraw-Hill, 3rd Edition, 2001.

608BTP01 - GENETIC ENGINEERING LAB

AIM

To provide hands on training in the Genetic Engineering by the designing simple experiments. This is a pre-requisite for Down-stream processing has offered in later semester.

OBJECTIVES

- At the end of the course, the student would have learnt about the cloning of genes, how to express them for protein production & subsequent purification of protein. This will be needed for any project work in modern biology.

1. Preparation of plasmid DNA.
2. Elution of DNA from agarose gels.
3. Ligation of DNA into expression vectors.
4. Transformation.
5. Optimisation of inducer concentration for recombinant protein expression.
6. Optimisation of time of inducer for recombinant protein expression.
7. SDS-PAGE, 2 D Gel, ISO – electric Focussing.
8. Western blotting.
9. Hybridisation with anti-sera.
10. PCR.

608BTP02 - BIOPROCESS LAB

AIM

This course aims to provide hands a training in the laboratory of Bio process Technology by performing simple experiments.

OBJECTIVES

- At the end of the course, the student would have learnt about Bioreactors & how to use them for practical applications. This will be beneficial to students to undertake project work in this area.

1. Thermal death kinetics
2. Batch sterilization design
3. Batch cultivation, estimation of kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing
4. Batch and 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 kla – sulphite oxidation method
7. Estimation of kla – power correlation method
8. Residence time distribution
9. Estimation of overall heat transfer coefficient
10. Continuous cultivation – x-d diagram, pulse and shift method, evaluation of kinetic parameters, exhaust gas analysis – carbon balancing, gas balancing.
11. Enzyme kinetics – micheies menton parameters.
12. Enzyme immobilization – gee intropment & cross linking methods.

SEVENTH SEMESTER
708BTT01 - DOWNSTREAM PROCESSING

AIM

This course aims to develop the skills of the students in the area of Downstream processing. This is a pre-requisite for courses in Bioprocess Technology.

OBJECTIVES

- At the end of the course, the student would have learnt about ,methods to obtain pure proteins, enzymes and in general about product development R & D. This will be handy for projects of Industries.

UNIT I DOWNSTREAM PROCESSING

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

UNIT II PHYSICAL METHODS OF SEPERATION

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS

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

UNIT IV PRODUCT PURIFICATION

Chromatography – principles, instruments and practice, adsorption, reverse phase, ionexchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS

Crystallization, drying and lyophilization in final product formulation.

TEXT BOOKS

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

REFERENCES

1. J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.
2. R.K. Scopes – Protein Purification – Principles And Practice, Narosa Pub. (1994).
3. Roger.G . Harrison , Paul Todd , Scott R.Rudge and Demetri P.Petrides, Bioseperation Science and Engineering , Oxford University Press , Newyork , 2003.

708BTT02 - PROTEIN ENGINEERING

AIM

This course aims to develop the skills of the students in the area of Protein Engineering. This is a pre-requisite for a few elective courses offered in the subsequent semesters.

OBJECTIVES

- At the end of the course, the student would have learnt structure and function of proteins of particular importance, the student will know the production of recombinant insulin & in general how to engineer protein to be used as therapeutics.

UNIT I BONDS AND ENERGIES IN PROTEIN MAKEUP

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

UNIT II AMINO ACIDS AND THEIR CHARACTERISTICS

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

UNIT III PROTEIN ARCHITECTURE

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

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Transmembrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

UNIT V PROTEIN ENGINEERING

Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *de novo* protein design.

TEXT BOOKS

1. Voet D. and Voet G., "Biochemistry", Third Edn. John Wiley and Sons, 2001
2. Branden C. and Tooze J., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999

REFERENCES

1. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993
2. Moody P.C.E. and Wilkinson A.J. "Protein Engineering", IRL Press, Oxford, UK, 1990.

ELECTIVE II, III, IV & V

708BTT03 - PRINCIPLES OF FOOD PROCESSING

AIM

To develop the skills of the students in the area of Food Process Technology and its applications.

OBJECTIVES

- At the end of the course, the student would have gained knowledge in various aspects of Food processing & its importance for industrial applications. This will facilitate the student to take up higher studies in the area.

