Curriculum & Syllabus

of

B.Tech. Biotechnology

(For the batch admitted in 2008-09)

K.S.RANGASAMY COLLEGE OF TECHNOLOGY
TIRUCHENGODE – 637 215

(An Autonomous Institution affiliated To Anna University of Technology Coimbatore and approved by AICTE, New Delhi)

K.S.Rangasamy College of Technology - Autonomous Regulation	**R 2008**
Department	**Biotechnology**
Programme Code & Name	**23: B.Tech. Biotechnology**

K.S. Rangasamy College of Technology, Tiruchengode - 637 215								
Curriculum for the Programmes under Autonomous Scheme								
Regulation	R 2008							
Department	Department of Biotechnology							
Programme Code & Name	23 : B.Tech Biotechnology							
Semester I								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230101G	Technical English	3	0	0	3	50	50	100
08230102G	Engineering Mathematics I	3	1	0	4	50	50	100
08230103G	Applied Physics	3	0	0	3	50	50	100
08230104G	Applied Chemistry	3	0	0	3	50	50	100
08230105S	Fundamentals of Programming (BT, Civil, Mech, MCT, Nano and Textile)	3	0	0	3	50	50	100
08230106C	Applied Biology	3	1	0	4	50	50	100
	PRACTICAL							
08230107P	Engineering Graphics Laboratory	1	0	3	3	50	50	100
08230108P	Applied Chemistry Laboratory	0	0	3	2	50	50	100
08230109P	Programming Laboratory	0	0	3	2	50	50	100
08230110P	Engineering Practices Laboratory	0	0	3	2	50	50	100
Total		19	2	12	29			1000
Semester II								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230201G	Communication skills	3	0	0	3	50	50	100
08230202G	Engineering Mathematics II	3	1	0	4	50	50	100
08230203G	Materials Science (all B.E./B.Tech. programmes except Nano)	3	0	0	3	50	50	100
08230204G	Environmental Science	3	0	0	3	50	50	100
08230205S	Basics of Electrical and Electronics Engineering (BT, Civil and Text)	3	1	0	4	50	50	100
08230206C	Object oriented programming (BT and Nano)	3	0	0	3	50	50	100
	PRACTICAL							
08230207P	Applied Physics Laboratory	0	0	3	2	50	50	100
08230208P	Applied Biology Laboratory	0	0	3	2	50	50	100
08230209P	Object oriented programming Laboratory	0	0	3	2	50	50	100
08230210P	Comprehension I	0	0	3	0	100	00	100
Total		18	2	12	26			1000

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Regulation	R 2008							
Department	Department of Biotechnology							
Programme Code & Name	23 : B.Tech Biotechnology							
Semester III								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230301G	Engineering Mathematics III (all B.E./B.Tech. programmes except Textile)	3	1	0	4	50	50	100
08230302C	Bioorganic Chemistry	3	0	0	3	50	50	100
08230303C	Microbiology	3	0	0	3	50	50	100
08230304C	Principles of Chemical Engineering	3	1	0	4	50	50	100
08230305C	Biochemistry	3	0	0	3	50	50	100
08230306C	Instrumentation Techniques	3	0	0	3	50	50	100
	PRACTICAL							
08230307P	Bioorganic chemistry Laboratory	0	0	3	2	50	50	100
08230308P	Microbiology Laboratory	0	0	3	2	50	50	100
08230309P	Instrumentation Techniques Laboratory	0	0	3	2	50	50	100
08230310P	Comprehension II	0	0	3	0	100	00	100
08230311P	Career competency Development I	0	0	2	0	100	00	100
	Total	18	3	14	26			1100
Semester IV								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230401C	Probability and Statistics (BT and Nano)	3	1	0	4	50	50	100
08230402C	Genetics	3	0	0	3	50	50	100
08230403C	Molecular Biology	3	0	0	3	50	50	100
08230404C	Basic Industrial Biotechnology	3	0	0	3	50	50	100
08230405C	Chemical Reaction Engineering	3	1	0	4	50	50	100
08230406C	Chemical Thermodynamics and Biothermodynamics	3	1	0	4	50	50	100
	PRACTICAL							
08230407P	Molecular Biology Laboratory	0	0	3	2	50	50	100
08230408P	Chemical Reaction Engineering Laboratory	0	0	3	2	50	50	100
08230409P	Chemical Engineering Laboratory	0	0	3	2	50	50	100
08230410P	Comprehension III	0	0	3	0	100	00	100
08230411P	Career Competency Development II	0	0	2	0	100	00	100
Total		18	3	14	27			1100

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Department	Department of Biotechnology							
Programme Code & Name	23 : B.Tech Biotechnology							
Semester V								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230501G	Professional Ethics	3	0	0	3	50	50	100
08230502C	Genetic Engineering	3	0	0	3	50	50	100
08230503C	Bioinformatics	3	1	0	4	50	50	100
08230504C	Bioprocess Engineering	3	1	0	4	50	50	100
08230505C	Enzyme Engineering and Technology	3	0	0	3	50	50	100
08230506C	Plant and Animal Biotechnology	3	1	0	4	50	50	100
	PRACTICAL							
08230507P	Genetic Engineering Laboratory	0	0	3	2	50	50	100
08230508P	Bioprocess Engineering Laboratory	0	0	3	2	50	50	100
08230509P	Enzyme Engineering Laboratory	0	0	3	2	50	50	100
08230510P	Career Competency Development III	0	0	2	0	100	00	100
	Total	18	3	11	27			1000
Semester VI								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230601G	Principles of Management	3	0	0	3	50	50	100
08230602C	Immunology	3	1	0	4	50	50	100
08230603C	Molecular Modeling and Drug Designing	3	1	0	4	50	50	100
08230604C	Protein Engineering	3	1	0	4	50	50	100
082306**E	Elective I	3	0	0	3	50	50	100
082306**E	Elective II	3	0	0	3	50	50	100
	PRACTICAL							
08230607P	Immunology Laboratory	0	0	3	2	50	50	100
08230608P	Bioinformatics Laboratory	0	0	3	2	50	50	100
08230609P	Industrial Biotechnology Laboratory	0	0	3	2	50	50	100
08230610P	Career Competency Development IV	0	0	2	0	100	00	100
Total		18	3	11	27			1000

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Programme Code & Name	23 : B.Tech Biotechnology							
Semester VII								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230701G	Total Quality Management	3	0	0	3	50	50	100
08230702C	Down Stream Processing	3	1	0	4	50	50	100
08230703C	Biotechnology of Stem cells	3	0	0	3	50	50	100
08230704C	Nanobiotechnology	3	1	0	4	50	50	100
082307**E	Elective III	3	0	0	3	50	50	100
082307**E	Elective IV	3	0	0	3	50	50	100
	PRACTICAL							
08230707P	Down Stream Processing Laboratory	0	0	3	2	50	50	100
08230708P	Plant and Animal biotechnology laboratory	0	0	3	2	50	50	100
08230709P	Project Work - Phase I	0	0	4	2	100	00	100
08230710P	Career Competency Development V	0	0	2	0	100	00	100
	Total	18	2	12	26			1000
Semester VIII								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
08230801C	Biopharmaceutical Technology	3	1	0	4	50	50	100
082308**E	Elective V	3	0	0	3	50	50	100
082308**E	Elective VI	3	0	0	3	50	50	100
	PRACTICAL							
08230804P	Project Work - Phase II	0	0	20	10	50	50	100
Total		9	1	20	20			400

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Regulation	R 2008							
Department	Department of Biotechnology							
Programme Code & Name	23 : B.Tech Biotechnology							
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
Electives I								
08230641E	Environmental Biotechnology	3	0	0	3	50	50	100
08230642E	Genomics and Proteomics	3	0	0	3	50	50	100
08230643E	Virology	3	0	0	3	50	50	100
08230644E	Molecular Biophysics	3	0	0	3	50	50	100
Electives II								
08230651E	Food Science and Technology	3	0	0	3	50	50	100
08230652E	Marine Biotechnology	3	0	0	3	50	50	100
08230653E	Metabolic Engineering	3	0	0	3	50	50	100
08230654E	Chromatographic Separations	3	0	0	3	50	50	100
Electives III								
08230761E	Immunotechnology	3	0	0	3	50	50	100
08230762E	Dairy and Bakery Technology	3	0	0	3	50	50	100
08230763E	Nanoscience and technology	3	0	0	3	50	50	100
08230764E	Bioprocess Modeling and Simulation	3	0	0	3	50	50	100
Electives IV								
08230771E	Tissue Engineering	3	0	0	3	50	50	100
08230772E	Molecular Phylogeny	3	0	0	3	50	50	100
08230773E	Cancer Biotechnology	3	0	0	3	50	50	100
08230774E	Systems biology	3	0	0	3	50	50	100
Elective V								
08230881E	Developmental Biology	3	0	0	3	50	50	100
08230882E	Food Biochemistry and Nutrition	3	0	0	3	50	50	100
08230883E	Bioinstrumentation	3	0	0	3	50	50	100
08230884E	Clinical Trial Management	3	0	0	3	50	50	100
Elective VI								
08230891E	Molecular Medicine	3	0	0	3	50	50	100
08230892E	Biodiversity and bioresource Management	3	0	0	3	50	50	100
08230893E	Bio- business	3	0	0	3	50	50	100
08230894E	Principles of Biomedical Engineering	3	0	0	3	50	50	100

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Department	Biotechnology		Programme Code & Name		23:B.Tech..Biotechnology			
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230101G	TECHNICAL ENGLISH (Common to all B.E./B.Tech. programmes)	3	0	0	3	50	50	100
Objective(s)	To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts, familiarize learners with different rhetorical functions of Technical English, help learners develop strategies that could be adopted while reading texts, help learners acquire the ability to speak effectively in English in real-life and career related situations, and train learners in organized academic and professional writing.							
1	GRAMMAR AND VOCABULARY				Total Hrs	9		
Word formation with prefixes and suffixes – synonyms and antonyms – verb patterns-subject – verb agreement – tenses (simple and compound tenses) – simple, compound and complex sentences – impersonal passive voice – use of conditionals – comparative adjectives (affirmative and negative) – expanding nominal compounds – articles – use of prepositions - phrasal verbs – commonly mispronounced and mis-spelt words – British and American vocabulary.								
2	LISTENING				Total Hrs	9		
Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas – note-taking: guided and unguided								
3	SPEAKING				Total Hrs	9		
Verbal and non verbal communication – speech sounds – syllables – word stress (structures and content words) – sentences stress – intonation – Pronunciation drills, tongue twisters – formal and informal English – oral practice – developing confidence – introducing oneself – asking for or eliciting information – describing objects – offering suggestions and recommendations – expressing opinions (agreement / disagreement) – giving instructions.								
4	READING				Total Hrs	9		
Exposure to different reading techniques – reading for gist and global meaning – predicting the content – skimming the text – identifying the topic sentence and its role in each paragraph – scanning – inferring / Identifying lexical and contextual meanings – reading for structure and detail – transfer of information / guided note-making – understanding discourse coherence – sequencing of sentences.								
5	WRITING				Total Hrs	9		
Introductions to the characteristics of technical style – writing definitions and descriptions – paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – classifying the data – analyzing / interpreting the data – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar.								
Total hours to be taught						45		
Text book (s) :								
1	Rizvi M Ashraf, "Effective Technical Communication", 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.							
Reference(s) :								
1	Dr.M.Balasubramanian and Dr.G.Anbalagan, "Performance in English", Anuradha Publications, Kumbakonam, 2007.							
2	Sharon J. Gerson, Steven M. Gerson, "Technical Writing – Process & Product". 3rd Edition, Pearson Education (Singapore) (p) Ltd., New Delhi, 2004.							
3	Mitra K. Barun, "Effective Technical Communication – A Guide for Scientists and Engineers", Oxford University Press, New Delhi, 2006.							

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Department	Biotechnology		Programme Code & Name			23:B.Tech..Biotechnology		
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230102G	ENGINEERING MATHEMATICS I (Common to all B.E./B.Tech. programmes)	3	1	0	4	50	50	100
Objective(s)	The course is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.							

I	MATRICES	Total Hrs	12

Column matrix as vector – linear independent and dependent of vector – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigenvectors – Cayley – Hamilton theorem (without proof) – Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

2	GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	Total Hrs	12

Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes –Evolute as envelope of normals

3	FUNCTIONS OF SEVERAL VARIABLES	Total Hrs	12

Functions of two variables – Partial derivatives – Total differential – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians.

4	ORDINARY DIFFERENTIAL EQUATIONS	Total Hrs	12

Linear differential equations of Second and higher order with constant coefficient when the R.H.S is e^{ax}, $x^n \; n > 0$, $\sin ax$, $\cos ax$, $e^{ax}x^n$, $e^{\alpha x}\sin\beta x$, $e^{\alpha x}\cos\beta x$, $x^n \sin\alpha x$ and $x^n \cos\alpha x$ – Differential Equations with variable coefficients (Cauchy's Form and Legendre's Linear Equation).

5	DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	Total Hrs	12

Simultaneous first order linear equations with constant coefficients – Method of variation of parameters – Solution of specified differential equations connected with electric circuits, bending of beams and simple harmonic motion (Differential equations and associated conditions need be given).

Total hours to be taught	60

Text book (s) :

1	Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.

Reference(s) :

1	Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – First Edition 1996,S.Chand and Co. – New Delhi 2007.
2	Grewal. B.S., "Higher Engineering Mathematics", Thirty Eighth Edition, Khanna Publishers, Delhi, 2004.
3	Kreyszig. E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.
4	Venkataraman.M.K, "Engineering Mathematics, Volume I & II Revised Enlarged", Fourth Edition", The National Pub. Co., Chennai, 2004.

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Department	Biotechnology	Programme Code & Name			23:B.Tech..Biotechnology			
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230103G	APPLIED PHYSICS (Common to all B.E./B.Tech. programmes)	3	0	0	3	50	50	100
Objective(s)	Design of acoustically good buildings, Structural identification of engineering materials, Non destructive Techniques, Application of Quantum Physics and Application of Lasers in Engineering and Technology.							

1	LASERS	Total Hrs	9
Introduction – principles of spontaneous emission and stimulated emission - Population inversion, Pumping-Types of Lasers:He-Ne,CO_2,Nd-YAG,Ruby Lasers, Semiconductor Laser- Applications: Lasers in Microelectronics, Welding, Heat Treatment and Cutting-Holography.			
2	FIBER OPTICS AND APPLICATIONS	Total Hrs	9
Principles-Modes of Propagation-Crucible-Crucible Technique-Classification based on materials, refractive index and modes of propagation-Splicing-Losses in Optical fiber-Light Sources for fibre optics-Detectors-Fiber optical Communication Links-Fiber optic Sensors: Temperature and Displacement measurement.			
3	QUANTUM PHYSICS AND APPLICATIONS	Total Hrs	9
Introduction to quantum theory-Dual Nature of Matter and Radiation-De-Broglie wavelength-Uncertainty principle and its applications-Compton effect-Expression for Compton Shift-Experimental Verification-Schrodinger's equation (Time dependent and Time independent) - Particle in a box-Electron microscope-Scanning electron microscope.			
4	ULTRASONICS	Total Hrs	9
Introduction of Ultrasonic Waves - Magnetostriction effect, Magnetostriction generator, Inverse piezoelectric effect, Piezoelectric generator-Detection of ultrasonic waves-Properties- Cavitation -Industrial Applications drilling, welding, soldering and cleaning- Non destructive testing- Pulse echo system, Through transmission and Resonance system.			
5	ACOUSTICS	Total Hrs	9
Introduction-Classification of Sound-Characteristics of musical sound - Loudness-Sound intensity Level(I_L)-Weber-Fechner Law-Decibel-Phon, Sone-Acoustics of building-Reverberation-Reverberation time-Sabine's formula-Absorption coefficient-Determination of absorption co-efficient-Factors affecting the acoustics of buildings and their remedies-Factors to be followed for good acoustic of building.			
Total hours to be taught			45
Text book (s) :			
1	"APPLIED PHYSICS", 1st Edition Authored by Dept. of Physics KSRCT.		
Reference(s) :			
1	Dr.Jayakumar S,"Engineering Physics", R K Publishers, Coimbatore, 2003.		
2	Dr.Arumugam.M, "Engineering Physics" , 5th Edition Anuradha Publications,Kumbakonam,2006.		
3	Gaur R.K and Gupta S.L, "Engineering Physics", Dhanpati Rai and Sons, New Delhi,2001.		
4	Charles Kittel, "Introduction to Solid State Physics", Dhanpati Rai and Sons, New Delhi,2001.		
5	Feynman, "Lecturers in Quantum Mechanics" 4th edition Narosa Publication, New Delhi, 2003.		

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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230104G	APPLIED CHEMISTRY (Common to all B.E./B.Tech. programmes)	3	0	0	3	50	50	100
Objective(s)	The student should be conversant with the principles involved in electro chemistry, corrosion and its inhibition treatment of water for industrial purposes and the concept of energy storage devices knowledge with respect to fuels and combustion polymer and engineering materials.							

1	WATER TREATMENT	Total Hrs	9

Turbidity, color, acidity, alkalinity, nitrogen, fluoride – (Definition, sources and sanitary significance only) – Water- Hardness- Estimation of hardness by EDTA method- Boiler feed water- scale formation, corrosion, caustic embrittlement, priming and forming- softening of water- lime soda process- zeolite process – demineralization – desalination – electro dialysis and reverse osmosis.

2	ELECTRO CHEMISTRY	Total Hrs	9

Electrochemical cells – reversible and irreversible cells – EMF – measurements – Standard Weston Cadmium cell – Nernst equation – problems – Electrodes – Single electrode potential – Types of electrodes – Calomel electrode – Electrochemical series – significance – Potentiometric titrations – Batteries – Lead acid and Ni-Cd batteries.

3	CORROSION AND CORROSION CONTROL	Total Hrs	9

Corrosion – Electrochemical and chemical – Mechanism – corrosion reaction – types of corrosion – differential aeration – granular - pitting – corrosion control – Sacrificial anode and Impressed current method – Inhibitors – Protective coatings – Preliminary treatment – Electroplating (Cr & Ni) – Paints – Constituents and their functions – mechanism of drying.

4	FUELS AND COMBUSTION	Total Hrs	9

Fuels – Calorific values – Gross and Net – Theoretical air for combustion – flue gas analysis – Orsat method – Coal – proximate and ultimate analysis – their importance – metallurgical coke – Petrol – Straight run, cracked and polymer petrol – Synthetic petrol – Fisher- Tropsch and Bergius method – Octane number – improving octane number by additives – Diesel – Cetane number – Water gas, producer gas and LPG.

5	POLYMERS	Total Hrs	9

Polymer structure – Nomenclature – Polymerization – types – mechanism (free radical only) – co-ordination polymerization – mechanism – individual polymers – Polyethylene, Polypropylene, PVC, Teflon, Acrylics, Nylon6-6, Bakelite, Polyester, Epoxy, Polyurethane – Structure, Preparation, Properties and Uses – Compounding and fabrication – Compression, Injection, Extrusion and Blow moulding– Foamed plastics.

Total hours to be taught	45

Text book (s) :

1	Applied Chemistry by R.Palanivelu, R.Parimalam, B.Srividhya, K.Tamilarasu and P.Padmanaban

Reference(s) :

1	Jain P.C. & Monica Jain, “Engineering Chemistry”, 14th Edition, Dhanpat Rai Publishing Co. New Delhi, 2002.
2	Clair N Sawyer and Perry L Mc Carty, ”Chemistry for Environmental Engineering”, 14th Edition TMH Book Company, New Delhi, 2002.
3	Dara S.S. “A text book of Engineering Chemistry”, S.Chand & Co. Ltd., 2003.
4	Uppal M.M. revised by S.C.Bhatia, ”Engineering Chemistry”, 6th Edition Khanna Publishers, New Delhi, , 2001.

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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230105S	FUNDAMENTALS OF PROGRAMMING (Common to Civil, Mech, MCT, BT, Text and Nano)	3	0	0	3	50	50	100
Objective(s)	To impart knowledge in the fundamentals of computer and programming language, storage devices.							

I	COMPUTER BASICS	Total Hrs	8
Evolution of computers- Generations of computers- Applications of computers- - Computer Memory and Storage- Input Output Media - Algorithm- Flowchart- Pseudo code – Program control structures- - Programming languages- - Computer Software- Definition- Categories of Software.			
2	C FUNDAMENTALS	Total Hrs	9
Introduction to C- Constants- Variables- Data types- Operators and Expressions- Managing Input and Output operations- Decision Making and Branching- Looping.			
3	ARRAYS AND FUNCTIONS	Total Hrs	10
Arrays- Character Arrays and Strings- User defined functions- Storage Classes			
4	STRUCTURES AND FILES	Total Hrs	10
Structures- Definition- Initialization- Array of Structures- Structures within structures- Structures and Functions- Unions- File Management.			
5	POINTERS	Total Hrs	8
Pointer Basics – Pointer Arithmetic – Pointers and array Pointers and character string Pointers and functions – Pointers and structures.			
Total hours to be taught			45
Text book (s) :			
1	Dr.K.Duraisamy, R.Nallusamy, R.Kanagavalli, S.Ponmathangi, D.Muthusankar, P.Kaladevi "Fundamentals of Programming", Techvision Publishers 2008.		
2.	E.Balagurusamy, "Programming in ANSI C", TMH, New Delhi, 2002.		
Reference(s):			
1	Rajaraman V, "Fundamentals of Computers", Fourth Edition, PHI 2006.		
2	Byron Gottfried, "Programming with C", II Edition, TMH, 2002.		

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology Autonomous Regulation</td><td>R 2008</td></tr>
<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="2">Program code & Name</td><td colspan="2">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester I</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230106C</td><td colspan="2">APPLIED BIOLOGY</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To Impart basic knowledge in biology Introduction to various subjects like biochemistry, Microbiology To focus on fundamentals as a Pre- requisite for forth coming semester.</td></tr>
<tr><td>1</td><td colspan="4">ORIGIN</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">The Science of Biology; The Nature of Molecules; The Chemical Building Blocks of Life; Cells, Tissues and Organisms; The Origin and Early History of Life; The Evidence for Evolution; The Origin of Species; Evolution and Phylogeny.</td></tr>
<tr><td>2</td><td colspan="4">DIVERSITY OF LIFE ON EARTH</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Systematics and Diversity; Prokaryotes; Protists; Fungi; Higher Plants; Coelomate and Noncoelomate Invertebrates; Vertebrates; Viruses.</td></tr>
<tr><td>3</td><td colspan="4">STRUCTURES</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Microbes & Plants: Vegetative development; Reproduction; Transport; Nutrition Animals; Development; Digestion; Circulation; Respiration; Reproduction; Nervous System; Sensory System; Endocrine system.</td></tr>
<tr><td>4</td><td colspan="4">FUNCTIONS</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Cell Structure; Membranes; Cell-Cell Interactions; Energy and Metabolism; How Cells Harvest Energy; Photosynthesis; How Cells Divide; Laws of inheritance – Mendelian and Non-Mendelian laws.</td></tr>
<tr><td>5</td><td colspan="4">ECOLOGY AND BEHAVIOR</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="8">Behavioral Biology; Population Ecology; Community Ecology; Dynamics of Ecosystems; The Biosphere; Conservation Biology; Biogeochemical cycle – C, N, P; Methods of studying natural vegetation by quadrants, bisect and transect.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>60</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. “Biology”, Tata Mc.Graw-Hill Publ. 7th Edition, 2005.</td></tr>
<tr><td>2</td><td colspan="7">McKee E and McKee T, “Biochemistry – an Introduction”, Win.C.Brown Publ., Dubuque, 1996.</td></tr>
<tr><td>3</td><td colspan="7">Soper R, Taylor D J, Green NPO and Stout GW, “Biological Science”,
Cambridge Univ. Press, 3rd Edition, 1998.</td></tr>
</table>

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	B.Tech. Biotechnology		Program code & Name			23: B.Tech. Biotechnology		
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230107P	ENGINEERING GRAPHICS LABORATORY	1	0	3	3	50	50	100
Objective(s)	Student's skill in the graphical communication of concepts and ideas in the design of engineering products are to be obtained by training them to understand objects by making free hand sketches of simple engineering objects and computer 2D and 3D modeling techniques. Use of drawing board and mini drafter is not at all required.							

