B.Tech. (Full Time) – Genetic Engineering

Curriculum & Syllabus

2007-08

Faculty of Engineering & Technology
SRM University
SRM Nagar, Kattankulathur – 603 203

S.R.M UNIVERSITY
B.Tech: GENETIC ENGINEERING
2007-08
CURRICULUM

SEMESTER I

Code	Category	Course	L	T	P	C
Theory						
MA 0111	B	Mathematics -I	3	2	0	4
LE 0101	G	English	1	0	2	2
PH 0101	B	Physics	3	0	0	3
CY 0101	B	Chemistry	3	0	0	3
GE 0101	E	Basic Engineering-I	4	0	0	4
Practical						
PH 0103	B	Physics Laboratory	0	0	2	1
CY 0103	B	Chemistry Laboratory	0	0	2	1
GE 0105	B	Computer Literacy	0	0	2	1
AR0130	E	Engineering Drawing	1	0	4	3
GE0107	G	NSS /NCC/NSO/YOGA	0	0	2	1
PD 0101	G	Personality Development- I*	0	0	2	-
Total			**15**	**2**	**16**	**23**
Total Contact Hours			**33**			

Semester – II

Code	Category	Course	L	T	P	C
Theory						
MA 0142	B	Mathematics LS-II	3	2	0	4
PH 0102	B	Material Science	2	0	2	3
GE0104	B	Principles of Environmental Science	2	0	0	2
BT 0102	P	Biochemistry	3	0	0	3
GE 0106	E	Basic Engineering II	4	0	0	4
BT 0104	B	Cell Biology	3	0	0	3
GE0108	G	Value Education	1	0	0	1
Practical						
ME 0120	E	Workshop Practice	0	0	4	2
CS 0140	B	Computer Practice	1	0	2	2
BT 0209	P	Biochemistry Laboratory	0	0	4	2
PD 0102	G	Personality Development-II	0	0	2	-
Total			**19**	**2**	**14**	**26**
Total Contact Hours			**35**			

G: General programme comprising language/communication skills, humanities and social sciences, economics and principles of management, and NSS/NCC/NSO/YOGA.
B: Basic sciences comprising Computer Literacy with Numerical Analysis, Mathematics, Physics, and Chemistry.
E: Engineering Sciences and Technical Arts comprising Engineering Graphics, Workshop Practice, Basic Engineering, etc.
P: Professional subjects corresponding to the Branch of Studies, which will include core subjects, electives, and project work.

* Audit course

Semester – III

Code	Category	Course	L	T	P	C
Theory						
BT 0201	P	Enzyme Technology	3	0	0	3
BT 0203	P	Genetics and Cytogenetics	3	0	0	3
BT 0205	P	Immunology	3	0	0	3
BT 0207	P	Microbiology	3	0	0	3
CH0215	E	Mechanical Operations & Heat Transfer	3	0	0	3
LE 0201/ LE 0203/ LE0205	G	German Language Phase-I/ Japanese Language phase-I/French Language Phase I	2	0	0	2
BT0217	B	Computer Skills	1	0	2	2
Practical						
BT 0211	P	Microbiology Laboratory	0	0	4	2
BT 0215	P	Immunology Laboratory	0	0	4	2
PD 0201	G	Personality Development-III	0	0	2	1
Total			**18**	**0**	**12**	**24**
Total Contact Hours			**30**			

Semester – IV

Code	Category	Course	L	T	P	C
Theory						
GN 0202	P	Basic Molecular Techniques	2	0	0	2
BT 0202	P	Molecular Biology	3	0	0	3
GN 0204	E	Stoichiometry and Engineering Thermodynamics	3	0	0	3
BT 0204	P	Bioprocess Principles	3	0	0	3
MA 0244	P	Biostatistics	3	1	0	4
LE 0202/ LE 0204/ LE 0206	G	German Language Phase-II/ Japanese Language phase-II/ French Language Phase II	2	0	0	2
GN 0206	P	Comprehension-I	0	2	0	1
Practical						
GN 0208	P	Molecular Techniques Laboratory	0	0	4	2
GN 0210	P	Bio process Engineering Laboratory	0	0	4	2
PD 0202	G	Personality Development-IV	0	0	2	1
Total			**16**	**3**	**10**	**23**
Total Contact Hours			**29**			

Semester – V

Code	Category	Course	L	T	P	C
Theory						
GN 0301	P	Advanced Molecular Techniques	2	0	0	2
GN 0303	P	Functional Genomics and Microarray Technology	3	0	0	3
CH 0317	E	Momentum Transfer	3	0	0	3
BT 0313	P	Bioprocess Engineering	3	0	0	3
BT 0315	P	Biophysics	3	0	0	3
GN 0305	P	Plant Tissue Culture and Transgenic Technology	2	0	0	2
PD 0301	G	Personality Development-V	1	0	2	2
Practical						
GN 0307	P	Gene Expression Laboratory	0	0	4	2
GN 0309	P	Plant Genetic Engineering Laboratory	0	0	4	2
GN 0311	P	Industrial Training 1**	0	0	2	1
Total			**17**	**0**	**12**	**23**
Total Contact Hours			**29**			

** Industrial Training 1 is of minimum two weeks has to be undergone by the student in the winter summer vacation of the II year.

Semester – VI

Code	Category	Course	L	T	P	C
Theory						
GN 0302	P	Recombinant DNA Technology	3	0	0	3
BT 0308	P	Bioinformatics	3	0	0	3
CH 0324	E	Chemical Reaction Engineering	3	0	0	3
GN 0304	P	Gene Therapy	2	0	0	2
GN 0306	P	Biosensors and Biochips	2	0	0	2
E1	P	Elective-1	3	0	0	3
GN 0308	P	Comprehension II	0	2	0	1
PD 0302	G	Personality Development-VI	1	0	2	2
Practical						
GN0310	P	Gene Cloning & DNA Sequencing Laboratory	0	0	4	2
GN0312	P	Bioinformatics Laboratory	0	0	4	2
Total			**17**	**2**	**10**	**23**
Total Contact Hours			**29**			

Semester – VII

Code	Category	Course	L	T	P	C
Theory						
BT 0407	P	Bioseparation Technology	3	0	0	3
GN 0401	P	Animal Cell Culture and Transgenic Technology	2	0	0	2
GN 0403	P	Nanobiotechnology in Healthcare	3	0	0	3
GN 0405	P	Stem Cell Biology	3	0	0	3
E2	P	Elective-2	3	0	0	3
GN 0407	P	Comprehension II	1	0	0	1
Practical						
GN 0409	P	Genome Analysis Laboratory	0	0	4	2
BT 0401	P	Animal Cell Culture Laboratory	0	0	4	2
BT 0413	P	Bioseparation Laboratory	0	0	4	2
GN 0411	P	Industrial Training 2 **	0	0	2	1
Total			**15**	**0**	**14**	**22**
Total Contact Hours			**29**			

** Industrial Training 2 is of minimum two weeks has to be undergone by the student in the winter summer vacation of the III year.

Semester – VIII

Code	Category	Course	L	T	P	C
Practical						
GN 0402	P	Project Work	0	0	16	8
BT 0402	P	Biosafety, Bioethics, IPR & Patents#	2	0	0	2
E-3	P	Elective 3 #	3	0	0	3
Total			**5**	**0**	**16**	**13**
Total Contact Hours			**21**			

These courses may be permitted as self study under special circumstances with prior approval

Credit Hour Summary Table

Semester	I	II	III	IV	V	VI	VII	VIII	Total	%
Total	23	26	24	23	23	23	22	13	177	100
G	3	1	3	3	2	2	0	0	14	8
B	13	14	2	0	0	0	0	0	29	16
E	7	6	3	3	3	3	0	0	25	14
P	0	5	16	17	18	18	22	13	109	62

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 177

ELECTIVES

	VI SEMESTER ELECTIVES	L	T	P	C
GN 0352	Human Genetics	3	0	0	3
BT 0304	Protein Engineering	3	0	0	3
GN 0354	Industrial Microbiology	3	0	0	3
GN 0356	Industrial management	3	0	0	3
	VII SEMESTER ELECTIVES				
BT 0403	Bioreactor Design	3	0	0	3
GN 0451	Biomedical Engineering	3	0	0	3
GN 0453	Genes and Diseases	3	0	0	3
	VIII SEMESTER ELECTIVES				
GN 0452	Bioconfinement of Genetically Modified Organisms	3	0	0	3
GN 0454	Food Safety & Genetically Modified Food	3	0	0	3
GN 0456	Pharmacoinformatics	3	0	0	3
GN0458	Molecular Medicine	3	0	0	3

SYLLABUS

I SEMESTER

		L	T	P	C
MA 0111	**MATHEMATICS – I**	**3**	**2**	**0**	**4**
	Prerequisite				
	Nil				

PURPOSE :

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

At the end of the course, the students should have been exposed Fully with the knowledge of Matrices and its applications the trigonometry, the concepts of Differential Calculus and Integral Calculus and their simple applications.

MATRICES

*Review types of matrices, properties. Inverse matrix Cramer's rule for solving a system of linear equations. – Rank of Matrix – Consistency and Inconsistency of a system of m linear equations in 'n' unknowns –Cayley Hamilton theorem – Eigen values and eigen vectors of a real matrix.

TRIGONOMETRY

*****Review of complex numbers. De Moiver's theorem and its applications. Expansion of $\sin n\theta \cos n\theta$ in terms of $\sin\theta$ *and* $\cos\theta$. Expansion of $\tan n\theta$ in terms of $\tan\theta$. Expansion of $\sin^n\theta$ *and* $\cos^n\theta$ in terms of sines and cosines of multiples of θ. Hyperbolic functions and inverse hyperbolic functions.

DIFFERENTIAL CALCULUS

Differentiation and Derivatives of simple functions – Successive Differentiation – Various forms of Algebraic and Trigonometric functions – Problems.

INTEGRAL CALCULUS

Various types of integration –by – Reduction formula for $e^{ax}x^n, \sin^n, \cos^n x, \sin^n x\cos^m x$ (without proof)-Problems

APPLICATIONS OF DIFFERENTIAL CALCULUS & INTEGRAL CALCULUS

Applications of differential calculus & integral calculus. Tangent & Normal-Radius of curvature – Velocity and acceleration . Integral calculus - Length & Area.

***No questions should be asked in the Review part**

TEXT BOOK

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38th Edition.
2. Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi,2000.
3. Dr.V.Ramamurthy & Dr. Sundarammal Kesavan Engineering Mathematics – Vol I & II Anuradha Publications, Revised Edition 2006.

REFERENCE BOOKS:

1. Kreyszig.E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons. Singapore,2001.
2. Kandasamy P etal. Engineering Mathematics, Vol.I (4th revised edition), S.Chand &Co., New Delhi,2000.
3. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.

4. Venkataraman M.K., Engineering Mathematics – First Year (2nd edition), National Publishing Co., Chennai,2000.

		L	T	P	C
LE 0101	**ENGLISH**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE

To provide an adequate mastery of communicative English Language training primarily - reading and writing skills, secondarily listening and speaking skills.

INSTRUCTIONAL OBJECTIVES

To provide language training to the engineering students which will enable them to understand and acquire knowledge in technical subjects.

LISTENING

Listening Practice – Hints on Listening – Listening Practice
Note Taking: Note Taking Strategies

SPEAKING

Definitions: Expressing Opinions (agreement / disagreement)-Offering Suggestions – Technical Definitions – Describing Objects – speaking practice.
Phonetics: Pronunciation-Phonetic Transcription-Stress-Intonation

READING

Comprehension: Skimming-scanning-close reading-Comprehension – Transferring Information – Exercise – An unseen passage should be given and questions may be asked in the form of True or False statements, MCQ, short answers.
Transcoding : Interpreting tables, flow charts, pie chart, bar diagram, tree diagram, graphs.

WRITING

Art of Writing: Writing Language – Rules for effective writing – Technical Essay Writing – Exercise
Report Writing: Technical Writing – Lab Report – Exercise
Letter Writing : Formal Letters – Letter to the Editor – Letter Inviting Dignitaries – Letter of Application Curriculum Vitae – Placing an Order.
Dialogue Writing

FOCUS ON AND COMMUNICATION AND "COMPUNICATION"

Communication : Basic Concepts – Process – Kinds – Routes – Forms – Factors – Barriers – Triangles Communication (Communicate through Computers – Power Point & Tele Conference).

INTERNAL ASSESSMENT

Based on the submission of Assignments and test performance of the students marks will be awarded.

TEXT BOOKS

Abraham Benjamin Samuel *"Practical Communication Communicative English LSRW2000"* – SRMEC – June 2006 Revised Edition.

Staff of the Department of Humanities and Social Science, Anna University, *"English for Engineers / Technologist,"* Vol.-I. Orient Longman, 1990.

REFERENCE BOOKS

Herbert. A. J. *"The structure of Technical English",* Orient Longman 1995.

Pickett and Laster, *"Technical English, Writing, Reading and Speaking",* New York Harper and Row Publications, 1997.

"Interactive course in phonetics and spoken English" published by Acoustics Engineers (ACEN) 2002.

Munter, Mary, *"Business Communication Strategy and Skill",* Prentice Hall Inc, New Jersey, 1987.

		L	T	P	C
PH 0101	**PHYSICS**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to develop scientific temper and analytical capability through learning physical concepts and their applications in engineering and technology. Comprehension of some basic physical concepts will enable the students to logically solve engineering problems.

INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand the general scientific concepts required for technology,
2. Apply the concepts in solving engineering problems,
3. Explain scientifically the new developments in engineering and technology, and
4. Get familiarized with the concepts, theories, and models behind many technological applications.

PROPERTIES OF MATTER AND SOUND

Properties of Matter: Hooke's law – Twisting couple on a cylinder – Shafts – Torsion pendulum-Bending of beams - Bending moment – Uniform bending and non-uniform bending – I shape girder. **Sound:** Shock waves – Mach number (simple problems) – Ultrasonic production (magnetostriction and piezoelectric methods) and application – Acoustics of buildings – Sources and impacts of noise – Sound level meter – Control of noise pollution.

ELECTROMAGNETISM AND MICROWAVES

Electromagnetism: Divergence, curl and gradient – Maxwell's equations – Wave equation for electromagnetic waves – Propagation in free space – Poynting vector – Rectangular and circular wave guides. **Microwaves:** Properties and applications – Generation by magnetron and reflex klystron oscillator – Travelling wave tube – Biological effects.

OPTICS

Photometry: Principles and Lummer-Brodhun photometer. **Lasers:** Principles and characteristics – Types of lasers (CO_2, excimer, NdYAG, GaAs, free electron) – Holographic mass storage. **Optical Fiber:** Principles – Physical structure and types – Optical fiber communication. **Photoelasticity:** Theory and applications.

CRYSTAL PHYSICS AND CRYOGENICS

Crystal Physics: Crystal directions – Planes and Miller indices – Basic symmetry elements – Translational symmetry elements – Reciprocal lattice – Diamond and HCP crystal structure – Imperfections in crystals. **Cryogenics:** Methods of liquefaction of gases (cascade process, Linde's process, and adiabatic demagnetization process) – Measurement of cryogenic temperatures.

ENERGY PHYSICS

Introduction to non-conventional energy sources – Solar cells – Thermoelectric power generators – Thermionic power generator – Magneto hydrodynamic power generator – Fuel cells (H_2O_2) – Solid state batteries (Lithium) – Low voltage and high voltage nuclear cells – Thermocouple based nuclear cell – Ultra capacitors.

TEXT BOOKS

1. Arumugam, M., Engineering Physics, 2nd edition, Anuradha Publishers, Kumbakonam, 2003.
2. Gaur and Gupta, Engineering Physics, 7th edition, Dhandapani and Sons, New Delhi, 1997.
3. Thiruvadigal, J. D., Ponnusamy, S., Vasuhi, P. S. and Kumar, C., Physics for Technologists, 5th edition, Vibrant Publication, Chennai, 2007.

REFERENCE BOOKS

1. Vasudeva, A. S., Modern Engineering Physics, Revised edition, S. Chand and Company Ltd., New Delhi, 2004.
2. Vasudevan, D. N., Fundamentals of Magnetism and Electricity, 11th edition, S. Chand and Company Ltd., New Delhi, 1983.

3. Nair, K. P. R., Atoms, Molecules and Lasers, Narosa Publishing House, New Delhi, 2006.
4. Pillai, S. O., Solid State Physics,5th edition, New Age International (P) Ltd., New Delhi, 2004.
5. Khan, B. H., Non-Conventional Energy Resources, Mechanical Engineering Series, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.

		L	T	P	C
CY 0101	**CHEMISTRY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

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

INSTRUCTIONAL OBJECTIVES

The students should be conversant with

1. The role of applied chemistry the field of engineering.
2. The knowledge of water quality parameters and the treatment of water.
3. The principles involves in corrosion and its inhibitions.
4. Important analytical techniques, instrumentation and the applications.
5. Knowledge with respect to the phase equlibria of different systems.

TECHNOLOGY OF WATER

Water quality parameters: Physical, Chemical & Biological - Hardness of water – estimation of hardness (EDTA method & O. Hehner"s method), Alkalinity – determination – disadvantages of using hard water in boilers: Scale, sludge formation – disadvantages – prevention – treatment: Internal conditioning – phosphate, calgon and carbonate conditioning methods – External: Zeolite, ion exchange methods - desalination – reverse osmosis and electrodialysis - domestic water treatment.

CORROSION AND ITS CONTROL

Corrosion: Basic concepts – principles, mechanism of chemical, electrochemical corrosion – Pilling Bedworth rule – galvanic corrosion – differential aeration corrosion - pitting corrosion - stress corrosion - factors influencing corrosion.

Corrosion control: cathodic protection – sacrificial anodic method – corrosion inhibitor. Protective coatings: surface preparation for metallic coatings - electro plating and electroless Plating - chemical conversion coatings – anodizing, phosphating & chromate coating.

PHASE EQUILIBRIA

Phase rule: Statement – explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis – two component systems: simple eutectic, Pb-Ag; Br, Cd - solid solution Cu-Ni and compound formation Mg-Zn - applications of eutectics.

POLYMERS AND REINFORCED PLASTICS

Classification of polymers – types of polymerization reactions – mechanism of addition polymerization: free radical, ionic and ziegler – Natta - effect of structure on the properties of polymers – strength, plastic deformation, plastics elasticity and physical nature –Preparation and properties of important resins:- Polyethylene, PVC, PMMA, Polyester, Teflon Bakelite, Epoxy resins, compounding of plastics, moulding methods - injection, extrusion, compression and calendaring - reinforced plastics – FRP – Carbon, Graphite, Glass– applications.

INSTRUMENTAL METHODS OF ANALYSIS

Basic principles, instrumentation of potentiometry, flame photometry – applications. Elementary theory – principle – instrumentation of UV – visible spectroscopy and atomic absorption spectroscopy and infrared spectroscopy.

TEXT BOOKS

1. Jain.P.C and Monika Jain, "Engineering Chemistry", Danpat Raj publishing company (P) Ltd, New Delhi – 2002.
2. Dara.S.S, Text book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi 2003.