UNIT I FOOD AND ENERGY

Constituents of food – carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

UNIT II FOOD ADDITIVES

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants – natural and artificial; food flavours; enzymes as food processing aids.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD

Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

UNIT IV FOOD BORNE DISEASES

Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

UNIT V 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, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

TEXT BOOKS

1. T.P. Coultate – Food – The Chemistry Of Its Components, 2nd Edn. Royal Society, London, 1992.
2. B. Sivasanker – Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.

REFERENCES

1. W.C. Frazier And D.C. Westhoff – Food Microbiology, 4th Ed., McGraw-Hill Book Co., New York 1988.
2. J.M. Jay – Modern Food Microbiology, CBS Pub. New Delhi, 1987.

708BTT04 - BIOCONJUGATE TECHNOLOGY

AIM

To develop the skills of Student in the area of Bio conjugate technology and its industrial applications.

OBJECTIVES

- At the end of the course, the student would have learnt about enzymes, nucleic acids and how to modify them for target specificity. Student also gets familiarized with the industrial applications of this technology.

UNIT I FUNCTIONAL TARGETS

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

UNIT II CHEMISTRY OF ACIVE GROUPS

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

UNIT III BIOCONJUGATE REAGENTS

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

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION

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

UNIT V BIOCONJUGATE APLICATIONS

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

TEXT BOOK

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 1999.

708BTT05 - CANCER BIOLOGY

AIM

To develop skills of the students in the area of Cancer Biology.

OBJECTIVES

- At the end of the course, the student would have learnt about pathogenesis of cancer, identifications of cancer through tools developed by biotechnology research & molecules synthesized for cancer therapy. This will be very beneficial for the student to take up projects in Cancer Biology.

UNIT I 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.

UNIT II PRINCIPLES OF CARCINOGENESIS

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

UNIT III 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/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IV PRINCIPLES OF CANCER METASTASIS

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

UNIT V 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 BOOKS

1. Maly B.W.J, "Virology A Practical Approach", IRLl Press, Oxford, 1987.
2. Dunmock N.J And Primrose S.B., "Introduction to Modern Virology", Blackwell Scientific Publications, Oxford, 1988.

REFERENCE

1. "An Introduction Top Cellular And Molecular Biology of Cancer", j Oxford Medical Publications, 1991.

708BTT06 - PLANT BIOTECHNOLOGY

AIM

To develop the skills of the students in the area of Plant Biotechnology.

OBJECTIVES

- At the end of the course the student would have learnt about the applications of Genetic Engineering in Plant and how to develop Transgenic plants. This will facilitate the student to take up project work in this area.

UNIT I ORGANIZATION OF GENETIC MATERIAL

Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation.

UNIT II CHLOROPLAST & MITOCHONDRIA

Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.

UNIT III NITROGEN FIXATION

Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM & VIRAL VECTORS

Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid – t- DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits.

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY

Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, theraputic products.

TEXT BOOKS

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.
2. Singh BD. Text Book of Biotechnology, Kalyani Publishers. 1998

REFERENCES

1. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
2. Ignacimuthu .S, Applied Plant Biotechnology, Tata McGraw-Hill. 1996.

708BTT07 - BIOPHYSICS

AIM

The develop the skills of the students in the area of Biophysics and is a prerequisite for PG studies in biotechnology.

OBJECTIVES

- At the end of the course, the student would have learnt about Molecular structure of biological systems, Cell permeability and conformation of proteins and Nucleic acids. This course facilitates the students to take specialization in computation Biology.

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS

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

UNIT II CONFORMATION OF NUCLEIC ACIDS

Primary strucutre – the bases – sugars and the phosphodiester bonds- double helical structure – the a, b and z forms – properties of circular DNA– topolgy – polymorphism and flexibility of DNA – strucutre of ribonucleic acids – hydration of nucleic acids.

UNIT III CONFORMATION OF PROTEINS

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

UNIT IV 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.

UNIT V ENERGETICS & 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.