1	CURVES AND SHAPES USED IN ENGINEERING PRODUCTS	Total Hrs	5
CONCEPTS AND CONVENTIONS- Primitive and Prismatic shapes - Conics – ellipse, parabola and hyperbola – equations used and parametric interpretations – ellipsoid, paraboloid and hyperboloid – involutes and cycloids – applications - tangents and normals – mathematical requirements – their importance and applications to engineering products			
2	FREE HAND SKETCHING PRACTICES	Total Hrs	5
Representation of Three Dimensional objects – Need for and importance of multiple views and their orientations – Concept of orthographic projection - Developing skills through free hand sketching of multiple views from pictorial views of objects – Isometric (pictorial) representation of objects from multiple views – simple exercises to practice.			
3	DEVELOPMENT OF SURFACES – ACTICES	Total Hrs	5
Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones - freehand sketching practices - simple exercises to practice.			
4	2D DRAFTING	Total Hrs	15
Importance of 2D drafting – sketching, mirroring, scaling, copying (simple and multiple) dimensioning - wiring diagram and piping layout drawings - Practice of Computer Aided Drafting and dimensioning using appropriate software packages.			
5	SOLID MODELING	Total Hrs	15
3D modeling techniques - constructive solid geometry (CSG) and boundary representation (BRep) techniques - solid modeling of simple and moderately complex engineering products – table, chair, V-block, flange coupling (one) half, bolts and nuts, computer monitor, slotted angle rack and such other products - Practice of solid modeling and extraction of 2D views using appropriate software packages.			
Total hours to be taught			45

Text book (s) :

1	K.Venugopal, "Engineering Graphics", New Age International (P) Limited, 2002.

Reference(s) :

1	Dhananjay.A. Jolhe, "Engineering Drawing", Tata McGraw Hill Publishing Co., 2007
2	K.V.Nataraajan "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
3	M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education, 2005.
4	Luzadder and Duff, "Fundamentals of Engineering Drawing" Prentice Hall of India Pvt Ltd, XI Edition – 2001

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Bio Technology			Program code & Name		23: B.Tech. Bio Technology		
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230108P	APPLIED CHEMISTRY LABORATORY	0	0	3	2	50	50	100
Objective(s)	Educate the theoretical concepts Experimentally							

(Any 10 experiments)

1.	Estimation of hardness of water by EDTA.	Total Hrs	3
2.	Estimation of alkalinity of water sample.	Total Hrs	3
3.	Estimation of chloride content in water sample.	Total Hrs	3
4.	Determination of dissolved oxygen in boiler feed water.	Total Hrs	3
5.	Determination of water of crystallization of a crystalline salt.	Total Hrs	3
6.	Conductometric titration of strong acid with strong base.	Total Hrs	3
7.	Conductometric titration of mixture of acids.	Total Hrs	3
8.	Precipitation titration by conductometric method.	Total Hrs	3
9.	Determination of strength of HCl by pH Meter.	Total Hrs	3
10.	Estimation of ferrous ion by potentiometric titration.	Total Hrs	3
11.	Determination of sodium and potassium in a water sample by flame photometry (Demo only).	Total Hrs	3
12.	Estimation of ferric ion by spectrophotometry (Demo only).	Total Hrs	3
Total hours to be taught			30

Lab Manual :

1. Chemistry Lab Manual by R.Palanivelu, R.Parimalam and B.Srividhya

REFERENCE :

1. J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Text book of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2004.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology		Program code & Name			23: B.Tech. BioTechnology		
Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230109P	PROGRAMMING LABORATORY	0	0	3	2	50	50	100
Objective (s)	At the end of program students should be able to perform programming in C language.							

(Any 10 experiments)			
1.	Write a C program to print Pascal's triangle.	Total Hrs	3
2.	Write a C program to print the sine and cosine series	Total Hrs	3
3.	Write a C program to perform Matrix multiplication	Total Hrs	3
4.	Write a C program to prepare and print the sales report.	Total Hrs	3
5.	Write a C program to perform string manipulation functions like string concatenations, comparison, find the length and string copy without using library functions	Total Hrs	3
6.	Write a C program to arrange names in alphabetical order	Total Hrs	3
7.	Write a C program to calculate the mean, variance and standard deviation using functions.	Total Hrs	3
8.	Write a C program to perform sequential search using functions.	Total Hrs	3
9.	Write a C program to print the Fibonacci series and to calculate the factorial of the given number using functions.	Total Hrs	3
10.	Write a C program to print the mark sheet of n students using structure	Total Hrs	3
11.	Write a C program to merge the given two files	Total Hrs	3
12.	Write a C Program to perform Swap using Pointers	Total Hrs	3
Total hours to be taught		30	

REFERENCE :

1.	Balagurusamy.E, Programming in ANSI C, Tata Mc GrawHill publication Pvt Ltd New York, 1992.
2.	Byron S. Gottfried, Jitender Kumar Chhabra , Programming in C, Tata Mc GrawHill publication Pvt Ltd New York, 2006

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Mechanical Engineering			Programme Code & Name		11 :B.E -Mechanical Engineering		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230110P	ENGINEERING PRACTICES LABORATORY	0	0	3	2	50	50	100
Objective(s)	To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical Engineering.							

1. PLUMBING (Safety aspects in Plumbing, Study of tools and equipments - preparation of models, Cutting and Threading of G.I. Pipes, Study of valves, taps and repairing. Measuring and marking practice of PVC & G.I. pipes - connection to service line)

2. SHEET METAL (Study of Tools, Equipments and Safety precautions, Drawing of tools and accessories, Different types of joints making - knocked up, double grooving joints, Model making –Trays, Baskets and Funnels)

3. ELECTRICAL WIRING(Safety aspects of Electrical wiring, Safety aspects of Electrical wiring, Wiring circuit for a lamp using single and Stair case switches, Wiring circuit for fluorescent lamps, Calculation of power and energy)

4. WELDING AND SOLDERING (Safety aspects of Welding and Soldering, Study of Gas and Arc Welding Equipments, Welding of Lap, Butt, T-joints & Corner Joints, Soldering of Small Electrical and Electronic Circuits)

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23:B.Tech.Biotechnology</td></tr>
<tr><td colspan="8">Semester II</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230201G</td><td colspan="2">COMMUNICATION SKILLS (Common to all B.E./B.Tech. programmes)</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To equip students of engineering and technology with effective speaking and listening in English, help them develop their soft skills and people skills, which will make the transition from college to workplace smoother, help them to excel in their jobs, enhance students performance at placement interviews, group discussion and other recruitment exercises.</td></tr>
<tr><td>1</td><td colspan="5">LISTENING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Barriers in Listening, Listening to academic lectures, Listening to announcements at railway stations, airports, etc, Listening to news on the radio / TV, Listening to casual conversation, Listening to live speech.</td></tr>
<tr><td>2</td><td colspan="5">COMMUNICATION</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">What is communication? - What does it involve? - Accuracy - fluency and appropriateness - Levels of formality, Differences between spoken and - written communication, Greeting and introduction - Making requests - Asking for permission - giving / denying permission - Offering help - accepting / declining help - Giving instructions - Giving directions - Art of small talk - Taking part in casual conversation - Making a short formal speech - Describing people - place - things and events.</td></tr>
<tr><td>3</td><td colspan="5">CONVERSATION SKILLS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Using the telephone - Preparing for a call - Stages of a call - Handling calls - Identifying self - Asking for repetitions - Spelling out names or words. Giving information on the phone - Making requests - Answering calls -Leaving messages on answering machines - Making / changing appointments - Making complaints – Reminding - Agreeing / disagreeing – Listening - Listening and taking messages - Giving instructions & responding to instructions.</td></tr>
<tr><td>4</td><td colspan="5">REMEDIAL GRAMMAR & VOCABULARY</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Subject – verb agreement - Tenses - ‘Do’ forms - Active and Passive voice - Use of negatives - Prepositions - Phrasal verbs - Correct use of words - Use of formal words in informal situations - Indianisms - Commonly - confused words - Common errors & remedial measures</td></tr>
<tr><td>5</td><td colspan="5">WRITTEN COMMUNICATION & CAREER SKILLS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Writing e-mails - Writing Reports - Note – taking and Note – making - Preparing curriculum vitae and cover - letters - Facing an interview - Presentation skills - Persuasion skills.</td></tr>
<tr><td colspan="7">Total Hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="8">Text book(s):</td></tr>
<tr><td>1</td><td colspan="7">Rizvi M Ashraf, “Effective Technical Communication”, 1st Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Kiranmai Dutt P, Geetha Rajeevan and Prakash C L N, “A Course in Communication Skills”, by Ebek – Cambridge University Press India Pvt. Ltd.,</td></tr>
<tr><td>2</td><td colspan="7">Naterop, cup “Telephoning in English – Cambridge University Press India Pvt.Ltd., 2007</td></tr>
<tr><td>3</td><td colspan="7">Richard, “New Interchange Services (Student’s Book)” – Introduction, Level – 1, Level – 2, Level – 3, Cambridge University Press India Pvt. Ltd., 2007.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology		Programme Code & Name		23:B.Tech..Biotechnology			
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230202G	ENGINEERING MATHEMATICS II (Common to all B.E./B.Tech. programmes)	3	1	0	4	50	50	100
Objective(s)	The course is aimed at developing the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.							

I	MATRICES	Total Hrs	12
Column matrix as vector – linear independent and dependent of vector – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigenvectors – Cayley – Hamilton theorem (without proof) – Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.			
2	GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	Total Hrs	12
Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes –Evolute as envelope of normals			
3	FUNCTIONS OF SEVERAL VARIABLES	Total Hrs	12
Functions of two variables – Partial derivatives – Total differential – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians.			
4	ORDINARY DIFFERENTIAL EQUATIONS	Total Hrs	12
Linear differential equations of Second and higher order with constant coefficient when the R.H.S is e^{ax}, $x^n \ n>0, \sin ax, \cos ax, e^{ax}x^n, e^{\alpha x}\sin\beta x, e^{\alpha x}\cos\beta x, x^n \sin\alpha x$ and $x^n \cos\alpha x$ – Differential Equations with variable coefficients (Cauchy's Form and Legendre's Linear Equation).			
5	DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	Total Hrs	12
Simultaneous first order linear equations with constant coefficients – Method of variation of parameters – Solution of specified differential equations connected with electric circuits, bending of beams and simple harmonic motion (Differential equations and associated conditions need be given).			
Total hours to be taught			60

Text book (s) :

1. Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.

Reference(s) :

1. Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – First Edition 1996,S.Chand and Co. – New Delhi 2007.
2. Grewal. B.S., "Higher Engineering Mathematics", Thirty Eighth Edition, Khanna Publishers, Delhi, 2004.
3. Kreyszig. E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.
4. Venkataraman.M.K, "Engineering Mathematics, Volume I & II Revised Enlarged", Fourth Edition", The National Pub. Co., Chennai, 2004.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology			Programme Code & Name		23:B.Tech..Biotechnology		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230203G	MATERIALS SCIENCE (Common to all B.E./B.Tech. programmes except Nano)	3	0	0	3	50	50	100
Objective(s)	To impart fundamental knowledge in various engineering subject and applications, application of conducting, superconducting and magnetic materials, application of dielectrics, new engineering materials and Nanomaterials in modern technology.							

I	CONDUCTING AND SUPERCONDUCTING MATERIALS	Total Hrs	9

Introduction - Free electron theory - Electrical conductivity - Expression for electrical conductivity - Thermal conductivity - Expression for thermal conductivity - Lorentz number - Widemann Franz law (derivation) - Verification of Ohm's law - Classical free electron theory - Advantages and drawbacks. Properties of superconductors - Critical field - Meissner's effect - Isotope effect - BCS theory - Type I and Type II superconductors - Josephson effect (qualitative) - High T_c superconductors - Applications: SQUID, Cryotron, Magnetic levitation.

2	SEMICONDUCTING MATERIALS	Total Hrs	9

Elemental and Compound semiconductors - Intrinsic and Extrinsic semiconductors - Properties - Carrier concentration in intrinsic and extrinsic semiconductors (derivation) - Fermi level - Variation of Fermi level with temperature and impurities - Hall effect - Hall coefficient - Experimental determination of Hall coefficient, Applications.

3	MAGNETIC MATERIALS	Total Hrs	9

Classification of magnetic materials - Properties - Heisenberg and Domain theory of ferromagnetism - Hystersis - Hard and Soft magnetic materials - Ferrites - Structure, Preparation and Applications - Magnetic recording and readout- Bubble memory - Magnetic tape - Floppy disc and Magnetic hard disc.

4	DIELECTRIC MATERIALS	Total Hrs	9

Introduction - Polarization: Electronic , Ionic, Orientational and Space charge – Frequency and temperature dependence of polarization - Active and Passive dielectric - Internal field - Clausius -Mosotti relation (derivation) - Dielectric losses - Dielectric breakdown mechanism - Ferroelectric materials: Properties and Applications.

5	NEW ENGINEERING MATERIALS	Total Hrs	9

Shape Memory Alloys (SMA): Characteristics, Properties of NiTi alloy and applications, Metallic glasses: Preparation, Properties and Applications. Nanomaterials: Fabrication methods - Top-down process: Ball Milling and Nanolithography - Bottom-up process: Vapor phase deposition method (PVD and CVD) - Carbon nano tubes: fabrication and applications.

Total hours to be taught	45

Text book(s):

1	"Material Science", 1st Edition, Authored by Dept. of Physics KSRCT, 2008.

Reference(s) :

1	Raghavan V,"Materials Science and Engineering", Prentice Hall of India, New Delhi, 2001.
2	Rajendran V., "Materials Science", Tata McGraw Hill, New Delhi, 2005.
3	Palanisamy P.K., "Materials Science", SCITECH Publications, Chennai, 2002.
4	Dr.Arumugam M., "Materials Science", Anuradha Agencies, Kumbakonam, 2003.
5	Dr. S. Muthukumaran, V. Mohan, S. Masilamani, M. Mani, "Materials Science" 1st Edition, Sri Krishna Publications, Chennai 2007.

K.S.Rangasamy College of Technology - Autonomous Regulation							R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech..Biotechnology		
Semester II							
Course Code	Course Name	Hours / Week			Credit	Maximum Marks	
		L	T	P	C	CA	ES	Total
08230204G	ENVIRONMENTAL SCIENCE (Common to all B.E./B.Tech. programmes)	3	0	0	3	50	50	100
Objective(s)	The student should be conversant with the evolution of environmentalism and the importance of environmental studies, various natural resources and the current threats to their sustainability, Significance and protection of bio diversity and various forms of environmental degradation and significant international conventions and protocols for the protection of environment.							

1	ATMOSPHERE AND ECOSYSTEM	Total Hrs	9

Atmosphere – composition of atmosphere (troposphere, stratosphere, mesosphere and thermosphere) - Ozone and ozone depletion – Air pollution – sources, effects and control – Green house effect - Global warming – Climate change – Acid rain - Planet Earth – Biosphere – Hydrosphere – Lithosphere. Concept of ecosystem – structure and functions of ecosystem- producers, consumers and decomposers - Energy flow – Ecological succession-Food chains-Food webs- Ecological pyramids-Introduction, types, characteristic features-structures and function of forest, grassland and aquatic ecosystems (ponds and rivers) - Case Studies in current scenario.

2	WATER RESOURCES AND ITS TREATMENT	Total Hrs	9

Water – hydrologic cycle – ground water – water shed – water use and quality – point and non-point sources of pollution – Oceans and fisheries – salinity – temperature – density – pressure – light – bioluminescence – Tsunamis – Glaciers – Water pollution – dissolved oxygen – surface water treatment – waste water treatment – Thermal pollution, noise pollution and control - Case Studies in current scenario.

3	LAND RESOURCES AND ITS DEGRADATION	Total Hrs	9

Land – weathering and erosion - types of weathering – types of soil – soil erosion – land slides – Wet land and deforestation- deserts – types – desertification – land degradation – features of desert – geochemical cycling – solid and hazardous waste, chemical waste, radio active waste – non hazardous waste - Case Studies in current scenario.

4	FUTURE POLICY AND ALTERNATIVES	Total Hrs	9

Future policy and alternatives – fossil fuels – nuclear energy – solar energy – wind energy – hydroelectric energy – geothermal energy – tidal energy – sustainability – green power – nano technology – international policy - - Case Studies in current scenario.

5	BIO DIVERSITY AND HUMAN POPULATION	Total Hrs	9

Introduction to Bio diversity-Definition, genetic species and ecosystem diversity.
Bio-geographical classification of India – Biodiversity in India – India as mega diversity nation – hotspots of biodiversity in India – threats to biodiversity – endemic and endangered- habitat – conservation of biodiversity – environment protection act – issues and possible solution – population growth - population explosion – environment and human health - Case Studies in current scenario.

Total hours to be taught	45

Text book(s):

1	Environmental Science by R.Palanivelu, R.Parimalam, and B.Srividhya.

Reference(s) :

1	Linda D. Williams – “Environmental Science Demystified”, Tata McGraw-Hill Publishing Company Limited, 2005.
2	G. Tyler Miller, JR _ “Environmental Science “, Thomson, 2004
3	William P. Cunningham – “Principles of Environmental Science”, Tata McGraw-Hill, New Delhi, 2007.
4	Bharucha Erach –“The Biodiversity of INDIA”, Mapin Publishing Private Limited, Ahmedabad, India.
5	Trivedi R.K., “Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Volume I & II, Environmedia.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology		Program Code & Name			23: B.Tech. Biotechnology		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230205S	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (Common to BT, Civil and Text)	3	1	0	4	50	50	100
Objective(s)	After the completion of this course, students gain knowledge in fundamentals of electrical engineering and the operational design aspects of DC and AC motor drives.							
1	DC AND AC CIRCUITS				Total Hrs	9		
Definition of current-potential-resistance, power, and energy-symbol and units-international system of units-Ohm's law- Kirchoff's law- solution of series, parallel and series parallel circuits-simple problems. Generation of alternating emf, average and Rms values-form and peak factors, concept of phasor representation- complex operator "j"-AC circuits involving RLC series circuits-reactance and impedance-power factor and power components in ac circuits-simple problems. Construction and principle of operation of Moving Coil and Moving iron instruments (only Voltmeter and ammeters) - dynamometer type wattmeter- Induction type energy meter- Megger.								
2	DC MACHINES & TRANSFORMERS				Total Hrs	9		
Construction of DC machines – Theory of operation of DC Generators –emf equation. Operating Principle of DC motors-types and their characteristics, torque equation. Construction and principle of operation of transformers- types- emf equation- transformation ratio.								
3	INDUCTION MACHINES				Total Hrs	9		
Construction of three phase motors –operating principles- types of three phase motors- torque equation-speed torque characteristics. Single phase motors- types- capacitor start capacitor run motors- shaded pole. (Qualitative analysis only)								
4	ELECTRONIC COMPONENTS AND DEVICES				Total Hrs	9		
Active and passive components, basic principles and characteristics of PN diode, zener diode, bipolar junction transistors-CC, CB, CE configuration. Symbol, truth table and circuit of basic logic gates- universal gates.								
5	POWER SUPPLIES				Total Hrs	9		
Operating principles of Half wave and full wave rectifier, Bridge rectifier, ripple factor, transformer utilization factor, rectifier efficiency, Voltage regulator-types. Introduction to SMPS and UPS.								
Total hours to be taught						Theory :45, Tutorial : 15 Total: 60		
Text books:								
1	B.R.Gupta and V.Singhal, "Basics of Electrical and Electronics Engineering", S.Chand & Co., New Delhi.							
References:								
1	B.R.Gupta, "Principles of Electrical Engineering", S.Chand & Co., 2002.							
2	K.A.Muraleedharan, R.Muthusubramanian and S.Salivahanan, "Basic Electrical and Electronics and Computer engineering, Tata McGraw Hill 1997.							
3	V.K.Mehta," Principles of Electrical Engineering and Electronics", S.Chand & Co.,New Delhi.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology		Programme code & Name		23 : B.Tech. Biotechnology			
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230206C	OBJECT ORIENTED PROGRAMMING (Common to BT and Nano)	3	0	0	3	50	50	100
Objective(s)	At the end of the semester students should have the knowledge of C++ Programming class objects, constructors, Destructors, inheritance, Streams in C++ and file handling.							
1	INTRODUCTION TO C++				Total Hrs	09		
Software evolution, OO Programming paradigms, Basic concepts and benefits of OOP, Application of OOP, Structures, tokens, keywords, identifiers, Basic data types, symbolic Constants, dynamic initialization, reference variables, scope resolution operator, type casting, operators and control statements, input and output statements in C++.								
2	CLASSES AND OBJECTS				Total Hrs	09		
Function prototyping, function components, passing parameters – call by reference, return by reference, inline function, default arguments, overloaded function, introduction to friend function and template function. Class specification- Member function definition, nested member function, access qualifiers, static data members and member functions. Instance creation, Objects as arguments, Returning objects, Friend class.								
3	CONSTRUCTOR, DESTRUCTOR AND OVERLOADING				Total Hrs	09		
Constructors – parameterized constructors, overloaded constructors, Constructors with default arguments, copy constructors, Destructors. Operator function – Overloading unary and binary operator, Data Conversion.								
4	INHERITACE				Total Hrs	09		
Defining derived classes, Single inheritance, Protected data with private inheritance. Multiple inheritances, Multi level inheritance, Hierarchical inheritance, Hybrid inheritance, Abstract Classes, Virtual Functions.								
5	STREAMS AND FILE HANDLING				Total Hrs	09		
Streams in C++, Stream classes, formatted and unformatted data, File streams, file pointer and manipulation, file open and close, Sequential and Random Access File, Exception handling principle and mechanism.								
Total hours to be taught						45		
Text book (s) :								
1	E. Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw Hill, Second Edition.							
Reference(s) :								
1	Ashok N.Kamathane, “Object Oriented Programming with ANSI & Turbo C++”, Pearson Education, New Delhi, 2003.							
2	SB Lippman and J Lajoie, “C++ Primer”, Pearson Education, New Delhi, 2001.							
3	H Schidt, “C++: The Complete Reference”, Tata McGraw Hill, New Delhi, 2003.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Bio Technology			Program code & Name		23 : B.Tech. Bio Technology		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230207P	APPLIED PHYSICS LABORATORY	0	0	3	2	50	50	100
Objective(s)	Educate the theoretical concepts Experimentally.							

(Any 10 experiments)			
1.	Determination of Rigidity modulus of a wire by torsional pendulum	Total Hrs	3
2.	Determination of Young's Modulus of the material of a uniform bar by non-uniform bending method	Total Hrs	3
3.	Determination of Young's Modulus of the material of a uniform bar by uniform bending method	Total Hrs	3
4.	Determination of viscosity of liquid by Poiseuille's method	Total Hrs	3
5.	Determination of acceleration due to gravity by compound (Bar) pendulum	Total Hrs	3
6.	Determination of Wavelength of Mercury Spectrum by Spectrometer Grating.	Total Hrs	3
7.	Determination of thickness of fiber by air wedge method.	Total Hrs	3
8.	Determination of wavelength of laser using grating and particle size determination.	Total Hrs	3
9.	Determination of velocity of ultrasonic waves and compressibility using ultrasonic interferometer	Total Hrs	3
10.	Determination of band gap energy of a semiconductor.	Total Hrs	3
11.	Determination of radius of curvature of a plano convex lens by Newton rings method.	Total Hrs	3
12.	Determination of thermal conductivity of a bad conductor using lee's disc method.	Total Hrs	3
Total hours to be taught			30

Lab Manual :

1. Physics lab manual by V.Mohan, M. Mani and S.Masilamani.

REFERENCE :

1. J.Mandham,R.C.Denney,J.D.Barnes and N.J.K Thomas, Vogel's text book of physics practical, 6th Edition 2004.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology		Program code & Name		23: B.Tech.., Biotechnology			
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230208P	APPLIED BIOLOGY LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of this course, the students would have learnt basic techniques used in Applied Biology and its application. This will be strength for students to take up research projects in the area of Modern Biotechnology.							