3. Willard H.A., Merit L.L and Dean J.A., "Instrumental methods of analysis" 6th Edition Van Nostrand, 1986.

REFERENCE BOOKS

1. Kuriacose J.C. and Rajaram J. Chemistry in Engineering and Technology, Volume II, Tata McGraw Hill p.b. Co., 1988.
2. Jeyalakshmi.R & Ramar. P, Engineering Chemistry, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari. M, Applied Chemistry, 2nd Edition, Sudhandhira Publications, 2003.
4. Arivalagan. K, Engineering Chemistry, 1st Edition, Mass publications, 2007.
5. P.Kamatchi, Applied Chemistry-I, Ponnuswamy publications, Chennai.
6. Dr. Helen P Kavitha Engineering Chemistry - I ILA Publications, 2002

		L	T	P	C
GE 0101	**BASIC ENGINEERING - I**	**4**	**0**	**0**	**4**
	Prerequisite				
	Nil				

PART A CIVIL ENGINEERING

PURPOSE

To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.

INSTRUCTIONAL OBJECTIVES

1. To know about different materials and their properties.
2. Engineering aspects related to buildings.
3. To know about importance of Surveying.
4. To know about the transportation systems.
5. To get exposed to the rudiments of engineering related to Dams, Water Supply, Transportation system and Sewage Disposal.

BUILDING MATERIALS AND THEIR PROPERTIES

Introduction - Civil Engineering – Building Materials – Brick, Stone, Cement, Steel, Concrete, timber – Properties – Uses. Units – Stress, strain and three modulii of elasticity – factor of safety - Centre of Gravity and Moment of Inertia for rectangle and circular section – simple problems.

BUILDINGS AND THEIR COMPONENTS

Buildings – Classification - Components of buildings and their functions Foundations - functions – classification of foundations – Bearing capacity Floorings – functions - Types - Cement Concrete flooring – Mosaic flooring - Marble flooring Roofs - Types – Requirements – Madras Terrace roof. Tall structure – types of structural systems.

UTILITY AND SERVICES

Surveying - Objective – Principles – Classification – Instruments used for Surveying. Dams - Purpose – Selection of site – Classification – Gravity dam (cross-section details only) Transportation system - Classification – Roadway - components – classification of roads - Railway – Cross-section of permanent way-components parts and functions. Docks and Harbour – classification – Terminology Bridges –components of a bridge - types of bridges.Water supply - Sources - Standards of drinking water (BIS) – elementary treatment methods – RO System Sewage disposal – Septic tank – function and components.

TEXT BOOKS

1. Raju K.V.B., Ravichandran P.T., Basics of Civil Engineering, Ayyappa Publications, Chennai, 2000.
2. Ramesh Babu, Civil Engineering , VRB Publishers, Chennai, 2000.

REFERENCE BOOKS

1. Rangwala,S.C., Engineering Materials, Charotar Publishing House, Anand, 1980.
2. National Building Code of India, Part V, Building Materials, 2005
3. Surendra Singh, Building Materials, Vikas Publishing Company, New Delhi, 1996

PART B MECHANICAL ENGINEERING

PURPOSE
To familiarize the students with the basics of Mechanical Engineering.

INSTRUCTIONAL OBJECTIVES
To familiarize with
1. The basic machine elements
2. The Sources of Energy and Power Generation
3. The various manufacturing processes

MACHINE ELEMENTS
Springs: Helical and leaf springs – Springs in series and parallel. **Cams:** Types of cams and followers – Cam profile. **Power Transmission:** Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. **Simple Problems.**

ENERGY
Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines - Hydro and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). **Simple Problems.**

MANUFACTURING PROCESSES
Sheet Metal Work: Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed (applications, advantages / disadvantages (gas and arc welding only)) – Gas cutting – Brazing and soldering. **Lathe Practice:** Types - Description of main components – Cutting tools – Work holding devices – Basic operations. **Simple Problems**. **Drilling Practice:** Introduction – Types – Description – Tools. S**imple Problems**.

TEXT BOOKS

1. Kumar, T., Leenus Jesu Martin., and Murali, G., Basic Mechanical Engineering, Suma Publications, Chennai, 2007.
2. Prabhu, T. J., Jai Ganesh, V., Jebaraj, S., Basic Mechanical Engineering, Scitech Publications, Chennai, 2000.

REFERENCE BOOKS

1. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Manufacturing Technology Vols. I & II, Media Publishers, 1986.
2. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2006.
3. Palanichamy, M.S., Basic Civil & Mechanical Engineering, Tata McGraw-Hill , New Delhi 1991.
4. Nagpal G. R., Power Plant Engineering, Khanna Publisher, Delhi,2004

		L	T	P	C
PH 0103	**PHYSICS LABORATORY**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE
The purpose of this course is to develop scientific temper and analytical capability among the engineering students.

INSTRUCTIONAL OBJECTIVES
At the end of the course, the student will be able to:
1. Understand scientific concepts in measurement of different physical variables
2. Develop the skill in arranging and handling different measuring instruments and
3. Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

LIST OF EXPERIMENTS
1. Determination of Young's Modulus of the material – Uniform bending

2. Determination of Rigidity Modulus of the material – Torsion Pendulum
3. Determination of velocity of Ultrasonic waves in liquids
4. Determination of dispersive power of a prism using spectrometer
5. Determination of laser parameter – Divergence and wavelength for a given laser source – laser grating
6. Particle size determination using laser
7. Study of attenuation and propagation characteristics of optical fiber cable
8. Calibration of voltmeter using potentiometer.
9. Calibration of ammeter using potentiometer.
10. Construction and study of regulation properties of a given power supply using IC

REFERENCE BOOKS

1. Chattopadhyay, D., Rakshit, P. C. and Saha, B., An Advanced Course in Practical Physics, 2nd edition, Books & Allied Ltd., Calcutta, 1990.
2. Chauhan and Singh, Advanced Practical Physics, Revised edition, Pragati Prakashan, Meerut, 1985.
3. Thiruvadigal. J. D., Ponnusamy. S., Vasuhi. P. S. and Kumar. C, Hand Book of Practical Physics, 5th edition, Vibrant Publication, Chennai, 2007.

		L	T	P	C
CY 0103	**CHEMISTRY LABORATORY**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

An integrated laboratory course consists of experiments from applied chemistry and is designed to illustrate the underlying principles of measurement techniques, synthesis, dynamics and chemical transformation.

INSTRUCTIONAL OBJECTIVES

Students should be able to understand the basic concept and its applications.

LIST OF EXPERIMENTS

1. Preparation of standard solutions.
2. Estimation of total hardness, permanent and temporary hardness by EDTA method.
3. Conductometric titration – determination of strength of an acid.
4. Estimation of iron by potentiometer – titration.
5. Determination of molecular weight of polymer by viscosity average – method.
6. Determination of dissolved oxygen in a water sample by Winkler"s method
7. Determination of Na / K in water sample by Flame photometry.
8. Estimation of Copper in ore.
9. Estimation of nickel in steel.
10. Determination of total alkalinity and acidity of a water sample.

REFERENCE

1. Chemistry department manual, Edition, 2003.

		L	T	P	C
GE0105	**COMPUTER LITERACY**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

This Lab Course will enable the students to understand the basics of computer and to know the basics of MS-Office.

INSTRUCTIONAL OBJECTIVES

- To learn the basics of computer.
- To work on Ms-Word, Ms-Excel, Ms-Power Point and Ms-Access

EXPERIMENTS TO IMPLEMENT

1. Study experiment on evolution of computer programming languages.
2. Suggest some of the Network Topologies that can be incorporated in your campus. Justify your choice.
3. Experiments to demonstrate directory creation and file creation.
4. Create a document with all formatting effects.
5. Create a document with tables.
6. Create labels in MS word.
7. Create a document to send mails using mail merge option.
8. Create an Excel File to analyze the student's performance. Create a chart for the above data to depict it diagrammatically.
9. Create Excel sheet to use built-in-function.
10. Create Excel sheet to maintain employee information and use this data to send mails using mail merge.
11. Create a Power Point presentation for your personal profile with varying animation effects with timer.
12. Consider student information system which stores student personal data, mark information and non academic details.
    * Use MS Access to create Tables and execute SQL queries to do this following
    * Display all student records.
    * Display student details with respect to his identity.
    * Delete some records from the table.
    * Find total marks obtained by student in each list.

TEXT BOOK

1. Introduction to Information Technology" ITL Education Solutions Ltd., Pearson 2nd Edition, 2006.

		L	T	P	C
AR0130	**ENGINEERING DRAWING**	**1**	**0**	**4**	**3**
	Prerequisite				
	Nil				

PURPOSE

1. To draw and interpret various projections of 1D, 2D and 3D objects.

INSTRUCTIONAL OBJECTIVES

To familiarize with

1. The construction of geometrical figures
2. The projection of 1D, 2D & 3D elements

FUNDAMENTALS OF ENGINEERING GRAPHICS

Lettering, two dimensional geometrical construction, conics, representation of three -dimensional objects – principles of projections – standard codes – projection of points.

PROJECTION OF LINES

Projection of straight lines

PROJECTION OF SOLIDS

Sections of solids and development of surfaces.

PICTORIAL PROJECTIONS-I

Orthographic projection, isometric projection of regular solids & combination of solids.

PICTORIAL PROJECTIONS-II

Conversion of orthographic to isometric. Introduction to perspective projection.

TEXT BOOKS

1. Ramachandran,S. "*Engineering Drawing*", Private Publication, Chennai, 2002.
2. Natarajan.C. R.. "*Engineering Drawing & Graphics*", Private Publication, Chennai, 1990.
3. Narayanan K.L & Kannaiah P., "*Engineering Graphics*", Scitech Publications, Chennai, 1999.

REFERENCE BOOKS

1. Bhatt N.D., "*Elementary Engineering Drawing (First Angle Projection*)",Charotar Publishing Co., Anand, 1999.
2. Venugopal.K. "*Engineering Drawing & Graphics*", New Age international Pvt. Ltd., 1999.

		L	T	P	C
GE0107	**NSS/NCC/NSO/YOGA**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

I. YOGA SYLLABUS

	PRACTICE	LECTURE
I	Meditation – Agnai, Asanas, Kiriyas, Bandas, Muthras	Benefits of Agnai Meditation
II	Meditation Santhi Physical Exercises (I & II)	Benefits of santhi Meditation
III	Kayakalpa Yoga Asanas, Kiriyas, Bandas, Muthras	Lecture & Practice
IV	Meditation Santhi Physical Exercises III & IV	Analysis of Thought
V	Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras	Benefits of Thuriyam
VI	Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras	Attitude
VII	Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras	Importance of Arutkappy & Blessings
VIII	Meditation Santhi Kayakalpa Asanas, Kiriyas, Bandas, Muthras	Benefits of Blessings
		Hours = 30

TEXT BOOKS:

1. Vedatri Maharshi , *"Yoga for Modern Age"*
2. Vedatri Maharshi, *" Simplified Physical Exercises"*

NATIONAL SPORTS ORGANISATION (NSO)

Each student must select two of the following games and practice for two hours per week. An attendance of 80% is compulsory to earn the credits specified in the curriculum.

List of games:

Basket Ball
Football
Volley Ball
Ball Badminton
Cricket
Throw ball

NATIONAL CADET CORPS (NCC)

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of an academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum.

IV. NATIONAL SERVICE SCHEME (NSS)

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

		L	T	P	C
PD 0101	**PERSONALITY DEVELOPMENT - I**	**0**	**0**	**2**	**0**
	Prerequisite				
	Nil				

PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation
5. Empirical Learning

Self-analysis SWOT - Time management - Creative chain story telling

Vocabulary games I – Attitude - Interpersonal skills

Motivation I - Vocabulary games II - Article review

Team building exercise - Critical Thinking - Event Management

Business situation - Leadership Qualities - Review

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete Internal evaluation on a regular Basis

SEMESTER II

		L	T	P	C
MA 0142	**MATHEMATICS – LS-II**	**3**	**2**	**0**	**4**
	Prerequisite				
	MA0111				

PURPOSE :
To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES:

At the end of the Course the students

1. Should have understood maxima and minima of two and three variables
2. Should have been fully exposed to Differential equations and Multiple integrals
3. Should have been able to apply Vector Calculus and three dimensional coordinate Geometry to their branches of Engg.

FUNCTIONS OF SEVERAL VARIABLES

Functions of two variables – partial derivatives – total differentiation – Taylor's expansion – maxima and minima of functions of two and three variables – Jacobians.

DIFFERENTIAL EQUATIONS

Differential equations of first order and higher degree – higher order differential equations with constant coefficients – variable coefficients – method of variation of parameters.

MULTIPLE INTEGRALS

Double integration in Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates.

VECTOR CALCULUS

*Review of Vector Algebra.

Gradient, divergence and curl – solenoidal, and irrotational fields – directional derivatives – line integrals – surface integrals – volume integrals, Integral theorem (without proof) and its applications- cubes and parallelopipeds

THREE DIMENSIONAL ANALYTICAL GEOMETRY

Direction cosines and direction ratios of a line – angle between two lines. Equation of a plane – equation of straight line – shortest distance between two skew lines – coplanar lines.

***No questions should be asked in the Review part**

TEXT BOOK

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38th Edition.
2. Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi,2000.
3. Dr.V.Ramamurthy & Dr. Sundarammal Kesavan, Engineering Mathematics – Vol I & II Anuradha Publications, Revised Edition 2006.

REFERENCE BOOKS:

1. Kreyszig.E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons. Singapore,2001.
2. Kandasamy P etal. Engineering Mathematics, Vol.I & II (4th revised edition), S.Chand &Co., New Delhi,2000.
3. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I & II (2nd edition), S.Viswanathan Printers and Publishers, 1992.
4. Venkataraman M.K., Engineering Mathematics – Vol. III (13th edition), National Publishing Co., Chennai,1998.

		L	T	P	C
PH0102	**MATERIAL SCIENCE**	**2**	**0**	**2**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to develop comprehension of the rapidly changing technological scenario and the requisite expertise for appropriate selection of materials for specific engineering applications.

INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand electrical properties of materials,
2. Understand the properties and applications of semi conducting materials,
3. Understand general properties and applications of magnetic and dielectric materials,

4. Understand the behaviour of materials on exposure to light,
5. Understand general properties and application of modern engineering and bio materials, and
6. Get familiarized with the concepts of Nano Science and Technology.

ELECTRONIC AND PHOTONIC MATERIALS

Electronic materials: Importance of Classical and Quantum free electron theory of metals – Fermi energy and Fermi Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications – High temperature Superconductivity. **Photonic materials:** LED and LCD materials – Photo conducting materials – Nonlinear optical materials (elementary ideas) and their applications.

MAGNETIC, DIELECTRIC AND MODERN ENGINEERING MATERIALS

Magnetic materials: Ferrites and garnets – Magnetic bubbles and their applications – Giant Magneto Resistance (GMR) – Colossal Magneto Resistance (CMR). **Dielectric materials:** Various polarization mechanisms in dielectrics (elementary ideas) and their frequency and temperature dependence – Dielectric loss – Piezo electric and ferro electric materials and their applications. **Modern engineering materials:** Shape memory alloys – Metallic glasses – Advanced ceramics and composites.

BIO MATERIALS

Classification of biomaterials – Comparison of properties of some common biomaterials – Effects of physiological fluid on the properties of biomaterials – Biological responses (extra and intra vascular system) – Metallic, Ceramic and Polymeric implant materials – Introduction to bio sensors and tissue engineering.

NANO MATERIALS AND NANOTECHNOLOGY

Basic concepts of Nano science and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nano materials – Carbon Nanotubes and applications – Material processing by Sol – Gel method, Chemical Vapour deposition and Physical Vapour deposition – Microwave Synthesis of materials – Principles of SEM, TEM and AFM .

MECHANICAL PROPERTIES OF MATERIALS

Stress Strain diagram for different engineering materials – Engineering and true stress strain diagram – Ductile and brittle material – Tensile strength – Hardness – Impact strength – Fatigue – Creep – Fracture (Types and Ductile to brittle transition) – Factors affecting mechanical properties.

PRACTICALS

1. Band gap determination using Post office box.
2. Dielectric constant measurement.
3. Photoconductivity measurement.
4. Resistivity determination for a semiconductor wafer using Four probe method.
5. Determination of Hall coefficient and carrier type for a semiconductor material.
6. To trace the hysteresis loop for a magnetic material.
7. Magnetic susceptibility – Quincke's method.
8. Determination of thermal conductivity – Lee's Disc method
9. Visit to Nano Technology Laboratory (optional)

TEXT BOOKS

1. S.O. Kasap, *Principles of Electronic Materials and Devices*, Tata McGraw Hill Edition, New Delhi, 2002.
2. Van Vlack, L.H., *Material Science for Engineers*, 6th edition, .Addision Wesley, 1985.
3. Thiruvadigal, J. D., Ponnusamy, S. and Vasuhi.P. S., *Materials Science*, 5th edition, Vibrant Publications, Chennai, 2007.

REFERENCE BOOKS

1. Rolf E. Hummel, *Electronic Properties of materials*, Narosa Publishing House, New Delhi, 1994.
2. Raghavan.V., *Materials Science & Engineering – A First Course*, 5th edition, Prentice Hall of India, New Delhi,2005.
3. Khanna. O. P., *A Text Book of Material Science & Metallurgy*, Revised edition, Dhanpat Rai Publications, New Delhi,2006.
4. Sujata V. Bhat, *Biomaterials*, 2nd edition, Narosa Publishing House, New Delhi, 2006.

5. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, *Nano Technology – Basic Science and Emerging Technologies*, 1st edition, Overseas Press,New Delhi,2005.

		L	T	P	C
GE 0104	**PRINCIPLES OF ENVIRONMENTAL SCIENCE**	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

The course provides the comprehensive knowledge in environmental science, environmental issues and the management.

INSTRUCTIONAL OBJECTIVES

1. The importance of environmental education, ecosystem and ethics.
2. Knowledge with respect to biodiversity and its conservation.
3. To create awareness on the various environmental pollution aspects and issues.
4. To educate the ways and means to protect the environment.
5. Important environmental issues and protection

ENIVRONMENT AND ECOSYSTEMS

Environmental education: definition - scope - objectives and importance. Concept of an ecosystem – types (terrestrial and aquatic ecosystems) – structure and function – ecological succession - food chains, food webs and ecological pyramids

BIODIVERSITY

Introduction: definition - genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife - endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

POLLUTION AND WASTE MANAGEMENT

Air and water pollution – classification of pollutants and their effects – control measures of air pollution. Waste water treatment (general) – primary, secondary & tertiary stages. Solid waste management: causes - effects of municipal waste, hazardous waste, bio medical waste - process of waste management.

CURRENT ENVIRONMENTAL ISSUES

Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and green house effect. Sustainable development: definition, objectives and environmental dimensions of sustainable development- environmental audit for sustainable development.