TEXT BOOKS

1. Biophysics; R. Glaser, Springer Verlag, 2000.
2. Biophysics: Molecules In Motion; R. Duane. Academic Press, 1999.

REFERENCE

1. Voet and voet , biochemistry, 2nd edition , John Wiley and Sons Inc.,1995.
2. Lehninger's principles of biochemistry,David L. Nelson and Micheal Mcox,Macmillon worth publications, 4th edition 2007.

708BTT08 - BIOLOGICAL SPECTROSCOPY

AIM

To develop the skills of the students in the area of Biological spectroscopy. Prerequisite for PG studies in Biotechnology.

OBJECTIVES

- At the end of the course, the student would have learnt about various kinds spectroscopic techniques to study biological system. This course is very effective in the area of Drug Design.

UNIT I OPTICAL ROTATORY DISPERSION

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II NUCLEAR MAGNETIC RESONANCE

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

UNIT III MASS SPECTROMETRY

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

UNIT IV X-RAY DIFFRACTION

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

UNIT V SPECIAL TOPICS AND APPLICATIONS

Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TEXT BOOKS

1. Campbell I.D and Dwek R.A., "Biological Spectroscopy", Benjamin Cummins and Company, 1986.
2. Atkins P.W., "Physical Chemistry", Oxford IV Edition, 1990.

708BTT09 – BIOETHICS

UNIT I HISTORY OF BIOETHICS

Bioethics as a discipline – philosophical reflections on experimenting with human subjects - active and passive euthanasia – culture assumption in the history of Bioethics – medical ethics in India and America.

UNIT II METHODS OF ETHICS ANALYSIS

Ethical reasoning, philosophical,clinical and cultural dimensions – challenge of ethical relativism – methods of philosophical theories and principles,methods of casuistry and methods of narrative approaches – narrative & justification in ethics.

UNIT III ETHICS IN CLINICAL SETTING

Ethics committee (hospital) – Inner working of an ethics committee – ethics consultation training – skills & roles – Facilitating medical ethics – case studies – ethics consultation in Indian Hospital & US Hospital.

UNIT IV CULTURAL ASSUMPTION IN BIOETHICS AND BIOETHICAL METHODS

Western bioethics on the Navajo reservation – communication through interpreters in healthcare – Aafrica and American perspectives in bioethics – Gender , race and class in delivery of health care – bioethics and human rights in the global ear.

UNIT V PRACTICE OF BIOETHICS

Introduction – ethical topics at the beginning of life – abortion, reproductive technologies, genetics and reproduction – ethical topics at the end of life – withholding and withdrawing medical treatment – advance care planning and surrogate decision making – euthanasia and physician assisted suicide.

TEXT BOOK

1. Bioethics , second edition , Nancy S.Jecker , Albert R.Jonsen,Robert A,Pearlman.Jones and Bartlett Publishers.

708BTT10 - ANIMAL BIOTECHNOLOGY

AIM

To develop the skills of the students in the area of animal biotechnology and its applications.

OBJECTIVES

- At the end of the course, the student would have learnt about animal cell culture, molecular diagnostic of animal diseases and Transgenic animal production. This will facilitate the student to undertake project work in this area.

UNIT I ANIMAL CELL CULTURE

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures- suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS

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

UNIT III THERAPY OF ANIMAL DISEASES

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

UNIT IV MICROMANIPULATION OF EMBRYO'S

What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

UNIT V TRANSGENIC ANIMALS

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TEXT BOOKS

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.
3. R.Ian Freshney Culture of Animal ceas, A Manual of basic technique 4th Edition 2002.

REFERENCE

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

708BTT11 - PROCESS EQUIPMENTS AND PLANT DESIGN

AIM

To develop the skills of the students in the area of process equipment and Design. This is a pre-requisite for higher PG studies in Biotechnology.

OBJECTIVES

- At the end of the course, the student would have learnt about various types of process equipment, principles involved in their function, and its industrial applications.

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS

Single and multi process exchangers, double pipe, U tube heat exchangers, combustion details supporting structure. Single and vertical tube evaporation, Single and multi effect evaporators, forced circulation evaporators.

UNIT II STORAGE VESSEL FOR VOLATILE AND NON VOLATILE FLUIDS, PRESSURE VESSEL STRUCTURE

Design of the following equipments as per ASME, ISI codes, drawing according to scale; monoblock and multiplayer vessels, combustion details and supporting structure.