1.	Qualitative analysis of carbohydrates such as Glucose, Fructose, Sucrose and Starch.	Total Hrs
2.	Qualitative analysis of amino acids such as Tyrosine, Phenyl alanine and Tryptophan	4
3.	Quantitative analysis of protein by Lowry's *et al*., method	4
4.	Quantitative analysis of glucose by Anthrone's method	4
5.	Quantitative analysis of cholesterol by Zak's method	4
6.	Quantitative analysis of DNA by Diphenyl amine method	4
7.	Blood cell count by Haemocytometer	4
8.	Differential count by Leishman's stain method	4
9.	Bioassay - Effect of pH on the activity of salivary amylase	4
10.	Staining of different stages of mitosis	4
Total hours to be taught		40

References :

1. Sadasivam, S. and Manickam, A. 2004. "Biochemical Methods ", Second Edition, New Age International Pvt .Ltd., New Delhi.
2. David T. Plummer, 2002. "An Introduction to Practical Biochemistry", Tata McGraw- Hill, New Delhi.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech.., Biotechnology			
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230209P	OBJECT ORIENTED PROGRAMMING LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of the semester the students would have learnt the basic techniques of OOP and simple applications of java.							

1.	Programs Using Functions • Functions with default arguments • Implementation of Call by Value, Call by Address and Call by Reference	Total hrs
2.	Simple Classes for understanding objects, member functions and Constructors • Classes with primitive data members • Classes with arrays as data members • Classes with pointers as data members – String Class • Classes with constant data members • Classes with static member functions	4
3.	Compile time Polymorphism • Operator Overloading including Unary and Binary Operators. • Function Overloading	4
4.	Runtime Polymorphism • Inheritance • Virtual functions • Virtual Base Classes • Templates	4
5.	File Handling • Sequential access • Random access	4
6.	Simple Java applications • for understanding reference to an instance of a class (object), methods • Handling Strings in Java	4
7.	Simple Package creation. • Developing user defined packages in Java	4
8.	Interfaces • Developing user-defined interfaces and implementation • Use of predefined interfaces	4
9.	Threading • Creation of thread in Java applications • Multithreading	4
10.	Exception Handling Mechanism in Java • Handling pre-defined exceptions • Handling user-defined exceptions	4
Total hours to be taught		40

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology			Programme Code & Name		23: B.Tech. Biotechnology		
Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230210P	COMPREHENSION I	0	0	3	0	100	00	100
Objective(s)	i. To improve the skill level of Engineering, Technology and Applied Science students. ii. To improve the employability of students in placement interviews.							
1	For each subject 200 Keywords/important words or terms (5 units x 40 words) are to be prepared using the students.							
2	These 200 Keywords are to be printed in double column (2 x 50 words) and in 2 pages and is to be handled over each student for all the subjects.							
3	The staff who handled the subject in the previous semester will handle their discussion period (3 periods / semester) as given below.							
4	The staff will question the students using 'W' and 'H' type questions linking the keywords.							
5	In a similar way the students have to prepare themselves for all the keywords.							
6	Each test will carry 100 questions and two hours duration. The questions will be of objective type: 'W' and 'H' type questions by attaching with keywords.							
7	Based on Test-I and Test-II, sessional marks (maximum 50 marks) will be awarded.							
8	Test-III will be held for all the units and all the subjects. The passing norms will be similar as other subjects (i.e. minimum 50/100 marks)							

Schedule for Conduct of Comprehension Subject		
Total No of weeks planned:10	Total No of subjects: 5 to 7	Total duration per week: 3 periods

Week No	Duration: 1½ period Subject No (No of units)	Duration: 1½ period Subject No (No of units)
W1	S1(3)	S2(3)
W2	S3(3)	S4(3)
W3	S5(3)	S6(3)
W4	Test-I (Portion: 3 units in each subject)	
W5	S1(2)	S2(2)
W6	S3(2)	S4(2)
W7	S5(2)	S6(2)
W8	Test-II (Portion: 2 units in each subject)	
W9	Discussion	
W10	Test-III (All 5 units and all the subjects)	

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech.Biotechnology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230301G	ENGINEERING MATHEMATICS III (Common to all B.E./B.Tech. programmes except Textile)	3	1	0	4	50	50	100
Objective(s)	The course objective is to impact analytical skills to the students in the areas of boundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.							
1	PARTIAL DIFFERENTIAL EQUATIONS				Total Hrs	12		
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.								
2	FOURIER SERIES				Total Hrs	12		
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's Identity – Harmonic Analysis.								
3	BOUNDARY VALUE PROBLEMS				Total Hrs	12		
Classification of second order quasi linear partial differential equations- Solutions of one dimensional wave equation – One dimensional heat equation - Fourier series solutions in Cartesian coordinates.								
4	FOURIER TRANSFORM				Total Hrs	12		
Fourier transform pair- Sine and Cosine transforms– Properties – Transforms of simple functions – Convolution theorem- Parseval's Identity – Problems.								
5	Z -TRANSFORM AND DIFFERENCE EQUATIONS				Total Hrs	12		
Z-transform - Elementary properties – Initial and final value theorem-Inverse Z – transform – Partial fraction method – Residue method - Convolution theorem - Solution of difference equations using Z - transform.								
Total hours to be taught						60		
Text book(s): :								
1	Veerarajan.T., "Engineering mathematics-III", Tata McGraw Hill Publishing Company Limited, New Delhi.							
2	Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.							
References :								
1	Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.							
2	Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23 : B.Tech. Biotechnology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230302C	BIOORGANIC CHEMISTRY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have gained in depth knowledge in Stereochemistry, Stereochemistry of enzyme reactions and Protein folding. This knowledge will be very helpful for learning other subjects in subsequent semesters.							
1	CONCEPTS IN ORGANIC CHEMISTRY				Total Hrs	09		
Stereochemistry – R,S notation – re-si faces – e,z isomerism- conformers- ethane – cyclopean - reactivates- mechanisms of sn1 sn2 reactions, e1 e2 reactions – ester formation and hydrolysis, reaction rates - hammond's postulate – h/d effects. Catalysis – general acid – base and covalent catalysis.								
2	STEREOCHEMISTRY OF ENZYMATIC REACTIONS				Total Hrs	09		
Stereospecific enzymatic reactions – fumarase catalysed reactions – NAD dependent oxidation and reduction reactions - Stereochemistry of nucleophilic reactions – chiral methyl group – chiral phosphate.								
3	CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM				Total Hrs	09		
The dehydrogenases – the proteases – ribonucleases – lysozyme- stability of proteins – stability – activity tradeoff.								
4	KINETICS OF PROTEIN FOLDING				Total Hrs	09		
Basic methods – two state kinetics – multi state kinetics – transition states in protein folding – 1h/2h exchange methods – folding of peptides.								
5	FOLDING PATHWAYS & ENERGY LANDSCAPES				Total Hrs	09		
Folding of ci2 – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones.								
Total hours to be taught						45		
Text book (s) :								
1	A. R. Fersht, "Structure And Mechanism In Protein Science", A Guide To Enzyme Catalysis and Protein Folding, W.H. Freeman, 1999.							
Reference(s) :								
1	A. R. Fersht, "Structure And Mechanism In Protein Science" A Guide To Enzyme Catalysis and Protein Folding; W.H. Freeman, 1999.							
2	Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23 : B.Tech. Biotechnology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230303C	MICROBIOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about all types of microorganisms, their growth characteristics and their industrial uses. This will be very helpful to students when they undertake project work in Biotechnology.							

1	INTRODUCTION	Total Hrs	10
History of Microbiology-contribution of Anton von Leewenhoek, Louis Pasteur, Lazzaro Spallanzani, John Tyndall, Joseph Lister, Robert Koch, Edward Jenner, Elie Metchnikoff. Microscopy - Principles and application of Light and electron microscope. Staining methods-Simple staining, gram staining, acid fast staining, spore staining, flagella staining, and capsule staining. Taxonomy and nomenclature.			
2	MICROBES-STRUCTURE AND MULTIPLICATION	Total Hrs	12
Bacterial anatomy-Structure, function, properties, cellular components, sporulation. Structure of Eukaryotic organisms like fungi, algae, and protozoa. Viruses- Structure and Replication.			
3	MICROBIAL NUTRITION AND GROWTH	Total Hrs	8
Nutritional requirements of bacteria and different media used for bacterial culture; growth curve, growth kinetics, factors affecting growth and different methods to quantitate bacterial growth. Host-microbe interactions.			
4	CONTROL OF MICROORGANISMS	Total Hrs	8
Physical and chemical control of microorganisms-Sterilization and disinfection- Dry heat, Moist heat, Filtration, Pasteurization ,Radiation and Various chemical agents. Anti-bacterial, anti-fungal and anti-viral agents, mode of action and resistance.			
5	INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY	Total Hrs	7
Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vit.b-12; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides; microorganisms and pollution control; biosensors. Recent advances in microbiology.			
Total hours to be taught			45

Text book (s) :	
1	Talaron K, Talaron A, Casita, Pelczar And Reid, “Foundations In Microbiology”, W.C. Brown Publishers, 1993.
2	Pelczar MJ, Chan ECS and Krein NR, “Microbiology”, Tata McGraw-Hill Edition, New Delhi, India.
3	Prescott LM, Harley JP, Klein DA, “Microbiology”, Wm. C. Brown Publishers, 3rd Edition, 1996.
Reference(s) :	
1	Ronald M. Atlas, “Principles of Microbiology”. WCB Mc Graw-Hill, 1997.
2	Salle. A.J., “Fundamental Principles of Microbiology”, TMH Edition, 1971.

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td>Biotechnology</td><td colspan="2">Program code & Name</td><td colspan="4">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester III</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230304C</td><td>PRINCIPLES OF CHEMICAL ENGINEERING</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">At the end of the course the students would have gained knowledge in Mass and Energy Conservation, Laws of Thermodynamics and Principles of Fluid Mechanics. This will help him to understand certain subjects of Engineering offered in this programme.</td></tr>
<tr><td>1</td><td colspan="5">OVERVIEW OF PROCESS INDUSTRY</td><td colspan="2">Total Hrs</td><td>08</td></tr>
<tr><td colspan="9">Mass and energy conservation; process automation; environment; SI units; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration</td></tr>
<tr><td>2</td><td colspan="5">MATERIAL BALANCES</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations</td></tr>
<tr><td>3</td><td colspan="5">FIRST AND SECOND LAWS OF THERMODYNAMICS</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.</td></tr>
<tr><td>4</td><td colspan="5">FLUID MECHANICS</td><td colspan="2">Total Hrs</td><td>10</td></tr>
<tr><td colspan="9">Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts; multiphase flow concepts.</td></tr>
<tr><td>5</td><td colspan="5">FLOW THROUGH PACKED COLUMNS</td><td colspan="2">Total Hrs</td><td>08</td></tr>
<tr><td colspan="9">Fluidisation; centrifugal and piston pumps; characteristics; compressors; work.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Bhatt B.I., Vora S.M. Stoichiometry. Tata McGraw-Hill, 3rd Edition, 1977.</td></tr>
<tr><td>2</td><td colspan="8">McCabe W.L., Smith J.C, Harriot P. “Unit Operations In Chemical Engineering”, McGraw-Hill Inc., 5th Edition, 1993.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Geankoplis C.J. “Transport Processes and Unit Operations”, Prentice Hall India, 2002.</td></tr>
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<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="2">Program code & Name</td><td colspan="3">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester III</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230305C</td><td colspan="2">BIOCHEMISTRY</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">At the end of the course, the students would have gained extensive knowledge in Metabolic Pathways. This will be helpful for courses like, Bioinformatics, Protein Engg. etc.</td></tr>
<tr><td>1</td><td colspan="4">BIOMOLECULES- INTRODUCTION</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Carbohydrates: Introduction, Classification: Monosaccharides, Disaccharides, polysaccharides. Lipids: Introduction, classification, Saturated and Unsaturated fatty acids. Nucleic acid: Nucleotide and Nucleoside – structure</td></tr>
<tr><td>2</td><td colspan="4">CARBOHYDRATES &LIPID METABOLISM</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Biosynthesis of Fatty acids, cholesterol, Tri acyl glycerol and oxidation of fatty acids, Biosynthesis and degradation of Starch and Glycogen. Glycolysis, TCA cycle Intermediatory Metabolism: HMPshunt and Gluconeogenesis</td></tr>
<tr><td>3</td><td colspan="4">AMINO ACIDS & NUCLEIC ACID METABOLISM</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Biosynthesis of Amino acids, Urea Cycle. Biosynthesis of nucleotides- Purine and Pyrimidine (De novo and Salvage pathway), Degradation of nucleotides by exo and endo nucleases.</td></tr>
<tr><td>4</td><td colspan="4">PROTEIN</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Proteins, Primary structure-Secondary structure-Teritary structure-Quartnary structure. Classification of proteins. simple, conjugated and derived proteins. Properties of proteins (physical and chemical), Denaturation and Renaturation.</td></tr>
<tr><td>5</td><td colspan="4">ENZYMES</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Introduction –classification of enzymes. Definition. Active site structure Lock & key model, Induced fit hypothesis. MM kinetics. LB Plot. Enzyme inhibition- Competitive Uncompetitive, Non competitive inhibition. Applications of Enzymes in food and other industries</td></tr>
<tr><td colspan="6">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="7">J.L.Jain, ”Fundamentals Of Biochemistry”, S.Chand and company publication.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="7">Leinnger, “Principles Of Biochemistry”, Nelson & Fox Maxwell publication Pvt. Ltd.</td></tr>
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K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23 : B.Tech. Biotechnology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230306C	INSTRUMENTATION TECHNIQUES	3	0	0	3	50	50	100
Objective(s)	At the end of the syllabus the students would have learnt about the working principles of optical methods, radioisotopes, spectroscopy and separation methods. This will facilitate the students to do the research work innovatively.							
1	ELECTROCHEMICAL AND CENTRIFUGATION TECHNIQUES				Total Hrs	05		
Buffers- Bicarbonate-blood buffer systems, Principles of redox reaction, Glass electrode for pH measurements. Centrifugation-Basic principles, centrifuge and their uses. Types- Preparative, analytical ultra centrifuge – applications.								
2	RADIOISOTOPES				Total Hrs	06		
Nature of Radioactivity- Types of radioactive decay, units of radioactivity. Interaction of radioactivity with matters. Detection and measurements of radioactivity- methods based on gas ionization and excitation-liquid scintillation								
3	CHROMATOGRAPHIC TECHNIQUES				Total Hrs	13		
Classification- Principles-adsorption chromatography- column, partition chromatography-paper, size exclusion. Ion exchange chromatography-Types of ion exchangers, affinity-GLC-HPLC Principle and application.								
4	ELECTROPHORESIS				Total Hrs	08		
General principles-support media-Electrophoresis of protein-SDS PAGE, Two dimensional PAGE, Isoelectric focusing, Isotachophoresis. Electrophoresis of Nucleic acid- Agarose gel electrophoresis of DNA, DNA sequencing gels, PFGE, electrophoresis of RNA.								
5	SPECTROSCOPIC TECHNIQUES				Total Hrs	13		
Atomic and molecular electronic spectroscopy- Beers-Lambert's law-UV-Visible-ORD, CD, Turbidometry and Nephlometry- Vibrational spectroscopy and nuclear spin orientation in magnetic fields- IR, Raman, NMR, ESR, Mass spectroscopy.								
Total hours to be taught						45		
Text book (s) :								
1	Skoog, D.A.., Holler, F.J., Nieman, T.A., "Principles of Instrumental analysis", Harcout college pub, 2001.							
2	Upadhaya, K., Upadhaya, A. Nath, N. "Biophysical chemistry", Himalaya Publishing House, 2007.							
Reference(s) :								
1	Wilson, K., Walker, J., "Practical Biochemistry", Cambridge University press, 1988.							
2	Kaur, H., "Introduction To Chromatography", Pragati Prakashan Publishers, 2001							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Bio Technology	Program code & Name			23: B.Tech. Biotechnology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230307P	BIOORGANIC CHEMISTRY LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of this laboratory course, the students would have learnt about spectroscopy, nephelometry & chromatography. In addition the student will also gain knowledge of operating these equipments.							

(Any 10 experiments)			
1.	Synthesis of aspirin	Total Hrs	3
2.	Hydrolysis of sucrose	Total Hrs	3
3.	Preparation of pyruvic acid from tartaric acid	Total Hrs	3
4.	Preparation of oleic acid from tartaric acid	Total Hrs	3
5.	Preparation of alpha d- glucopyranose pentaacetate	Total Hrs	3
6.	Isolation of lycopene from tomato paste	Total Hrs	3
7.	Preparation of l-cysteine from hair	Total Hrs	3
8.	Cellulase degradation by Acid Hydrolysis	Total Hrs	3
9.	Isolation of Albumin from Egg	Total Hrs	3
10.	. Isolation and purification casein from milk.	Total Hrs	3
Total hours to be taught			30

Lab Manual :

1. Practical Biochemistry – Kieth Wilson and John Walker.

REFERENCE :

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

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Bio Technology	Program code & Name			23: B.Tech. Bio Technology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230308P	MICROBIOLOGY LABORATORY	0	0	3	2	50	50	100
Objective(s)	To learn about the culturing of microorganism, their identification by hands on training.							

(Any 10 experiments)			
1.	Laboratory safety and sterilization techniques	Total Hrs	3
2.	Preparation of culture media – nutrient broth and nutrient agar	Total Hrs	3
3.	Pure culture techniques-(Pour plate, streak plate, Spread plate)	Total Hrs	3
4.	Preservation of bacterial cultures	Total Hrs	3
5.	Staining techniques – Gram's staining & fungal staining	Total Hrs	3
6.	Isolation of microorganisms from soil	Total Hrs	3
7.	Physiological characteristics of Microorganisms Starch hydrolysis	Total Hrs	3
8.	Carbohydrate fermentation test	Total Hrs	3
9.	Urease test	Total Hrs	3
10.	Triple sugar iron agar test	Total Hrs	3
11.	Catalase test	Total Hrs	3
12.	Antibiotic sensitivity test	Total Hrs	3
13.	Growth curve – observation and growth characteristics of bacteria	Total Hrs	3
Total hours to be taught			

Lab Manual :

1. Kannan,N (2002).Laboratory manual in General Microbiology. Panima Publishing corporation, New Delhi

Reference(s) :

1. Cappuccino, J.G.,Sherman,N (2004).Microbiology. A Laboratory Manual. AWL

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech.Bio Technology			
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230309P	INSTRUMENTATION TECHNIQUES LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of this laboratory course, the students would have learnt about spectroscopy, nephelometry & chromatography. In addition the student will also gain knowledge of operating these equipments							

(Any 10 experiments)			
1.	Precision and validity in an experiment using absorption spectroscopy.	Total Hrs	3
2.	Validating Lambert-Beer's law using kmno4	Total Hrs	3
3.	Finding the molar absorbtivity and stoichiometry of the Fe (1, 10 phenanthroline) 3 using absorption spectrometry	Total Hrs	3
4.	Finding the pKa of 4-nirophenol using absorption spectroscopy.	Total Hrs	3
5.	UV spectra of nucleic acids.	Total Hrs	3
6.	Chemical actinometry using potassium ferri oxolate	Total Hrs	3
7.	Estimation of SO-4 by nephelometry.	Total Hrs	3
8.	Estimation of AL3+ by flourimetry	Total Hrs	3
9.	Limits of detection using aluminum alizarin complex	Total Hrs	3
10.	Chromatography analysis using TLC.	Total Hrs	3
11.	Chromatography analysis using column chromatography.	Total Hrs	3
Total hours to be taught			30

Lab Manual :	
1.	Practical Biochemistry – Kieth Wilson and John Walker

Reference(s) :	
1.	Principles of Instrumental analysis, V edition- Skoog, Holler, Nieman.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology			Programme Code & Name		23: B.Tech. Biotechnology		
Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230310P	COMPREHENSION II	0	0	3	0	100	00	100
Objective(s)	i. To improve the skill level of Engineering, Technology and Applied Science students. ii. To improve the employability of students in placement interviews.							
1	For each subject 200 Keywords/important words or terms (5 units x 40 words) are to be prepared using the students.							
2	These 200 Keywords are to be printed in double column (2 x 50 words) and in 2 pages and is to be handled over each student for all the subjects.							
3	The staff who handled the subject in the previous semester will handle their discussion period (3 periods / semester) as given below.							
4	The staff will question the students using 'W' and 'H' type questions linking the keywords.							
5	In a similar way the students have to prepare themselves for all the keywords.							
6	Each test will carry 100 questions and two hours duration. The questions will be of objective type: 'W' and 'H' type questions by attaching with keywords.							
7	Based on Test-I and Test-II, sessional marks (maximum 50 marks) will be awarded.							
8	Test-III will be held for all the units and all the subjects. The passing norms will be similar as other subjects (i.e. minimum 50/100 marks)							

Schedule for Conduct of Comprehension Subject		
Total No of weeks planned:10	Total No of subjects: 5 to 7	Total duration per week: 3 periods

Week No	Duration: 1½ period Subject No (No of units)	Duration: 1½ period Subject No (No of units)
W1	S1(3)	S2(3)
W2	S3(3)	S4(3)
W3	S5(3)	S6(3)
W4	Test-I (Portion: 3 units in each subject)	
W5	S1(2)	S2(2)
W6	S3(2)	S4(2)
W7	S5(2)	S6(2)
W8	Test-II (Portion: 2 units in each subject)	
W9	Discussion	
W10	Test-III (All 5 units and all the subjects)	

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td>Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="4">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester III</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230311P</td><td>CAREER COMPETENCY DEVELOPMENT I</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">i. To improve the skill level of Engineering, Technology and Applied Science students.
ii. To improve the employability of students in placement interviews</td></tr>
<tr><td>Skills sets to be improved</td><td colspan="8">a. Aptitude skills
• Arithmetic ability
• Verbal Reasoning
• Non verbal Reasoning
b. Programming skills
• C language
• OOPS concepts and C++ (BT, EEE, ECE,CSE,IT)
• Data Structures (BT, EEE,ECE,CSE,IT)
c. Written Communication Skills
• Comprehension
• Grammar
• Essay Writing
• Technical Report Writing
• Technical paper Writing
d. Oral Communication Skills
• News Reading
• Informing a News item
• Self introduction
• 2 minutes talk – Informed
• 2 minutes talk - Extempore
e. Technical Paper Presentation
• Presenting a paper on recent topics
f. Group Interaction
• Debate
• Group Discussion – Informed Topic
• Group Discussion – Topic on the spot
g. Technical Interview Skills
• Basic MPC knowledge
• Broad Knowledge of the branch
• Indepth knowledge on specific subjects of interest
h. HR Interview Skills
• Adoptability
• Creativity
• Flexibility
• Achievement orientation
• Continuous learning
• Hardworking nature
• Decisiveness
• Self development
• Questioning</td></tr>
<tr><td>Focus</td><td colspan="8">The focus of CCD is to develop these in three semesters (CCD-I, II and III) and reinforce them in another two semesters (CCD IV and V).</td></tr>
<tr><td>Execution</td><td colspan="8">• Total No. of weeks : 12
• 3 Hrs/week and 2 credits
• Only Continuous Assessment and No End Semester examination.
• Evaluation based on written test, oral test and technical paper presentation.
• Every 20 students should be engaged by a staff member during communication hour and oral test
• Every 30 students should be monitored by a staff member to conduct written test.</td></tr>
</table>

Schedule	Week	Activity
	1	Training
	2	Training
	3	Evaluation I - Written
	4	Evaluation I -
	5	Training
	6	Evaluation II - Written
	7	Evaluation II - Oral
	8	Training
	9	Evaluation III - Written
	10 - 12	Evaluation III - Oral
Evaluation	Evaluation I	60 marks(average of 3 tests)
	Evaluation II	20 marks
	Evaluation III	20 marks
	Total	100 marks

<table>
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<tr><td colspan="2">Department</td><td colspan="2">Biotechnology</td><td colspan="2">Program code & Name</td><td colspan="3">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester IV</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230401C</td><td colspan="2">PROBABILITY AND STATISTICS (Common to BT and Nano)</td><td>3</td><td>1</td><td>0</td><td>4</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">At the end of the course, the students would have the fundamental knowledge of the basic probability concepts. Acquire skills in handling situations involving more than one random variable and functions of random variable. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.</td></tr>
<tr><td>1</td><td colspan="5">PROBABILITY AND RANDOM VARIABLES</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="9">Axioms of probability – Conditional probability – Total probability – Baye’s theorem – Random variable – Probability mass function – Probability density function – Moments – Moment generating function – Properties.</td></tr>
<tr><td>2</td><td colspan="5">STANDARD DISTRIBUTIONS</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="9">Binomial Distribution – Poisson Distribution– Geometric Distribution – Negative Binomial Distribution– Normal Distribution - Exponential Distribution – Gamma Distribution – Weibull Distributions – Properties – Problems.</td></tr>
<tr><td>3</td><td colspan="5">TWO DIMENSIONAL RANDOM VARIABLES</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="9">Marginal and Conditional Distributions - Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.</td></tr>
<tr><td>4</td><td colspan="5">TESTING OF HYPOTHESIS</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="9">Test of significance of small samples – Students ’t’ test – Single mean – Difference of means – F – Test – Chi-Square test – Goodness of fit – Independence of Attributes – Large Samples – Difference of proportions – Test of significance - single mean – Difference of means.</td></tr>
<tr><td>5</td><td colspan="5">DESIGN OF EXPERIMENTS AND QUALITY CONTROL</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="9">Analysis of variance – One way classification – CRD – Two way classification – RBD – Latin square – Control charts – $\overline{X}$ chart – R chart – C chart.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1.</td><td colspan="8">Kapur J.N. and Saxena H.C., “Mathematical Statistics”, S Chand, New Delhi, 1997.</td></tr>
<tr><td>2.</td><td colspan="8">Gupta S.C. and Kapur J.N., "Fundamentals of Mathematical Statistics", S Chand, Ninth Edition, New Delhi, 1996.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="8">Walpole R.E. Myers R.H. Myers R.S.L. and Ye K., "Probability and Statistics for Engineers and cientists", Seventh Edition, Pearsons Education, Delhi, 2002.</td></tr>
<tr><td>2.</td><td colspan="8">Mille I.R. and Freund J.E., "Probability and Statistics for Engineers", Prentice Hall, 1995.</td></tr>
</table>

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230402C	GENETICS	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have learnt the basic of genetics and various methods of mutations, problems. It helps the students to take up PG course in Biotechnology.							