ENVIRONMENTAL PROTECTION

National and international concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

TEXT BOOKS

1. Sharma.B.K. and Kaur, "Environmental Chemistry"" Goel Publishing House, Meerut, 1994.
2. De.A.K., "Environmental Chemistry", New Age International (p) lt., , New Delhi, 1996.
3. Kurian Joseph & R. Nagendran, "Essential of Environmental Studies"" Pearson Education, 2004.

REFERENCE BOOKS

1. Dara S.S., A Text Book of Environmental Chemistry and pollution control, S.Chand & Company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari.M, Environmental Science – Challenges and Changes, 1st Edition, Sudhandhira Publications, 2007.
4. Arivalagan.K, Ramar.P & Kamatchi.P, Principles of Environmental Science, 1st Edition, Suji Publications, 2007.

		L	T	P	C
BT0102	**BIOCHEMISTRY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Deals with the study of structural and functional aspects of biomolecules.

INSTRUCTIONAL OBJECTIVES

1. To study the structure and properties of carbohydrates.
2. Discuss the structure, properties and reactions of proteins and amino acids
3. Discuss the structure, properties of fats and lipids
4. To study the composition, structure and functions of nucleic acids

CARBOHYDRATES, LIPIDS AND PROTEINS

Monosaccharides, complex carbohydrates, glycoproteins, lectins, Lipids and cell membranes – types of membrane lipids, phospholipids and glycolipids from bimolecular sheets, Protein structure and function – Primary, Secondary, Tertiary, Quarternary Structures.

METABOLISM OF CARBOHYDRATES

Glycolysis, Glucogenesis, Citric acid cycle and Glycogen metabolism.

PROTEIN METABOLISM

Protein turnover and Aminoacid catabolism, Biosynthesis of aminoacids.

FATTY ACID METABOLISM AND NUCLEIC ACID METABOLISM

Overview of Fatty Acid Metabolism, synthesis and degradation of fatty acids, Denovo synthesis of Nucleotides.

OXIDATIVE PHOSPHORYLATION

Oxidative Phosphorylation – regulation – light reactions of Photosynthesis

TEXT BOOK:

Biochemistry by Jeremy M.Berg, John L.Tymozko, Lubert Styer, Fifth edition, W.H.Freeman and Company, 1514 pages.

		L	T	P	C
GE 0106	**BASIC ENGINEERING – II**	**4**	**0**	**0**	**4**
	Prerequisite				
	Nil				

PURPOSE

This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments. It also provides fundamentals of electronic devices, transducers and integrated circuits.

INSTRUCTIONAL OBJECTIVES

1. At the end of the course students will be able
2. To understand the basic concepts of magnetic, AC & DC circuits.
3. To explain the working principle, construction, applications of DC & AC machines & measuring instruments.
4. To gain knowledge about the fundamentals of electric components, devices, transducers & integrated circuits.

PART A ELECTRICAL ENGINEERING

ELECTRICAL MACHINES

Definition of mmf, flux and reluctance, leakage flux, fringing, magnetic materials and B-H relationship. Problems involving simple magnetic circuits.Faraday's laws, induced emfs and inductances, brief idea on Hysteresis and eddy currents. Working principle, construction and applications of DC machines and AC machines (1-phase transformers, 3-phase induction motors, single phase induction motors – split phase, capacitor start and capacitor start & run motors).

AC & DC CIRCUITS

Circuit parameters, Ohms law, Kirchhoff's law. Average and RMS values, concept of phasor representation. RLC series circuits and series resonance, RLC parallel circuits (includes simple problems in DC & AC circuits) Introduction to three phase systems – types of connections, relationship between line and phase values. (qualitative treatment only)

WIRING & LIGHTING

Types of wiring, wiring accessories, staircase & corridor wiring, Working and characteristics of incandescent, fluorescent, SV & MV lamps. Basic principles of earthing, simple layout of generation, transmission & distribution of power.

TEXT BOOKS

1. Kothari D P and Nagrath I J , Basic Electrical Engineering , Tata McGraw Hill,1991
2. Mehta V K ,Principles of Electronics S Chand & Co,1980

REFERENCE BOOKS

1. Kothari D P and Nagrath I J ,Basic Electrical Engineering , Tata McGraw Hill,1991
2. Mithal G K , Electronic Devices and Circuits, Khanna Publications,1997

PART B ELECTRONICS ENGINEERING

ELECTRONIC COMPONENTS AND DEVICES

Passive components – Resistors, Inductors and Capacitors and their types.

Semiconductor: Energy band diagram, Intrinsic and Extrinsic semiconductors, PN junction diodes and Zener diodes – characteristics.

Transistors: PNP and NPN transistors – theory of operation – Transistor configurations – characteristics – comparison.

Special semiconductor devices : FET – SCR – LED – V I characteristics – applications.

Rectifiers: Half wave and full wave rectifier – capacitive filter – wave forms – ripple factor – regulation characteristics.

TRANSDUCERS AND MEASURING INSTRUMENTS

Transducers: General features and classification of transducers, Resistive Transducers – Potentiometer, Unbonded strain gauge-Bonded strain gauge-Load cell, Inductive transducers – Differential output transducers – LVDT, Flow transducers, Temperature Transducers – Thermistors, Thermocouple and pyrometers.

Measuring Instruments: Basic principles and classification of instruments, Moving coil and moving iron instruments, CRO – Principle of operation.

DIGITAL ELECTRONICS & LINEAR ICs

Digital Fundamentals: Number systems – Boolean Theorems – DeMorgan's Theorem - Logic gates – Implementation of Boolean Expression using Gates.

Integrated Circuits: IC fabrication – Monolithic Technique, Function of Operational Amplifier.

TEXT BOOKS

1. Muthusubramanian.R, Salivahanan.S, Muraleedharan.K.A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw - Hill ,1999.
2. Metha V.K, "Principles of Electronics ",S. Chand & Co.,1980.
3. Kalsi H S, Electronics Instrumentation", ISTE publication,1995

REFERENCE BOOKS

1. Kothari D. P and Nagrath IJ, "Basic Electrical Engineering", Tata McGraw- Hill, 1991.
2. Thomas L.Floyd "Electronic devices", Addison Wesley Longman (Singapore) Pvt . Ltd., 5th Edition.

		L	T	P	C
BT0104	**CELL BIOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The course is aimed to make the student understand the basic concept of cell structure, membrane, cellular functions of different types of cell, modes of cellular signaling and signal amplification

INSTRUCTIONAL OBJECTIVES

1. To study cell structure and functions of organelle functions
2. Exposure on transportations through cell membrane
3. To focus on different receptors and model of signaling
4. To introduce the concept of cell signaling

AN OVERVIEW OF CELLS AND CELL RESEARCH

Origin and evolution of cells, cells as experimental models, tools of cell biology – chemistry of cells – molecular composition of cells, central role of enzymes, metabolic energy, biosynthesis of cell constituents, cell membrane.

CELL STRUCTURE AND FUNCTION – I

Nucleus, Endoplasmic reticulum, Golgi apparatus and Lysosomes, Bioenergetics and Metabolism – Mitochondria, chloroplasts, Peroxisomes.

CELL STRUCTURE AND FUNCTION – II

The cytoskeleton and cell movement, cell surface – transport of small molecules, Endocytosis, cell –cell interactions-Adhesion junctions-Tight junctions-Gap junctions- Plasmodesmata

CELL SIGNALING – CELL REGULATION

Signaling molecules and their receptors, functions, pathways of intracellular signal transduction – the Cell Cycle –Mitosis and Meiosis –Cell death and cell renewal-Programmed cell death-Stem cells- Embryonic stem cells and therapeutic cloning.

CANCER

The Development and causes of cancer, tumour viruses, oncogenes, prevention and treatment.

TEXT BOOK :

The Cell: A molecular approach by Geoffrey M.Cooper.ASM Press, Pages:673

		L	T	P	C
GE 0108	**VALUE EDUCATION**	**1**	**0**	**0**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

INSTRUCTIONAL OBJECTIVES

- To help individuals think about and reflect on different values.
- To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large.
- To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening

Value Education—Introduction – Definition of values – Why values? – Need for Inculcation

of values – Object of Value Education – Sources of Values – Types

Values:

Personal values
Social values
Professional values
Moral and spiritual values
Behavioral (common) values

Personal values – Definition of person – Self confidence – Self discipline – Self Assessment – Self restraint – Self motivation – Determination – Ambition – Contentment – Humility and Simplicity - Sympathy and Compassion – Gratitude -Forgiveness – Honesty – Courtesy.

Social values – Definition of Society – Units of Society - Individual, family, different groups – Community – Social consciousness – Equality and Brotherhood – Dialogue – Tolerance – Sharing – Responsibility – Co-operation Freedom – Repentance and Magnanimity.

Professional values – Definition – Competence – Confidence – Devotion to duty –Efficiency – Accountability – Respect for learning /learned – Willingness to learn-Open and balanced mind – Team spirit – Professional Ethic – Willingness for Discussion – Aims – Effort – Avoidance of Procrastination and slothfulness –Alertness.

Behavioral values – Individual values and group values – Good manners at home and outside – Equality – Purity of thought, speech and action – Understanding the role of religion – Faith – Understanding the commonness of religions – respect for other faiths – unity in diversity – Living together – Tolerance – Non-violence – Truthfulness – Common aim – Unified effort towards peace – Patriotism.

REFERENCE BOOKS

1. Dr. S. Ignacimuthu S. J., *"Values for life"*, Better yourself Books, Bandra Mumbai-600 050 (1999).
2. *"Values(Collection of Essays)"*., Published by : Sri Ramakrishna Math., Chennai—4.,(1996)
3. Prof. R.P.Dhokalia., "*Eternal Human Values*", NCRT –Campus Sri Aurobindo Marg., New Delhi - 110 011.
4. Swami Vivekananda., "*Education*", Sri Ramakrishna Math., Chennai-4(1957)
5. "*Tirukural*" (English Translation by Dr.G.U.Pope).
6. "*The Bible*"
7. "*The Kuran*"
8. "*The Bagavath Geetha*"

		L	T	P	C
ME0120	**WORKSHOP PRACTICE**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

INSTRUCTIONAL OBJECTIVES

To familiarize with

1. The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. The production of simple models in the above trades.

LIST OF EXPERIMENTS

EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.

FITTING

Tools & Equipments – Practice in Filing and Drilling.

Making Vee Joints, Square, dovetail joints, Key making.

CARPENTRY
Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

SHEET METAL
Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

WELDING
Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

SMITHY
Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOKS
1. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice – Theory, practice and work book", Suma Publications, 2005.

REFERENCE BOOKS
1. Kannaiah,P. & Narayanan,K.C. Manual on Workshop Practice, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. First year Engineering Workshop Practice, Ramalinga Publications, Madurai, 1999.

		L	T	P	C
CS0140	**COMPUTER PRACTICE**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE :
To introduce programming languages C and C++ as tools to solve problems and to provide hands on training.

INSTRUCTIONAL OBJECTIVES:
After completing the course, the students should be able to
- Understand the program development life cycle
- Design algorithms to solve simple problems using computers
- Convert algorithms into C and C++ programs and execute

PROGRAMMING FUNDAMENTALS
Computer Basics; Program Development Life Cycle: Flow Chart, Algorithm, Compilation and Execution; Introduction to C Language: program structure, variables, keywords, data types; Input / Output functions: scanf, printf; simple programs.

DECISION AND LOOP CONTROL STRUCTURE

Logical operators; Decision statements : if/else, switch/case statements; Loop control statements – for, while, do/while.

ARRAYS AND FUNCTIONS

Arrays:
Introduction to arrays; one dimensional arrays: declaration , reading and printing array elememts, sorting and searching.
Functions:
Definition; declaration of functions; return statement; recursion.

INTRODUCTION TO OOP CONCEPTS
OOP concepts: data hiding, encapsulation, inheritance, overloading, polymorphism; classes and objects; constructor and destructor; simple program in C++.

INHERITANCE AND OVERLOADING
Inheritance – single, multiple, multilevel; Overloading – Function overloading, Operator overloading.

List of Exercises:
Note to the Instructors: Design exercise problems to demonstrate the use of C and C++ in the area of specialization.

1. programs to demonstrate the use of scanf( ) and printf( ) functions
2. programs to evaluate arithmetic expressions
3. programs using conditional statements
4. programs using for,while , do…while
5. programs on arrays
6. programs to perform matrix addition and multiplication
7. programs to implement functions
8. programs to illustrate recursion
9. Program to create classes and objects using C++
10. Program to implement Constructor and Destructor in C++
11. Program to implement single inheritance in C++
12. Program to implement Function overloading in C++
13. Program to implement Operator overloading in C++

REFERENCE BOOKS

1. Computer Practice Laboratory Manual, SRM University
2. Kanetkar P.Yashwant,"Let us C", BPB publications, 2002.
3. Ashok N.Kamthane, "Programming with ANSI and Turbo C", Pearson Education, 2006.
4. Herbert Schildt, "The Complete Reference C++", TataMcGrawHill, 2001, 3rd Edition.
5. Robert Lafore, "Object Oriented Programming in Microsoft C++", The Waite Group, Galgotia Publications Pvt. Ltd., 2002.

		L	T	P	C
BT0209	**BIOCHEMISTRY LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE
Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.

INSTRUCTIONAL OBJECTIVES
The students should be able to understand and develop their skills in
1. Accuracy and Precession of analysis
2. Qualitative testing of Carbohydrates
3. Identification of amino acids and proteins
4. Quantitative analysis of nucleic acids and enzymes.

LIST OF EXPERIMENTS
1. pH measurements and preparation of buffers.
2. Qualitative tests for Carbohydrates.
3. Estimation of sugars.
4. Estimation of proteins by Lowry's method / Biuret method.
5. Estimation of cholesterol by Zak's method.
6. Determination of saponification number of lipids.
7. Estimation of Amino acids.
8. Separation of amino acids - Thin layer chromatography.
9. Separation of sugars - Paper chromatography
10. Biochemical estimation of DNA /RNA using Spectrophotometer

REFERENCE BOOKS:
Laboratory Manual

		L	T	P	C
PD 0102	**PERSONALITY DEVELOPMENT - II**	**0**	**0**	**2**	**0**
	Prerequisite				
	Nil				

PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Puzzles I - Poster design/Caption/Slogan writing (Social issues) - Bone of contention I – debate

Bone of contention II - Puzzle II - Survey and Reporting (favorite channel, music, food)

Interpretation of Visuals of I & II - Vocabulary games III

Book Review - Quiz I - Presentation Skills I

Presentation Skills II - Analytical Thinking - Review

EVALUATION
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete Internal evaluation on a regular Basis

III SEMESTER

		L	T	P	C
BT0201	**ENZYME TECHNOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Provides an opportunity to understand the theoretical concepts of enzyme technology principles in a more explicit and concentrated manner

INSTRUCTIONAL OBJECTIVES

1. To understand the different types of enzymes
2. Enzyme purification,
3. mechanisms of action of enzymes
4. Techniques of enzyme immobilization

INTRODUCTION TO ENZYMES

Classification of enzymes, specificity of enzyme action – monomeric and oligomeric enzymes,-Factors modifying enzyme activity, biotechnological applications of enzymes and applications of enzymes in various industries.

CHEMICAL NATURE OF ENZYME CATALYSTS

Structural Components of Enzymes – Structure, apoenzymes, prosthetic group, cofactors, Mechanisms of reactions catalysed by enzymes – Metal activated enzymes – metalloenzymes –involvement of co enzymes.

FREE AND IMMOBILISED ENZYME KINETICS

Classification of enzymes, Kinetics of single substrate reactions, turnover number, Enzyme Inhibition, presteady state kinetics, Kinetics of multi-substrate reactions, Allosteric enzymes – The Monad – Changeux – Wyman model (MCW) and The Koshland – Nemethy – Filmer (KNF) model, Temperature and pH effects on enzyme activity. Methods of immobilization of enzymes, Kinetics of immobilized enzymes – Effects of external mass transfer and intra – particle diffusion.

EXTRACTION AND PURIFICATION OF ENZYMES

Methods of production of enzymes, Extraction of Enzymes –soluble enzymes – membrane bound enzymes – Nature of extraction medium – purification of enzyme – criteria of purity **–** Determination of molecular weight of enzymes.

INSTRUMENTAL TECHNIQUES IN ENZYMATIC ANALYSIS

Principles – Manometry – Spectrophotometry – Spectrofluorimetry – Electrochemical methods – Enthalpimetry – Radio chemical methods – Automation in enzymatic analysis.

TEXT BOOKS

1. *Enzymes* by Trevor palmer
2. *Enzymes* by Robert A. Copeland, 2nd edition.
3. *Biochemical Engineering* by Harwey W. Blanch and Douglas S. Clark

		L	T	P	C
BT0203	**GENETICS AND CYTOGENETICS**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course introduces the fundamentals of genetics. It discusses the basics laws of chromosome structure sex linked chromosomes and inherited disorders, identification of genetic material and genetic transfer.

INSTRUCTIONAL OBJECTIVES

To introduce and discuss the

1. Fundamental laws of genetics
2. Types of blood groups and antigen

3. Concept of sex chromosome, links, disorders and gene mapping
4. Methods of identification of genetic material
5. Types of genetic transfer

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

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

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

VARIATION IN CHROMOSOME STRUCTURE AND NUMBER
Deficiencies – duplication –inversion- translocation – positive effects-human chromosome techniques (karyotyping)- chromosome aberration in humans-classification of mutation- classification of ploidy, -variation in chromosome number-extra chromosomal inheritance-cytogenetical abnormalities in humans

RECOMBINATION IN BACTERIA
Transformation, Transduction, Conjugation – mapping, fine structure mapping in merozygotes- plasmids and episomes.

TEXT BOOK:
Principles of Genetics by Gardner, Simmons, Snustad, 8th edition – John Wiley and Sons, Inc., 2003.

		L	T	P	C
BT0205	**IMMUNOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE
Aimed at introducing the science of immunology and detail study various types of immune systems their classification structure and mechanism of immune activation**.**

INSTRUCTIONAL OBJECTIVES
1. The immune system ,their structure and classification ,genetic control of antibody production
2. Cellular immunology
3. Mechanism of activation in hypersensitive immune reaction

OVERVIEW OF THE IMMUNE SYSTEM
Innate Immunity, adaptive immunity, comparative immunity cells and organs the immune system – Antigens.

IMMUNOGLOBULIN STRUCTURE AND FUNCTIONS
Basic structures of Immunoglobulins – I g classes and biological activities, Antigenic determinants on Ig, B Cell receptor, Monoclonal antibodies – cytokines – complement system

ANTIGEN – ANTIBODY INTERACTIONS
Antibody Affinity and activity – Precipitation reactions- agglutination reactions- Radio immunoassay-ELISA-Western blotting, Immunoprecipitation, Immuno fluroscence, immunoelectron microscopes, flow cytometers-MHC Antigen processing & presentations.

T CELL & B CELL MATURATION, ACTIVATION & DIFFERENTIATION
T Cell receptor, T Cell maturation, activation and differentiation B Cell generation, activation and differentiation cell mediated effectors responses.

IMMUNE SYSTEM IN HEALTH & DISEASE
Leukocyte migration and inflammation, hypersensitive reactions, immune response to infection diseases vaccines.