UNIT III EXTRACTOR, DISTILLATION AND ABSORPTION TOWER

Construction details and assembly drawing; Plate and Packed Extraction Towers; Plate and Packed absorption Towers; Plate and Packed Distillation Towers.

UNIT IV PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES

Various types of pumps, Principle of working, construction, usages, advantages and disadvantages; Various types of seals, effectiveness, usages; Pneumatic Seals; Gate, Globe and Butterfly Valves, their material of construction; Pneumatically Controlled Valves.

UNIT V PIPING, PLANT LAY OUT AND DESIGN

Various types of Piping, material of construction, their usage; Pipe lay out; Modern Plant Design and case Studies.

TEXT BOOKS

1. Brownbell I.E., Young E.H., Chemical Plant Design, 1985
2. Kern D.Q. "Heat Transfer", McGraw-Hill, 1985.

REFERENCE

1. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", McGraw-Hill, 1976.

708BTT12 - BIOPHARMACEUTICAL TECHNOLOGY

AIM

The develop skills of the students in the area of Biopharmaceutical Technology. This course is effective for PG studies in Biotechnology.

OBJECTIVES

- At the end of the course, the students would have learnt about Drug manufacture, Drug action and Drug metabolism and production of Biopharmaceuticals. This will facilitate the students to take up projects work in this area of Biotechnology.

UNIT I INTRODUCTION

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

UNIT II DRUG ACTION, METABOLISM AND PHARMACOKINETICS

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmaco kinetics.

UNIT III MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS

Types of reaction process and special requirements for bulk drug manufacture.

UNIT IV PRINCIPLES OF DRUG MANUFACTURE

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

UNIT V BIOPHARMACEUTICALS

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

TEXT BOOKS

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

708BTT13 - MOLECULAR MODELING & DRUG DESIGN

AIM

To develop skills of students in the area of Molecular modeling. Prerequisite for courses on Drug Design.

OBJECTIVES

- At the end of the course the student would have learnt Classical & Statistical mechanics, and Quantum mechanics and its applications.

UNIT I INTRODUCTION TO CLASSICAL MECHANICS

Newtons laws of motion – time intervals- algorithms.

UNIT II INTRODUCTION TO STATISTICAL MECHANICS

Boltzman's Equation – Ensembles – Distribution law for non interacting molecules – Statistical mechanics of fluids.

UNIT III QUANTUM MECHANICS

Photoelectric effect – De Broglies hypothesis – Uncertainty principle – Schrodingers time independent equation – particle in a one -dimensional box.

UNIT IV GROMOS, GROMACS, AMBER & DOCK

Energy minization, application of Fourier transformer – force fields – principal components analysis – RMSD calculation – applications – dynamics of a molecule – concepts of parallezing work.

UNIT V GAUSSIAN 98

Methods – Basic sets – Model chemiststrix – inputs – outputs – uses.

TEXT BOOKS

1. Statistical Mechanics; D. McQuarrie, Narosa, 1999.
2. Quantum Mechanics; D. McQuarrie, Narosa, 1999.

REFERENCE

1. GROMOS Handbook.

708BTT14 - METABOLIC ENGINEERING

AIM

To develop skills of the students in the area of Metabolic Engineering.

OBJECTIVES

- At the end of the course, the student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.

UNIT I INTRODUCTION

Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feedback regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feedback regulation, cumulative feedback regulation, amnio acid regulation of rna synthesis, energy charge, regulation, amino acid regulation of rna synthesis, energy charge, regulation, premeability control passive diffusion, active transport group transportation.

UNIT II SYNTHESIS OF PRIMARY METABOLITES

Alteration of feedback regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.

UNIT III BIOSYNTHESIS OF SECONDARY METABOLITES

Precursor effects, prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS

Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble substances.

UNIT V REGULATION OF ENZYME PRODUCTION

Strain selection, improving fermentation, recognising growth cycle peak, induction, feedback 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., 1980.
2. Stanbury P.F., And Whitaker A., "Principles Of Fermention Technology", Pergamon Press, 1984.