1	GENETICS AND HEREDITY	Total Hrs	09
Introduction to genetics. Genotype and phenotype, Mendelian laws of Inheritance, Test cross, back cross; Structural organization of eukaryotic chromosomes: Nucleosome structure, Euchromatin, heterochromatin, telomeres, Satellite DNA, centromeres, Types of chromosome on the basis of centromeres; Lampbrush chromosomes; polytene chromosomes; Extrachromosomal inheritance; maternal effects and cytoplasmic inheritance, Chi square analysis.			
2	LINKAGE AND CROSSING OVER	Total Hrs	09
Fine structure of the gene: cistron, recon, mutan; Linkage; crossing over: molecular mechanism- double strand break model, Holiday model, Genetic mapping of chromosomes: Diploid mapping- two point cross, three point cross, Haploid mapping; Lod score analysis.			
3	CYTOGENETICS	Total Hrs	09
Sex determination in plants and animals: Concepts of autosomes and allosomes, XX-XY,XX-XO,ZW-ZZ,ZO-Types; Sex differentiation; Dosage compensation; Sex linked inheritance, Sex influenced inheritance Multi Alleles; Lethality and Interaction of genes. Karyotyping- amniocentesis; banding techniques			
4	CHROMOSOMAL ABERRATIONS & MUTATIONS	Total Hrs	09
Structural changes: duplications, translocations, inversions; Numerical changes: aneuploidy ; Euploidy; polyploidy ; Types of mutations; lethal mutations, silent mutations, adaptive mutations, biochemical mutations& chemical mutagens, ionizing and non-ionizing radiations; Ames Test.			
5	GENETIC MATERIAL IN POPULATIONS	Total Hrs	09
Population genetics: gene pool, gene frequencies, Hardy-Weinberg law and its applications, factors affecting allele frequencies- selection, mutation, migration and genetic drift; Inbreeding depression; Heterosis; speciation; pedigree analysis.			
Total hours to be taught			45

Text book (s) :	
1.	Tamarin, R.H., “Principles of Genetics”, Tata McGraw Hill, New Delhi, 2002.
2.	Verma, P.S. and Agarwal, V.K., “Cell Biology, Genetics & Evolution & Ecology”, S.Chand & Co., New Delhi, 1991.
Reference(s) :	
1.	Gardner, E.J, Simmons, M.J, and Snustad, D.P., “Principles of Genetics”, John Wiley & Sons, New Delhi, 1991.
2.	Strickberger, M.W., “Genetics”, Prentice Hall of India, New Delhi, 1996.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230403C	MOLECULAR BIOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about the structure of Nucleic acid, DNA replication and how the expression is regulated. This Knowledge will be very useful for students to study specialized subjects in Modern biology & Biotechnology.							
1	OVERVIEW OF MOLECULAR BIOLOGY				Total Hrs	08		
DNA and RNA as the genetic Material, Griffith experiment, Hershey and Chase experiment, Avery Mc Cleod and Mc Carthy experiments. Transformation, Conjugation and Transduction.								
2	STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION				Total Hrs	10		
Confirmation of DNA and RNA. Replication in Prokaryotes and Eukaryotes. Replication models and types. Enzymology of DNA Replication, Mechanism and events in Replication. Phage replication.								
3	TRANSCRIPTION				Total Hrs	10		
Prokaryotic and Eukaryotic Transcription, RNA polymerase, transcription factors, mechanism of transcription, Post transcriptional modification. Capping, adenylation. Features of promoters and enhancers, ribozymes. Processing of mRNA, rRNA and tRNA.								
4	TRANSLATION				Total Hrs	08		
Genetic code, Protein synthesis mechanism. Prokaryotic and Eukaryotic translation- initiation, elongation and termination of Protein synthesis. Inhibitors of Translation. Post translational modification-Glycosylation, Phosphorylation and Sulfation. Protein targeting.								
5	REGULATION OF GENE EXPRESSION				Total Hrs	09		
Operon Concept. Negative Control (Lac Operon), Positive control (Arabinose operon), Tryptophan Operon. Mutation –Spontaneous and Induced. Repair of DNA. Method of studying gene expression.								
Total Hours Taught						45		
Text book (s) :								
1.	David Frifelder, “Molecular Biology”, Narosa Publication House. New Delhi, 1999.							
2.	Benjamin Lewin, “Gene VIII”, Oxford University Press. New Delhi, 2000.							
Reference(s) :								
1.	Watson J.D., Hopkins, W.H., Roberts J. W., Steitz, J.A., and Weiner A.M., “Molecular Biology of the Gene”, The Benjamin/Cummings Publication Company, California, USA. 1987.							
2.	Old, B., Richard, M.T., and Primrose, S.B, “.Principles of Gene Manipulation: An introduction to Genetic Engineering”, Black Well Science Publication, Malden, USA. 2001.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230404C	BASIC INDUSTRIAL BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about production of primary & secondary metabolites, enzymes and single cell proteins on an industrial scale. This will be very beneficial for certain specialized courses & project work.							
1	INTRODUCTION TO INDUSTRIAL BIOPROCESS				Total Hrs	07		
Basis and Development of industrial fermentation processes-Screening for new metabolites, stock cultures, substrates for industrial fermentation, media and inoculum preparation								
2	PRODUCTION OF PRIMARY METABOLITES				Total Hrs	10		
A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid); amino acids (glutamic acid, phenyalanine, aspartic acid) and alcohols (ethanol, butanol)								
3	TRANSCRIPTION				Total Hrs	10		
Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin) aminoglycosides (streptomycin) macrolides (erythromycin), vitamins-Vitamin B_{12}, Riboflavin, gibberellins.								
4	PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS				Total Hrs	08		
Production of industrial enzymes such as proteases, amylases, lipases, Production of Microbial insecticides, biofertilisers, biopreservatives (Nisin), biopolymers (xanthan gum)								
5	PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS				Total Hrs	10		
Production of Single cell Proteins from Wood, Carbohydrates, Sewage and Alkanes. Microbial transformation-Transformation of steroids, ascorbic acid, antibiotics and pesticides								
Total Hours Taught						45		
Text book (s) :								
1.	Wulf Cruger and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, Panima Publishing Corporation, New Delhi.							
2.	Casida Jr, L.E., “Industrial Microbiology”, New Age International (P) Ltd. New Delhi.							
Reference(s) :								
1.	Murrey Moo & Young, D. 1998. “Comprehensive Biotechnology”, Pergamon. New Delhi							
2.	Presscott, D. 2002. “Industrial Microbiology”, CBS Publishers, New Delhi.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230405C	CHEMICAL REACTION ENGINEERING	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the student would have learnt chemical kinetics, various types of reactors and how they function. This will help the student to take up PG course in Bioprocess, Biochemical engineering. And also the project work.							
1	SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING					Total Hrs		08
Broad outline of chemical rectors; rate equation; concentration and temperature dependence; development of rate equation for Irreversible uni molecular type first- order reactions, Irreversible Bio molecular type Second - order reactions , Irreversible Tri molecular type Third- order reactions , Irreversible reactions in series.								
2	IDEAL REACTORS					Total Hrs		10
Ideal Reactors for a single Reaction, Design for a single Reaction, Multiple-reactor systems, Recycle reactor, Autocatalytic Reactions Design for parallel Reactions, Potpourri of Multiple Reactions, Irreversible First-order Reactions in series, First-Order followed by Zero-order reactions, Reversible reactions semi-batch reactors, performance equation for single rectors; multiple reactor system; multiple reactions.								
3	FLOW AND NON IDEAL FLOW					Total Hrs		10
RTD in ideal flow; Non- ideal flow models; Compartment models, Dispersion Model, Tank in series Model, Convection model for Laminar flow, Earliness of mixing, Segregation and RTD, Reactor performance with non-ideal flow.								
4	GAS-SOLID, GAS-LIQUID REACTIONS					Total Hrs		09
Resistance and rate equations; Pore diffusion resistance combined with surface kinetics ,Porous catalyst particles, Heat effects during reaction, Performance equation for reactors containing porous catalyst particles, Product distribution in multiple reactions, heterogeneous catalysis; reaction steps.								
5	FIXED BED AND FLUID BED REACTORS					Total Hrs		08
G/L reactions on solid catalysis ; trickle bed, slurry reactors; three-fluidized beds ; reactors for fluid-fluid reaction; tank Reactors ,fluid-fluid reactors, fluid-particle reactions and reaction rate and rate controlling steps.								
Total hours to be taught								45
Text book (s) :								
1.	Levenspiel, O., “Chemical Reaction Engineering”, 3rd Edition. John Wiley, New Delhi, 1999.							
2.	Gavhane, K.A., “Chemical Reaction Engineering “ Vol I & Vol II, Nirali Prakashan Publisher, New Delhi, 2000.							
Reference(s) :								
1.	Missen, R.W., Mims, C.A. and Saviile B.A., “Introduction to Chemical Engineering and Kinetics”; John Wiley, New Delhi, 1999.							
2.	Fogler, H.S., “Elements of Chemical Engineering” Prentice Hall India, New Delhi, 2002.							

K.S.Rangasamy College of Technology Autonomous Regulation							R 2008	
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230406C	CHEMICAL THERMODYNAMICS AND BIOTHERMODYNAMICS	3	1	0	4	50	50	100
Objective(s)	At the end of the course the students would have learnt about thermodynamic properties of fluids, Chemical potential, fugacity, Gibbs-Duhem equation, Phase equilibria etc. The knowledge gained in this course will be very useful for studying certain specialized subjects offered in later semesters.							
1.	THERMODYNAMIC PROPERTIES OF FLUIDS					Total Hrs		08
Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications								
2.	SOLUTION THERMODYNAMICS					Total Hrs		10
Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.								
3.	PHASE EQUILIBRIA					Total Hrs		10
Criteria for phase equilibria; Phase equilibria in single-component systems, Phase equilibria in multi component system, Duhem theorem, Vapor-Liquid equilibria, Bubble-point equilibria, Dew-point equilibria, Flash vaporization, phase diagram for binary solutions, Azeotrope, Liquid-liquid equilibrium diagrams, Binary liquid-liquid equilibria and ternary equilibrium diagrams .								
4.	CHEMICAL REACTION EQUILIBRIA					Total Hrs		09
Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.								
5.	THERMODYNAMIC ANALYSIS OF PROCESSES					Total Hrs		08
Concept of lost work; entropy generation; Entropy and irreversibility processes; power cycle; Coefficient of performance, Refrigerator capacity, Vapour-compression cycle, Adsorption refrigeration, Liquefaction, Rankin cycle, Reheat cycle, Regenerative cycle, Otto cycle, Diesel cycle, Dual cycle.								
Total hours to be taught								45
Text book (s) :								
1.	Smith, J.M., Van Ness, H.C. and Abbot, M.M., "Chemical Engineering Thermodynamics", McGraw-Hill, 6th Edition, New Delhi, 2001.							
2.	Narayanan, K.V., "A Text Book of Chemical Engineering Thermodynamics". Prentice Hall India, New Delhi, 2002.							
Reference(s) :								
1.	Sandler, S.I., "Chemical and Engineering Thermodynamics." John Wiley, New Delhi, 1989.							
2.	Bevan Ott, J. Juliana Boerio Goats., ."Chemical Thermodynamics" Elsevier Ltd., USA, 2000.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230407P	MOLECULAR BIOLOGY LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of this course, the students would have learnt basic techniques used in Molecular Biology and its application. This will be strength for students to undertake research projects in the area of molecular biology							

Any Five experiments		
S.No.	Name of Experiments	Total Hrs
1.	Agarose gel electrophoresis	3
2.	Extraction of plasmid DNA	3
3.	Extraction of genomic DNA from bacteria	3
4.	Extraction of genomic DNA from plants	3
5.	Extraction of genomic DNA from animal cells	3
6.	Extraction of total RNA	3
7.	Gel elution	3
8.	Phage titration	3
Total hours to be taught		24

References :

1. Sambrook, J. and Russsel, D.W., "Molecular cloning – A laboratory manual", Third edition, Cold Spring Harbor Laboratory Press, Cold Spring harbor, New York, USA, . 2001.
2. Ansubel, F.M., Brent, R., Kingston, R.E. and Moore, D.D., "Current Protocols in Molecular Biology". Geone Publication Associates, New York, USA, 1988.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230408P	CHEMICAL REACTION ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of the course, the student would have learnt about Performance characteristic of reactor procedures and how to perform them. This will be very useful for specialized project work that the students undertake in the subsequent semesters.							
Any Seven Experiments								
S.No.	Name of experiments					Total Hrs		
1.	Performance characteristic of semi batch reactor-I					4		
2.	Performance characteristic of semi batch reactor-II					4		
3.	Kinetic study in batch Reactor -I					4		
4.	Kinetic study in batch Reactor –II					4		
5.	RTD studies in mixed flow reactor					4		
6.	RTD studies in plug flow reactor					4		
7.	Performance characteristic of mixed flow reactor					4		
8.	Performance characteristic of plug flow reactor					4		
Total hours to be taught						32		
Reference :								
1.	Pauline M. Doran, “Bioprocess Engineering Principles”. Academic Press, New York, USA, 2003.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230409P	CHEMICAL ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective (s)	At the end of the course, the student would have learnt about filtration, Distillation, Extraction procedures and how to perform them. This will be very useful for specialized project work that the students undertake in the subsequent semesters.							

1.	Flow measurement using Venturimeter	Total Hrs	4
2.	Flow measurement using Orifice meter	Total Hrs	4
3.	Pressure drop in pipes	Total Hrs	4
4.	Studies on packed columns	Total Hrs	4
5.	Studies on Fluidization	Total Hrs	4
6.	Studies on Filtration	Total Hrs	4
7.	Studies on Roll crusher	Total Hrs	4
8.	Studies on steam distillation	Total Hrs	4
9.	Distillation in packed column	Total Hrs	4
10.	Liquid-liquid equilibria in extraction	Total Hrs	4
11.	Studies on Jaw crusher	Total Hrs	4
12.	Studies on Simple distillation	Total Hrs	4
Total hours to be taught			48

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology			Programme Code & Name		23: B.Tech. Biotechnology		
Semester IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230410P	COMPREHENSION III	0	0	3	0	100	00	100
Objective(s)	i. To improve the skill level of Engineering, Technology and Applied Science students. ii. To improve the employability of students in placement interviews.							
1	For each subject 200 Keywords/important words or terms (5 units x 40 words) are to be prepared using the students.							
2	These 200 Keywords are to be printed in double column (2 x 50 words) and in 2 pages and is to be handled over each student for all the subjects.							
3	The staff who handled the subject in the previous semester will handle their discussion period (3 periods / semester) as given below.							
4	The staff will question the students using 'W' and 'H' type questions linking the keywords.							
5	In a similar way the students have to prepare themselves for all the keywords.							
6	Each test will carry 100 questions and two hours duration. The questions will be of objective type: 'W' and 'H' type questions by attaching with keywords.							
7	Based on Test-I and Test-II, sessional marks (maximum 50 marks) will be awarded.							
8	Test-III will be held for all the units and all the subjects. The passing norms will be similar as other subjects (i.e. minimum 50/100 marks)							

Schedule for Conduct of Comprehension Subject		
Total No of weeks planned:10	Total No of subjects: 5 to 7	Total duration per week: 3 periods

Week No	Duration: 1½ period Subject No (No of units)	Duration: 1½ period Subject No (No of units)
W1	S1(3)	S2(3)
W2	S3(3)	S4(3)
W3	S5(3)	S6(3)
W4	Test-I (Portion: 3 units in each subject)	
W5	S1(2)	S2(2)
W6	S3(2)	S4(2)
W7	S5(2)	S6(2)
W8	Test-II (Portion: 2 units in each subject)	
W9	Discussion	
W10	Test-III (All 5 units and all the subjects)	

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td>Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="4">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester IV</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230411P</td><td>CAREER COMPETENCY DEVELOPMENT II</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">i. To improve the skill level of Engineering, Technology and Applied Science students.
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<tr><td>Skills sets to be improved</td><td colspan="8">a. Aptitude skills
• Arithmetic ability
• Verbal Reasoning
• Non verbal Reasoning
b. Programming skills
• C language
• OOPS concepts and C++ (BT, EEE, ECE,CSE,IT)
• Data Structures (BT, EEE,ECE,CSE,IT)
c. Written Communication Skills
• Comprehension
• Grammar
• Essay Writing
• Technical Report Writing
• Technical paper Writing
d. Oral Communication Skills
• News Reading
• Informing a News item
• Self introduction
• 2 minutes talk – Informed
• 2 minutes talk - Extempore
e. Technical Paper Presentation
• Presenting a paper on recent topics
f. Group Interaction
• Debate
• Group Discussion – Informed Topic
• Group Discussion – Topic on the spot
g. Technical Interview Skills
• Basic MPC knowledge
• Broad Knowledge of the branch
• Indepth knowledge on specific subjects of interest
h. HR Interview Skills
• Adoptability
• Creativity
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• Achievement orientation
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• Questioning</td></tr>
<tr><td>Focus</td><td colspan="8">The focus of CCD is to develop these in three semesters (CCD-I, II and III) and reinforce them in another two semesters (CCD IV and V).</td></tr>
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• 3 Hrs/week and 2 credits
• Only Continuous Assessment and No End Semester examination.
• Evaluation based on written test, oral test and technical paper presentation.
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Schedule	Week	Activity
	1	Training
	2	Training
	3	Evaluation I - Written
	4	Evaluation I -
	5	Training
	6	Evaluation II - Written
	7	Evaluation II - Oral
	8	Training
	9	Evaluation III - Written
	10 - 12	Evaluation III - Oral
Evaluation	Evaluation I	60 marks(average of 3 tests)
	Evaluation II	20 marks
	Evaluation III	20 marks
	Total	100 marks

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology		Programme Code & Name		23:B.Tech. Biotechnology			
Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230501G	PROFESSIONAL ETHICS	3	0	0	3	50	50	100
Objective(s)	To create an awareness on Ethics and Human Values and instill Moral and Social Values in Students.							
1	INTRODUCTION				Total Hrs	9		
Ethics defined – Engineering as a profession – Core qualities of professional practitioners – Theories of right action – Major ethical issues – Three types of inquiry – Kohlberg's stages of moral development – Carol Gilligan theory – Moral dilemmas – Moral autonomy – Value based ethics.								
2	ENGINEERING AS SOCIAL EXPERIMENTATION				Total Hrs	9		
Comparison with standard experiments – Relevant information – Learning from the past – Engineers as managers, consultants and leaders – Accountability – Role of codes – Code of ethics for engineers; introduction, rules of practice and professional obligations – The space shuttle challenger case study.								
3	ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK				Total hrs	9		
Safety and Risk – Types of risks – Safety and the engineer – Designing for safety – Risk Benefit analysis – Accidents - The three mile Island disaster case study – The Chernobyl disaster case study.								
4	RESPONSIBILITIES AND RIGHTS				Total Hrs	9		
Collegiality – Two senses of loyalty – Professional rights and responsibilities – Conflict of Interest – Collective Bargaining – Confidentiality – Acceptance of bribes / gifts – Occupational crimes – Whistle Blowing.								
5	GLOBAL ISSUES				Total Hrs	9		
Globalization – Cross Cultural Issues – The Bhopal gas tragedy case study – Computer ethics – Weapons development – Intellectual property rights (IPR)								
Total hours to be taught						45		
Text book :								
1	Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India (P) Ltd, New Delhi, 2005.							
References:								
1	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.							
2	Govindan K.R., and Sendhil Kumar S., "Professional Ethics and Human Values", Anuradha Publications, Chennai, 2007.							

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230502C	GENETIC ENGINEERING	3	0	0	3	50	50	100
Objective(s)	To develop skills of the students in the area of genetic Engineering. This will be a pre-requisite for electives like genomics & proteomics and the student would learn about various aspects of genetic engineering and its application This will be very useful for the student to undertake research /project work in Modern Biology.							

1	BASICS OF RECOMBINANT DNA TECHNOLOGY	Total Hrs	08
Role of genes within cells, genetic elements that control gene expression, Restrictions enzymes, DNA modifying enzymes, restriction enzyme mapping safety guidelines of recombinant DNA research.			
2	CREATION OF RECOMBINANT MOLECULES	Total Hrs	10
Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and phage vectors, cosmids, prokaryotic and eukaryotic expression vectors. Insect, Yeast and Mammalian vectors.			
3	CONSTRUCTION OF LIBRARIES	Total Hrs	11
Construction of genomic and c DNA libraries including expression libraries in phage and plasmid vectors; λ-phage، λ -ZAP, T7-based plasmid expression vectors, baculoviral expression and purification of recombinant proteins.			
4	TECHNIQUES IN GENETIC ENGINEERING	Total Hrs	10
PCR-Mechanism-Types-Inverse PCR, Nested PCR, RACE PCR, Taqman assay, Molecular beacons, RAPD,RFLP site directed mutagenesis, methods of nucleic acid sequencing- Sanger's method, Maxam Gilbert, Automated sequencing method, Micro-array technique, DNA fingerprinting, Yeast two hybrid system.			
5	APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY	Total Hrs	06
Cloning in plants, Ti plasmid, Chromosome engineering in plants, Engineered novel traits in plants by RNAi technology, terminator technology, and transgenic animals, Knockout transgenic mice.			
Total Hours Taught			45

Text book (s) :

1	Old, P.W. and Primrose S.B. (2001). Principles of gene manipulation. Blackwell Science Publications, Malden, USA.
2	Glick, B.R., and Pasternak, J.F (1998). Molecular Biotechnology. Principles and applications in recombinant DNA, ASM Press, Washington, USA.
3	Benjamin Lewin (2000). Gene IX, Oxford University Press. New Delhi.

Reference(s) :

1	Winnacker, E.L. (1987). From Genes to Clones, Introduction to Gene Technology, Panima Educational Book Agency, New Delhi.
2	Ansubel, F.M., Brent, R., Kingston, R.E., and Moore, D.D (1988). Current Protocols In Molecular Biology. Greene Publishing Associates, New York.