TEXT BOOK:
Kuby Immunology by Richard A. Golds by Tharmas J. kindt fourth edition 2000 and Barbara Osborne. W.H.freeman and company

		L	T	P	C
BT0207	**MICROBIOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE
Introducing the fundamentals of microbiology through the study of the characteristics of microorganisms, multiplication, growth in different media, metabolic pathways, effects of microbe and their control.

INSTUCTIONAL OBJECTIVES
1. To highlight the roles and characteristics of microorganisms
2. To impart knowledge on the basic concept of replication in microorganisms
3. To study in detail the growth of microorganisms and impact of environment on their growth
4. To evaluate explicitly, the metabolic pathways, role of microbes in public health; insight into the physical and chemical control of microorganisms.

INTRODUCTION TO MICROBIOLOGY
Characterization, Classification and Identification of microorganisms, Microscopic examination of Micro organisms morphology and fine structure of bacteria, cultivation of bacteria, reproduction & growth, pure cultures and cultural characteristics.

MICROBIAL PHYSIOLOGY AND GENETICS
Enzymes and their regulation, Microbial metabolism energy production, utilization of energy & biosynthesis, bacterial genetics.

MICROBIAL PHYSIOLOGY AND GENETICS
Fungi – importance, characteristics, morphology, reproduction, physiology cultivation & classification of fungi, molds & repair association with other organisms. Algae – importance of algae – characteristics of algae, classification protozoa: Ecology, importance, morphology, reproduction and classification of protozoa – control of micro organisms.

VIRUSES OF BACTERIA, ANIMAL AND PLANTS
Bacteriophages- General characteristics-Morphology and structure, Classification and Nomenclature-Bacteriophages of *E.coli* – Replication -viruses of plants and animals- Structure- Replication- Classification-isolation and identification-fatal diseases associated with viruses in animals-viroids

ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY
Microbiology of soil – aquatic microbiology, Microbiology of domestic water and waste water. Microbiology of fuel and Industrial microbiology

TEXT BOOK
Microbiology by Pelczar, JR E.C.S Chan and noel R.Krieg. Fifth edition Tata Mc GrawHill -2006

		L	T	P	C
CH 0215	**MECHANICAL OPERATIONS & HEAT TRANSFER**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE
This course is concerned with filtration and agitation operations & modes of heat transfer and their applications.

INSTRUCTIONAL OBJECTIVES
To familiarize the students with filtration operation, agitation and mixing of liquids, heat conduction phenomena, convective heat transfer phenomena and heat exchange equipments.

FILTRATION
Introduction, cake filters, discontinuous pressure filter: principle and working of filter press, continuous vacuum filter: principle and working of rotary drum filters, centrifugal filter: principle and working of suspended batch centrifuges, filter media, filter aids, principles of cake filtration, pressure drop through filter cake, compressible and incompressible filter cakes, filter-medium resistance, constant pressure filtration, continuous filtration, constant rate filtration, working principle of centrifugal filters.

AGITATION AND MIXING OF LIQUIDS
Units and dimensions, dimensional analysis: Buckingham's π theorem.
Principles of agitation, agitation equipment, flow patterns: prevention of swirling, draft tubes. Standard turbine design, power consumption, power correlation, significance of dimensionless groups, effect of system geometry, calculation of power consumption in Newtonian liquids. Blending and mixing: blending of miscible liquids, blending in process vessels, stratified blending in storage tanks, jet mixers, motionless mixers, mixer selection.

HEAT CONDUCTION
Introduction to various modes of heat transfer, Fourier's law of heat conduction, effect of temperature on thermal conductivity, steady-state conduction, compound resistances in series, heat flow through a cylinder, critical radius of insulation in pipes.

CONVECTIVE HEAT TRANSFER
Heat flux, average temperature of fluid stream, overall heat transfer coefficient, LMTD, individual heat transfer coefficients, relationship between individual and overall heat transfer coefficients. Concept of heat transfer by convection, natural and forced convection, application of dimensional analysis for convection, heat transfer to fluids without phase change: heat transfer coefficient calculation for natural and forced convection, heat transfer to fluids with phase change: heat transfer from condensing vapours, dropwise and film-type condensation, heat transfer coefficients calculation for film-type condensation.

HEAT-EXCHANGE EQUIPMENT
Typical heat exchange equipment, counter current and parallel-current flows, enthalpy balances in: heat exchanges, total condensers. Double pipe exchanger, single-pass 1-1 exchanger, 1-2 parallel-counterflow exchanger, 2-4 exchanger, heat-transfer coefficients in shell-and-tube exchanger, coefficients for crossflow, correction of LMTD for crossflow. Condensers: shell-and-tube condensers, kettle-type boilers, Calculation of number of tubes in heat exchangers.

TEXT BOOK
1. Warren L. Mccabe, Julian C. Smith and peter Harriott, "Unit Operations of Chemical Engineering", 6th Edn., McGraw Hill International Edition, NewYork 2001.

REFERENCE BOOKS
1. Narayanan C.L.& Bhattacharya, "Mechanical Operation for Chemical Engineering",1993.
2. Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.M., "Coulson & Richardson's Chemical Engineering", Vol. II, 4th Edn., Butter worth Heinemann, Oxford, 1996.
3. Donald Q. Kern, "Process Heat Transfer", Tata McGraw Hill Book Co., New Delhi, 1997.

		L	T	P	C
LE0201	**GERMAN LANGUAGE PHASE I**	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE
This course is designed to teach the students the basics of the German language.

INSTRUCTIONAL OBJECTIVE
For beginners with no knowledge of German acquiring basic verbal and communication skills.

INTRODUCTION
German Language, Alphabets and Pronunciation.

THEMEN
Name, Land, Leute, Beruf, Familie geschwister, Einkaufen, Reisen, Zahlen, Haus, Freunden, Essen and Stadium, Fest, Zeit.

LISTENING
Listening to the cassette and pay special attention to the meaning and sounds. Listening Comprehension – A nnouncements / Airport / Station / General.

READING
Listening to the cassette and reading it allowed.
READING COMPRENSION BASICS / STATION / NEWS / NOTICE BOARDS.

GLOSSARY
Technical Words Lesson (1-5)

TEXT BOOK WITH CASSETTES

1. Grundkurs Deutsch
2. Momentmal (Max Mueller Bhavan – Goethe Institute, Germany).

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
LE0203	**JAPANESE LANGUAGE PHASE I**	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE
This course is designed to teach the students the basics of the Japanese language.

INSTRUCTIONAL OBJECTIVE
For beginners with no knowledge of Japanese to acquire basic communication Skills.

Alphabets (Hiragana), Self Introduction, Greetings, Classroom expressions, Numbers,
Conversation.

Alphabets Hiragana (continued),Vocabularies.
Counters .Time expression. Conversation

Katakana and related vocabulary.
Kanjis –introduction. conversation.

Lesson-1 Watashiwa Nihonjin desu. Grammar,Marume &Sentence pattern.Marume.
Conversation.

TEXT BOOKS
1. Nihongo Shoho I main Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba (Work Book)
4. Japanese for Dummies.(Conversation) CD.

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
LE0205	**FRENCH LANGUAGE PHASE I**	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

INTRODUCTION AND PRONUNCIATION
Introduction of the French Language, Alphabets and Pronunciation, Greetings (Wishing, Thanking and Bidding good bye), Introducing oneself & someone Presenter quelqu'un et se presenter - conversational French sentences based on the topics discussed above.

VOCABULARY
Numbers and Dates, Days, Months and Seasons, Time, Nouns, Professions and Nationalities. Conversational sentences on weather, time, and professions.

GRAMMAR
Basic Verbs (Avoir, Etre, Aller, Faire) – Conjugation – Present tense, Affirmative, Negative, Interrogative, Adjectives (Qualitative), Subject Pronouns and Disjunctive Pronouns.

CONVERSATION AND LISTENING
Conversational sentences on physical description and expressions with verbs like avoir, etre and faire

GRAMMAR
Prepositions (a, de,dans, en, sur,sous, pour….),Contracted Articles, Question Tag
(Qui, Quel, Ou, ……etc)

TEXT BOOK:
1. Panorama – Goyal Publishers
2. Apprenons le Francais I, Sarawathy publication.

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
BT0217	**COMPUTER SKILLS**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE
Designing database for different applications is an important area of program development. This course provides the students to understand the problems with file processing system and how it can be handled effectively in Database System through various design tools, design techniques and algorithms.

INSTRUCTIONAL OBJECTIVES
The course provides the following essential skills in database technology:
1. Design of database for any given problem
2. Provide the proof for good database design after carefully eliminating certain problems inherent in Initial Database Design.
3. Design Logical Database Schema and Mapping it to implementation level schema through Database Language Features.

INTRODUCTION
DBMS- Data model- Data Independence- Data Catalog- DBMS Architecture & Data Abstraction- DBMS Languages- DBMS System Structure- ER Model: Objects, Attributes and its Type, Entity and Entity Set, Relationship & Relationship Set-

DATABASE DESIGN
Design Issues in choosing attributes or entity set or relationship set- Constraints- Super Key- Candidate Keys- Primary Key- ER Diagram Notations- Goals of ER Diagram- Weak Entity Set- ER Diagram Construction- Tabular Representation of Various ER Schema- Views

STRUCTURED QUERY LANGUAGE
SQL: Overview, the Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT- Nested Queries- Aggregate Functions- Null Values.

RELATIONAL MODEL DESIGN TECHNIQUE
Pitfalls in relational database-1NF- Super Key & Functional dependency: Closure of Functional Dependency Set- Closure of Attribute Set- Minimal Functional Dependency Set- 2NF- BCNF- 3 NF.

SEQUENCING DATABASES
Sequencing Databases-(DNA and proteins Sequencing) - GenBank and Swiss Prot- Derived Databases-Pfam, BLOCKS, etc. Structure Databases-Collection- validation of Structure Data- PDB and NDB- Derived Databases, SCOP, PALI, etc.

LIST OF EXPERIMENTS
1. Simple Queries
2. Built-in-functions
3. Group Functions
4. Multiple sub-queries
5. SQL Views & Triggers
6. Bioinformatics databases

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, McGraw-Hill, 4th Edition, 2002.
2. Raghu Ramakrishnan, Johannes Gehrke, *Database Management System*, McGraw Hill, 3rd Edition 2003.
3. David J. Parry-Smith, Teresa K. Attwood, *Introduction to Bioinformatics*, Longman, 1999.

REFERENCE BOOKS

1. Elmashri & Navathe, *Fundamentals of Database System*, Addison-Wesley Publishing, 3rd Edition, 2000.
2. Date C.J, *An Introduction to Database*, Addison-Wesley Pub Co, 7th Edition, 2001.
3. Jeffrey D. Ullman, Jennifer Widom, *A First Course in Database System*, Prentice Hall, AWL 1st Edition, 2001.
4. Peter Rob, Carlos Coronel, *Database Systems – Design, Implementation, and Management*, 4th Edition, Thomson Learning, 2001.

		L	T	P	C
BT0211	**MICROBIOLOGY LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE
Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.

INSTRUCTONAL OBJECTIVES
The students should be able to
1. Understand explicitly the concepts
2. Develop their skills in the preparation, identification and quantification of microorganisms

LIST OF EXPERIMENTS
1. Sterilization techniques
2. Media preparation
3. Microscopy and Micrometry

4. Isolation, enumeration and purification of microbes from a given sample
5. Staining Techniques (Simple, Gram staining, spore staining)
6. Motility test by Hanging drop method
7. Biochemical Characterization of Bacteria
   - Oxidation/Fermentation Test
   - Catalase, Oxidase and Urease Tests
   - IMViC test
   - Hydrogen Sulfide Test and Nitrate Reduction Test.
   - Casein and Starch Hydrolysis
7. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
8.. Growth Kinetics (Bacterial Growth Curve)
9. Isolation of antibiotics producing bacteria
10. Isolation and characterization of plant microbes

REFERENCE BOOK
Laboratory Manual

		L	T	P	C
BT0215	**IMMUNOLOGY LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	CELL BIOLOGY				

PURPOSE
Provides an opportunity to experimentally verify the theoretical concepts already studied. it also helps in understanding the theoretical principles in a more explicit and concentrated manner .

INSTRUCTIONAL OBJECTIVES
The students should be able to develop their skills
1. Isolation of antibodies
2. Purification of antibodies
3. Immunoelectrophoresis

LIST OF EXPERIMENTS
1. Blood grouping
2. Leukocyte count
3. PBMC preparation and their enumeration
4. Production of polyclonal antibodies – preparation of antigen – protocol for immunization in rabbits
5. Methods of bleeding-purification of polyclonal antibodies
6. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL
7. Immunodiffusion, Immunoelectrophoresis.
8. Affinity chromatography for antibody purification.
9. ELISA-DOT and plate ELISA
10. Western blotting

REFERENCE BOOK
Laboratory manual

		L	T	P	C
PD 0201	**PERSONALITY DEVELOPMENT -III**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
1. To guide thought process.
2. To groom students' attitude.

3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Goal Setting - Problem Solving - Emotional Quotient

Assertiveness - Stress Management - Quiz II

Lateral Thinking (Situational) - Team Work (Role Plays) Impromptu - Text Analysis

Business plan presentation I - Business plan presentation II - Chinese Whisper

Picture Perfect - Case Studies - Review

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete Internal evaluation on a regular Basis

IV SEMESTER

		L	T	P	C
GN0202	**BASIC MOLECULAR TECHNIQUES**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The subject deals with the principles of basic techniques that are essential for genetic engineering and recombinant DNA technology

INSTRUCTIONAL OBJECTIVES

To give theoretical background for the basic molecular biology techniques

AGAROSE GEL ELECTROPHORESIS OF DNA
Agarose gel electrophoresis – agar, agarose, structure of agarose, movement of DNA in agarose gel, staining of DNA in agarose gel – ethidium bromide – structure-binding with DNA and florescence, other dyes for DNA staining, DNA loading dyes and their movement in agarose gels- applications of agarose gel electrophoresis. Principle of Pulsed Field Gel Electrophoresis and its applications.

PAGE OF PROTEIN AND DNA
Principle of polyacrylamide gel electrophoresis (PAGE) - native and denaturing PAGE difference and applications. Protein staining – coommossie staining, silver staining, ponceau staining. Enzyme staining – positive staining and negative staining with examples. PAGE for running DNA – native gel and denaturing gel.

DNA and RNA isolation
Plasmid DNA isolation – principles of plasmid DNA isolation, different methods of plasmid isolation – classical and spin column methods. Principles and protocols for phage DNA isolation. Principles and protocols for genomic DNA isolation from bacteria, plants, animal tissues and blood – classical and spin column methods.Principles and protocols for different RNA isolation method – Guanidium isothicyanate method, Trizol method, column based method. mRNA purification using oligo-dT cellulose and sepharose column chromatography, mRNA purification using column

Purification and quantification of nucleic acids
Purification of nucleic acids – the need for purification – phenol chloroform purification followed by ethanol or isopropanol precipitation, purification by LiCl precipitation, gel purification of DNA by freeze-squeeze method, phenol freeze-thaw method, spin column method. Quantification of nucleic acids visual estimation, spectrophotometric method, fluorimetric method. Concetration of nucleic acids by precipitation and re-dissolving, vacuum concentration and freeze drying (Lyophilization).

Commonly used *E.coli* strains and transformation
Genetic markers and genotype of *E. coli* strains that are commonly used in molecular biology. Selection markers, screening markers, principle of blue-white selection using *LacZ* gene. Principles and protocols for preparation of chemically competent cell by calcium chloride method and Hanahan's method. Principles and protocols for preparation of electro-competent cell. Principles and protocols for transformation of bacteria by using chemically competent cells and electro-competent cell.

References:
Molecular Cloning – A Laboratory Manual by Sambrook and Russell

		L	T	P	C
BT0202	**MOLECULAR BIOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE
This subject discusses the fundamentals concepts and basic principles such as structure of DNA / RNA, transcription, translation gene regulation, and RNA splicing.

INSTRUCTONAL OBJECTIVES
To impart knowledge on Nucleic acids and their characteristics, transcription, translation, protein sorting, regulation of gene expression

INTRODUCTION TO MOLECULAR BIOLOGY - DNA AND RNA
Scope and History. Structure of DNA-Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, features of Watson and Crick model, major and minor groove, Supercoiling- twist, writhe and linking number. Forms of DNA- A, B, Z. Structure and function of mRNA, rRNA, tRNA. Secondary structures in RNA.

REPLICATION AND REPAIR
Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote. Proof reading activity, 5'→ 3' exonuclease activity, topoisomerase activity, Telomeric DNA replication and Plasmid Replication-theta model, strand displacement model and rolling circle model. DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

TRANSCRIPTION AND POST TRANSCRIPTIONAL MODIFICATIONS
Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryote and eukaryote. Post transcriptional processing of mRNA – 5'capping, splicing (including different types), polyadenylation and RNA editing.

TRANSLATION AND POST TRANSLATIONAL PROCESSING
Genetic code and Wobble hypothesis. Translation in prokaryote and eukaryote. Post translational modifications. Principles protein sorting and targeting into endoplasmic reticulum, mitochondria, chloroplast, and nucleus.

GENE REGULATION

Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon-*lac* operon, *trp* operon, *ara* operon and *gal* operon.

TEXT BOOKS:

1. *Molecular Biology of Gene* - Watson
2. *Molecular and Cellular Biology*- Stefen Wolfe

		L	T	P	C
GN 0204	**STOICHIOMETRY AND ENGINEERING THERMODYNAMICS**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course deals with formulation and solution of material balances on chemical process systems, and transformation of energy from one form to another.

INSTRUCTIONAL OBJECTIVES

To familiarize the students with Basic principles of process calculations, material balance calculations, basic concepts and first law of thermodynamics, volumetric properties of pure fluids and second law of thermodynamics

INTRODUCTION

Units and dimensions, the mole unit, mole fraction (or percent) and mass fraction (or percent), analyses of a mixture, concentrations, basis of calculations, predicting P-V-T properties of gases using the following equations of state: ideal gas law, Van der Waals equation, Redlich-Kwong equation, calculation of density.

CHEMICAL EQUATION AND MATERIAL BALANCES

Basics of chemical equation and stoichiometry, limiting reactant, excess reactant, conversion, selectivity, yield. Basic concepts involved in material balance calculations, material balance problems without chemical reactions: membrane separation, mixing, drying, crystallization. Basic concepts of recycle, bypass and purge streams.

BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

Basic concepts: work, energy, heat, internal energy, extensive and intensive properties, state and path functions, First law of thermodynamics, energy balance for closed systems, equilibrium, the reversible process, constant-v and constant-p processes, enthalpy, heat capacity, energy balances for steady-state flow processes.

UNIT IV VOLUMETRIC PROPERTIES OF PURE FLUIDS

PVT behavior of pure substances, virial equations of state, the ideal gas, equations for process calculations(for an ideal gas in any mechanically reversible closed-system process): isothermal process, isobaric process, isochoric process, adiabatic process, and polytropic process. Application of the virial equations, introduction to cubic equations of state: van der Waals equation, Redlich/Kwong equation, theorem of corresponding states; acentric factor.