REFERENCE

1. Zubay G., " Biochemistry ", Macmillan Publishers, 1989.

708BTT15 - NANOBIOTECHNOLOGY

UNIT I INTRODUCTION TO CONCEPTS OF NANOTECHNOLOGY 9

Principle of size, Types of approaches-nano architecture, Molecular manipulations – Bond width Sp hybridization, allotropy, mean path, tensile strength. Overivew of micro and nano systems, synthesis properties and characterization of nano materials. Four generation of nano science, Fabrication, Application of nano particles (long and short term).

UNIT II INTRODUCTION TO NANO CHEMISTRY 9

Classification of Nano structed material, properties characterization of fullerene, Carbon nanotube, Quantum Dot, Nanowire, Nanopore and its application, colloidal gold. Recent trends of gold nano particles.

UNIT III NANOMOLECULES IN BIOSYSTEMS 9

Proteins, lipids, DNA, Nanoconjutie, Chemistry, peptide coupled Nanoparticle, Biological nanomotors, SAM, Primary moleculer manufacturing systems, nanofactory, concepts of mechnosynthesis, and mechnochemistry, nanocircuits, nanophotons, nanoions molecular, electric properties**.**

UNIT IV NANO BIOTECHNOLOGY AND MICRO ORGANISM 9

PHA, cyanophcin inclusion, magnetosome, alginates, bacteriophages, bacteriospores, bacterial protein complex, S-layer protein, bacteriorhodpsin

UNIT V NANOSCALE DEVICE FOR DRUG DELIVERY 9

Nanoscale device for drug delivery and gene delivery, microarray – nanobiochip, biosensor. Nanobased therapy of cancer – cell destruction, nanorobotics-advantages and disadvantages, nanopathology.
Environmental impact of nanoscience to society is it good or bad, nanotoxicology and economic, health aspects of nanobiotechnology.

TOTAL: 45 PERIODS

TEXT / REFERENCE BOOKS:

1. Jain K.K, Nanobiotechnology in Molecular Diagnostics – Current Techniques and Applications. Taylor and Francis Publications 2006.
2. Salata O.V. Applications of nanoparticles in biology and medicine. Journal of Nanobiotechnology, 2:3, 2004.
3. Bernard H.A Relim, Microbial Bionanotechnology, 2006**.**

708BTP01 - DOWNSTREAM PROCESSING LAB

AIM

To provide hands on training in downstream processing by through simple experimentation in the laboratory. This will be a pre-requisite for project work.

OBJECTIVES

- At the end of the course, the student has gained the knowledge to perform various techniques used in Down Stream Processing and how to make a finished project.

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dyno mill – batch and continuous
4. Precipitation – ammonium sulphite precipitation
5. Ultra filtration separation
6. Aqueous two phase extraction of biologicals
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

708BTP02 - IMMUNOLOGY LAB

AIM

The develop skills of students in Immunology by performing simple experiments in the laboratory.

OBJECTIVES

- At the end of the course the student would have gained knowledge to perform techniques like blood grouping, ELISA, & identification of T-cell, Immuno fluorescence etc. This will be of help in facilitating the students for project work.

1. Handling of animals, immunization and raising antisera
2. Identification of cells in a blood smear
3. Identification of blood group
4. Immuno diffusion & immuno electrophoresis
5. Testing for typhoid antigens by Widal test
6. Enzyme Linked Immuno Sorbent Assay (ELISA)
7. Isolation of peripheral blood mononuclear cells
8. Isolation of monocytes from blood
9. Immuno fluorescence
10. Identification of t cells by T-cell rossetting using sheep RBC.

EIGHT SEMESTER

808BTT01 - TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOK

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint (2006).

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

ELECTIVE - VI
808BTT02 - STEM CELL TECHNOLOGY

UNIT I STEM CELLS AND CELLULAR PEDIGREES
Scope of stem cells – definition of stem cells – concepts of stem cells – differentiation , maturation , proliferation , pluripolericy, self – maintainance and self – renewal – problems in measuring stem cells – preservation protocols.

UNIT II STEM CELL CONCEPT IN PLANTS
Stem cell and founder zones in plants – particulary their roots – stem cells of shoot meristems of higher plants.