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230503C	BIOINFORMATICS	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the students would have learnt about Bioinformatics and its tools using various soft wares. Students get knowledge in algorithms and data structure through the subject.							
1	INTRODUCTION TO BIOINFORMATICS				Total Hrs	08		
Definition –scope of Bioinformatics-use of computers in prediction of structure of DNA, protein and RNA-search engines-search algorithms-Introduction to Database –Characteristics and categories of Bioinformatics Databases.								
2	MANAGING BIOLOGICAL DATABASE				Total Hrs	10		
Database in Molecular Biology-Pub med-primary –derived database-sequencing databases-DNA and protein sequencing- Genbank- Swissprot. Derived databases-Pfam-BLOCKS. Structural databases-PDB, SCOP and CATH.								
3	PATTERN MATCHING				Total Hrs	08		
Pairwise sequence alignment –Local Vs global alignment-dot matrix analysis- Substitution matrices- Dynamic programming: Needleman Wunch & Smith waterman method – BLAST- FASTA- Multiple sequence alignment.								
4	MACHINE LEARNING AND PHYLOGENY				Total Hrs	13		
Neural networks-statistical methods-hidden Markov model- Gene prediction algorithm: methods of gene prediction –gene prediction tools-Phylogenetic analysis-Distance matrix methods, character based methods, methods of evaluating phylogenies.								
5	APPLICATION OF BIOINFORMATICS				Total Hrs	06		
Methods of RNA structure prediction-Protein structure prediction-2D and 3D structure prediction-metabolic pathways-microarray design and Data analysis-Drug designing –Quantitative structure activity relationship –Molecular Docking.								
Total Hours Taught						45		
Text book (s) :								
1	S.C.Rastogi, 'Bioinformatics –Concepts, skills& applications' – CBS publishers & Distributors, New Delhi, 2003.							
2	B.Bergeron, Bioinformatics computing, Prentice Hall of India, New Delhi, 2002							
Reference(s) :								
1	C.Gibas and P.Jambeck,'Developing Bioinformatics Skills''O'Reilly Shroff Publishers and Distributors Pvt,Ltd,New york,USA,1999.							
2	Dan Gus field, 'Algorithms and string trees and sequences', Cambridge University Press, New York, USA,1997							
3	Attwood, T.K and parry Smith, D.J. 'Introduction to Bioinformatics', Pearson Education Asia, New Delhi, 2001.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230504C	BIOPROCESS ENGINEERING	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the students would have learnt about fermentation process, Cell Disruption Methods and Purification processes. This will serve as an effective course to understand Bioseparation process in detail.							

1	INTRODUCTION	Total Hrs	09
Historical development of Bioprocess technology, An overview of traditional and modern applications of Biotechnological processes. Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification, characterization of biomolecules, characterization of fermentation broth, morphology of cells, theological behaviour, etc.			
2	FERMENTATION PROCESSES	Total Hrs	09
Techniques of enzyme immobilization, General requirements of fermentation processes; basic design and construction of fermenters and ancillaries; medium requirements for fermentation processes; various commercial media for industrial fermentation; Sterilization of air, liquid media.			
3	PROCESS DESIGN AND OPERATION OF BIOREACTORS	Total Hrs	09
Phases of Cell growth in batch cultures; Mass transfer in heterogeneous biochemical systems; O_2 transfer in submerged fermentation processes, Operational modes of bioreactors: batch, continuous, fed-batch, and continuous cultivation; recombinant cell culture processes; bioreactor strategies for maximizing product formation; bioprocess design considerations for plant and animal cell culture.			
4	PRIMARY SEPARATION	Total Hrs	09
Dead end filtration, filter media, type of filters used, sedimentation and centrifugation, centrifuges, cross flow filtration, cell disruption methods for intracellular products, physical-mechanical methods, chemical methods, cell lysis and inclusion and solubilisation of body formation.			
5	FINAL PURIFICATION	Total Hrs	09
Precipitation, adsorption, Principles of chromatographic separation, various chromatographic separations, Electrophoretic separation processes; dialysis, reverse osmosis, Ultrafiltration, cross flow ultrafiltration and Electro dialysis, crystallization, lyophilisation and drying.			
Total hours to be taught			45

Text book (s) :

1. Bailey, J. and Ollis, David F. “Fundamentals of Biochemical engineering”, Tata McGraw Hill, New Delhi, 1986.
2. Belter, P.A. and Cussler, E. “*Bioseparations”*, Wiley – Interscience Publication, Canada 1988.

Reference(s) :

1. Stanbury, F.P., Whitaker, A. and Hall, S.G “Principles of fermentation Technology”, Aditya Books, Pvt, Ltd, 1997.
2. Shuler,M.L. and Kargi, F.” *Bioprocess Engineering Basic Concepts”,* Prentice Hall of India, Pvt Ltd, New Delhi, 2003.

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230505C	ENZYME ENGINEERING AND TECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the student would have learnt about enzymes, their mode of action, Kinetics of enzyme action and techniques like enzyme immobilization, purification of enzymes & Biosensors. This knowledge gained through this course will be helpful for project work in the semesters.							
1	INTRODUCTION TO ENZYMES				Total Hrs	09		
Classification and Nomenclature of enzymes. General properties of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specify of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis.								
2	KINETICS OF ENZYME ACTION				Total Hrs	09		
Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multi substrate reactions – mechanisms and kinetics; turnover number; types of inhibition & models – substrate, product. Allosteric regulation of enzymes, Monod Changeux Wyman model, pH and temperature, effect on enzymes & deactivation kinetics.								
3	ENZYME IMMOBILIZATION				Total Hrs	09		
Physical and chemical technique for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Effect of biotic and abiotic factors on enzyme immobilization.								
4	PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM DIFFERENT SOURCES				Total Hrs	09		
Production and purification of crude enzyme extracts from plants, animals and microbial sources; methods of characterization of enzymes; development of enzymatic assays. Recombinant enzymes such as serine protease, lysozyme, ribonuclease, polymerase, etc.,								
5	ENZYME APPLICATIONS				Total Hrs	09		
Application of enzymes in analysis; design of enzyme electrodes and their application as biosensors in industry, healthcare and environment, Biotechnological applications of enzymes. Role of enzymes in rDNA technology and Bioinformatics.								
Total Hours to be taught						45		
Text Books :								
1.	Palmer, T. “Enzymes: Biochemistry, Biotechnology and Clinical chemistry”. Affiliated East – West Press Pvt. Ltd., New Delhi. 2004.							
2.	Voet, D. and Voet, G. “Biochemistry”, Third Edition. John Wiley and Sons, Singapore, 2001.							
References :								
1.	James. E. Bailey and David F. Ollis, “Biochemical Engineering Fundamentals”, 2nd Edition. McGraw-Hill, New Delhi. 1986.							
2.	Nicholas C.Price and Lewis Stevens. “Fundamentals of Enzymology”, Oxford University Press publication, New Delhi. 2001.							

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230506C	PLANT AND ANIMAL BIOTECHNOLOGY	3	1	0	4	50	50	100
Objective(s)	To develop the skills of the students in the area of plant and Animal Biotechnology and its wide applications. To widen the knowledge about the production and applications of Transgenic plants and animals.							
1	PLANT TISSUE CULTURE				Total Hrs	10		
Introduction to plant tissue culture; Preparation of tissue culture media; Callus culture; Suspension culture; Cell culture; Batch culture; Continuous culture; Shoot tip Culture; Micropropagation; Somatic embryogenesis; Transfer and establishment of whole plants into greenhouse and field.								
2	GENE TRANSFER TECHNIQUES				Total Hrs	10		
Transformation techniques: Direct gene transfers: Electroporation, particle gun method, Lipofection, Microinjection, Fiber mediated DNA delivery; Laser induced DNA delivery. Biological gene transfer: Agro bacterium mediated gene delivery; Protoplast culture, Germplasm preservation and cryopreservation.								
3	TRANSGENIC PLANTS				Total Hrs	8		
Examples of useful plants: Disease resistance; Inset resistance; virus resistance; Modification of seed protein quality: Modification of Chloroplast and Mitochondria functions; gene silencing; Guidelines and safety regulations for transgenic plants.								
4	ANIMAL CELL LINE				Total Hrs	9		
Introduction to animal cell culture, Basic tissue culture techniques; chemically defined medium and serum free media; maintenance and preservation of animal cell cultures; suspension cultures; Continuous – Flow cultures; Immobilized cultures; Somatic cell fusion.								
5	TRANSGENIC ANIMALS				Total Hrs	8		
Transgenic animals produced, Transgenic mice, Transgenic rabbits, Transgenic cattle, Transgenic Pig, Transgenic Fish, Embryo sex determination; Artificial insemination. Ethical issues related to transgenic animals.								
Total hours to be taught						45		
Text book (s) :								
1	Singh,B.D. Text book of Biotechnology, First Edition, Kalyani Publishers, New Delhi. 1998.							
2	Ranga,M.M.Animal Biotechnology, Second Edition, Agrobios India limited,Jodhpur.2002.							
Reference(s) :								
1	Smith, H.R. Plant Tissue Culture, Second edition, Academic Press, California, USA.2005.							
2	Rama Dass,P.and Meera Rani, S. Text Book of Animal Biotechnology, Akshara Printers, New Delhi.1997.							
3	Masters, J.R.W. Animal Cell culture. Practical Approach, Oxford University Press, UK,2000							

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230507P	GENETIC ENGINEERING	0	0	3	2	50	50	100
Objective(s)	At the end of this course, the students would have learnt basic techniques used in Genetic							
(9 experiments)								

S.No.	Name of the Experiments	Total Hrs
1.	Restriction enzyme digestion	3
2.	Ligation of DNA	3
3.	Transformation and screening for recombinants	3
4.	Conjugation	3
5.	PCR	3
6.	Gel Elution	3
7.	SDS PAGE	3
8.	Western Blot	3
9.	Southern Blotting	3
Total hours to be taught		27
Lab Manual :		
1.	Sambrook, J. and Russsel, D.W., “Molecular cloning – A laboratory manual”, Third edition, Cold	
2.	Ansubel, F.M., Brent, R., Kingston, R.E. and Moore, D.D., “Current Protocols in Molecular Biology”.	

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230508P	BIOPROCESS ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective(s)	Educate the theoretical concepts of Bioseparation experimentally to the students.							
(8 experiments)								

S.No.	Name of the Experiments	Total Hrs
1.	Media Optimization – Plackett Burman design	4
2.	Media Optimization – Response surface methodology	4
3.	Preparation of bioreactor, utilities of bioreactor operation	4
4.	Thermal Death Kinetics	4
5.	Batch Sterilization	4
6.	Batch cultivation, Estimation kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing	4
7.	Fed Batch cultivation, exhaust gas analysis – carbon balancing, gas balancing	4
8.	Total cell retention Cultivation, exhaust gas analysis – carbon balancing, gas balancing	4
Total hours to be taught		32
Lab Manual :		
1.	Pauline M .Doran, “Bioprocess Engineering Principles”. Academic Press, New York, USA, 2003.	

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Semester V								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230509P	ENZYME ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective(s)	To develop skills of the students in the area of Enzyme Engineering.							
(9 experiments)								

S.No.	Name of the Experiments	Total Hrs
1.	Isolation of Intra cellular Enzyme from Fungi	3
2.	Isolation of Extra cellular Enzyme from Bacteria	3
3.	Enzyme Assay - Protease	3
4.	Enzyme Kinetics - Michaels Mendon parameters	3
5.	Acid phosphates activity – Effect of different temperature and pH	3
6.	Acid phosphates activity – Effect of different substrates	3
7.	Enzyme immobilization - Gel entrapment by sodium alginate	3
8.	Enzyme immobilization - Cross Linking	3
9.	Enzyme inhibition Kinetics	3
10.	Production of α amylase, Invertase and Cellulase	3
Total hours to be taught		30
Lab Manual :		
1.	Talwar, G.P. and Gupta, S.K. A Handbook of Practical and Immunology. CBS Publishers & Distributors, New Delhi, 2003	

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<tr><td colspan="8">Semester V</td></tr>
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<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230510P</td><td>CAREER COMPETENCY DEVELOPMENT III</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">i. To improve the skill level of Engineering, Technology and Applied Science students.
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<tr><td>Skills sets to be improved</td><td colspan="7">a. Aptitude skills
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c. Written Communication Skills
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• Grammar
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• Self introduction
• 2 minutes talk – Informed
• 2 minutes talk - Extempore
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• Presenting a paper on recent topics
f. Group Interaction
• Debate
• Group Discussion – Informed Topic
• Group Discussion – Topic on the spot
g. Technical Interview Skills
• Basic MPC knowledge
• Broad Knowledge of the branch
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• Adoptability
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• Achievement orientation
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Evaluation	Evaluation I	60 marks(average of 3 tests)
	Evaluation II	20 marks
	Evaluation III	20 marks
	Total	100 marks

K.S.Rangasamy College of Technology - Autonomous Regulation						R 2008			
Department	Biotechnology		Programme Code & Name			23:B.Tech.Biotechnology			
Semester VI									
Course Code	Course Name	Hours / Week				Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
08230601G	PRINCIPLES OF MANAGEMENT	3	0	0		3	50	50	100
Objective(s)	Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge in international aspect of management.								
1.	HISTORICAL DEVELOPMENT					Total Hrs	9		
Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.									
2.	PLANNING					Total Hrs	9		
Nature & Purpose – Types of Plans – Steps involved in Planning – Objectives – Setting Objectives – process of Management by Objectives – Strategies, Policies & Planning Premises – Forecasting – Decision making.									
3.	ORGANISING					Total Hrs	9		
Nature and purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and limitations – De-Centralization and Delegation of Authority – Staffing – Selection process – Techniques – HRD – Managerial Effectiveness.									
4.	DIRECTING					Total Hrs	9		
Scope – Human Factors – Leadership – Types of Leadership – Motivation – Hierarchy of needs – Motivation Theories – Motivational Techniques – Job Enrichment – Communication – process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.									
5.	CONTROLLING					Total Hrs	9		
System and process of Controlling – Requirements for effective control – the Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.									
Total hours to be taught							45		
Text book (s):									
1.	Harold Kooritz & Heinz Weihrich, “Essentials of Management”, Tata McGraw-Hill, 1998.								
2.	Joseph L Massie, “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.								
Reference(s):									
1.	Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.								
2.	Decenzo David, Robbin Stephen A, “Personnel and Human Reasons Management”, Prentice Hall of India, 1996.								
3.	JAF Stomer, Freeman R. E and Daniel R “Gilbert Management”, Pearson Education, Sixth Edition, 2004.								
4.	Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.								
5.	Prasad L.M, “Principles of Management”, Sultan Chand & Sons Ltd, 2003.								

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23:B.Tech. Biotechnology			
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230602C	IMMUNOLOGY	3	1	0	4	50	50	100
Objective(s)	To introduce the concept of immune response in a mammalian host thereby emphasize their significance in innovation in developing therapeutic modalities for immunological disorders of humans, to orient the students to the biology of the immune system							

1.	THE CELLS OF IMMUNE SYSTEM	Total Hrs	09
An overview of the immunology-Introduction to Immunology, Cells and tissues of the immune system. Haematopoiesis: Origin and differentiation of Lymphocytes and phagocytic cells- receptors and signals that control lymphocyte lineage comment. Immunogens and antigens- Classification of the immune response; Lymphoid organ.			
2.	HUMORAL IMMUNITY	Total Hrs	09
Elements of Humoral immunity- B lymphocytes: - role of surface immunoglobulin receptor in intracellular signaling and transcription to produce antibodies. Immunoglobulin- Classes and subclasses; antibody diversity- Clonal proliferation theory. Hybridoma technology for production of monoclonal.			
3.	CELLULAR IMMUNITY	Total Hrs	09
Thymus derived (T) Lymphocytes: Classification and stages of development- apoptosis, T cell receptor gene rearrangement, and antigen presenting cells. Macrophages, Langerhan's cells, dendritic cells and B lymphocytes- mechanism of phagocytosis- the cell biology of antigen processing and presentation including molecular structure and assembly of MHC molecules.			
4.	IMMUNITY TO INFECTION AND HYPERSENSITIVITY REACTIONS	Total Hrs	09
An overview of immune responses to infections, Hypersensitivity reactions: Classification, case studies with remedial measures; cytokines, Mechanism of T lymphocyte activation- macrophage activation and granuloma formation. Immunological tolerance- role of cytokines and regulatory and immunosuppressive T cells-m role of B cells in oral tolerance- T cell tolerance- idiotype.			
5.	IMMUNOLOGY OF TUMORS, AUTOIMMUNITY AND TRANSPLANTATION	Total Hrs	09
Transplantation: types, immunological mechanisms of graft rejection- immunological strategies to prevent graft rejection- role of immuno-suppressive drugs. Auto-immunity: HLA alleles and disease susceptibility- an overview of the immuno-pathogenic mechanisms of auto-immunity- therapeutic approaches. Tumors: Immune response to tumors- type of tumor antigens.			
Total hours to be taught			45

Text book (s) :

1. Kuby, J. H. 2002. "Immunology", 5th Edn., W. H. Freeman Publication, New York, USA.
2. Abbas, K. A., Litchman, A. H. and Pober, J. S. 2005. "Cellular and Molecular Immunology", 4th Edn., W. B. Saunders Co., Pennsylvania, USA.

Reference(s) :

1. Roitt, I., Brostoff, J. and David, M. 2001. "Immunology", 6th Edn., Mosby publishers Ltd., New York, USA.
2. Tizard, R.I. 2004. "Immunology", 4 th Edn., Saunders college publishing, Chennai Microprint Pvt. Ltd., Chennai.

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech. Biotechnology			
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230603C	MOLECULAR MODELING AND DRUG DESIGNING	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the student would have gained knowledge in various aspects of Drug Designing. This will facilitate the student to take up higher studies in the area.							
I.	CONCEPTS IN MOLECULAR MODELING				Total Hrs	8		
Introduction; Coordinate System; potential energy surfaces molecular graphics; Components of Molecular Graphics hardware and software; Mathematical concepts – introduction of molecular mechanics and quantum mechanics.								
2.	MOLECULAR MECHANICS				Total Hrs	10		
Features of molecular mechanics, force fields; Bond structure and bending angles – electrostatic, Vander Waals and non-bonded interactions, hydrogen bonding in molecular mechanics; Derivatives of molecular mechanics energy function; Calculating thermodynamic properties using force field; Transferability of force field parameters, treatment of delocaliised *pi* system; Force field for metals and inorganic systems – Application of energy minimization								
3.	MOLECULAR DYNAMICS SIMULATION METHODS				Total Hrs	10		
Molecular Dynamics using simple models; Molecular Dynamics with continuous potentials and at constant temperature and pressure; Time-dependent properties; Solvent effects in Molecular Dynamics; Conformational changes from Molecular Dynamics simulation..								
4.	MOLECULAR MODELING IN DRUG DISCOVERY				Total Hrs	8		
Deriving and using 3D pharmacophore; Molecular Docking; Structure-based methods to identify lead compounds, Mechanism of their action ; *de novo* ligand design; Applications of 3D Database Searching and Docking								
5.	STRUCTURE ACTIVITY RELATIONSHIP				Total Hrs	9		
QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronic; Topology; Quantum Chemical based Descriptors. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations.								
Total Hours Taught						45		
Text book (s) :								
1.	Andrew R. Leach “Molecular Modeling – Principles and Applications”; Second Edition, Prentice Hall, USA							
Reference(s) :								
1.	Fenniri, H., “Combinatorial Chemistry – A practical approach”, Oxford University Press, UK, 2000.							
2.	Lednicer, D., “Strategies for Organic Drug Discovery Synthesis and Design”; Wiley International Publishers, 1998.							
3.	Gordon, E.M. and Kerwin, J.F., “Combinatorial chemistry and molecular diversity in drug discovery”; Wiley-Liss Publishers, 1998.							
4.	Swatz, M.E., “Analytical techniques in Combinatorial Chemistry”; Marcel Dekker Publishers, 2000.							

K.S.Rangasamy College of Technology, Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23 : B.Tech. Biotechnology			
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230604C	PROTEIN ENGINEERING	3	1	0	4	50	50	100
Objective(s)	At the end of the course the student would have learnt structure and function of proteins of particular importance; the student will know the production of recombinant insulin & in general how to engineer protein to be used as therapeutics.							
1	BONDS AND ENGINEERS IN PROTEIN MAKE-UP				Total Hrs		05	
Different bonds in protein formation: Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions. Elucidation of protein structure by X-ray Crystallography, NMR, ESR and MALDI-TOF of Mass spectrometry.								
2	AMINO ACIDS AND PROTEINS				Total Hrs		05	
Amino acids classification and their molecular properties (size, solubility, charge, pKa), Chemical relativity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups), Protein classification and their molecular properties.								
3	PROTEIN ARCHITECTURE				Total Hrs		12	
Primary structure: peptide mapping, peptide sequencing – automated Edman degradation method High – throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine super secondary structure: topology diagrams, Prediction of substrate binding sites, Ramachandran plot diagrams Tertiary structure: Domains, protein folding, denaturation, overview of methods to determine 3D structures, Superficial structures. Quaternary structure: Molecular nature, formation of complexes.								
4	STRUCTURE-FUNCTION RELATIONSHIP				Total Hrs		15	
DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eukaryotic transcription factors, Zinc finger proteins, helix-turn helix motifs in homeodomain, Leucine zipper proteins, Membrane proteins: General characteristics, Trans membrane segments, prediction, bacteriorhodopsin and photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture.								
5	PROTEIN ENGINEERING				Total Hrs		08	
Recombinant insulin to reduce aggregation and inactivation, *de novo* protein design, Protein databases such as primary, secondary, tertiary and composite. Structural similarities. Molecular modeling.								
Total Hours to be taught							45	
Text Books :								
1.	Voet, D. and Voet, G. “Biochemistry”, Third Edition. John Wiley and Sons, Singapore, 2001.							
2.	Branden, C. and Tooze, J., “Introduction to protein structure” Second Edition, Garland Publishing, New York, USA, 1999.							
References :								
1.	Creighton T.E. “Proteins”, Second Edition, Freeman WH, USA, 1993.							
2.	Moody, P.C.E. and Wilkinson, A.J. “Protein Engineering”, IRL Press, Oxford, UK, 1990.							

K.S.Rangasamy College of Technology Autonomous Regulation								R2008
Department	Biotechnology	Program code & Name	23:B.Tech. Biotechnology					
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230607P	IMMUNOLOGY LABORATORY	0	0	3	2	50	50	100
Objective(s)	To develop skills of the students in the area of Immunology. At the end of the course the students would have learnt about the Immunology Techniques. This knowledge will be very useful for students to study specialized subjects in Biotechnology.							

(Any 10 experiments)

S.No.	Name of the Experiments	Total Hrs
1.	Blood Grouping	3
2.	Separation of Blood serum	3
3.	Single Radial Immunodiffusion	3
4.	Immunoelectrophoresis	3
5.	Viral Disease Research Laboratory(VDRL)Test	3
6.	Rapid Plasma Reagent (RPR)Test	3
7.	Pregnancy Slide Test	3
8.	ASO(Anti Strepto Lysine-O)test	3
9.	Rheumatoid Arthritis (RA) test	3
10.	Widal Tube agglutination	3
11.	ELISA-Sandwich	3
Total hours to be taught		33

Reference :

1. Talwar, G.P. and Gupta, S.K. 2004. A Handbook of Practical and Immunology. CBS Publishers & Distributors, New Delhi.

K.S.Rangasamy College of Technology Autonomous Regulation								R2008
Department	Biotechnology	Program code & Name			23:B.Tech. Biotechnology			
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230608P	BIOINFORMATICS LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of the course, the student would have gained knowledge about the various aspects Bioinformatics.							

(Any 7 experiments)

S.No.	Name of the Experiments	Total Hrs
1.	Office Automation a. Newspaper Printing. b. Course Details – Power Point Presentation. c. Chat handling.	3
2.	Basic Unix Commands	3
3.	Biological database.	3
4.	Sequence Alignment. d. Pairwise Alignment - Global & Local Alignment. e. Multiple sequences Alignment. - Clustal X	3
5.	Phylogenetic Analysis - Phylip.	3
6.	Structure Visualization Tools. - Rasmol, SPDB Deep Viewer.	3
	Structural Alignment.	3
7.	Homology Modeling - SPDB Deep Viewer.	3
8.	Structure Prediction. - Modeller 7v7	3
9.	Docking - Hex Tool.	3
Total hours to be taught		33

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech. Biotechnology			
Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230609P	INDUSTRIAL BIOTECHNOLOGY LABORATORY	0	0	3	2	50	50	100
Objective(s)	To Educate the theoretical concepts of Bioseparation experimentally to the students.							

(Any 10 experiments)

S.No.	Name of the experiments	Total Hrs
1.	Production of Citric acid	3
2.	Production of ethanol from yeast	3
3.	Production of wine from black grapes	3
4.	Production of Bear from cereals	3
5.	Production of Protease	3
6.	Production of Antibiotics using Streptomycin species	3
7.	Production of Vitamins	3
8.	Production of growth regulators	3
9.	Production of Biofertilizers(N – Fixers & P - Solubilizers)	3
10.	Production of Biocontrol Agents	3
11.	Production of Single cell Protein (Spirulina)	3
12.	Production of Vermicompost	3
Total hours to be taught		36

Reference

1. Cruger, W.,Cruger, A., “Biotechnology :A textbook of Industrial Microbiology”, Panima Publishing Corporation, New Delhi, 2000.