SECOND LAW OF THERMODYNAMICS

Statements, heat engines, Carnot's theorem, ideal-gas temperature scale; Carnot's equations, concept of entropy, entropy changes of an ideal gas undergoing a mechanically reversible process in a closed system, mathematical statement of the second law, entropy balance for open systems, statement of the third law of thermodynamics.

TEXT BOOKS

1. David M. Himmelblau, "Basic Principles and Calculations in Chemical Engineering", 6th Edn., Prentice-Hall of India, New Delhi, 1998.
2. Smith, J.M., Van Ness, H.C., and Abbott, M.M., "Introduction to Chemical Engineering Thermodynamics", 6th Edn., McGraw Hill International Edition, Singapore 2001.

REFERENCE BOOKS

1. Bhatt B.I. and Vora S.M., "Stoichiometry", 3rd Edn., Tata McGraw-Hill Publishing Company, New Delhi, 1996.

2. Rao Y.V.C, Chemical Engineering Thermodynamics (1997), University Press, Hyderabad

		L	T	P	C
BT 0204	**BIOPROCESS PRINCIPLES**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This subject puts emphasis on the basic engineering principles of bioprocess. it also highlights the modern application of biotechnological process and the role of bio process engineer in biotechnological industry.

INSTRUCTIONAL OBJECTIVES

- To study the historical development of bio process technology design and construction of fermentor and parameters to be monitored and controlled in fermentation process
- To evaluate the kinetics and thermodynamics of enzymatic process
- To teach the principle of sterilization design
- To study the stoichiometry and energetics of cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

INTRODUCTION TO BIOPROCESS

Historical development of bioprocess technologies, role of bioprocess engineer in the biotechnology industry, concept of Bioprocess, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. A brief survey of organisms, processes, products and market economics relating to modern industrial biotechnology.

FERMENTATION PROCESS

General requirements of fermentation processes; Isolation, preservation and improvement of industrially important micro- organisms, development of innocula for industrial fermentations. Different types of fermentations, Basic design and construction of fermentor and ancillaries, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry solid-substrate fermentation and its applications.

METABOLIC STOICHIOMETRY AND ENERGETICS

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass available, electron balances, yield coefficient of biomass and product formation, maintenance coefficients, energetics analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

MEDIA DESIGN AND STERILIZATION FOR FERMENTATION PROCESS

Designing of media for fermentation processes, Types of media, design and usage of various commercial media for industrial fermentations, thermal death kinetics of micro organisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air, design of sterilization equipment.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

Phases of cell growth in batch cultures, simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms. Growth associated (primary) and non-growth associated (secondary) product formation kinetics, Leudking – Piret models, substrate and product inhibition on cell growth and product formation.

REFERENCE BOOKS:

1. Pauline.M.Doran ., "Bioprocess Engineering Principles";Academic press ..
2. Peter F.Stanbury, Allan Whitaker, "Principles of Fermentation Technology"
3. Michael L.Shuler and Fikret Kargi, "Bioprocess Engineering Basic concepts", Prentice Hall, 1992.

MA0244	**BIOSTATISTICS**	**L**	**T**	**P**	**C**

		3	**2**	**0**	**4**
	Prerequisite				
	Nil				

PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

At the end of the course, student should be able

1. To understand measures of dispersion
2. To get exposed to probability distributions and their applications
3. To be familiar with tests of significance
4. To acquaint themselves with quality control

INTRODUCTION TO BIO-STATISTICS (numerical problems only)

Handling univariate and bivariate data – Measures of central tendency – Measures of dispersion –Skewness & Kurtosis – Correlation and Regression .

PROBABILITY & THEORETICAL DISTRIBUTIONS

Probability concepts – conditional probability – Baye's theorem – one – dimensional random variables – expectation, variance, moments.

Theoretical distributions : Binomial, Poisson, Normal (Problems only).

TESTING OF HYPOTHESIS

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportion, standard deviation, difference between standard deviation. Chi-square test for goodness of fit, independence of attributes.

ANALYSIS OF VARIANCE

Small sample tests based on t and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA– one –way classification, Two-way classification.

STATISTICAL QUALITY CONTROL

Introduction – Process control – control charts for variables - $\overline{X}$ and R, $\overline{X}$ and s charts control charts for attributes : p chart, np chart, c chart.

TEXT BOOKS

1. S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi , 2003.
   (**Unit -1** Chapter 2 Section 2.1, 2.3 – 2.9, Chapter 3 Section 3.1 – 3.7,3.8.1, 3.9, 3.13, 3.14, Chapter 10 Section 10.1-10.3,10.3.1,10.6, 10.7.1, 10.7.3-10.7.5, **Unit –II** Chapter 4 Section 4.1- 4.8, Chapter 5 Section 5.1-5.4, Chapter 6 Section 6.1-6.4, Chapter 7 Section 7.1-7.61, Chapter 8 Section 8.2 **UNIT III** Chapter 12 Section 12.4- 12.15, Chapter 13 Section 13.5, 13.7.2, 13.7.3 **UNIT IV** Chapter 14 Section 14.2, 14.2.8-14.5.5, Chapter 5 Section 5.1-5.3)
2. S.C.Gupta & V.K.Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi , 2003.
   (**UNIT V** Chapter 1 Section 1.10, 1.0-1.7.3.)

REFERENCE BOOK

1. W.Ewans & G.Grant, Statistical Methods in Bio informatics – An Introduction.

		L	**T**	**P**	**C**
LE0202	**GERMAN LANGUAGE PHASE - II**	**2**	**0**	**0**	**2**
	Prerequisite				
	GERMAN LANGUAGE PHASE - I				

PURPOSE

This course is designed to improve the skills in German language.

INSTRUCTIONAL OBJECTIVE

To familiarize the students with the basic grammatical, verbal and communication skills.

SPEAKING;

Dialogue – Questioning / Basic queries / Conversational with practical exposure.

GRAMMATIK (WRITING)
Verben, Wortstellung, Nomen, Pronomen, Artikel, Nominitativ, Akkusativ, Dativ, Adjective, Prasens, Perfect and Neben Satze.

GLOSSARY
Technical words. Lesson (6-10)

TEXT BOOK WITH CASSETTES
A. Grundkurs Deutsch
B. Momentmal
(Prescribed by Max Mueller Bhavan – Goethe Institute, Germany).

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
LE0204	**JAPANESE LANGUAGE PHASE II**	**2**	**0**	**0**	**2**
	Prerequisite				
	JAPANESE LANGUAGE PHASE I				

PURPOSE
This course is designed to improve the skills in Japanese language.

INSTRUCTIONAL OBJECTIVE
To familiarize the students with the basic grammatical, verbal and communication skills.

Lesson 2-{Korewa Tsukue desu } – Grammar, Sentence pattern, Marume .
Conversation

Lesson 3 – [Kokoni denwa ga arimasu] - Grammar, Sentence pattern, Marume .Copnversation

Lesson 4– {Asokoni hito ga imasu} - Grammar, Sentence pattern, Marume .
Lesson 5– {Akairingo wa ikutsu arimasu ka}-Grammar, Sentence pattern, Marume . Conversation.

Lesson 6– {Barano hana wa ippon ikura desu ka}- Grammar, Sentence pattern.Marume.Conversation

TEXT BOOKS
1. Nihongo Shoho Imain Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba (Work Book)
4. Japanese for Dummies.(Conversation) CD.

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
LE0206	**FRENCH LANGUAGE PHASE II**	**2**	**0**	**0**	**2**
	Prerequisite				
	FRENCH LANGUAGE PHASE I				

PURPOSE
This course is designed to improve the skills in French language.

INSTRUCTIONAL OBJECTIVE
To familiarize the students with the basic grammatical, verbal and communication skills.

Sports (Ski, natation, tennis, Tour de France), Cuisine (French dishes),Cinema

(Review of a film) – Articles on these topics and group discussion will be followed.

GRAMMAR
Possessive Adjectives, Demonstrative Adjectives, Past tense – Passé Compose(Verbe Auxiliare:.Etre et Avoir)

Culture and Civilization French Monuments (Tres celebres), French History (Jeanne d' Arc, Louis XIV, Prise de la Bastille), Culture and Civilisation (vin, fromage, mode, parfums)

Transport system, government and media in France – articles on these topics.

Comprehension and Grammar Comprehension passages and conversational sentences in different situations (at the restaurant, at the super market)

TEXT BOOK:
1. Panorama – Goyal Publishers
2. Apprenons le Francais II, Sarawathy Publications

SCHEME OF EVALUATION
Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks
External 50 – 3 hours final written exam

		L	T	P	C
GN 0206	**COMPREHENSION-I**	**0**	**2**	**0**	**1**
	Prerequisite				
	Nil				

PURPOSE
In this course, the students will be made to review the subjects taught in the earlier semesters.

INSTRUCTIONAL OBJECTIVES
1. To emphasize the importance of basic core subjects taught in the previous semesters.
2. To improve the technical knowledge, problem-based learning, and principles of techniques.
3. To counsel students to improve their basic knowledge so that they will be better prepared for the campus interview.

Biochemistry, Cell Biology, and Enzyme technology
Structure and properties of carbohydrates, proteins, lipids-Cell structure, function, and signaling-Enzyme kinetics, catalyst, and techniques for purification

Genetics and Cytogenetics, Immunology, and Microbiology
Chromosomes, linkage, and crossing-over, Mendelian genetics-Recombination in bacteria-Immune system-Antigen and Antibody-B and T cells-Microbial physiology and genetics-Environmental and Industrial microbiology

Scheme of Assessment
Answers to objective questions will be evaluated

		L	T	P	C
GN 0208	**MOLECULAR TECHNIQUES LABORATORY**	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The practical deals with basic techniques that are essential for genetic engineering and recombinant DNA technology

INSTRUCTIONAL OBJECTIVES
To give hands-on training in basic molecular biology techniques

List of Experiments

1. Agarose gel electrophoresis
2. Plasmid DNA isolation
3. Phage DNA isolation
4. Genomic DNA isolation
5. RNA isolation
6. Formaldehyde gel electrophoresis of RNA
7. Quantification of nucleic acids
8. Restriction digestion
9. Competent cell preparation
10. Transformation
11. Blue-white selection for recombinant clones

TEXT BOOK

1. Laboratory Manual
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

		L	T	P	C
GN 0210	**BIOPROCESS ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

Enables the student to develop their skills in the field of enzyme isolation its assay, enzyme kinetics and microbial fermentation.

INSTRUCTIONAL OBJECTIVES

The students will be able to

1. Develop their practical skills in enzyme isolation and purification.
2. Evaluate enzyme kinetics
3. Carry out enzyme immobilized reaction and microbial culture
4. Develop practical skill in submerged and solid state fermentation.

LIST OF EXPERIMENTS

1 Isolation of proteolytic organism from soil sample
2 Glucose assay by dDNS method
3 Evaluations of enzyme kinetic parameters
4 Enzyme activity calculation
5 Determination of optimum pH for enzyme
6 Determination of optimum temperature for an enzyme
7 Enzyme immobilized by alginate gel method
8 Hydrolysis of starch by immobilized method
9 Effect of substrate concentration on biomass yield
10 Solvent extraction techniques for product recovery

REFERENCE BOOK:

Laboratory Manual

		L	T	P	C
PD 0202	**PERSONALITY DEVELOPMENT - IV**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES

1. To guide thought process.

2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Motivation II - Interpretation of Visuals of I & II

Humor in real life - Body language - Collage and poster designing and slogan writing

Brain Teasers – JAM - Current News Update I

Current News Update II - Enactment (SKIT –I) - Enactment (SKIT – II)

Survey and Reporting (heroes, sports persons etc.) - Quiz III - Review

EVALUATION:
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete Internal evaluation on a regular Basis

V SEMESTER

		L	T	P	C
GN 0301	**ADVANCED MOLECULAR TECHNIQUES**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The subject deals with the principles of advanced techniques that are essential for genetic engineering and recombinant DNA technology

INSTRUCTIONAL OBJECTIVES
To give theoretical background for the advanced molecular biology techniques

PCR
Principle of polymerase chain reaction (PCR). Components of PCR reaction and factors affecting optimization of PCR. Enzymes used in PCR and their properties. Features of an optimum primer, gene specific primer and degenerate primer, RT-PCR, inverse PCR, TAIL PCR, Loop-mediated isothermal amplification (LAMP), Real time PCR

SOUTHERN HYBRIDIZATION
Principle of Southern hybridization, probes for Southern hybridization, principle of radioactive probe labeling, hybridization, washing and detection. principle of non-radioactive labeling and detection methods (ECL labeling and DIG labeling).
DNA SEQUENCING

DNA Sequencing – Principle of manual and automated sequencing using Sanger method, pyrosequencing, massively parallel sequencing (454 sequencing). History of genome sequencing and genome sequencing strategies– map based approach and shotgun approach. Genome size and number of genes in different species. Prospects of individual genome sequencing and personalized medicine.

PROTEIN SEQUENCING, SYNTHESIS AND IDENTIFICATION

Protein sequencing – Edman degradation method, N-terminal sequencing method and sequencing using mass spectropmetry. Peptide synthesis by Solid-phase peptide synthesis method (Robert Bruce Merrifield). Yeast one-hybrid screening, Yeast two-hybrid screening, Phage Display

MANIPULATION OF GENE SEQUENCES AND ARTIFICIAL GENE SYNTHESIS

Random mutagenesis, site-directed mutagenesis (Quickchage site directed mutagenesis protocol from Stratagene)- artificial gene synthesis by FokI method and single-step PCR assembly method. Oligonucleotide synthesis by phosphoramidite chemistry.

TEXT BOOK

Molecular Cloning – A Laboratory Manual by Sambrook and Russell

REFERENCES:

Mandecki W and Bolling TJ (1988) FokI method of gene synthesis. Gene 15:68(1):101-7
Stemmer et al (1995) Single-step assembly of a gene and entire plasmid from large number of oligodeoxyribonucleotides. Gene 16: 164(1): 49-53

		L	T	P	C
GN 0303	**Functional Genomics and Microarray Technology**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course deals with the organization of various genome, mapping methods, functional genomics, DNA micro array experiments, methodology and applications and functional proteomics.

INSTRUCTIONAL OBJECTIVES

- To impart knowledge on genome, functional genome and functional proteome
- To understand the principles involved in the tools of functional genomics and proteomics.

GENOME AND GENOME MAPPING

Introduction, History and perspectives of genomics, Classification, Genome-genome size and organization in eukaryotes, molecular markers – RAPD, RFLP, SSR, AFLP, SNP, Genome mapping in eukaryotes – linkage mapping – map construction, Physical mapping – Sequencing - BAC libraries

GENE EXPRESSION PROFILING

Aligning Whole Genome Alignment (WGA)– prediction of coding regions – gene structure – conserved motifs, comparative genomics, methods of gene discovery - Prediction of gene function – methods – annotation, Coding and non coding genes and RNA, Gene expression – regulatory mechanism, Expression profiling – Northern, RT-PCR, DD-RT-PCR, EST library – cDNA library, cDNA AFLP - SAGE

MICROARRAY TECHNOLOGY

Microarrays – Principle, methodology, RNA quality and quantification, array design, cDNA array, oligo array, array fabrication, labeling, single dye, double dye; labeling efficiency, Hybridization, washing and scanning, Image acquisition and data capturing, Data analysis – normalization, error models – error due to replication, slide and experiment, expression value, T-test, MANOVA, hierarchical clustering, volcano plot, criteria for significant genes, Applications of microarrays in health, agriculture and pharmaceuticals

PROTEOMICS

Proteomics – types, classification, methods – 1D PAGE, 2D-PAGE, LC-PAGE
Protein abundance, mass spectrometry, Protein modifications (PTM), MS and Post translational modifications, Proteomics – applications

TOOLS OF FUNCTIONAL GENOMICS

Functional genomics – tools, mutagenesis, Over expression mutants, Knock-out mutants, RNAi silencing, Applications in human health, pharma and agrochemicals

Text Book

1. Principles of Genome Analysis by Richard M. Twyman and Sandy B. Primrose
2. Functional Genomics by Chris Town
3. Principles of Proteomics (Advanced Text Series) by R. M. Twyman

Reference Book

1. Plant Genomics and Proteomics by Christopher A. Cullis
2. Functional Genomics (Methods in Molecular Biology) by Michael J. Brownstein and Arkady Khodursky
3. Functional Genomics: A Practical Approach by Stephen P. Hunt and Rick Livesey
4. Plant Functional Genomics by Dario Leister

		L	T	P	C
CH 0317	**MOMENTUM TRANSFER**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course deals with behavior of fluids.

INSTRUCTIONAL OBJECTIVES

To familiarize with the basic concepts and fluid-flow phenomena, kinematics of flow, phenomena of flow past immersed bodies, various aspects of transportation of fluids and various aspects of metering of fluids.

FLUID FLOW PHENOMENA

Nature of fluids: incompressible and compressible, hydrostatic equilibrium, manometers, potential flow, boundary layer, the velocity field, laminar flow, Newtonian and non-Newtonian fluids, Newton's-law of viscosity, turbulence, Reynolds number and transition from laminar to turbulent flow, Eddy viscosity, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary-layer formation in straight tubes..

KINEMATICS OF FLOW

Streamlines and stream tubes, equation of continuity, Bernoulli equation, pump work in Bernoulli equation.
Flow of incompressible fluids in conduits and thin layers: friction factor, relationships between skin-friction parameters, average velocity for laminar flow of Newtonian fluids, Hagen-Poiseuille equation, hydraulically smooth pipe, von Karman equation, roughness parameter, friction-factor chart, equivalent diameter, form friction losses in Bernoulli equation, couette flow.

FLOW PAST IMMERSED BODIES

Drag, drag coefficients, drag coefficients of typical shapes, Ergun equation, terminal settling velocity, free and hindered settlings, Stokes' law, Newton's law, criterion for settling regime, fluidization, conditions for fluidization, minimum fluidization velocity.

TRANSPORTATION OF FLUIDS

Introduction to: pipe and tubing, joint and fittings, stuffing boxes, mechanical seals, gate valves and globe valves, plug cocks and ball valves, check valves.-Classification and selection of pumps, blowers and compressors. -Pumps: developed head, power requirement, suction lift and cavitation, NPSH, constructional features and working principle of single suction volute centrifugal pump, characteristic curves of a centrifugal pump, comparison of devices for moving fluids, constructional features and working principle of jet ejectors.

METERING OF FLUIDS

Constructional features and working principles of: venturi meter, orifice meter, rotameters, pitot tube, target meters, vortex-shedding meter, turbine meter, magnetic meters.-Application of Bernouli equation to venturi meter and orifice meter, flow rate calculations from the readings of venture meter, orifice meter and pitot tube.

TEXT BOOK

Warren L. Mccabe, Julian C. Smith and peter Harriott, "***Unit Operations of Chemical Engineering***", 6th Edn., McGraw Hill International Edition, NewYork 2001

REFERENCE BOOKS

1. Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.M., "***Coulson & Richardson's Chemical Engineering***", Vol. I, 6th Edn., Butter worth Heinemann, Oxford, 1999.
2. Noel de Nevers, "***Fluid Mechanical for chemical Engineers***", 2nd Edn., McGraw Hill International Editions, 1991.