UNIT III STEM CELL CONCEPT IN ANIMALS
Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –Tumour stem cells, Ebryonic stem cell biology - factors influencing proliferation and differentiation of stem cells – hormone role in differentiation.

UNIT IV HAEMOPOIETIC STEM CELL
Biology – growth factors and the regulation of haemopoietic stem cells.

UNIT V POTENTIAL USES OF STEM CELLS
Cellular therapies – vaccines – gene therapy – immunotherapy – tissue engineering – blood and bone marrow – Fc cells.

TEXT BOOKS

1. Stem cells – Elsevier : CS Potten , 1997.
2. Essentials of stem cell biology , Robert Paul Lanza , 2006.
3. encyclopedia of stem cell research , volume 1 Clive Svendensen , Allison D.Ebert.

808BTT03 - IMMUNO TECHNOLOGY

AIM

To develop the skills of the students in the area of Immunotechnology pre-requisite for PG studies in biotechnology & related fields.

OBJECTIVES

- At the end of the course, the student would have learnt various techniques like developing diagnostic tests, characterization of lymphocytes, purification of antigens, Antibody Engineering etc. This knowledge will beneficial for Industrial applications.

UNIT I ANTIGENS

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

UNIT II ANTIBODIES & IMMUNODIAGNOSIS

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

UNIT III ASSEMENT O CELL MEDIATED IMMUNITY

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

UNIT IV IMMUNOPATHOLOGY

Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cels, immuno cytochemistry – immuno
fluoresecence, immuno enzymatic and immuno ferrtin techniques, immuno electron microscopy.

UNIT V MOLECULAR IMMUNOLOGY

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immune therapy with genetically engineered antibodies.

UNIT VI CURRENT TOPICS IN IMMUNOLOGY

Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

TEXT BOOKS

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

REFERENCE

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

808BTT04 - NEUROBIOLOGY AND COGNITIVE SCIENCES

AIM

To develop the skills of students in the area of macrobiology and cognitive sciences.

OBJECTIVES

- At the end of the course, the student would have learnt about the human nervous system, neurophysiology & nuurophaemacology. The student also gains knowledge in the mechanisms of neurological behaviour.

UNIT I NEUROANATOMY

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

UNIT II NEUROPHYSIOLOGY

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

UNIT III NEUROPHARMACOLOGY

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

UNIT IV APPLIED NEUROBIOLOGY

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

UNIT V BEHAVIOUR SCIENCE

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

TEXT BOOK

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

808BTT05 - BIOPROCESS ECONOMICS AND PLANT DESIGN

AIM

To develop skills of the students in the area of Bioprocess Economics and Plant Design.

OBJECTIVES

- At the end of the course, the student would have learnt about Business organizations, project design and development, Economics of plant Design and Quality control requirements.

UNIT I PROCESS ECONOMICS AND BUSINESS ORGANIZATIONS

Definition of Bio Process, Bio Process Economics, Importance of various M-inputs- Globalization concept-Competition by Dumping-It's effect on Plant size-Status of India with adjoining ASEAN countries (Singapore, Malaysia, Indonesia etc)-Project profile concept-details; Structure and Types of Organizations; Simple Management Principles.

UNIT II 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 Budgetory investment and production costs.

UNIT III 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; Profitablity Standards, Project profitability evaluation, Alternative investments and Replacements; Annual reports, Balance Sheets, Performance Analysis.

UNIT IV PROCESS OPTIMIZATION TECHNIQUES

Optimum design-Design Strategy, Economic-Balance, Different unit-Operations with Single and Multiple Variables.

UNIT V QUALITY AND QUALITY CONTROL

Current good manufacturing practices. Concepts of Quality Control in 20th 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 BOOKS

1. Peters M.S., Klaus D. Plant Design and Economics for Chemical Engineers. McGraw-Hill International Edition, Chemical Engineering series, 1991.
2. Senapathy R. Text Book of Principles of Management and Industrial Psychology. Lakshmi Publications, 2001.

REFERENCE

1. Rudd and Watson. Strategy for Process Engineering, Wiley Publications.1987.