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester VI</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230610P</td><td>CAREER COMPETENCY DEVELOPMENT IV</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">i. To improve the skill level of Engineering, Technology and Applied Science students.
ii. To improve the employability of students in placement interviews</td></tr>
<tr><td>Skills sets to be improved</td><td colspan="7">a. Aptitude skills
• Arithmetic ability
• Verbal Reasoning
• Non verbal Reasoning
b. Programming skills
• C language
• OOPS concepts and C++ (BT, EEE, ECE,CSE,IT)
• Data Structures (BT, EEE,ECE,CSE,IT)
c. Written Communication Skills
• Comprehension
• Grammar
• Essay Writing
• Technical Report Writing
• Technical paper Writing
d. Oral Communication Skills
• News Reading
• Informing a News item
• Self introduction
• 2 minutes talk – Informed
• 2 minutes talk - Extempore
e. Technical Paper Presentation
• Presenting a paper on recent topics
f. Group Interaction
• Debate
• Group Discussion – Informed Topic
• Group Discussion – Topic on the spot
g. Technical Interview Skills
• Basic MPC knowledge
• Broad Knowledge of the branch
• Indepth knowledge on specific subjects of interest
h. HR Interview Skills
• Adoptability
• Creativity
• Flexibility
• Achievement orientation
• Continuous learning
• Hardworking nature
• Decisiveness
• Self development
• Questioning</td></tr>
<tr><td>Focus</td><td colspan="7">The focus of CCD is to develop these in three semesters (CCD-I, II and III) and reinforce them in another two semesters (CCD IV and V).</td></tr>
<tr><td>Execution</td><td colspan="7">• Total No. of weeks : 12
• 3 Hrs/week and 2 credits
• Only Continuous Assessment and No End Semester examination.
• Evaluation based on written test, oral test and technical paper presentation.
• Every 20 students should be engaged by a staff member during communication hour and oral test
• Every 30 students should be monitored by a staff member to conduct written test.</td></tr>
</table>

Schedule	Week	Activity
	1	Training
	2	Training
	3	Evaluation I - Written
	4	Evaluation I -
	5	Training
	6	Evaluation II - Written
	7	Evaluation II - Oral
	8	Training
	9	Evaluation III - Written
	10 - 12	Evaluation III - Oral
Evaluation	Evaluation I	60 marks(average of 3 tests)
	Evaluation II	20 marks
	Evaluation III	20 marks
	Total	100 marks

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech. Biotechnology			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230701G	TOTAL QUALITY MANAGEMENT	3	0	0	3	50	50	100
Objective(s)	To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management, statistical approach for quality control, ISO and QS certification process and its need for the industries.							
1	INTRODUCTION				Total Hrs	9		
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Quality Council, Quality Statements, Deming Philosophy, Barriers to TQM Implementation.								
2	TQM PRINCIPLES				Total Hrs	9		
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement, Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures-Basic Concepts, Strategy.								
3	STATISTICAL PROCESS CONTROL (SPC)				Total Hrs	9		
The tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New Management tools.								
4	TQM TOOLS				Total Hrs	9		
Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages, Types.								
5	QUALITY SYSTEMS				Total Hrs	9		
Need for ISO 9000 Quality Systems, ISO 9000:2000 ISO 14000 Quality Systems – Elements Concepts, Implementation, Documentation, Quality Auditing, – Requirements and Benefits, Non Conformance report.								
Total hours to be taught						45		
Text book (s) :								
1	Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, 1999. (Indian reprint 2002).							
Reference(s) :								
1	James R.Evans & William M.Lidsay, “The Management and Control of Quality”, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).							
2	Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.							
3	Jayakumar.V, Total Quality Management-Lakshmi Publications, 2006.							
4	Suburaj, Ramasamy-TMH, 2005.							

K. S. Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology		Program code & Name			23 : B.Tech. Biotechnology		
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230702C	DOWN STREAM PROCESSING	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the student would have learnt about, methods to obtain pure proteins, enzymes and in general about product development R & D. This will be handy for projects of Industries.							

1.	DOWNSTREAM PROCESSING	Total Hrs	08
Introduction to downstream processing principles characteristics of bimolecular and bioprocesses. Cell disruption for product release – mechanical, Bead Mill Disruption, High Pressure Homogenizer, enzymatic and chemical methods – Alkali Treatment, Detergent Solubilisation, Cell Wall Permeabilization, and Enzyme Digestion. Pretreatment and stabilization of bioproducts.			
2.	PHYSICAL METHODS OF SEPERATION	Total Hrs	10
Theory of batch filtration, Pretreatment of Fermentation broths – heating, coagulation and flocculation, absorption filter aids: filter media; equipment – Plate and frame filter press, Leaf filter; continuous filtration. Centrifuges – Tubular Bowl centrifuge; DISC Bowl centrifuge.			
3.	ISOLATION OF PRODUCTS	Total Hrs	10
Adsorption, liquid - liquid extraction, aqueous two-phase extraction and equipment, membrane separation – ultra filtration and reverse osmosis, dialysis and equipment, precipitation of proteins by different methods – Adsorption Process ; Adsorption Isotherms; batch Adsorption , Adsorption in CSTR; Adsorption in fixed bed.			
4.	PRODUCT PURIFICATION	Total Hrs	09
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques; Electrokinetic's methods of separation.			
5.	FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS	Total Hrs	08
Crystallization, crystallization theory, crystallization practice; equipment for crystallization. Drying – Theoretical Consideration and drying equipment and different types of formulation procedure.			
Total hours to be taught			45

Text book (s) :	
1.	P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pub, 1988.
2.	R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann, 1992.
3.	B. Sivasankar, BioSeparation – Principles and Techniques, Prentice Hall of India Private Limited, New Delhi, 2006.
Reference(s) :	
1.	J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.
2.	R.K. Scopes – Protein Purification – Principles And Practice, Narosa Pub. 1994.

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme code & Name</td><td colspan="3">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230703C</td><td colspan="2">BIOTECHNOLOGY OF STEM CELLS</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">At the end of the course the students will have enough knowledge about the stem cell research methodologies.</td></tr>
<tr><td>1</td><td colspan="5">ORIGIN OF HUMAN STEM CELLS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Origin and characterisation of human stem cells and potential applications for stem cell research. Origin and characterisation of human stem cells, plasticity of human somatic stem cell research. novel stem cell based therapies, scientific and technical obstacles to overcome before realising the potential clinical use of novel human stem cell based therapy. cord blood, stem cell marker</td></tr>
<tr><td>2</td><td colspan="5">HUMAN EMBROYONIC STEM CELL RESEARCH</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Possible sources for human embryonic stem cell, Growing human ESC in laboratory, Current advantages and limitations of hESC and human somatic cells, Examination the need for new cell lines, Developments regarding establishment of human stem cell banks and registries. Government of hESC research, Ethical issues at stake, regulation in European member states regarding human ESC research, Regulation in some Non European countries regarding hESC research.</td></tr>
<tr><td>3</td><td colspan="5">PROTOCOLS FOR ISOLATION AND IDENTIFICATION OF STEM CELLS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Preparation of complete neuroculture, culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astocytes and oligodentrocytes; Immuno-labeling procedure</td></tr>
<tr><td>4</td><td colspan="5">GENE THERAPY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Possibilities to overcome immuno-rejection in stem cell therapy, Haematopoietic stem cell transplantation-A new therapy for autoimmune disease, Prenatal diagnosis of genetic abnormalities using fetal CD34+ stem cells. Stem cells in treatment for major disease and reparative medicine, ESC a promising tool for cell replacement therapy, herm - line therapy.</td></tr>
<tr><td>5</td><td colspan="5">TISSUE ENGINEERING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Basic principles and consideration- cell type and source, metabolic requirements of cells, reconstruction of connective tissues, reconstruction of epithelial or endothelial surfaces- cells embedded in extracellular matrix material, culture on a single surface and sandwich configuration, bioreactor design on tissue engineering- hollow fibre systems, Microcarrier based systems, tissue engineering of the liver</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1</td><td colspan="8">Animal cell culture - A practical approach by John R.W. Master - Oxford University Press, 2004.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1</td><td colspan="8">Tissue engineering, Principles and applications in engineering by Bernhard Palsson, Jeffery A.Hubble, Robert P.Lonsey, Joseph D. Bronzino- CRC press, 2005.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R2008
Department	Biotechnology	Program code & Name			23: B.Tech. Biotechnology			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230704C	NANOBIOTECHNOLOGY	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the students would have gained extensive knowledge in Nanobiotechnology, involvement macromolecules in Nanobiotechnology, application in drug delivery, cancer treatment.							
1	INTRODUCTION TO NANOBIOTECHNOLOGY				Total Hrs.	9		
Introduction to Nanobiotechnology-micro and nanosystems and technologies; overview of nanodevices and techniques. Synthesis and characterization of nanoscale materials- strategies for nanoarchitecture (top down and bottom up approaches) - fabrication technologies and characterization – self assembly systems.								
2	SYNTHESIS OF NANOPARTICLES				Total Hrs	9		
Inorganic nanoscale systems for biosystems-nanostructure materials –fullerness: properties and characterization – carbon nano tubes: characterization and application-quantum dots and wires. Synthesis of gold, silver and silica nanoparticles – nanopores.								
3	NANOMOLECULES IN BIOSYSTEMS				Total Hrs.	9		
Nanomolecules in biosystems-proteins, lipids, RNA and DNA-nanoscale elements for delivery of materials into cells- peptide coupled nanoparticles – DNA based artificial nanostructures – proteins as components in nanodevices, lipids in self assembly structures.								
4	USE OF MICROORGANISMS IN NANOBIOTECHNOLOGY				Total Hrs.	9		
NanoBiotechnology and Microorganisms –PHA in nanoBiotechnology –cyaophycin inclusions- magnetosomes-alignates- bacteriophages-bacterial spores-bacterial protein complexes-s-layer proteins-bacteriorhodopsin.								
5	APPLICATION OF NANOBIOTECHNOLOGY				Total Hrs.	9		
NanoBiotechnology in drug delivery-nanoscale devices for drug delivery-micelles for drug delivery –protein targeting: small molecules-protein interactions-microarray and genome chips- nanobiosensors and nanobiochips. Nanotechnology for cancer diagnosis and treatment. NanoBiotechnology for cell destruction.								
Total Hours Taught						45		
Text book (s) :								
1.	K.K.Jain(2006), Taylor, “Nanobiotechnology” in molecular diagnostics –current techniques and applications.							
2.	BernardH.A Relim - Microbial Bionanotechnology							
Reference(s) :								
1.	O.V.Salata. Journal of nanoBiotechnology(2004),2:3. Applications of nanoparticles in biology and medicine							
2.	CM.Niemeyer and CA Mirkin. NanoBiotechnology – concepts, applications and perspectives.							

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech.., Biotechnology			
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230707P	DOWN STREAM PROCESSING LABORATORY	0	0	3	2	50	50	100
Objective(s)	At the end of the course, the student has gained the knowledge to perform various techniques used in Down Stream Processing and how to make a finished project.							

Any Five experiments

S.No.	Name of Experiments	Total Hrs
1.	Studies on Cell Disruption and Cell Separation by using Sonication method	3
2.	Separation of solid and liquid using Centrifugation method	3
3.	Studies on Sedimentation (sand type)	3
4.	Studies on Filtration using plate and frame filter press	3
5.	Aqueous two phase Extraction by using acetic acid and benzene	3
6.	Studies on simple Leaching	3
7.	Studies on Column Chromatography	3
8.	Studies on ammonium sulphite precipitation	3
Total hours to be taught		24

References :

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

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name		23: B.Tech.., Biotechnology				
Semester VII								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
08230708P	PLANT AND ANIMAL BIOTECHNOLOGY LABORATORY	0	0	3	2	50	50	100
Objective (s)	The student would have learnt about the applications of genetic engineering in plant and how to develop Transgenic plants. The student would have learnt about animal cell culture, molecular diagnostic of animal diseases and transgenic animal production.							

S.No	Name of the experiments	Total Hours
	PLANT BIOTECHNOLOGY	
1	Preparation of Media	3
2	Surface sterilization	3
3	In vitro seed germination	4
4	Organ culture	4
5	Haploid plant Production (Ovary and Pollen culture)	4
6	Multiplication of plant through Micropropagation	4
7	Callus culture	4
8	Agrobacterium mediated gene transformation	4
9	Preparation of synthetic Seed	4
10	Somatic Embryogenesis	4
	ANIMAL BIOTECHNOLOGY	
11	Preparation of tissue culture medium and Membrane filters	4
12	Trypsinization of Monolayer and sub culturing	3
Total hours to be taught		45

Reference(s) :

1. Rama Dass,P.and Meera Rani, S.Text Book of Animal Biotechnology, Akshara Printers, New Delhi.1997
2. Masters,J.R.W. Animal Cell culture. Practical Approach, Oxford University Press, UK,2000

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23 : B.Tech.. Biotechnology</td></tr>
<tr><td colspan="8">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230709P</td><td colspan="2">PROJECT WORK-PHASE I</td><td>0</td><td>0</td><td>4</td><td>2</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To make the student understand the practical problem solving process in the Biotech industry.</td></tr>
<tr><td></td><td colspan="7">Each student has to select a project from any industrial related problems or innovations in technology or critical studies related to Biotechnology during the VII semester. The student can undertake the project work individually or in a batch consisting a maximum of three students. The works to be undertaken during this phase is given below:
i. Identifying the area of proposed project work
ii. Selecting a suitable name for the above work
iii. Identifying the problem areas in Biotech industry for the proposed work
iv. Collecting relevant literature for the above work
v. Framing the methodology for the experimental design
vi. Making all the above works into bound book form
vii. Appearing for Viva-voce examination at the end of semester</td></tr>
</table>

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester VII</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230710P</td><td>CAREER COMPETENCY DEVELOPMENT V</td><td>0</td><td>0</td><td>2</td><td>0</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">i. To improve the skill level of Engineering, Technology and Applied Science students.
ii. To improve the employability of students in placement interviews</td></tr>
<tr><td>Skills sets to be improved</td><td colspan="7">a. Aptitude skills
• Arithmetic ability
• Verbal Reasoning
• Non verbal Reasoning
b. Programming skills
• C language
• OOPS concepts and C++ (BT, EEE, ECE,CSE,IT)
• Data Structures (BT, EEE,ECE,CSE,IT)
c. Written Communication Skills
• Comprehension
• Grammar
• Essay Writing
• Technical Report Writing
• Technical paper Writing
d. Oral Communication Skills
• News Reading
• Informing a News item
• Self introduction
• 2 minutes talk – Informed
• 2 minutes talk - Extempore
e. Technical Paper Presentation
• Presenting a paper on recent topics
f. Group Interaction
• Debate
• Group Discussion – Informed Topic
• Group Discussion – Topic on the spot
g. Technical Interview Skills
• Basic MPC knowledge
• Broad Knowledge of the branch
• Indepth knowledge on specific subjects of interest
h. HR Interview Skills
• Adoptability
• Creativity
• Flexibility
• Achievement orientation
• Continuous learning
• Hardworking nature
• Decisiveness
• Self development
• Questioning</td></tr>
<tr><td>Focus</td><td colspan="7">The focus of CCD is to develop these in three semesters (CCD-I, II and III) and reinforce them in another two semesters (CCD IV and V).</td></tr>
<tr><td>Execution</td><td colspan="7">• Total No. of weeks : 12
• 3 Hrs/week and 2 credits
• Only Continuous Assessment and No End Semester examination.
• Evaluation based on written test, oral test and technical paper presentation.
• Every 20 students should be engaged by a staff member during communication hour and oral test
• Every 30 students should be monitored by a staff member to conduct written test.</td></tr>
</table>

Schedule	Week	Activity
	1	Training
	2	Training
	3	Evaluation I - Written
	4	Evaluation I -
	5	Training
	6	Evaluation II - Written
	7	Evaluation II - Oral
	8	Training
	9	Evaluation III - Written
	10 - 12	Evaluation III - Oral
Evaluation	Evaluation I	60 marks(average of 3 tests)
	Evaluation II	20 marks
	Evaluation III	20 marks
	Total	100 marks

K.S.Rangasamy College of Technology Autonomous Regulation								R 2008
Department	Biotechnology	Program code & Name			23: B.Tech. Biotechnology			
Semester VIII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230801C	BIOPHARMACEUTICAL TECHNOLOGY	3	1	0	4	50	50	100
Objective(s)	At the end of the course, the students would have learnt about What are Drugs, Drug action, Drug metabolism, and various dosage forms of Biopharmaceuticals to facilitate the students to take up projects in this area of Pharmaceutical Biotechnology.							
1.	INTRODUCTION TO PHARMACOLOGY				Total Hrs	10		
Historical outlines of drugs, classification of drugs, Physico-chemical properties of drugs, Routes of administration of drugs, drug metabolism, controlled release drug delivery system, drug stability, Sources: plant, marine and microorganisms.								
2.	DRUG DISCOVERY				Total Hrs	08		
Drug discovery an introduction, basic clinical evolution of new drugs, bioavailability of drugs, quantitative and qualitative assay of drugs by biological testing, packing techniques like compression of tablets, wet & dry granulation, direct compression, tablet presses and coating.								
3.	PHARMACOKINETICS AND BIOTRANSFORMATION				Total Hrs	10		
Pharmacokinetics, Pharmacokinetics: introduction, absorption, distribution, elimination and metabolism of drugs, sites of action, Phase I and Phase II reactions, prodrugs, adverse drug effects, Role of Enzymes in drug metabolism.								
4.	PHARMACEUTICAL DOSAGE FORMS AND APPLICATIONS				Total Hrs	08		
Oral solid dosage forms, compressed tablets, types, pills, solutions, syrups, juices, nasal solutions, emulsions, lotions and extracts. Applications of various drugs in human body and site of action								
5.	BIOPHARMACEUTICALS				Total Hrs	09		
Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives. Common drugs which are abused, Antibiotics, human insulin, interferon, somatostalim, somatotropin - its preservation and analytical methods.								
Total Hours to be Taught						45		
Text book (s) :								
1.	Remington, “The Science and Practice of Pharmacy”. Lippincott Williams and Wilkins, 20th edition, 2001.							
2.	Gareth Thomas, “Medicinal Chemistry an Introduction”. John Wiley, New Delhi, 2000.							
Reference(s) :								
1.	Katzung, B.G. “Basic and Clinical Pharmacology”, Prentice Hall of India, New Delhi, 1995.							
2.	Tripathi, K.D. “Essentials of Medical Pharmacology”, Jaypee Brothers Medical Publishers (P) Ltd. 6th Edition, John Wiley, New Delhi, 2000.							

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<tr><td colspan="9">Semester VIII</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230804P</td><td colspan="2">PROJECT WORK – PHASE II</td><td>0</td><td>0</td><td>20</td><td>10</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To make the student understand the practical problem solving process in the Biotech industry.</td></tr>
<tr><td></td><td colspan="8">The student can undertake the project work individually or in a batch consisting a maximum of three students. The project work should the continuation of the project work phase-I.

i. After completion of VII sem exams this phase has to be commenced
ii. The work has to be carried out in the industry
iii. All the observations have to be noted down
iv. Testing and analysis has to be done
v. Conclusions has to be maid
vi. The phase I work has to be consolidated with phase II work
vii. The project work must be made in to a bound book form
viii. Appearing for viva-voce exams at the end semester</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23: B.Tech. Biotechnology			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230641E	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	To develop skills of the students in the area of Environmental Biotechnology and its prerequisite for PG studies in Biotechnology.							
1	ENVIRONMENTAL POLLUTION				Total Hrs	09		
Sources of Pollution-Air Pollution-Acid rain-Effect of Air pollution-Control measures of air pollution-Water Pollution-waste water treatment—Control measures of water pollution-Dissolved oxygen-Biological oxygen Demand-Chemical Oxygen Demand.								
2	SOIL FORMATION				Total Hrs	09		
Ecosystem-Formation of Soil-Physical and Chemical process of Soil Formation –Pedogenesis-Factors affecting soil formation-Active factors for soil formation-Soil Classification—Soil complex and its properties-Soil organic matter-Humus formation-Importance of Humic Acid.								
3	SOIL MICROBIOLOGY				Total Hrs	09		
Microbial Flora of Soil-Microbial Growth-Ecological Adaptations of Microorgnaisms-Soil enzymes(Phosphatase,Cellulase,Urease and Dehydrogenase)and theirrole in nature-Soil microbial population and their importance								
4	BIODEGRADATION				Total Hrs	09		
Pesticides-Effects of Pesticides-Pesticide degradation-Fungicides-effects of fungicides-Fungicide degradation-DDT-Simple aromatics-Chlorinated Polyaromatic Petroleum Products-Surfactants.								
5	BIOREMEDIATION				Total Hrs	09		
Bioremediation of oil spilled and salt affected Soils by using microorganisms and Plants-Role of Biological indicators in Bioremediation-Solid Waste management-dairy,Pulp,Dye,Leather and Pharmaceutical waste management-Biofertilizers for poor soil management								
Total hours to be taught						45		
Text Book(s)								
1	Stainer,R.Y.,Ingraham J.L.,Wheelis ,M.L.,painter.,R.R., " General Microbiology" , Mc Millan Publications, 1989.							
2	Foster,C.f.,John Ware.,d.A., " Environmental Biotechnology", Ellis Hon wood Ltd., 1987.							
Reference(s) :								
1	Subba Rao,N.S., "Soil Microbiology", Oxford & IBH PublishersPvt.Ltd,New Delhi, 2004.							
2	Karnely,D.,Charbarty.,K.,Omen .,G.S., "Biotechnology and Biodegradation Advances in Applied Biotechnology Series,Vol2", Golf Publishers Co, London, 1989.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230642E	GENOMICS AND PROTEOMICS	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students should have the knowledge of the Genome sequence, Functional Genomics, proteomics and about the tools for proteomics.							
1	STRUCTURAL GENOMICS				Total Hrs	9		
Overview of genome; Genome sequence acquisition and analysis; comparative homologies, evolutionary changes; SNPs; Genetic analysis: Linkage mapping and analysis; High resolution chromosome maps; Physical mapping, YAC, BAC, Hybrid mapping strategies, microarrays; Sequence specific tags (SST), Sequence-tagged sites(STS), ISH, FISH, RFLP, RAPD								
2	DNA SEQUENCING				Total Hrs	9		
Variations in sequencing methods: Ladder, Fluorescent, Mass Spectrometry, Shotgun, Transposon-mediated, etc); Automation Sequencing; Finding genes and mutations; Implications of DNA sequencing; Implications of sequencing genomes.								
3	FUNCTIONAL GENOMICS				Total Hrs	9		
Construction and screening of cDNA libraries; PCR: variations in PCR; cDNA microarrays, gene disruptions, Yeast two-hybrid system, serial analysis of gene expression (SAGE), SAGE Adaptation for Downsized Extracts (SADE); applications of DNA arrays, Pharmacogenomics.								
4	PROTEOMICS				Total Hrs	9		
Overview of sequence analysis: Databases, datamining, Sequence alignment; Algorithms in proteomics, Applications of Proteomics: proteome mining, protein expression profiling, protein-protein interactions, protein modifications; automation.								
5	TOOLS FOR PROTEOMICS				Total Hrs	9		
2D Electrophoresis, IEF, HPLC, Protein digestion techniques; Mass Spectrophotometry: MALDI-TOF, Mass analyzers, Peptide Mass Fingerprinting; protein arrays.								
Total hours to be taught						45		
Text book (s) :								
1	Liebler DC, “Introduction to Proteomics, Tools for the new biology”, Humana Press, 2002.							
2	Hunt SP, Livesey FJ, “Functional Genomics”, Oxford University Press, 2000.							
Reference(s) :								
1	Cantor CR, “Genomics”, John Wiley, 1999.							
2	Westermier R, Naven T, “Proteomics in practice, A laboratory manual of proteome analysis”, John Wiley-VCH, 2002.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230643E	VIROLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students should have the complete knowledge of Viruses, its classifications and infections caused by viruses.							
1	INTRODUCTION				Total Hrs	9		
General properties – classification – cultivation – Isolation and Identification of viruses – Serodiagnosis and Molecular diagnosis of viral infection.								
2	VIRAL VACCINES				Total Hrs	9		
Pox viruses – Variola, vaccines. Herpus viruses – Herpus simplex, Varicella zoster, Cytogalovirus, Epstein Barr virus. Adeno viruses – Hepatitis viruses, Papova viruses – Papiloma, Polyoma – Parvo virus.								
3	VIRUSES DIFFERENT TYPES				Total Hrs	9		
Picorna viruses, Polio, Rhino virus.Orthomyxo virus – Influenza. Paramyxo viruses – Para influenza, mumps, measles. Rhabdo virus – Reo virus – Roto virus.								
4	PATHOGENIC VIRUSES				Total Hrs	9		
Alpha viruses – Eastern Equine Encephalitis virus. Flavi viruses – Yellow fever virus, Dengue virus, Japanese B encephalitis virus, KFD – Rubella – Retro viruses – HIV, HTLV.								
5	MODERN METHODS OF ANIMAL CARE				Total Hrs	9		
Modern methods of care, management, breeding and maintenance of lab animals – rabbits, mic, rats, guinea pigs. Laboratory uses of animals with reference to Microbiology, anybody production. Gnotobiotic animals. Disposal of animal house wastes.								
Total hours to be taught						45		
Text book (s) :								
1	Chakraborthy P. “A Text book of microbiology”, New central book agency Pvt, Ltd, 2003.							
Reference(s) :								
1	Dimmok N.J, Prmrose S.B, “Introduction to Modern Virology”, Blackwell Scientific publications, 1994.							
2	Partric R. M, “Medical Microbiology”, Mosby publications, 1990.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective I								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230644E	MOLECULAR BIOPHYSICS	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have learnt about molecular structures of biological systems, cell permeability and conformation of protein and nucleic acid. This course facilitates the students to take specialization in computational biology.							
1	MOLECULAR STRUCTURE OF BIOLOGICAl SYSTEM				Total Hrs	9		
Intra molecular bonds – covalent – ionic and hydrogen bonds – biological structures – general features – water structure – hydration – interfacial phenomena and membranes – self assembly and molecular structure of membranes.								
2	CONFORMATION OF NUCLEIC ACID				Total Hrs	9		
Primary structure – the bases – sugars and phosphodiester bonds – double helical structure – the a, b and z forms – properties of circular DNA – topology – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.								
3	CONFORMATION OF PROTEINS				Total Hrs	9		
Conformation of the Petide bond – secondary structures – Ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.								
4	CELLULAR PERMEABILITY AND ION TRANSPORT				Total Hrs	9		
Ionic conductivity – transport across ion channels – mechanism – ion pumps – proton transfer – nerve conduction – techniques of studying ion transport and models.								
5	ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS				Total Hrs	9		
Concepts in Thermodynamics – force and motion – entropy and stability – analysis if fluxes – diffusional potential – basis properties of fluids and biomaterials – laminar and turbulent flows.								
Total hours to be taught						45		
Text book(s):								
1	Springer, V., Glaser, R. “Biophysics”, 2000.							
Reference(s) :								
1	Duane,R. “Biophysics : Molecules in motion”, Academic press,1999.							