		L	T	P	C
BT 0313	**BIOPROCESS ENGINEERING**	**3**	**0**	**0**	**3**
	Prerequisite				
	BIOPROCESS PRINCIPLES				

PURPOSE

This subject deals with the design, analysis monitoring modelling and simulation aspect of bi reactors

INSTRUCTIONAL OBJECTIVES

1. To strengthen the knowledge on design operation and stability analysis of bioreactors
2. Bioreactor scale up
3. Methods of on line and off line monitoring of bio process
4. Modern bio technological process
5. Fundamentals of modelling and simulations of bio process.

DESIGN AND ANALYSIS OF BIOREACTORS

Modelling of Non-ideal Behaviour in Bioreactors-Tanks-in-series and Dispersion models-applications to design of continuous sterilizers; Design and operation of novel bioreactors-Air-lift loop reactors; Fluidized bed-bioreactors; Stability analysis of bioreactors.

BIOREACTOR SCALE-UP

Transport phenomena in Bioprocess systems, Regime analysis of bioreactor processes, Correlations for oxygen transfer; Scale-up criteria for bioreactors based on oxygen transfer and power consumption.

MONITORING OF BIOPROCESSES

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites; State and parameter estimation techniques for biochemical processes; computers and interfaces, Computer-based data acquisition, monitoring and control-LABVIEW Software.

MODERN BIOTECHNOLOGICAL PROCESSES

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

MODELLING AND SIMULATION OF BIOPROCESSES

Study of Structured Models for analysis of various bioprocesses; Model simulation using MATLAB-SIMULINK and ISIM software packages.

TEXT BOOKS

1. Alba S., Humphrey E and Milli N.R., "*Bio Chemical Engineering*" Academic Press, 1973.
2. Scragg.A.H "*Bioreactors in Biotechnology*"- A Practical approach
3. Bailey and Ollis, "*Biochemical Engineering Fundamentals*", McGraw Hill (2nd Ed.). 1986.
   Peter F.Stanbury, Allan Whitaker, "*Principles of Fermentation Technology*"

		L	T	P	C
BT 0315	**BIOPHYSICS**	**3**	**0**	**0**	**3**
	Prerequisite				

	BIOCHEMISTRY				

PURPOSE
To introduce the theories and concepts of biophysics of biomolecules which are considered important in biotechnology applications

INSTRUCTIONAL OBJECTIVES
1. Learn the structures of biological molecules
2. To understand the concept of structural analysis
3. Learn the techniques for analysis and determination of structure of biomolecules

STRUCTURES OF BIOLOGICAL MACROMOLECULES
Levels of structures in proteins, nucleic acids and polysaccharides - primary, secondary, tertiary and quaternary structures

CONFORMATIONAL ANALYSIS OF PROTEINS: PROTEIN STRUCTURE
Polypeptide chain geometries, internal rotation angles, Ramachandran plot, potential energy calculations, forces that determine protein structure – hydrogen bonding, hydrophobic interactions, ionic interactions, disulphide bonds – prediction of protein structure.

CONFORMATIONAL ANALYSIS OF NUCLEIC ACIDS
General characteristics of nucleic acid structure – geometric – Glycosidic bond – rotational isomers, ribose puckering – backbone rotation angles and steric hindrances – forces stabilizing ordered forms – base pairing and base stacking

TECHNIQUES FOR THE STUDY OF BIOLOGICAL STRUCTURE
Electron Microscopy, Ultracentrifuge, Viscometry, Molecular –sieve chromatography, electrophoresis, NMR and EPR.

OTHER TECHNIQUES
X-Ray crystallography, X-ray fiber diffraction, light scattering, Neutron scattering

TEXT BOOK:
Biophysical Chemistry, Cantor and Schimmel, part I and II, W.H. Freeman and co 1997.

		L	**T**	**P**	**C**
GN 0305	**PLANT TISSUE CULTURE AND TRANSGENIC TECHNOLOGY**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE
This course deals with engineering gene of interest to produce transgenic animals and plants for human welfare

INSTRUCTIONAL OBJECTIVES
- To make the students to understand the basic concepts and applications of plant tissue culture
- To impart knowledge on production of transgenic plants and exploiting it as bioreactors

BASICS OF PLANT TISSUE CULTURE
History of plant tissue culture-totipotency-organising a tissue culture lab-sterilization techniques- callus-differentiation of cell and organs -clonal propagation-Regeneration
and hardening-somaclonal variation

PREPARATION OF TISSUE CULTURE MEDIA
Different media used for plant tissue culture-Composition of MS, Gamborg, White media-Use of hormones-Auxins- Cytokinins

TISSUE CULTURE TECHNIQUES
Callus culture- suspension culture -micropropagation-somatic embryogenesis- embryo culture –protoplast fusion- synthetic seeds- anther culture. Applications of tissue culture.

PLANT TRANSFORMATION
Agrobacterium – mechanism of T-DNA transfer -Ti plasmids derived vector system – biolistic gene transfer – reporter genes-GUS—marker genes-selectable and scorable markers-constitutive and tissue specific promoters-strategies for developing marker free transgenic plants-chloroplast transformation

APPLICATIONS OF TRANSGENIC PLANTS
Bt transgenics – virus resistant plants (coat protein, anisense RNA) – glyphosate resistant transgenics – Genetic manipulation of flower pigmentation (Blue Rose)– Vitamin A and iron fortified rice – Plant-made antibodies and edible vaccines.

TEXT BOOKS
Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek
Plant Biotechnology by S. Ignacimuthu

		L	T	P	C
PD 0301	**PERSONALITY DEVELOPMENT - V**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES
At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self confidence to face the placement process

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Syllogism - Binary Logic [cause & effect] - Assertive & Counter Argument - Simple Interest - Time & Work - Time & Distance

Upstream & Downstream Reasoning - Verbal Comprehension I - Verbal Comprehension II- Compound Interest-Logarithms - Surds & Indices

Verbal Reasoning I - Verbal Reasoning II - Verbal Reasoning III – Percentage – Test – Averages

Deductive Reasoning I - Deductive Reasoning II - Language Usage I - Decimal Fractions - Profit & Loss – Probability

Language Usage II - Logic Games I - Logic Games II – Area - Pipes & Cisterns – Test

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class
SCHEME OF EXAMINATION
Complete internal evaluation on a regular basis

		L	T	P	C
GN 0307	**GENE EXPRESSION LABORATORY**	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The practical deals with advanced techniques that is essential for genetic engineering and recombinant DNA technology

INSTRUCTIONAL OBJECTIVES
To give hands-on training in advanced molecular biology techniques

List of Experiments

1. Designing gene specific primers using suitable software
2. PCR and RT-PCR
3. Restriction digestion for Southern transfer
4. Southern transfer of digested DNA
5. Probe labeling, purification and Southern hybridization
6. Washing the blot and detection
7. Dot blotting and dot blot hybridization
8. Formaldehyde gel electrophoresis
9. Northern transfer
10. Northern hybridization

Text Book

1. Laboratory Manual
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

		L	T	P	C
GN 0309	**PLANT GENETIC ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

PURPOSE
Provides an opportunity to understand the basic practices of plant tissue culture. It also helps in understanding the theoretical principles of producing transgenic plants in a more explicit and concentrated manner.

INSTRUCTONAL OBJECTIVES
The students should be able to
Understand explicitly the concepts
Develop their skills in the plant tissue culture techniques

LIST OF EXPERIMENTS

1. Preparation of Tissue Culture Media
2. Callus Induction, using rice embryo/endosperm culture
3. Preparation of *Agrobacterium* competent cells
4. *Transformation of Agrobacterium* with binary vector plasmid
5. *Agrobacterium*-mediated transformation of tobacco leaf disc/rice calli
6. Co-cultivation
7. Selection
8. Subculture
9. GUS assay
10. Transgene Analysis by PCR

REFERENCE BOOK
Laboratory Manual from the Department

		L	T	P	C
GN 0311	**Industrial Training 1**	**0**	**0**	**2**	**1**
	Pre-requisite				
	Nil				

The student has to undergo industrial training for a minimum period of two weeks during the winter/summer vacation of the II year. After undergoing the training in an industry, the student will be asked to submit a report that will be evaluated

VI SEMESTER

		L	T	P	C
GN 0302	**RECOMBINANT DNA TECHNOLOGY**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The subject deals with different strategies of gene cloning and construction of genomic and cDNA library and applications of recombinant DNA technology

INSTRUCTIONAL OBJECTIVES

- To strengthen the knowledge on various strategies of gene cloning
- To impart the knowledge on gene expression

MOLECULAR TOOLS FOR GENE CLONING

Restriction enzymes- Dam, Dcm and CpG methylation sensitivity of restriction enzymes-star activity of restriction enzymes. modifying enzymes, DNA and RNA polymerases, reverse transcriptase, terminal transferase, DNA/RNA modifying enzymes-methylases-CpG methylase (M.Sss I), dam methylase, M.EcoR I.. Ligases – Ecoli DNA ligase, T4 DNA ligase, T4 RNA ligase. RNases-RNaseI, RNaseA, RNaseH - Nucleases – RNase free DNAse-Exonuclease I, Exonucelase III, Mung Bean Nuclease. Kinases - T4 polynucleotide kinase. Phosphatases- Topoisomerase.

VECTORS FOR GENE CLONING

Introduction to cloning vectors, plasmid vectors (high copy and low copy), phage vectors, cosmid vectors, phasmid vectors, BAC vectors and YAC vectors

CLONING TECHNIQUES

Cloning after restriction digestion - blunt and cohesive end ligation – creation of restriction sites by PCR-cloning using linkers and adapters - cloning after homopolymer tailing. Strategies for cloning PCR products – TA cloning -TOPO-TA cloning-TOPO-Blunt cloning-cloning blunt end PCR product using *Sfr*I restriction enzyme and T4 DNA ligase (PCR-Script Amp Cloning Kit from Stratagene).

CONSTRUCTION OF GENE LIBRARIES

Construction of cDNA library- construction subtractive cDNA library – construction of genomic DNA library – BAC library – YAC library

EXPRESSION OF RECOMBINANT PROTEIN IN E.COLI

Plasmid expression vectors-general features, promoters used in expression vectors -cloning of genes in correct reading frame in expression vector- purification of recombinant protein using Histidine tag, GST tag, chitin binding domain and intein. Codon use in different organisms-codon usage database-codon optimization to increase the expression of recombinant protein.

TEXT BOOKS:

1. Principles of gene manipulation by Old and Primrose
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

		L	T	P	C
BT0308	**BIOINFORMATICS**	**3**	**0**	**0**	**3**
	Prerequisite				

	Nil				

PURPOSE

Aims at providing an elementary knowledge of bio informatics and its application

INSTRUCTIONAL OBJECTIVE

1. Scope of Bioinformatics
2. Introduction to sequence alignment and programming
3. Database and their use
4. Protein analysis using bio informatics tools
5. DNA mapping and other special topics in bio informatics
6. Introduction to PERL

INTRODUCTION AND NCBI

Internet basics; Connecting to internet; Email; FTP; www; The NCBI data model: Introduction, BIOSEQ's, BIOSEQ- sets, SEQ- ANNOT, SEQ- DESCR.

BIOLOGICAL DATABASES

Biological databases-primary sequence databases- Composite sequence databases- Secondary databases-composite protein pattern databases-structure classification databases. Genome Information Resources: DNA sequence databases-specialized genomic resources, GRAIL, GENSCAN

ALIGNMENT TECHNIQUES

Pairwise Alignment Technique: Database searching-algorithms and programs-comparing two sequences-identity and similarity-global and local alignment- pairwise database searching. Multiple sequence Alignment: Goal of multiple sequence alignment-Computational Complexity-Manual methods-Simultaneous methods-Progressive methods-Databases of multiple alignment-Secondary database searching-Analysis packages.

PROTEIN ANALYSIS

Protein identity based on composition, Motifs and patterns, secondary structure prediction, specialized secondary structures, tertiary structure

INTRODUCTION TO PERL

Using PERL to facilitate biological analysis-Strings, numbers, variables-Basic input & output- File handles-Conditional Blocks & loops- Pattern matching- Arrays-Hashes.

TEXT BOOKS

1. Andreas D Baxevanis & B F Francis," *Bioinformatics- A practical guide to analysis of Genes & Proteins*", John Wiley, 2002.
2. T K Attwood, D J Parry-Smith," *Introduction to Bioinformatics*", Pearson Education, 1st Edition, 11th Reprint 2005.

REFERENCE BOOKS

1. C S V Murthy,"*Bioinformatics*", Himalaya Publishing House, 1st Edition 2003.
2. S.C.Rastogi & others, " *Bioinformatics- Concepts, Skills, and Applications*", CBS Publishing, 2003.
3. Michael R Barnes & Ian C Gray, " *Bioinformatics for Geneticists*", John Wiley, 2003.

		L	T	P	C
CH 0324	**CHEMICAL REACTION ENGINEERING**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course helps the students to develop a clear understanding of the fundamentals of chemical reaction engineering.

INSTRUCTIONAL OBJECTIVES

To familiarize:

- Basic concepts of reactor design.
- Different types of ideal reactors.
- Various aspects of design for single reactions.

- Methods of accounting non-ideal behaviour of ideal reactors.
- Various aspects of solid catalysts.

BASICS OF REACTOR DESIGN
Kinetics of homogeneous reactions: concentration-dependent term of a rate equation, temperature-dependent term of a rate equation, predictability of reaction rate from theory. Interpretation of batch reactor data: constant-volume batch reactor, varying-volume batch reactor, temperature and reaction rate, search for a rate equation.
IDEAL REACTORS
Introduction to reactor design. Ideal reactors for a single reaction: ideal batch reactors, steady-state mixed flow reactors, steady-state plug flow reactors.

SINGLE REACTIONS
Design for single reactions: size comparison of single reactors, multiple-reactor systems, recycle reactor.

NON-IDEAL FLOW
Basics of non-ideal flow: **E**-age distribution of fluid-RTD, conversion in non-ideal flow reactors. Dispersion model: axial dispersion, chemical reaction and dispersion. Tanks-in-series model: pulse response experiments and the RTD, chemical conversion.

SOLID CATALYSTS
Determination of surface area, void volume and solid density, pore-volume distribution, catalyst preparation, promoters and inhibitors, catalyst deactivation,

TEXT BOOK
1. Octave Levenspiel, "Chemical Reaction Engineering",3rd Edn., John Wiley & Sons, Singapore, 1999.

REFERENCE BOOKS
1. Smith J.M, "Chemical Engineering Kinetics",3rd Edn.,McGraw Hill International Editions, New Delhi,1981.
2. 2. Scott Fogler H., " Elements of Chemical Reaction Engineering",2nd Edn.,Prentice Hall of India, New Delhi,1995.

		L	T	P	C
GN0304	**GENE THERAPY**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The course imparts advanced knowledge on gene therapy and detailed study of various types of gene therapy and its applications

INSTRUCTIONAL OBJECTIVES
- To impart basic knowledge on various methods of gene therapy and its applications

PRINCIPLES OF GENE THERAPY
Gene therapy – concepts- vector for gene therapy- ex vivo and in vivo gene therapy somatic gene therapy – germ line gene therapy

SOMATIC AND GERMLINE GENE THERAPY
Prenatal somatic gene therapy- embryo somatic gene therapy-fetal somatic gene therapy- postnatal somatic gene therapy- germ line gene therapy.

VIRAL AND NON VIRAL VECTORS FOR GENE THERAPY
Gene transfer agents – Viral- Retro, adeno, adeno associated and herpes virus-non-viral agents- modes of gene delivery

CLASSICAL GENE THERAPY
Increasing gene dose in deficient cell- on suppressor genes – Disease with recessive heredity- direct killing by suicide gene therapy- indirect killing – secretion gene therapy

APPLICATIONS OF GENE THERAPY

Gene repair- stem cells and gene therapy- application – treatment of genetic diseases — cancer- bone regeneration – cardiovascular gene therapy — neurological diseases

TEXT BOOK

1. Gene therapy by Keith Green berg
2. Stem cells biology and gene therapy by Peter J. Quesen Horry

		L	T	P	C
GN 0306	**BIOSENSORS AND BIOCHIPS**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE

This course make the students knowledgeable in different aspects of Biosensors and bioinstrumentation and their applications

INSTRUCTIONAL OBJECTIVES

To familiarize :

- Basics concepts of biosensors.
- Enzymes based biosensors
- Microbial biosensors.
- Immunosensors
- Transducers and devices

INTRODUCTION TO BIOSENSORS

Basic concept of biosensors, biomolecules used as sensors, devices used in biosensors, methods of preparation of biosensors, principles of bioelectronics involved in bioinstrumentation

ENZYME BASED BIOSENSORS

Unmediated and mediated enzyme electrodes; basic techniques- Enzyme immobilization – protective membranes, instrumentation. Ferrocene based glucose sensor, ferrocene based cholesterol biosensor. Applications of enzyme biosensors

MICROBIAL BIOSENSORS &IMMUNOSENSORS

Principles, construction of microbial biosensors, Immobilization of microbes, Electrochemical devices; applications of microbial sensors- immunoectrodes; basic concept. Alkaline phosphatase labelled immunoassays, glucose oxidase in electochemical immunoassays. Immunoassays using enzymatic amplification electrodes.Coupling of immunoassays with enzymatic recycling electrodes.

TRANSDUCERS AND DEVICES

Transducers: Optical transducers, Fluorescence transducers, Acoustic transducer Acoustic wave device, Acoustic wave device sensors for studying biomolecular interactions Consuctimetric and imedimetric Polarizable and non polarizable electrodes acoustic, plasmon resonance, holographic and microengineered sensors for monitoring low molecular weight analytes, proteins, DNA and whole cells.

BIOCHIPS

Biochips- definition- principle- preparation – Applications- DNA chips- protein biochips – rhodopsin based biochips

REFERENCE BOOKS

Biosensors: A Practical Approach. 1990 Ed By A.E.G.Cass, ORL Press
Biomolecular sensors. 2002 Ed By Electra Gizeli and Christopher R.Lowe, Publ. Taylor & Francis, London

		L	T	P	C
GN0308	**COMPREHENSION-II**	**0**	**2**	**0**	**1**
	Prerequisite				

	Nil				

PURPOSE

In this course, the students will be made to review the subjects taught in the earlier semesters.

INSTRUCTIONAL OBJECTIVES

1. To emphasize the importance of basic core subjects taught in the previous semesters.
2. To improve the technical knowledge, problem-based learning, and principles of techniques.
3. To counsel students to improve their basic knowledge so that they will be better prepared for the campus interview.

Molecular Biology, Bioprocess Principles, and Biophysics

Structure of DNA / RNA, transcription, translation gene regulation, and RNA splicing-Bioprocess, Fermentation, Sterilization, and kinetics of microbial growth- biophysics of biomolecules and techniques for analysis of the biomolecules

Genomics, Plant Biotechnology

Genome and genome mapping, gene expression profiling, microaaray, proteomics, applications, Plant tissue culture techniques and plant transformatiom methods, transgenic plants.

Recombinant DNA technology

Enzymes used in cloning, cloning strategies, construction of cDNA and genomic library, applications

Scheme of Assessment

Answers to objective questions will be evaluated

		L	**T**	**P**	**C**
PD 0302	**PERSONALITY DEVELOPMENT VI**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

INSTRUCTIONAL OBJECTIVES

At the end of the course the students will be able to

1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self confidence to face the placement process

METHODOLOGY

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Self Introduction - Narration - Current News Update – Numbers - Height & Distance - Square & Cube Roots

Current Tech Update - Verbal Aptitude Test I - GD –I - Odd man out series - Permutation & Combination - Problems on ages

GD –II - Resume Writing - Mock Interview I / reading comprehension - Problems on trains – Allegation of Mixtures - Test

Mock Interview II / reading comprehension - Mock Interview III/ reading comprehension - GD – III - Ratio & Proportion - Clocks - H.C.F & L.C.M

GD – IV - Verbal Aptitude Test II – Review – Partnership – Puzzles – Test

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class

SCHEME OF EXAMINATION
Complete Internal evaluation on a regular Basis

		L	T	P	C
GN0310	GENE CLONING AND DNA SEQUENCING LABORATORY	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

PURPOSE
The practical deals with creating recombinant DNA molecules and their molecular analysis indirectly by restriction digestion and PCR as well as directly by DNA sequencing.

INSTRUCTIONAL OBJECTIVES
To give hands-on training in creating recombinant DNA molecules

List of Experiments

1. Digestion and gel elution of vector and inserts
2. Ligation and transformation
3. Verification of cloning by colony PCR and patching the positive colonies
4. Plasmid isolation from PCR positive colonies
5. Confirmation of cloning by restriction digestion
6. Set up DNA sequencing reaction
7. Cleaning the sequencing reaction product
8. Automated DNA sequencing
9. Sequence Editing
10. Sequence analysis by BLAST

		L	T	P	C
GN 0312	**BIOINFORMATICS LABORATORY**	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

1. Knowledge of different biological database
2. Sequence retrieval from biological database
3. Identification of protein sequence
4. Sequence similarity searching of protein sequences
5. Variants of Blast
6. Multiple sequence alignment
7. Dynamic programming method- local alignment
8. Dynamic programming method- global alignment
9. Pattern finding in proteins

REFERENCE BOOK: Lab Manual

VII SEMESTER

		L	T	P	C
BT0407	**BIOSEPARATION TECHNOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	BIOPROCESS ENGINEERING				

PURPOSE

The course provides an opportunity to understand the importance of the Bioseparation process, economics and process design criteria for various classes of bio products.

INSTRUCTIONAL OBJECTIVES

1. To make the student understand the importance of Bioseparation processes
2. Cell disruption
3. Filtration, sedimentation and extraction
4. Product resolution
5. Product crystalisation and drying and process economics

INTRODUCTION TO BIOSEPARATION PROCESS

Role and importance of Bioseparation process in biotechnological processes. Problems and requirements of bioproduct purification.Cost- cutting strategies Characteristics of biological mixtures – Process of Classification of Bioproducts -Biological activity Analysis of purity-Process economics-Capital and operating cost analysis

CELL DISRUPTION AND SEDIMENTATION

Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

FILTRATION, PRECIPITATION AND EXTRACTION

Membrane based separations micro and ultra filtration theory, design and configuration of membrane separation equipment, applications, precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), *in situ* product removal.

CHROMATOGRAPHY AND ELECTROPHORESIS

Adsorptive chromatographic separation processes, gel permeation chromatography, all electrophoresis techniques including capillary electrophoresis, hybrid separation technologies-membrane chromatography, electro chromatography. -HPLC

PRODUCT CRYSTALLISATION AND DRYING9

Crystallisation.-Principles-Nucleation-Crystal growth-Kinetics-Batch crystallizers-Process crystallizers of proteins-Scaleup and design- Drying –Principles-Water in biological solids-Heat and mass transfer-Dryer description and operation-Vacuum shelf and rotary dryer-Freeze dryer-Spray dryer-Scaleup and design-spreadsheet and simulators.

TEXT BOOKS

1. Roger G Harrison et al "*Bioseparation Science and Engineering*" Oxford University Press, 2003
2. Belter PA and Cussler E, " *Bioseparations* ", Wiley 1985

REFERENCE BOOKS

1. Wankat P.C, " *Rate controlled separations* ", Elsevier, 1990
2. 2.Asenjo J.M., " *Separation processes in Biotechnology* " Marcel Dekker Inc. 1993.

		L	T	P	C
GN 0401	**ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE

This course deals with the culturing of cells, preservation and characterization and Monoclonal antibody production

INSTRUCTIONAL OBJECTIVES

- To impart knowledge on cell culture techniques
- To make the students to understand the concepts and techniques of Monoclonal antibody production

BIOLOGY OF CULTURED ANIMAL CELLS

Cell culture-Introduction-the use, advantages & disadvantages-Cell types & its characters, differentiation-Growth of cells in culture-Importance of aseptic techniques. Culture media & culture conditions-Maintenance and storage of cell cultures- Biosaftey and biohazards

PRESERVATION AND CHARACTERIZATION OF CELL LINES

Primary culture, subculture, and cell lines-Cloning and selection-Cell separation and characterization-Differentiation-Transformation and Immortalization-Contamination- Cryopreservation techniques

SCALING UP OF ANIMAL CELL CULTURE

Cell quantification methods-Cell viability measurements-Growth kinetics-Scale up of suspension & monolayer cultures-Air lift bioreactors

PRODUCTION OF TRANSGENIC ANIMALS

Methodology of production of transgenic animals – Retroviral vector method – DNA micro injection – Engineered embryonic stem cell method, Oocyte culture and Transgenic animals- Dolly – Transgenic Cattle – Transgenic Goat and Pigs – Transgenic Birds

APPLICATIONS OF ANIMAL CELL CULTURE AND TRANSGENIC ANIMALS

Animals cells as bioreactors – therapeutic proteins – Enzymes – Vaccines– applications of transgenic animals for the production of recombinant proteins, better nutrition, bioindicator-ornamental transgenic fish.

TEXT BOOKS

1. Culture of Animal cells by R.I. Freshney, Fifth edition
2. Culturing of Animal cells. Biotol publications
3. Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek

		L	T	P	C
GN 0403	**NANOBIOTECHNOLOGY IN HEALTHCARE**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course is for advanced undergraduates students with a working knowledge of materials and biotechnology. This course introduces the basis of nanoscale processing in health care, different methodology and fabrication of medical devices for diseases diagnosis and therapeutic applications. This course is beginning of what incredible developments around the world in nanobiotechnological healthcare products..

INSTUCTIONAL OBJECTIVES

- To introduce the concept of nanotechnology and its application in healthcare
- Introduction to different equipment used in nanotechnology
- To introduce targeted drug delivery using nanotechnology.

BASICS

Behavior of molecules in solution; DNA machines; Molecular motors; Patterning single molecules; Nano-structured surfaces – applications in cell engineering; Optical and electronic measurements of charge transport in biomolecules; Membrane Proteins; Nanopore engineering; Bilayer Techniques

DNA NANOSTRUCTURE AND CHARACTERIZATION

Introduction, DNA Arrays; DNA nanomechanical devices; DNA for coding & information storage; DNA based computation; Atomic Force Microscopy; Scanning Tunnelling Microscopy; Confocal Microscopy

MICROFLUIDICS AND LAB-ON-A-CHIP
Introduction; concepts and advantages of microfluidic devices; Fluidic transport; Stacking and Scaling; Materials for the Manufacture (silicon, glass, polymers); Fluidic Structures; Fabrication Methods; Surface Modifications; Spotting; Detection Mechanisms

POLYMER NANOCONTAINERS
Introduction, Liposomes in Biotechnology, Polymer Nanocontainers in Therapy, Dendrimers, Layer-by-layer deposition, block copolymers self assembly and nanocontainers; Polymer nanocontainers with controlled permeability; block copolymer protein hybrid system, stimuli responsive nanocapsules, biomaterials and Gene therapy

DRUG DELIVERY
Nano materials synthesis and characterization; Different Methodology Used in the targeted Drug delivery; Bio Marker Using Nano Materials; Targeted delivery for Disease Diagnosis and therapeutics; Different Detection Methods for Targeted Delivery

TEXT BOOKS
Nanobiotechnology: Concepts, Application and Perspectives by Christof M. Niemeyer & Chad A. Mirkin published by Wiley-VCH

		L	T	P	C
GN 0405	**STEM CELL BIOLOGY**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE
The course offers an opportunity the students to understand the basics of stem cells Embryonic stem cells, Adult stem cells and genetic engineering of stem cells

INSTRUCTIONAL OBJECTIVES
To make the student gain knowledge in
- Stem cell basics
- Growing of ES cells in lab
- Differentiation of stem cells
- Application of stem cells

STEM CELL BASICS
Unique properties of stem cells – embryonic stem cells - adult stem cells – umbilical cord stem cells – similarities and differences between embryonic and adult stem cells. Properties of stem cells – pluripotency – totipotency – multipotency.

EMBRYONIC STEMCELLS
Invitrofertilization – human embryonic stem cells – blastoeyst – innercell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation ES cells for differentiation – properties of ES cells – human ES cells – Monkey and Mouse ES cells.

ADULT STEM CELLS
Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation – trans differentiation – plasticity – different types of adult stem cells.

STEM CELL IN DRUG DISCOVERY AND TISSUE ENGIEERING
Taret identification – Manipulating differentiation pathways – stem cell therapy Vs cell protection - stem cell in cellular assays for screening – stem cell based drug discovery platforms, drug screening and toxicology.

GENETIC ENGINEERING AND THERAPEUTIC APPLICATION OF STEM CELLS
Gene therapy – genetically engineered stem cells – stem cells and Animal cloning – transgenic animals and stem cells – Biomarkers in Cancer – Therapeutic applications – parking disease - Neurological disorder – limb amputation – heart disease - spinal cord injuries – diabetes –burns Matching the stem cell with trans plant recipient - HLA typing Alzheimers disease – spinal cord injuries tissue engineering application – production of complete organ - kidney – eyes - heart – brain.

REFERENCE BOOKS

1. Stem cells Hand Book by Stewart Sell
2. Stem cell Research by Nancy E. Snow
3. Human Embryonic Stem cells by Ann.A. Kiessling
4. Stem cell and future of regenrative medicine. National Academic press
5. Stem cell and Cloning by David A. Prentice and Michael A. Palladin.

		L	T	P	C
GN 0407	**Comprehension II**	**1**	**0**	**0**	**1**
	Pre requisite				
	Nil				

		L	T	P	C
GN 0409	**GENOME ANALYSIS LABORATORY**	**0**	**0**	**4**	**2**
	Pre-requisite				
	Nil				

PURPOSE

Provide an opportunity to practice different genome analysis tools

INSTRUCTIONAL OBJECTIVES

The students will be able to get exposure on various bioinformatics tools available for analyzing genes and genomes

1. Sequence retrieval from biological database
2. Knowledge on variants of BLAST
3. Gene prediction
4. Translation the sequences and ORF finding
5. Splice site junction prediction
6. Protein targeting signal sequence prediction
7. Pattern searching
8. Comparative genome analsis
9. Phylogeny analysis
10. Contig Assembly

REFERENCE BOOK

Lab Manual and software manuals

		L	T	P	C
BT 0401	**ANIMAL CELL CULTURE LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	ANIMAL BIOTECHNOLGY				

PURPOSE

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.

INSTRUCTONAL OBJECTIVES

The students should be able to

1. Understand explicitly the concepts
2. Develop their skills in the animal cell culture techniques

LIST OF EXPERIMENTS

1. Preparation of culture media and sterilization
2. Organ culture. Fibroblast culture.
3. Adaptation of Animal virus in cell lines BHK-21-vero cell line.
4. Study of effect of anti cancer agent in cell culture.

5. MTT Assay
6. Live cell counting
7. Leukocyte culture
8. Culturing of spleen cells
9. Myeloma cell culture
10. Fusion of cells by PEG

REFERENCE BOOK
Laboratory Manual

		L	T	P	C
BT0413	**BIOSEPARATION LABORATORY**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE
Provides an opportunity to experimentally verify the theoretical concepts already studied. it also helps in understanding the theoretical principles in a more explicit and concentrated manner.

INSTRUCTIONAL OBJECTIVES
The students will be able to get exposure on various Bioseparation process such as
1. Cell disruption techniques
2. Product enrichment techniques
3. Product purification methods

LIST OF EXPERIMENTS
1. Chemical cell disruption and assay for intracellular products
2. Mechnical cell disruption and assay for intracellular products
3. Separation of insolubles by filtration / sedimentation / centrifugation
4. Ammonium sulphate precipitation and dialysis
5. Gel analysis/ assay for dialysed product
6. Ion Exchange chromatography
7. Gel flitration
8. FPLC
9. HPLC
10. Gas chromatography

REFERENCE BOOK:
Scopes AK, " *Protein Purification* " , IRL Press, 1993.

		L	T	P	C
GN 0411	**Industrial Training 2**	**0**	**0**	**2**	**1**
	Pre requisite				
	Nil				

The student has to undergo industrial training for a minimum period of two weeks during the winter/summer vacation of the III year. After undergoing the training in an industry, the student will be asked to submit a report that will be evaluated

VIII SEMESTER

		L	T	P	C
GN 0402	**PROJECT WORK**	**0**	**0**	**16**	**8**
	Pre-requisite				
	Nil				

Description

At the end of the 7th semester, students will be assigned to projects based on the submitted abstracts. During the 8th semester, 3 review meetings will be conducted during which their progress will be monitored and evaluated by their oral presentations. The students are expected to submit a written thesis of their project at the end of the semester followed by *viva voce* examination.

		L	T	P	C
BT 0402	**BIOSAFETY, BIOETHICS, IPR & PATENTS**	**2**	**0**	**0**	**2**
	Pre-requisite				
	Nil				

PURPOSE

This course creates awareness on the Biosafety, bioethics, Intellectual property rights and patenting of bio-technological processes.

INSTRUCTIONAL OBJECTIVES

- To introduce the biosafety regulations and ethical concepts in biotechnology
- To emphasize on IPR issues and need for knowledge in patents in biotechnology

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BIOSAFETY

BIOSAFETY-REGULATORY FRAMEWORK FOR GMOS IN INDIA

Regulatory framework in India governing GMOs-Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety Committee (IBC), Review Committee on Genetic Manipulation, Genetic Engineering Approval Committee (GEAC), State Biosafety Coordination Committee (SBCC), District Level Committee (DLC). Recombinant DNA Guidelines (1990), Revised Guidelines for Research in Transgenic Plants (1998), Seed Policy (2002), Prevention Food Adulteration Act (1955), The Food Safety and Standards Bill (2005), Plant Quarantine Order (2003), Regulation for Import of GM Products Under Foreign Trade Policy (2006-2007), National Environment Policy (2006). Rules for the manufacture, use/import/export and storage of hazardous microorganisms/genetically engineered organisms or cells (Ministry of Environment and Forests Notification, 1989).

BIOSAFETY-REGULATORY FRAMEWORK FOR GMOS AT INTERNATIONAL LEVEL

Convention of Biological Diversity (1992) – Cartagena Protocol on Biosafety – Objectives and salient features of Cartagena Protocol – Advanced Information Agreement (AIA) procedure – procedures for GMOs intended for direct use-risk assessment-risk management-handling, transport, packaging and identification of GMOs-Biosafety Clearing House-unintentional transboundary movement of GMOs-Benefits of becoming a party to the Cartagena Protocol- status of implementation in India.

BIOETHICS

What is bioethics? The legal and socioeconomic impacts of biotechnology-Public education of the process of biotechnology involved in generating new forms of life for informed decision-making – ethical concerns of biotechnology research and innovation.

INTELLECTUAL PROPERTY RIGHTS

Intellectual property rights-TRIP- GATT-International conventions patents and methods of application of patents-Legal implications-Biodiversity and farmer rights

PATENTS AND PATENT LAWS

Objectives of the patent system - Basic principles and general requirements of patent law-biotechnololgical inventions and patent law-Legal development-Patentable subjects and protection in biotechnology-The patenting living organisms.

REFERENCES:

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection-Oxford and IBH Publishing Co. New Delhi.
2. Sasson A, Biotechnologies and Development, UNESCO Publications.
3. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi
4. Regulatory Framework for GMOs in India (2006) Ministry of Environment and Forest, Government of India, New Delhi
5. Cartagena Protocol on Biosafety (2006) Ministry of Environment and Forest, Government of India, New Delhi

VI SEMESTER ELECTIVES

		L	T	P	C
GN 0352	**Human Genetics**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

GENOME ORGANIZATION AND INHERITANCE

Organization, Human multigene families and repetitive coding DNA, Extragenic repeated DNA sequences and transposable elements, Inheritance-Autosomal Dominant Inheritance-Autosomal Recessive Inheritance- Factors that May Complicate Inheritance Patterns- Consanguinity in Human Populations, Sex-Linked and Mitochondrial Inheritance, X inactivation- Sex-Linked Inheritance- Sex-Limited and Sex-Influenced Traits- Mitochondrial Inheritance.

GENOME MAPPING AND DEVELOPMENTAL GENETICS

Physical Mapping - Low resolution physical mapping, High resolution physical mapping, Genetic mapping- Two-point mapping, Multipoint mapping, Parametric linkage analysis, Nonparametric linkage analysis, Development genetics- Genetic Mediators of Development, the Molecular Toolbox- Pattern Formation.

MEDICAL GENETICS

The Chromosomal Basis of Human Disease- Nomenclature-Abnormalities of Chromosome Number-Abnormalities of Chromosome Structure- Pregnancy Loss- Cancer genetics- Cancer Genes- Oncogenes, Activation of proto-oncogenes, Tumor suppressor genes, Molecular Basis of Cancer, Control of the cell cycle, Defects of Metabolic Processes- Pharmacogenetics

IDENTIFICATION OF DISEASE GENES

Identifying human disease genes - Principles and strategies in identifying disease genes, Position-independent strategies for identifying disease genes, positional cloning, Positional candidate strategies to identify candidate genes by a combination of their map position and expression, function or homology, confirming a candidate gene

THE GENETICS OF COMMON DISEASES

Genetic Screening, Genetic Diagnosis, and Gene Therapy, Population Screening for Genetic Diseases, Molecular Tools for Screening and Diagnosis, Prenatal Diagnosis of Genetic Disorders and Congenital Defects, Fetal Treatment, Pedigree analysis and Genetic Counseling.

Text Book

1. Human Molecular Genetics – Tom Strachan and Andrew P. Read
2. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad & White.

Reference Book

1. Human Genetics and Genomics, Third Edition - Bruce R. Korf
2. Human Genetics : Principles and Approaches - Friedrich Vogel and Arno G. Motulsky

		L	T	P	C
BT 0304	**PROTEIN ENGINEERING**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The course imparts advanced knowledge on proteins through a detailed study of protein Structure, its characteristics property and significance in biological systems .