K.S.Rangasamy College of Technology, Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23: B.Tech. Biotechnology			
Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230651E	FOOD SCIENCE AND TECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have gained knowledge in various aspects of Food processing & its importance for industrial applications. This will facilitate the student to take up higher studies in the area.							

1	PRINCIPLES OF FOOD PROCESSING	Total Hrs	9
Scope and importance of food processing - Principles and methods of food preservation – Types of Sterilization, Pasteurization, Canning, and blanching - Freezing, Refrigeration, dehydration, additives, and irradiation			
2	TYPES OF FOOD PROCESSING AND PRESERVATION	Total Hrs	9
Fruit and vegetable Technology – Preservation of fruits and vegetables by heat, chemicals, sugar, salt, fermentation, drying etc.; Technology of milk and milk products - processing of market milk, Milk product processing - cheese, butter, ice cream - Processing of meat and meat product. cereal and legume technology – rice, wheat - products – bread making etc.,			
3	FOOD BIOTECHNOLOGY	Total Hrs	9
Current status of food processing industries- application of Biotechnology to food production. Genetically modified foods; microorganisms as food - Single cell protein - Technological aspects of industrial production of beer and wine, Applications of enzymes in food processing industry.			
4	FOOD MICROBIOLOGY	Total Hrs	9
Microbial growth pattern, Factors influencing the growth of microorganisms. Types of microorganism normally associated with food, mold, yeast and bacteria. Food spoilage -Factors responsible for food spoilage; food infections and food intoxication			
5	FOOD QUALITY ASSURANCE	Total Hrs	9
Food safety - Agencies that control food supply; National and International guidelines. Food adulteration and food safety. Sensory analysis in quality control, Food laws and standards, Safety measures,			
Total Hours to be taught			45

Text book (s) :	
1	Frazier, W.C. and Westhoff, D.C., Food Microbiology. Tata McGraw-Hill Publishing Company Ltd., New Delhi. 1995.
2	Sivasankar, B., Food Processsing and Preservation. Thrid Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
Reference(s) :	
1	James M .Jay, Modern Food Microbiology. Fourth Edition ,CBS Publishing Company Ltd., New Delhi, 2005.
2	Prescott and Dunn, Industrial Microbiology, Fourth Edition , CBS Publishing Company Ltd., New Delhi,1987.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23: B.Tech. Biotechnology			
Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230652E	MARINE BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students should have enough knowledge about the Marine microbes, Aquatic animals and biomedical importance of marine organisms.							
1	INTRODUCTION TO MARINE MICROBES IN THE OCEAN				Total Hrs	9		
Marine microbial diversity - Criterion Habitats -Presence of other organisms:Symbiotic, Free-living, Biofilm, Proximity to the ocean surface or sediments :Euphotic -Mesopelagic - Bathopelagic - Benthos (sediments)- Concentration of nutrients and required growth substrates: Oligotrophic, Mesotrophic , Eutrophic - interactions between marine microbes: symbiosis and pathogenesis: the abundance and distribution of bacterial and viral pathogens - Metabolic capabilities of marine microbes: adapting to extreme environments - Algal blooms- marine bacteria. Applying marine microbes using biotechnology: industrial applications, energy production, medical applications, using marine microbes to meliorate environmental deterioration.								
2	BIOTECHNOLOGY OF AQUATIC ANIMALS				Total Hrs	9		
Shellfish and Crustacean Culture; Aquaculture- shrimps, edible mussels, pearl oyster, crabs;Fish Physiology - reproductive genetics: gynogenesis, androgensis, polyploidy, control of sex,artificial insemination, eye stalk ablation - Development of Healthy Fish Diets, Disease Prevention in Fish, and .GM fish and shellfish- Disease resistance in marine animals and DNA Vaccine development for aquacultured fish - gene banks, cryopreservation. Isolation and characterization of biosynthetic gene clusters, the cloning and expression of the genes in recombinant systems, mariculture and aquaculture of marine invertebrates such as bryozoans, sponges, and tunicates.Isolation, cultivation and fermentation of microorganisms from their invertebrate hosts.								
3	BIOMEDICAL IMPORTANCE OF MARINE ORGANISMS				Total Hrs	9		
Seafood Allergy: Clinical Symptoms, Immunological Mechanisms and Molecular Biology Marine Pharmacology: Pharmaceutical and Bioactive Natural Products -Microalgae as a Source of Bioactive Molecules- New Antibiotics and Medicines from Marine Organisms- Potentialities in the Treatment of Infectious Diseases, Osteoporosis and Alzheimer's Disease Cyanobacterial Biotechnology -The Secondary Metabolites and Biosynthetic Gene Clusters of Marine Cyanobacteria.- Applications in Biotechnology - Secondary Metabolites From Marine-derived Fungi, Probiotics								
4	BIOMATERIALS AND BIOPROCESSING				Total Hrs	9		
Polymers & biomaterials: agarose, agar, alginates, carrageaas, chitin, chitosan, carotene, heparin, marine flavourants - environmentally friendly antifouling compounds Biopotential uses of halophilic organisms. Role of halophilic bacteria and artemia in salt purification.								
5	ENVIRONMENTAL IMPACTS OF AQUATIC BIOTECHNOLOGY				Total Hrs	9		
Control of oil spills and bioremediation - viral therapy. -Genetically Engineered Marine Organisms : Environmental and Economic Risks and Benefits								
Total hours to be taught						45		
Text book (s) :								
1	D. H. Attaway and 0. R. Zaborsky. (eds). Marine Biotechnology: Volume I, Pharmaceuticals and Bioactive Natural Products. New York: Plenum. 1993.							
Reference(s) :								
1	P. Weber. "Abandoned seas: Reversing the decline" World Watch. Paper 116, November, 1993, p.5							
2	D. A. Powers "New frontiers in marine biotechnology: Opportunities for the 21st century." In: Marine Biotechnology in the Asian Pacific Region (eds). C. G. Lundin and R. A. Zilinskas. The World Bank and SIDA. Stockholm. 1995, p. 17							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230653E	METABOLIC ENGINEERING	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.							
1	INTRODUCTION				Total Hrs	9		
Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amnio acid regulation of rna synthesis, energy charge, regulation, amino acid regulation of rna synthesis, energy charge, regulation, premeability control passive diffusion, active transport group transportation.								
2	SYNTHESIS OF PRIMARY METABOLITES				Total Hrs	9		
Alteration of feed back regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.								
3	BIOSYNTHESIS OF SECONDARY METABOLITES				Total Hrs	9		
Precursor effects, prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites								
4	BIOCONVERSIONS				Total Hrs	9		
Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble substances								
5	REGULATION OF ENZYME PRODUCTION				Total Hrs	9		
Strain selection, improving fermentation, recognising growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.								
Total hours to be taught						45		
Text book (s) :								
1	Wang D.I.C., Cooney C.L., Demain A.L., Dunnil.P, Humphery A.E., Lilly M.D., “Fermentation And Enzyme Technology”, John Wiley And Sons., 1980.							
2	Stanbury P.F., And Whitaker A., “Principles Of Fermention Technology”, Pergamon Press, 1984.							
Reference(s) **:**								
1	Zubay G., "Biochemistry ", Macmillan Publishers, 1989.							

K.S.Rangasamy College of Technology, Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230654E	CHROMATOGRAPHIC SEPARATIONS	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about the different methods of chromatography. The student will know about the applications of chromatography in different fields in Biotechnology.							

1	INTRODUCTION	Total Hrs	12
Classification of techniques, distribution coefficients, retention chromatography, sorption mechanisms, retention parameters, factors affecting retention, qualitative and quantitative aspects of chromatography, peak shape sorption isotherms, column efficiency, band broadening processes, selectivity and resolution.			
2	CLASSICAL CHROMATOGRAPHY	Total Hrs	07
Stationary and mobile phases, applications of ion exchange size exclusion, Thin layer chromatography (TLC), High performance thin layer chromatography (HPLC) and HPTLC			
3	HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	Total Hrs	10
Introduction – design – design of a typical HPLC machine – type of columns – manufacturing applications.			
4	GAS CHROMATOGRAPHY	Total Hrs	10
Introduction – instrumentation – columns – qualitative and quantitative aspects of gas chromatography – quantitative analysis of GC.			
5	TYPES OF CHROMATOGRAPHY	Total Hrs	12
Principles – types of chromatography – scopes and limitations – applications – capillary electrophoresis.			
Total Hours to be taught			45

Text books :

1. Swell, P.A. and Clarke, B., “Chromatographic separations”, John Wiley & Sons, Singapore, 1991.
2. Lindsay, B., “High Performance Liquid Chromatography”, John Wiley & Sons, Singapore, 1991.

References :

1. Wilhard, F. and Meritt, F., Instrumental methods of chemical analysis. Fifth Edition, D. Vannostrand, New York, USA. 1994.
2. Wilson, K. and Walker, J. Practical Biochemistry, Cambridge University Press, USA. 2003.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech. Biotechnology			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230761E	IMMUNOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	To develop the skills of the students in the area of immunotechnology pre- requesting for PG studies in biotechnology and related fields. At the end of the course the student would have learnt various techniques like developing diagnostic tests, characterization of lymphocytes, purification of antigens, antibody engineering etc.							
1	INTRODUCTION				Total Hrs	09		
Immunogens and antigens- Classification of the immune response: Innate: Role of inflammatory cells, acquired immunity and its components. Adjuvants and their mode of action.								
2	IMMUNODIAGNOSIS				Total Hrs	09		
Western blot analysis, immuno electrophorosis, SDS- PAGE, purification and synthesis of antigens. ELISA- principle and applications. Principles and applications of Radio Immuno Assay (RIA), Immunochromatography.								
3	IMMUNOPATHOLOGY				Total Hrs	09		
Preparation and storage of tissues, identification of various cell types and antigens in tissues. Isolation and characterization of cell types from inflammatory site and infected tissues. Immunocytochemistry- immuno fluorescence, immuno enzymatic and immuno ferrtin techniques and immunoelectron microscopy.								
4	MOLECULAR IMMUNOLOGY				Total Hrs	09		
Vaccine Types,Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immuno therapy with genetically engineered antibodies.								
5	TECHNIQUES IN IMMUNOTECHNOLOGY				Total Hrs	09		
Trends in immunology of infectious diseases and tumours. Antigen- antibody interactions, Isolation of pure antibody, assays of circulating immune complexes. Isolation of lymphocyte populations.								
Total hours to be taught						45		
Text book (s) :								
1	Roitt, I. Brostoff, J. and David, M. Immunology, 6th Edn. Mosby publishers Ltd., USA. 2001.							
2	Talwar G. P. and Gupta S. K. A hand book of practical and clinical immunology, Vol. I &II. CSB Publications, New Delhi, 1992.							
Reference(s) :								
1	Kuby,J .H. Immunology, 5th Edn. W. H. Freeman Publication USA. 2002.							
2	Tizard, R.I. Immunology, 4 th Edn. Saunders college Publishing, USA. 2004.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230762E	DAIRY AND BAKERY TECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about Science of Technology of food processing particularly in Bakery and Dairy technology which could develop entrepreneurial strength among them.							

1	INTRODUCTION TO BAKERY AND DAIRY TECHNOLOGY	Total Hrs	09
Current status, growth rate, and economic importance of Bakery and Dairy Industry in India. Product types, Equipments used, product quality characteristics, faults and corrective measures for Bakery and Dairy Technology- Defining and assessing quality of ingredients & products...			
2	TECHNOLOGY OF BREAD MAKING	Total Hrs	09
Plant layout of a bakery. Ingredients & processes for bread making -Characteristics of yeast; Wheat flour - treatments – Grade and ageing of flour – Tests for flour quality; Method and Steps involved in Processing – Characteristics of good bread; Defects, causes and remedies.			
3	BAKERY PRODUCTS	Total Hrs	09
Cakes-Different types of cake making processes; Sugar batter method; Flour batter method; Modified sugar batter method; Whipping and Blending method. Importance of baking time and temperature; Biscuits -Fermented dough biscuits, Cookies, Cream biscuits, Pastry-Short crust ; Puff Flaky, Defects, causes and remedies in Cakes .Biscuits and Pastry products			
4	MILK PROCESSING TECHNOLOGY	Total Hrs	09
Physicochemical characteristics of milk and factors affecting them. Production, collection, Standardization, processing, cooling, storage, transportation, of liquid milks. quality assessing of milk in dairy industry-detection of adulteration, determination of price of the milk			
5	TYPES OF MILK PRODUCTS	Total Hrs	09
Methods of preparation/production, quality grading parameters, packaging, storage characteristics, uses and shelf-life of cream, butter; evaporated ,condensed and skimmed, instants milk powders, Ice-Creams, cheeses, and other milk products			
Total Hours Taught			45

Text book (s) :	
1	Cereals in Bread making: A molecular colloidal Approach by Ann-Charlotte Eliasson and Kare Larsson, CBS Publishers and Distributed, New Delhi.
2	Milk and Dairy product Technology by Edgar Spreer; CBS Publishers and Distributed, New Delhi, 2005.
Reference(s) **:**	
1	Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.

K.S.Rangasamy College of Technology - Autonomous Regulation								R2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230763E	NANOSCIENCE AND TECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the students would have gained extensive knowledge in Nanobiotechnology, involvement macromolecules in Nanobiotechnology, application in drug delivery, cancer treatment.							
1	INTRODUCTION TO NANOBIOTECHNOLOGY				Total Hrs			9
Introduction to nanobiotechnology-micro and nanosystems and technologies; overview of nanodevices and techniques. Synthesis and characterization of nanoscale materials- strategies for nanoarchitecture (topdown and bottom up approaches) - fabrication technologies and characterization – self assembly systems.								
2	SYNTHESIS OF NANOPARTICLES				Total Hrs			9
Inorganic nanoscale systems for biosystems-nanostructure materials –fullerness: properties and characterization – carbon nano tubes: characterization and application-quantum dots and wires. Synthesis of gold, silver and silica nanoparticles – nanopores.								
3	NANOMOLECULES IN BIOSYSTEMS				Total Hrs			9
Nanomolecules in biosystems-proteins, lipids,RNA and DNA-nanoscale elements for delivery of materials into cells- peptide coupled nanoparticles – DNA based artificial nanostructures – proteins as components in nanodevices, lipids in self assembly structures.								
4	USE OF MICROORGANISMS IN NANOBIOTECHNOLOGY				Total Hrs			9
Nanobiotechnology and Microorganisms –PHA in nanobiotechnology –cyaophycin inclusions- magnetosomes-alignates- bacteriophages-bacterial spores-bacterial protein complexes-s-layer proteins-bacteriorhodopsin.								
5	APPLICATION OF NANOBIOTECHNOLOGY				Total Hrs.			9
Nanobiotechnology in drug delivery-nanoscale devices for drug delivery-micelles for drug delivery –protein targeting: small molecules-protein interactions-microarray and genome chips- nanobiosensors and nanobiochips. Nanotechnology for cancer diagnosis and treatment. Nanobiotechnology for cell destruction.								
Total Hours Taught								45
Text book (s) :								
1	K.K.Jain, Taylor - Nanobiotechnology in molecular diagnostics –current techniques and applications, 2006.							
2	BernardH.A Relim - Microbial Bionanotechnology							
Reference**(**s) :								
1	O.V.Salata.Journal of Nanobiotechnology, 2:3. Applications of nanoparticles in biology and medicine, 2004.							
2	CM.Niemeyer and CA Mirkin. Nanobiotechnology – concepts , applications and perspectives.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme code & Name			23:B. Tech. Biotechnology			
Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230764E	BIOPROCESS MODELING AND SIMULATION	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the students would have learnt about fermentation process, Cell Disruption Methods and Purification processes with reference to bioprocess modeling.							

1	OVERVIEW OF FERMENTATION PROCESSES	Total Hrs	9
Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.			
2	METABOLIC STOICHIOMETRY AND ENERGETICS	Total Hrs	9
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth			
3	REACTION KINETICS IN BIOPROCESS	Total Hrs	9
Reaction kinetics for biological systems- M.M kinetics, enzyme deactivation kinetics; heterogenous reactions in bioprocessing- concentration gradients and reaction rates in solid catalysts, internal mass transfer in heterogenous reactions; Thiele modules - solid – liquid mass transfer correlations, minimizing mass transfer effects.			
4	MODELING AND SIMULATION OF BIOPROCESSES	Total Hrs	9
Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.			
5	SIMULATION METHODS	Total Hrs	9
Simulation: Introduction, Iterative convergence methods like interval halving, Newton-Raphson and explicit convergence methods. Numerical integration of ordinary differential equation and explicit numerical integration algorithm.			
Total hours to be taught			45

Text book (s) :

1	Shuler,M.L. and Kargi,F. " *Bioprocess Engineering - Basic concepts* – Second Edition Prentice Hall of India Pvt. Ltd., 2005
2	Peter F. Stanbury, Stephen J. Hall & A. Whitaker, *Principles of Fermentation Technology,* Second Edition, Butterworth – Heinemann An Imprint of Elsevier India Pvt. Ltd., 2005.

Reference(s) :

1	"Bioprocess technology: modeling and transport phenomena", by H.E.A.van den Akker, Biotol series, 6th edition.
2	"Process modeling, simulation and control for chemical engineering", by William L.Luyben, McGraw Hill 2nd ed.,
3	Bailey and Ollis, "Biochemical Engineering Fundamentals*",* McGraw Hill (2nd Ed.), 1986.
4	Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications*.*

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230771E	TISSUE ENGINEERING	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students will have enough knowledge of tissue engineering.							
1	INTRODUCTION TO TISSUE ENGINEERING				Total Hrs		9	
Basic definition; current scope of development; use in therapeutics and in vitro testing								
2	STRUCTURE AND ORGANIZATION OF TISSUES:				Total Hrs		9	
Epithelial, connective; vascularity, lymph. Basic developmental biology								
3	TRANSPORT PROPERTIES OF TISSUES				Total Hrs		9	
Introduction to mass transfer, Diffusion of simple metabolites, Diffusion & reaction of proteins								
4	GENERAL ASPECTS OF CELLS IN CULTURE				Total Hrs		9	
Transport limits on 3D cultures, Cell-Matrix & Cell-Cell Interactions, cell migration and control of cell migration, Differential cell adhesion & tissue organization, Hormone & Growth Factor Signaling, Growth factor delivery in tissue engineering, Scaffolds *&* tissue engineering - Basic properties, Basic transplantation immunology, Quantitative analysis of receptor-ligand binding, Applications of growth factors: VEGF/angiogenesis								
5	STEM CELLS				Total Hrs		9	
Introduction, Hematopoiesis, Stem cells & bone , ES cells, Cell surface markers, FACS analysis, Basic wound healing, Introduction to liver pathophysiology, Cell transplantation for liver tissue engineering. In vitro organogenesis, Physiological models.								
Total hours to be taught							45	
Text book (s) :								
1	Samuel E. Lynch, Be Roberts J. Geng, “Tissue Engineering”.							
2	Bernard Prish, “Tissue-Engineering’.							
Reference(s) :								
1	Lanza And Langer, “Principle Of Tissue Engineering”.							
2	Atala And Lanza (Elsevier), “Methods Of Tissue Engineering”.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230772E	MOLECULAR PHYLOGENY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students will have enough knowledge of molecular pathogeny, pathogenic interactions and modern methods to control pathogens.							
1	OVERVIEW				Total Hrs	9		
Historical perspective – discovery of microscope, Louis Pasteur' contributions, Robert Koch's postulates, early discoveries of microbial toxins, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, various pathogens types and modes of entry.								
2	HOST – DEFENSE AGAINST PATHOGENESIS AND PATHOGENIC STRUCTURES.				Total Hrs	9		
Attributes and components of microbial pathogenesis, host defense, skin mucosa, cilia, secretions, physical movements, limitations of free iron, antimicrobial compounds, mechanisms of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, pathogenic adaptation to overcome the above defenses.								
3	MOLECULAR PATHOGENESIS(WITH SPECIFIC EXAMPLES				Total Hrs	9		
Virulence, virulence factors, virulence – associated factors and virulence life style factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio cholerae, cholera toxin, coregulated pili, filamentous phage, survival E.Coli, Pathogens: Enterotoxigenic E.Coli (ETEC) labile and stable toxins, Entero – pathogenic E.Coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment: Enterohaemerrohogic E.Coli (EHEC), mechanism of bloody Diarrhoea and hemolytic uremic syndrome, Enteroagrigative E.Coli (EAEC). Shigella, entri, macrophage, apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory responses, tissue damage plasmodium: Life cycle, erythrocyte stages, transport mechanisms and processes to support the rapidly growing Schizont, parasititarous vacuoles and knobe protein transport, antimalarials based on transport processes. Influenza viruse: intracellular stages, neuraminidase & haemagglutinin in entry,M1 & M2 proteins in assembly and disassembly, action of amantidine.								
4	EXPERIMENTAL STUDIES ON HOST – PATHOGENIC INTERACTIONS				Total Hrs	9		
Virulance assays: adherence invasion, cytopathic, cytotoxic effects. Criteria & testsin identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses.								
5	MODERN APPROACHES TO CONTROL PATHOGENS				Total Hrs	9		
Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of variety of pathogens, vaccines – DNA, subunit and cocktail vaccines.								
Total hours to be taught						45		
Text book (s) :								
1	Iglewski, B.H. and Clark V.L. "Molecular basis of bacterial pathogenesis", Academic press, 1990.							
2	Peter, W. Julian, K. & George, S. "Methods in microbiology: Bacterial pathogenesis, Academic press, 1998.							
Reference(s) :								
1	Recent reviews in infection.Immunology.,Mol.Microbiol,Biochem.J.,EMBO							
2	Nester,Anderson,Roberts,Pearsiall,Nester, "Microbiology: A Human perspective", McGraw-Hill, 2001							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective IV								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230773E	CANCER BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have learnt about pathogenesis of cancer, identifications of cancer through tools developed by biotechnology research & molecules synthesized for cancer therapy. This will be very beneficial for the student to take up projects in Cancer Biology.							
1	FUNDAMENTALS OF CANCER BIOLOGY				Total Hrs	09		
Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.								
2	PRINCIPLES OF CARCINOGENESIS				Total Hrs	09		
Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.								
3	PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER				Total Hrs	09		
Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.								
4	PRINCIPLES OF CANCER METASTASIS				Total Hrs	09		
Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.								
5	NEW MOLECULES FOR CANCER THERAPY				Total Hrs	09		
Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.								
Total hours to be taught						45		
Text book (s) :								
1	Maly B.W.J, “Virology A Practical Approach”, IRLl Press, Oxford, 1987							
2	Dunmock N.J And Primrose S.B., “Introduction to Modern Virology”, Blackwell Scientific Publications, Oxford, 1988.							
Reference(s) :								
1	“An Introduction Top Cellular And Molecular Biology of Cancer”, j Oxford Medical Publications, 1991.							