INSTRUCTIONAL OBJECTIVES

- To focus and advanced knowledge on primary secondary structure of and their determined
- Protein design principles and database analysis

INTRODUCTION TO PROTEIN ENGINEERING

Primary structure, secondary structure, tertiary structure, quaternary structure, Ramachandran plots.

PROTEIN STRUCTURE PREDICTION 9

Strategies for design of novel proteins-strategies for the design of structure and function, computer methods in protein modeling

PRODUCTION OF NOVEL PROTEINS
Site and strategies for heterologous expressions, methods for expressing recombinant proteins in yeast, invitro mutagenesis.

CHARACTERIZATION OF PROTEINS
NMR spectroscopy, crystallography, spectroscopic and calorimetric methods.

APPLICATIONS OF PROTEIN ENGINEERING
Design of polymeric biomaterials, nicotinic acetylcholine receptors as a model for a super family of ligand - gated ion channel proteins

TEXT BOOK:
Protein engineering and design by Paul R.carey, academic press, 1996, 361 pages.

		L	T	P	C
GN 0354	**INDUSTRIAL MICROBIOLOGY**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE
This course explores microbiological industry development, scope of microbiological industries, microbes in microbiological industries, biomass and metabolite production, microbes in mine industries, microbes in waste treatment industries.

INSTRUCTIONAL OBJECTIVES
After taking this course, students are provided with understanding and knowledge on the value of microbes in life rather than as disease agents. It is expected that the students will be motivated to develop their innovation on exploiting microbes for positive purposes in human living.

INTRODUCTION AND HISTORY
Definition, scope and roles of microbiology and its relation to other disciplines; fundamentals and characteristics of the roles of microbes in bioprocess technology; nomenclature and classification of microbes; review of microbes commonly used in bioprocess industries: bacteria, actinomycetes, yeasts, fungi, viruses and algae; history of industrial microbiology; Role of microorganisms in petroleum degradation and bioleaching.

MICROORGANISMS OF INDUSTRIAL IMPORTANCE
Selection of Microorganisms; Primary and Secondary Screening; Types of stock culture, Strain Improvement Strategies; Strain Identification & Strain Preservation of Industrial Microorganisms for overproduction of Primary and Secondary metabolites; Medium requirements for fermentation process-carbon, nitrogen, minerals, vitamins and other nutrients-examples of simple and complex media.

PRODUCTION OF PRIMARY AND SECONDARY METABOLITES
A brief outline of processes for the production of some commercially important Organic acids (citric acid, taconic acid , lactic acid , acetic acid , gluconic acid) and amino acids (glutamic acid , lysine, aspartic acid, phenylalanine etc.) and Alcohols (ethanol, 2,3,-butanediol etc.) Study of production process for various classes of low molecular weight secondary metabolites: Antibiotics-beta-lactams (Penicillins, Cephalosporins etc.), Aminoglycosides (streptomycin, kanamycin etc.), macrolides (erythromycin), quinines, aromatics etc.; Vitamins and Steroids.

PRODUCTION OF COMMERCIALLY IMPORTANT ENZYMES AND PROTEINS

Proteases, Amylases, Lipases, Cellulases, Pectinases, Isomerases and other commercially important enzymes for the food and pharmaceutical industries; Production of recombinant proteins having therapeutic and diagnostic applications; production of vaccines.

FERMENTATION

Definition of fermentation; fermentor/bioreactor; fermentation media; raw materials – molasses and types, corn steep liquor, sulphite waste liquor and whey. Buffers, precursors, inhibitors, and antifoam agents. inoculum preparation. Types of Fermentation Processes: Surface, Submerged and Solid state fermentation, Batch and Continuous fermentation. Down stream processing – Precipitation, filtration, centrifugation, distillation, cell disruption, solvent recovery, drying,

TEXT BOOK

1. Crueger and A. Crueger; Biotechnology: A Textbook of Industrial Microbiology (Eng. Ed. T. D. Brook). Sinaeur Associates, 1990.
2. L. E. Casida, Jr.; Industrial Microbiology. Wiley Eastern Ltd., 1989.

REFERENCE BOOK

1. G. Reed (Ed.); Prescott and Dunn's Industrial Microbiology (4th Ed.). CBS Publishers, 1987.
2. H. J. Rehm, G. Reed and H. Pape (Eds.) Biotechnology (A Comprehensive Treatise vols. 1-8). VCH, 1986.

		L	T	P	C
GN 0356	**INDUSTRIAL MANAGEMENT**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The course strengthens the students to apply their scientific and technical knowledge in entrepreneurship and effectively manage their ventures through a study of more advanced level topics on the subject of study.

INSTRUCTIONAL OBJECTIVES

To emphasize and lay focus on the

- Principles of management
- operation of management
- project management
- finance management

PRINCIPLES OF MANAGEMENT

Principles of management-Management functions-planning-organizing-organization structures-span of control-Delegation-Directing-Leadership and motivation-Controlling-Decision making-Single stage decision making under risk-Multistage decision making, decision making under uncertainly-equally likely-minimax and maximum criteria.

OPERATION MANAGEMENT

Operation management-production systems and functions-product design and selection, concept of total quality management and ISO 9000 system of standards-concept of supply chain management,

PROJECT MANAGEMENT

Project management-projects and management-network analysis-critical path method (CPM) network-finding critical path-slacks-crashing (time-cost trade off)-PERT network.

MARKETING MANAGEMENT

Marketing management-Concept of market and marketing-marketing function, marketing mix-market research-Advertising and sales promotion-human resource management-manpower requirement analysis-recruitment and training-job analysis-job evaluation, wages and incentives

FINANCIAL MANAGEMENT

Financial management-objectives/functions-concept of time value of money-basics of financial accounting, profit and loss account, balance sheet, costing, elements of costs-cost sheet, allocation of overheads. Break even analysis depreciation, significance and methods of depreciation.

TEXT BOOKS

1. Mazda F, Engineering Management, Addison Wesley
2. Buffa E.S. & Sarin R.K. Modern Production/Operations Management, John wiley

VII SEMESTER ELECTIVES

		L	T	P	C
BT 0403	**BIOREACTOR DESIGN**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The course imparts advanced knowledge on bioreactor design for efficient utilization of the principles in bioprocess technology

INSTRUCTIONAL OBJECTIVES

To familiarize:

- .Basic concepts of bioreactor design .
- Bioreactor instrumentation and control
- Methods and strategies for fermentation control
- Modelling and simulation of fermentation processes
- Plant and animal cell bioreactors

BIOREACTOR DESIGN

Types of Bioreactor, Heat transfer, Scale – up, Airlift Bioreactors, Introduction, Design and construction of the airlift – loop reactor, Hydrodynamics, Three – phase flow, Mixing, Oxygen transfer.

BATCH AND CONTINUOUS GROWTH

Growth, Measurement of microbial growth (direct), Measurement of microbial growth (indirect), Kinetics of cell growth in batch culture, Continuous culture.

MIXING, MASS TRANSFER AND INSTRUMENTATION CONTROL OF BIOREACTORS

Introduction, Mass transfer, Theory of mixing, Rheological properties, Bioreactor sensor characterizes, Temperature measurement control, principles of dissolved oxygen measurement and control, principles of PH / redox measurement and control, deduction and prevention of foam, determination of biomass and application of biosensors.

BIOREACTOR OFF – GAS ANALYSIS

Introduction, generalized gas balance equations, Steady – state balancing, Derived quantities based on combined gas analysis and gas mass balancing techniques, Gas analysers.

MODELING OF PLANT AND ANIMAL CELL BIOREACTORS

Modelling, digital simulation, formulation and solution of problems by simulations, digital simulation programming languages, ISIM (interactive simulation language) Plant cells, Animal cells.

TEXT BOOK:

1. "***Bioreactors in Biotechnology***", Ellis Horwood series, 1991. A. H. SCRAGG.

		L	T	P	C
BT 0451	**BIOMEDICAL ENGINEERING**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The course offers an opportunity the students to understand the principles of biomedical engineering concepts

INSTRUCTIONAL OBJECTIVES
To make the student gain knowledge and skills in

- Basic human biology concepts
- Application of biomechanics
- Biosystem modeling
- Importance of ultrasound signaling

INTRODUCTION
Anatomy of human-various bones-functions-muscles-types-function

MUSCLE STRUCTURE AND ITS FUNCTIONS
Muscle structure and its attachment with skeleton-rate of contraction and force generation-Activation contraction-locomotion-stability-forces on ground-forces on muscles-energy requirement-mechanisms of walking, running and trotting-sports.

BIOMECHANICS
Mechanical analysis of performance-rehabilitation biomechanics-mechanics of prosthetics and orthotics-biomechanics of human injury and orthopaedics fixation-mechanics of bones and joint-dynamics of man machine interaction.

BIOSYSTEM MODELING
Electrical impedance cephalography-biotelemetry-biosignal analyzer-biosystem modelling.

ULTRASOUND IN DIAGNOSIS
Ultrasound in diagnosis-limb prosthetics and orthotics-sensory aids for the blinds-assisting the heart and kidney-ECG-EEB-Physiological equipments.

REFERENCES:
1. Atilla Hincal A., Suheylakas, H, Biomedocal Science&Technology, Plenum Press Newyork

		L	T	P	C
GN 0453	**GENES AND DISEASES**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE
To understand the genes that control or influence the development of human diseases

INSTRUCTIONAL OBJECTIVES
To emphasize and lay focus on the diseases that are controlled by genes in human and the way those genes are functioning.

Introduction to the diseases due to defective genes. Dominance, recessive, codominance, autosomal and sex-linked inheritance of diseases. Chromosomal maps. Blood and lymph diseases, cancers, diseases of the digestive system.

Diseases of ear, nose and throat, Diseases of the eye, female-specific diseases, diseases of glands and hormones.

Diseases of heart and blood vessels, diseases of the immune system, male specific diseases, disease of muscle and bone.

Neonatal diseases, Diseases of the nervous system, nutritional and metabolic diseases

Respiratory diseases, diseases of skin and connective tissue, Chromosome map

TEXT BOOKS
Genes and Diseases, NCBI Bookself, free e-book
http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gnd/tocstatic.html

VIII SEMESTER ELECTIVES

		L	T	P	C
GN 0452	**BIOCONFINEMENT OF GENETICALLY MODIFIED ORGANISMS**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course deals with the importance of bioconfinement of genetically modified organisms

INSTRUCTIONAL OBJECTIVES

- To make the students to understand the need of bioconfinement of genetically engineered organisms
- To impart knowledge on methods of bioconfinement

INTRODUCTION TO BIOCONFINEMENT

Genetically Engineered Organisms –Bioconfinement - Methods of Bioconfinement,
International Aspects - History of Confinement - Social Acceptability of Bioconfinement Methods,

NEED FOR BIOCONFINEMENT

Risk factors - Effects on Nontarget Species - Delaying the Evolution of Resistance - Food Safety and Other Issues - Need for Bioconfinement

BIOCONFINEMENT OF PLANTS AND ANIMALS

Genetically Engineered Trees - Transgenic Grasses - Transgenic Algae-Effectiveness at Different Spatial and Temporal Scales - Monitoring and Managing Confinement Failure -bioconfinement of fish, and insects

BIOCONFINEMENT OF VIRUSES, BACTERIA, AND OTHER MICROBES

Introduction - Potential Effects or Concerns, and Need for Bioconfinement in Viruses, Fungi, and Bacteria

BIOLOGICAL AND OPERATIONAL CONSIDERATIONS FOR BIOCONFINEMENT

Execution of Confinement - International Aspects - Bioconfinement - Bioconfinement Research

TEXT BOOK

1. Biological confinement of genetically engineered organisms by national research council : National Academic press

		L	T	P	C
GN 0454	**FOOD SAFETY AND GENETICALLY MODIFIED FOOD**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE:

Aimed at enabling the student to understand the concept of biotechnology in food processing preservation and genetically engineered food

INSTRUCTIONAL OBJECTIVES:

- To emphasise the importance of food safety, Bio process in food preservation, Important fermented food products, Food quality and safety, Genetically Engineered food and labeling

STATE OF FOOD TODAY

Adulteration –Filth -Microorganisms -Chemicals and Other Additives-Genetically Manipulated Organisms - Ethnic Foods and Cultural Differences-The Food and Drug Administration -The Centers for Disease Control and Prevention -The Environmental Protection Agency

MICROBIOLOGICAL HAZARDS AND CHEMICAL HAZARDS

Microbiological Contamination-Clostridium botulinum –Vibrio-Salmonella- HepatitisA-Ecoli O157:H7 - Campylobacter -Listeria -Bovine Spongiform Encephalopathy -chemical Contaminants-Pesticides -Alar in Apples -Mercury - Seafood -Fungal Toxins

FOOD PROCESSING AND FOOD PRESERVATION
Biotechnology in relation to the food industry, nutritive value of food, Food Processing Irradiation -Packaging - Bioprocessing of meat, fisheries, vegetables, diary products, enzymes and chemicals used in food processing, biochemical engineering for flavour and food production.

FERMENTED FOOD PRODUCTS& FOOD SPOILAGE
Dairy, products, meat. Fishery, non beverage plant products, beverages and related products of baking.-Food borne illness, quality control, case studies on Biotechnology in the evolution of food quality, HFCS (High Fructose Corn Syrup) and mycoproteins.

GENETIC ENGINEERING AND FOODS
Genetically engineered food- labaling-Bovine Somatotropin in Milk- -Chymosin -Lite beer -Tryptophan - Transgenic plants-tomato -Methionine-enriched oil -Frost-resistance Drought and Salinity resistance -Herbicide Resistance -InsectResistance-*Bacillus thuringiensis* toxin - B.t. maize -Fungal Resistance potatoes-Virus Resistance -Plant Pharmaceuticals -*beta* -carotene in rice -transgenic "heart-healthy" canola oil -Edible vaccines -Hepatitis B vaccine in maize-Cholera vaccine in potatoes -Transgenic Animals -Growth hormone gene in pigs -*alpha*-lactalbumin and lactoferrin in milk -Transgenic Fish -Atlantic salmon -Animal Cloning-Biotechnology Benefits, Risks and Public Perceptions

TEXT BOOKS
1. Potten N.M. " Food Science" The AVL Publishing Co. 2002
2. Piefzer F.M. " Food Microbiology " Academic Press, 1989

REFERENCE BOOKS:
1. Lindsay, Willis Biotechnology, "Challenges for the flavour and food industries", Elsevier Applied Science, 1988,
2. Roger A., Gorden B., and John T., " Food Biotechnology", 1989.
3. George J.B., "Basic Food Microbiology", CBS Publishers & Distributors, 1987.
4. James M.J. "Modern Food Microbiology", CBS Publishers & Distributors, 1987.

		L	T	P	C
GN 0456	**PHARMACOINFORMATICS**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE
The course offers a more focused study on the important aspects of information technology and biotechnology in pharmacology

INSTRUCTIONAL OBJECTIVES
- Modern information techniques in pharmacy
- Robotics and automation in pharmacy
- Legal and ethical aspects of information technology in pharmacy

INTRODUCTION TO INFORMATICS
Computers – computer networks – operating system – Windows – MacOS – UNIX – local and wide area network – internet

COMPUTER APPLICATIONS AND INFORMATION MANAGEMENT
Word processing – computer graphics – image processing – graphic design – Multimedia – spread sheet – statistical software – data representation – computer modeling – computer aided drug design – storage and retrievel of information – search algorithms – data bases – Drug information data bases

MODERN INFORMATION TECHNIQUES IN PHARMACY
Computer mediated communications and collaboration – e-mail – mailing links and newsgroups -Pharmacy-related discussion forums -Intranets-Software for remote collaboration –Telemedicine- Drug information systems-Public health information systems -Information technologies in pharmaceutical error prevention

ROBOTICS AND AUTOMATION IN PHARMACY

Technical cybernetics -Pattern recognition -Sensors -Artificial intelligence -Knowledgebased information systems -Computer-aided decision support -Pharmacy automation. Automated medication dosage,- filling,- and packaging -Coding of information, bar-codes-Medication distribution and management- inventory control. Computerized narcotic systems - Integrated health care information systems -Electronic patient record - Computerized medical record system -Health care financial systems- management and planning systems - Patient education and continuity of pharmacy care

LEGAL AND ETHICAL ASPECTS OF INFORMATICS

Health information confidentiality rules-Security and privacy in medical information systems -Biometrics - Accountability and liability of information users and providers. Intellectual property protection and copyright-Regulation of the information infrastructure

TEXT BOOK

1. Quantitative molecular pharmacology and informatics in drug discovery by Michael lutz,Jerry Kenatin
2. molecular pharmacology A short course by Jerry Kenatin : John Wiley and Sons publications.

		L	T	P	C
GN 0458	**MOLECULAR MEDICINE**	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

The course imparts advanced knowledge on use of biological molecules as medicine in human health care sector employing biotechnology

INSTRUCTIONAL OBJECTIVES

- To focus and impart advanced knowledge on molecular basis of diseases, Vaccine technology, Molecular Therapeutics, Synthetic peptides

INTRODUCTION TO MOLECULAR MEDICINE

Introduction to Molecular Medicine : Overview of the subject -Molecular mechanisms in development and differentiation -Molecular and biomedical aspects of ageing

GENE EXPRESSION AND PROTEIN FUNCTIONAL DEFECTS IN DISEASE

Vesicle trafficking in cells -Abnormal protein function and disease -Diseases of DNA repair and genomic instability -RNA processing and disease-Oncology-Chromosomal translocations and leukaemia: identification of novel therapeutic targets -Lymphoma -Skin cancer-Solid tumours: renal carcinoma-Lung and circulatory disease-Coagulation and haemophilia -Atherosclerosis -Cystic fibrosis -Molecular aspects of neurodegenerative disease-Prion proteins -Alzheimer's and Huntington's diseases

MOLECULAR PHARMACOLOGY

Pharmacogenetics -Drug discovery -Drug design and development -Molecular aspects of infectious diseases-Intracellular pathogens: Bacillary dysentery Extracellular pathogens: Botulism and tetanus -Viral pathogens: Dengue haemorrhagic fever

IMMUNOLOGICAL ASPECTS OF MOLECULAR MEDICINE

Autoimmunity and transplantation -Human genome and predisposition to autoimmunity -Transgenic models of autoimmunity-Lessons from animal models for manipulation of the immune system

MOLECULAR BIOTECHNOLOGY

Recombinant proteins; state of the art, problems, new developments -Antibodies, design production, engineering -Peptides and derivatives as therapeutic agents-Gene therapy and delivery – Nanotechnology and pharmaceuticals – Drug delivery systems-Commercialisation -Clinical trials/ethics

REFERENCES:

1. Gary Walsh – “Proteins – Biochemistry and Biotechnology” Robert A. Meyers - Encyclopedia of Molecular Cell Biology and Molecular Medicine (Ed) – Vol I, II ed.
2. Barry Halliwell - Free Radicals in Health and Disease