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23:B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Elective IV</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230774E</td><td colspan="2">SYSTEMS BIOLOGY</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">To provide basic and advanced information about phylogenetics and its analysis. To educate the students about the methods and comparative analysis</td></tr>
<tr><td>1</td><td colspan="4">PHYLOGENETIC ANALYSIS AND PARSIMONY ANALYSIS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Phylogenetics analysis - Introduction, Methods- the matrix, homology, character coding, choosing outgroups, weighting, the tree, multiple trees, tree statistics; models of causation-Parsimony analysis -Introduction, the legacy of Willi Hennig, methods, searching, parsimony analysis using Nona</td></tr>
<tr><td>2</td><td colspan="4">OPTIMIZATION ALIGNMENT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Introduction, going down to get the tree length, going up to get ancestral states, short cuts and errors, improvements; Techniques for analyzing large data sets - Traditional techniques, Composite Optima, Ratchet, Sectorial searches, tree-fusing, tree-drifting, combined methods, minimum length, TNT</td></tr>
<tr><td>3</td><td colspan="4">PARTITIONING OF MULTIPLE DATASETS IN PHYLOGENETIC ANALYSIS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Measures of support -The bootstrap, Jackknife, Noise, Direct measures of support-Partitioning of multiple datasets in phylogenetic analysis - Statistical tests of data incongruence, Measures of character interaction incombined analysis, congruence, incongruence and phylogenetic inference</td></tr>
<tr><td>4</td><td colspan="4">COMPARATIVE PHYLOGENOMICS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Complex model organism genome databases - Database foundations, genome databases, homology and genome databases; Comparative phylogenomics - Genomics and systematics, genomics techniques – cloning and library construction, megabase DNA isolation, physical mapping, shortgun sequencing; Subgenomics – comparative maps and syntheny, Primer batteries and multiplexing.</td></tr>
<tr><td>5</td><td colspan="4">COMPARATIVE METHODS AND ANALYSIS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Correlated evolution and independent contrasts, importance of topology, examining the tempo and mode of evolutionary change. Analyzing data at the population level -Sequence and Allele frequency data</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1.</td><td colspan="7">Rob Desalle, Gonzalo Giribet, Ward Wheeler, Springer, “Techniques in molecular systematics and evolution”.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Gusfield, Dan. “Algorithms on strings Trees and Sequences”, 1st ed., Cambridge University Press, 2005.</td></tr>
<tr><td>2.</td><td colspan="7">Baldi, P., Brunak,S., “Bioinformatics: The Learning Approach”, 2nd ed., MIT Press 2001.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230881E	DEVELOPMENTAL BIOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the will have enough knowledge about theoretical embryology and practical embryology.							
1	PRINCIPLES OF DEVELOPMENTAL BIOLOGY				Total Hrs	9		
Life cycles and evolution of developmental patterns, principles of experimental embryology, Genes and development: techniques and ethical issues, differential gene expression, cell-cell communication in development.								
2	EARLY EMBRYONIC DEVELOPMENT				Total Hrs	9		
Fertilization; early development in invertebrates and vertebrates; case study: Drosophila, frog.								
3	LATER EMBRYONIC DEVELOPMENT				Total Hrs	9		
Ectoderm, Mesoderm, Endoderm, development of tetrapod limb, sex determination, metamorphosis, regeneration, ageing								
4	RAMIFICATIONS OF DEVELOPMENTAL BIOLOGY				Total Hrs	9		
Overview of plant development, environmental regulation of animal development: teratology, abnormalities; developmental mechanisms of evolutionary change: 'Hox' genes, homologous pathways of development, developmental correlation, developmental constraints.								
5	PRACTICAL EMBRYOLOGY				Total Hrs	9		
Immunological aspects of development, Mechanisms of genomic imprinting, Experimental embryology: Growth of cells in artificial conditions, fate maps and cell lineage analysis from embryos, microinjection into drosophila embryos, cell transplantation in Xenopus; nuclear transplantation.								
Total hours to be taught						45		
Text book (s) :								
1.	Vasudeva Rao K. "Developmental Biology: A modern synthesis", Oxford and IBH Publishing Co.Pvt.Ltd., 1998.							
2.	Parasher YK." Developmental Biology", Campus Book Intl., 2000.							
Reference(s) :								
1.	Wolpert L., Beddington R, Brockes J., Jessel T., Lawrence P., Meyerowitz E "Principles of Development", Oxford University Press, 1998.							
2.	Gilbert SF "DevelopmentalBiology", Sinauer Associates, Inc, Sunderland, Massachusetts, 2000.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230882E	FOOD BIOCHEMISTRY AND NUTRITION	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students would have learnt about Nutritional Biochemistry, it gives an overview of the nutritional aspects of metabolism along with disease states. Essentials like micronutrients and energy regulation is covered.							
1	FOOD NUTRITION AND HEALTH.				Total Hrs	09		
Concept of food nutrition - Nutritional classification; Basic food groups; dietary allowances -Standards for different age group. Fuel value of carbohydrates, Fats and Protein-Basal energy metabolism. Nutritional significances of Macro Nutrition from different food sources								
2	FOOD CHEMISTRY				Total Hrs	09		
Food chemistry-definition and importance, water in food, water activity and shelf life of food. Functional properties of sugars, polysaccharides, protein and fat in foods. Food colours and flavors, browning reaction. Enzymes in foods, food contaminants, additives and toxicants.								
3	METABOLISM OF MACRONUTRIENTS				Total Hrs	09		
Carbohydrate - digestion, transport, glucose metabolism, glycogen storage & release (EMP pathway Krebs Cycle), Fermentation of carbohydrates & Gluconeogenesis, fructose/galactose, glycolysis, gluconeogenesis. Lipids - digestion, transport, metabolism, ketosis, cholesterol metabolism, Protein - digestion, transport, metabolism, gluconeogenesis, nitrogen removal								
4	OVERVIEW OF MICRONUTRIENTS				Total Hrs	09		
Micronutrients - overview, enzymatic cofactors, (B1-6, biotin, vit K), contribute to one carbon usage (folate, B12), antioxidants (Vit E, C, Se, carotenoids), metals or pro-oxidants (Fe), metals or pro-oxidants (Cu, Zn), hormones (iodine, Vit A & D), bone formation (Vit D, Ca, P, Mg), influence vascular homeostasis (Na, K, Cl) and those of unique interest (Al, Cr, Pb)								
5	NUTRITION & DISEASE				Total Hrs	09		
The influence of nutrition on diseases- Cardiovascular disease; cancer; Inborn errors of metabolism; Energy regulation - starvation, diabetes type I and II; obesity, Vitamin and minerals deficiency diseases associated								
Total hours to be taught						45		
Text book (s) :								
1.	M. Swaminathan, Essentials of Food and Nutrition Vol. I & II, Ganesh and Company, Madras.							
2.	Food: Facts and Principles-N. Shakuntala Manay, N.Shadksharawamis.							
Reference(s) :								
1.	Meyer, L.H. Food Chemistry. East-West Press Pvt. Ltd., New Delhi. Potter, N., 1973.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23 : B.Tech. Biotechnology			
Elective V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230883E	BIOINSTRUMENTATION	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students should have learnt about the working principles of optical methods, spectroscopy and other bioinstrumentation techniques.							
1	EM - WAVES				Total Hrs		9	
Electromagnetic radiation and equation for wave, Quantization of energy and its calculations, definition and importance of spectroscopy, Region of different spectra, adsorption and emission spectra, Instruments, signal to noise radio, spectral width; signal intensity, Fourier Transformation. UV – VIS: theory of electronic spectra (atomic and band spectra, L – B law, application and expectation), Instrumentation, chromophore, auxochrome, Woodward's Rule, Solvent effect (Bathochromic shift etc), Application to small Biomolecules.								
2	FREQUENCY AND VIBRATION				Total Hrs		9	
Vibration (different models, di and poly atomic): frequency, wave number, Hook's law, Instrumentation, vibration-rotation spectrum of CO_2, factors influencing vibrational frequency (vibronic coupling, H- bond, electronic factors, bond angles etc).Introduction to Raman: pure rotationl and vibrational Raman spectrum, mutual exclusion principles, Application to simple and Biomolecles.								
3	LIGHT WAVES				Total Hrs		9	
Plane polarized light, circular and elliptical polarized light, Definition of circular dichroism(CD) and Optical rotatory dispersion(ORD) and comparative discussion, Fluorescence, principle, SO->S1->T1(difference with phosphoresence) Jablonski diagram, characteristic of fluorescence(stokes's shift, life time, mirror image rule etc) and molecules show fluorescence, Quenching and stern volmer plot, Fluorescence energy transfer(FRET),Application to simple and biomolecules.								
4	CHEMICAL SHIFTS				Total Hrs		9	
Principle, chemical shift(different unit) and factors influencing chemical shift, correlation data, solvent effect, Spin-spin coupling and splitting and factors involve, relaxation(1D spectra), Application to small and biomolecules.								
5	VECTORS AND SYMMETRY				Total Hrs.		9	
Vectors and symmetry (application, point group, lattice, elementary ideas of space group), Diffraction and fourier transformation, Application (steps in solving crystal structures, coordinates etc, PDB database).								
Total Hours Taught							45	
Text book (s) :								
1.	Willard and Merrit, H.,Phi, "Instrumental methods of analysis",1999							
Reference**(**s) :								
1.	Skoog, D." Instrumental methods of analysis", 2000							

<table>
<tr><td colspan="8">K.S.Rangasamy College of Technology, Autonomous Regulation</td><td>R 2008</td></tr>
<tr><td colspan="2">Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Elective V</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230884E</td><td colspan="2">CLINICAL TRIAL MANAGEMENT</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">At the end of the course the students will have a complete knowledge of Ethical guidelines, clinical trials and clinical researches.</td></tr>
<tr><td>1</td><td colspan="5">ETHICAL GUIDELINES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Ethical Guidelines for Biomedical Research on Human guidelines – student of specific principles for chemical evaluation – Human Genome project DNA banking – prenatal diagnosis – principles in transplantation.</td></tr>
<tr><td>2</td><td colspan="5">STATISTICS AND PROBABILITY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Biostatics – probability – sampling – estimation – hypothesis – Data analysis and nova – simple linear regression – multiple regression.</td></tr>
<tr><td>3</td><td colspan="5">CONTACT RESEARCHES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Contact research – delivery model – CR Business environment – CR Information research – Contact research – Regulatory affairs and contact research – schedule Y_1 – contact research and clinical trial environment.</td></tr>
<tr><td>4</td><td colspan="5">CILNICAL TRIALS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Clinical trial – protocol approval – Informed consent – responsibility of sponsor – investigator – ethics committee – types of clinical trials – structure & contents of clinical report. Data blinding & randominization – data management – trial subjects – recruiting.</td></tr>
<tr><td>5</td><td colspan="5">TECHNICAL PRESENTATION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">Technical presentation – clinical research, regulation affairs – clinical trials laboratories in India – present status – setting up clinical trial company – clinical research education and training in India – India as a site fr conducting clinical – outsourcing trends.</td></tr>
<tr><td colspan="7">Total Hours Taught</td><td colspan="2">45</td></tr>
<tr><td colspan="9">Text book (s) :</td></tr>
<tr><td>1.</td><td colspan="8">ICMR, Ethical guidelines for biological research on human subjects, Indian council of Medical Research Press, New Delhi, 2000.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="8">The drug and cosmetic rule. Schedule Y. Requirements and guidelines for permission to import and/ or manufacture of new drugs for sale or to undertake clinical trials. Government of India, New Delhi, 1945.</td></tr>
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<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2008</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23:B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Elective VI</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>08230891E</td><td colspan="2">MOLECULAR MEDICINES</td><td>3</td><td>0</td><td>0</td><td>3</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">The understanding of health and disease of humans at the cellular and molecular level and to develop tools of molecular biology and gene technology tools for the development of novel diagnostics and therapeutics through technology</td></tr>
<tr><td>1</td><td colspan="4">BASIC CONCEPTS IN MOLECULAR MEDICINE</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">An overview of the orgnaisation of the human genome,chromosome and genes; r-DNA and Genetic Engineering techniques used in molecular medicine;transcriptional control of gene expression; transmission of human genetic disease; the human genome project;oncogenes and tumor suppressor genes; molecular diagnostic testing; genetic counseling; transgenic mice as models of human diseases.</td></tr>
<tr><td>2</td><td colspan="4">DEVELOPMENT OF MOLECULAR MEDICINE</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Molecular Mechanisms of Human Disease. Infectious Agents- Biological Aspects and Clinical Implications. Molecular Haematology and Oncology. Selection and Evolution: Implications for Molecular Medicine. Molecular Basis of Development of Medicine- Diagnostic and Therapeutic Potential. Human embryonic stem cells: biology and clinical implications.</td></tr>
<tr><td>3</td><td colspan="4">MOLECULAR SIGNALING MECHANISM IN HUMAN DISEASES.</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Molecular signaling mechanism in human diseases. p27kip1-connecting oncogenes to cell cycle control” “Roles of micro RNAs in animal development and human cancer” “Epigenic programming of the genome in embryos and germ cells” Ubiquitin mediated proteolysis in senescence and immune signalling” “Nucleocytoplasmic shuttling and transcriptional regulation: an analysis of the STAT signalling system” “Nuclear Organisation of transcription” “Ubiquitination and disposal of cell surface receptors- Lessons from viruses”.</td></tr>
<tr><td>4</td><td colspan="4">MOLECULAR DIAGNOSTIC AND THERAPEUTIC APPROACHES FOR HUMAN DISEASES</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Role of DNA micro array and protein chips; biotherapy; probiotic; phage therapy; virotherapy with (replication-elective or conditionally replicating) lytic viruses; si RNA therapeutics;concept of personalised medicine and pharmacogenomics, photodynamic therapy.</td></tr>
<tr><td>5</td><td colspan="4">EMERGING TRENDS : INDUSTRIAL APPLICATIONS OF MOLECULAR MEDICINE</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="8">Emerging trends in molecular medicine- expert reviews on molecular medicine related to vaccine design and systemic diseases-developments as updated from time to time.</td></tr>
<tr><td colspan="7">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="8">Text book (s) :</td></tr>
<tr><td>1.</td><td colspan="7">John Bradle, David Johnson and David Rubenstein. Lecture notes in molecular biology, Blackwell Publishing, 2001.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Jameson Larry J. Principles of Molecular Medicine, Humana Press 1998. John-Wiley & Sons, Inc. (eds.), 2002.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech..Biotechnology			
Elective VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230892E	BIODIVERSITY AND BIORESOURCE MANAGEMENT	3	0	0	3	50	50	100
Objective(s)	At the end of the course students understand about the natural resources and its importance. It also useful to go far the conservation of natural resources and biodiversity.							

1	INTRODUCTION TO BIODIVERSITY	Total Hrs	9
Biodiversity - Definition-Types, Diversity of genes (genetic diversity), species (species diversity and ecosystems (ecosystem diversity); Goals and constraints of Biodiversity Science. Genetic Diversity - Nature and origin of Genetic Variation, Measuring Genetic Variation by Allozyme, Species Diversity – Measurement, Concepts of species richness, abundance, and turnover, species/area relationships, global distribution of species richness; Hot Spot analysis; A general account on Ecosystem diversity.			
2	LOSS OF BIODIVERSITY AND HUMAN INFLUENCE ON BIODIVERSITY	Total Hrs	9
-Species Extinction- Fundamentals causes, Deterministic and Stochastic processes, Current and Future Extinction rates; methods of estimating loss of biodiversity- Threatened species, The IUCN threat Categories (Extinct, Endangered, Vulnerable, Rare, Intermediate and Insufficiently known);			
3	BIODIVERSITY AND HUMAN WELFARE	Total Hrs	9
A very general account on uses of Bioresources- plant uses: food, timber, medicinal ornamental and other uses- animal uses: food animals (terrestrial and aquatic), non food uses of animals, Domestic livestock- uses of microbes. Valuing Biodiversity-Instrumental (Goods, Services, and Information and Psychospiritual values) and Inherent or Intrinsic values, ethical and aesthetic values-An outline account on methods of valuing biodiversity.			
4	INFORMATION RESOURCES OF BIODIVERSITY	Total Hrs	9
Libraries, Electronic Media, Directories of biodiversity information, Catalogues, Indexes, Indexes and registers for described species, Identification aids .Literature search using electronic research tools - search engines, ebooks, ejournals, edatabases, subject gateways/subject directories, news feeds.			
5	SUSTAINABLE MANAGEMENT AND CONSERVATION OF BIODIVERSITY AND BIORESOURCES	Total Hrs	9
Sustainable management - National polices and Instruments relating the protection of the wild/ domesticated flora and fauna as well as habitats; International policies and Instruments - A general account on multilateral treaties- the role of CBD, IUCN, GEF, IBPGR, NBPGR, WWF, FAO, UNESCO and CITES. Conservation *In situ Ex situ* Conservation			
Total hours to be taught			45

Text book (s) :

1. Groombridge, B, "Global Biodiversity – Status of the Earth's Living Resources", Groombridge, B (ed.). Chapman and Hall, London. 1992.
2. Virchow, D, "Conservation and Genetic Resources", Springer – Verlag, Berlin. 1998

Reference(s) :

1. Gary, K.M. and Ronald C. C, "Principles of Conservation Biology", Sinauer Associates, Inc., Massachusetts. 1994.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech..Biotechnology			
Elective VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230893E	BIOBUSINESS	3	0	0	3	50	50	100
Objective(s)	This inter-disciplinary course is designed to enable students to develop an effective conceptual framework for addressing BioBusiness related opportunities and challenges. We will examine priority needs, business trends, and the implications of life science and biotechnology innovation for such industry sectors as healthcare, pharmaceuticals, medical devices, agribusiness, environmental technology and other bio-related emerging sectors.							
1	UNDERSTANDING BIOBUSINESS				Total Hrs	9		
Introduction to BioBusiness, Fundamentals of Biotech for BioBusiness, New versus Old BioBusiness, Wealth Creation in BioBusiness: The Role of Innovation.								
2	BIOBUSINESS TRENDS AND OPPORTUNITY AREAS				Total Hrs	9		
Healthcare, the BioMedical Sciences, Agriculture and Agribiotechnology, The Environment and Environmental Biotechnology, Industrial Life Sciences and Biotechnology, Where Things Stand: A Quick Survey of Regional and Global Strengths and Capabilities.								
3	ISSUES AND CHALLENGES IN BIOBUSINESS				Total Hrs	9		
Creating World Class Corporations and Biotech Clusters, Moral, Ethical and Social Concerns and Opportunities, Intellectual Property, Technology Licensing and Branding Concerns and Opportunities, Policy and Regulatory Concerns and Opportunities, Human Resource Concerns and Opportunities, Financing Concerns and Opportunities.								
4	MAKING THINGS HAPPEN				Total Hrs	9		
Public Policy Opportunities, Entrepreneurial Opportunities, Investment and Investment Management Opportunities Open Discussion and Course Review.								
5	GROUP PROJECT PRESENTATION				Total Hrs	9		
Case studies of different industries and their strategic planning.								
Total hours to be taught						45		
Text book (s) :								
1.	Gurinder Shahi. BioBusiness in Asia: How Asian Countries Can Capitalize on the Life Science Revolution. Pearson Prentice Hall, 2004.							
Reference(s) :								
1.	Cynthia Robbins-Roth From Alchemy to IPO: The Business of Biotechnology, HarperCollins, 2001.							
2.	Gurinder S Shahi BioBusiness: A Strategic Perspective Global BioBusiness Books, 2005.							
3.	Newspapers and magazines as The Economist, Newsweek, Business Week, Financial Times, the New York Times, The Wall Street Journal and so on.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2008
Department	Biotechnology	Programme Code & Name			23:B.Tech..Biotechnology			
Elective VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
08230894E	PRINCIPLES OF BIOMEDICAL ENGINEERING	3	0	0	3	50	50	100
Objective(s)	At the end of the course the students should have learnt about the working principles of various instruments applied in medical physics and engineering.							
1	INTRODUCTION AND BIOINSTRUMENTATION				Total Hrs	9		
Modern health care and its evolution. Application of Engineering in Medicine. Introduction to mortality and ethics, moral norms, redefining health, terminally ill and euthanasia, human experimentation-definition, purpose, informed consent, regulation of medicine, device innovation, ethical issues, safe medical devices. Electrical Potentials in the human body. Neuromuscular system: neurons, synapses and muscles, electrical properties of nerves and muscles, problems and diagnostics. Basic bioinstrumentation systems								
2	BIOMATERIALS & BIOMECHANICS				Total Hrs	9		
Materials used to mimic/replace body functions. Basic material types and possible functions, tissue response mechanisms, invitro and invivo testing, and considerations for long term usage. Integrated design issues of multicomponent materials design in prosthetic devices for hard and soft tissues. Introduction to biomechanics. Response of living tissues to prolonged load application. Dynamics of muscle and joints. Biorheology of physiological fluids.								
3	BIOPHOTONICS				Total Hrs	9		
Principles of optics and lasers in biomedicine, the interaction of light with biological tissues, optical fibers, basic circuits in fiber optic communication system, fiber optics in gastroenterology, transmission of signals, endoscope, bronchoscope, gastro scope; optical coherence tomography. Lasers in dentistry. Laser Doppler flowmetry, Optical properties of biological tissues and measurement techniques; photochemical, thermal, photoablative interaction mechanisms and their applications in photodynamic therapy; biostimulation, coagulation, vaporization, ablation, photodisruption, plasma formation, and shock wave generation; clinical applications of lasers, Laser safety								
4	MEDICAL IMAGING				Total Hrs	9		
X-rays, design considerations of X-ray tubes, projections, 3D-2D, slice identification, medical image modalities-CAT, magnetic resonance (MR) imaging, positron emission tomography (PET), single photon emission computed tomography (SPECT), computer tomography (CT), and ultrasound-underlying physical processes, signal processing, basic imaging parameters- resolution, contrast, and noise Data acquisitions, sampling and quantization, and clinical applications.								
5	BIOSENSORS				Total Hrs	9		
Biological components involved in biosensors, immobilization of biological components to transducers; principal performance characteristics, fabrication and biomedical applications of electrochemical, optical, piezoelectric and termistor based biosensors.								
Total hours to be taught						45		
Text book (s) :								
1.	Joseph D. Bronzino (ed), “The Biomedical Engineering Handbook”, volumes I & II, CRC Press, Florida, US, 2000.							
2.	Enderle. J, Blanchard. S & Bronzino.J (Eds), “Introduction to Biomedical Engineering”, Academic Press, 2000							
Reference(s) :								
1.	Bushberg J T, Scibert J.A and Leidholdt E M ,Boone J.M, “The Essential physics of medical Imaging”, Lippincott Williams and Wilkins, USA, 2002.							
2.	Buxton. R. B, “Introduction to Functional Magnetic Resonance Imagining: Principles & Techniques”, Cambridge Univ, Press, UK, 2002.							
3.	Fung. Y.C, “Biomechanics”, Springer - Verlag, New York, 1981							