Curriculum & Syllabus

of

B.Tech. Biotechnology

(For the batch admitted in 2007-08)

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 2007
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 2007							
Department	Department of Biotechnology							
Programme Code & Name	23 : B.Tech. Biotechnology							
Semester I								
Course Code	Course Name	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230101G	Technical English	3	0	0	3	50	50	100
07230102G	Engineering Mathematics I	3	1	0	4	50	50	100
07230103G	Applied Physics	3	0	0	3	50	50	100
07230104G	Applied Chemistry	3	0	0	3	50	50	100
07230105G	Fundamentals of Programming	3	0	0	3	50	50	100
07230106S	Basics of Electrical and Electronics Engineering	3	1	0	4	50	50	100
	PRACTICAL							
07230107P	Applied Physics Laboratory	0	0	3	2	50	50	100
07230108P	Applied Chemistry Laboratory	0	0	3	2	50	50	100
07230109P	Programming Laboratory	0	0	3	2	50	50	100
07230110P	Engineering Practices Laboratory	0	0	3	2	50	50	100
Total		18	2	12	28			1000
Semester II								
Course Code	Course Name	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230201G	Communication Skills	3	0	0	3	50	50	100
07230202G	Engineering Mathematics II	3	1	0	4	50	50	100
07230203G	Materials Science	3	0	0	3	50	50	100
07230204G	Environmental Science	3	0	0	3	50	50	100
07230205C	Applied Biology	3	1	0	4	50	50	100
07230206C	Object Oriented Programming	3	0	0	3	50	50	100
	PRACTICAL							
07230207P	Engineering Graphics Laboratory	1	0	3	3	50	50	100
07230208P	Applied Biology Laboratory	0	0	3	2	50	50	100
07230209P	Object Oriented Programming Laboratory	0	0	3	2	50	50	100
07230210P	Comprehension I	0	0	3	0	100	00	100
Total		19	2	12	27			1000

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Semester III								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230301G	Engineering Mathematics III	3	1	0	4	50	50	100
07230302C	Bioorganic Chemistry	3	0	0	3	50	50	100
07230303C	Microbiology	3	0	0	3	50	50	100
07230304C	Principles of Chemical Engineering	3	1	0	4	50	50	100
07230305C	Biochemistry	3	0	0	3	50	50	100
07230306C	Instrumentation Techniques	3	0	0	3	50	50	100
	PRACTICAL							
07230307P	Bioorganic chemistry Laboratory	0	0	3	2	50	50	100
07230308P	Microbiology Laboratory	0	0	3	2	50	50	100
07230309P	Instrumentation Techniques Laboratory	0	0	3	2	50	50	100
07230310P	Comprehension II	0	0	3	0	100	00	100
07230311P	Career competency Development I	0	0	2	0	100	00	100
	Total	19	3	14	26			1100
Semester IV								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230401C	Probability and Statistics	3	1	0	4	50	50	100
07230402C	Genetics	3	0	0	3	50	50	100
07230403C	Molecular Biology	3	0	0	3	50	50	100
07230404C	Basic Industrial Biotechnology	3	0	0	3	50	50	100
07230405C	Chemical Reaction Engineering	3	1	0	4	50	50	100
07230406C	Chemical Thermodynamics and Biothermodynamics	3	1	0	4	50	50	100
	PRACTICAL							
07230407P	Molecular Biology Laboratory	0	0	3	2	50	50	100
07230408P	Chemical Reaction Engineering Laboratory	0	0	3	2	50	50	100
07230409P	Chemical Engineering Laboratory	0	0	3	2	50	50	100
07230410P	Comprehension III	0	0	3	0	100	00	100
07230411P	Career competency Development II	0	0	2	0	100	00	100
	Total	18	3	14	27			1100

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Semester V								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230501S	Principles of Management	3	0	0	3	50	50	100
07230502C	Genetic Engineering	3	0	0	3	50	50	100
07230503C	Bioinformatics	3	1	0	4	50	50	100
07230504C	Bioprocess Engineering	3	1	0	4	50	50	100
07230505C	Enzyme Engineering and Technology	3	0	0	3	50	50	100
072305**E	Elective I	3	0	0	3	50	50	100
	PRACTICAL							
07230507P	Genetic Engineering Laboratory	0	0	3	2	50	50	100
07230508P	Bioprocess Engineering Laboratory	0	0	3	2	50	50	100
07230509P	Enzyme Engineering Laboratory	0	0	3	2	50	50	100
07230510P	Comprehension IV	0	0	3	0	100	00	100
07230511P	Career competency Development III	0	0	2	0	100	00	100
	Total	18	2	14	26			1100
Semester VI								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230601S	Professional Ethics	3	0	0	3	50	50	100
07230602C	Immunology	3	1	0	4	50	50	100
07230603C	Molecular Modeling and Drug Designing	3	0	0	3	50	50	100
07230604C	Protein Engineering	3	1	0	4	50	50	100
072306**E	Elective II	3	0	0	3	50	50	100
072306**E	Elective III	3	0	0	3	50	50	100
	PRACTICAL							
07230607P	Immunology Laboratory	0	0	3	2	50	50	100
07230608P	Bioinformatics Laboratory	0	0	3	2	50	50	100
07230609P	Industrial Biotechnology Laboratory	0	0	3	2	50	50	100
07230610P	Comprehension V	0	0	3	0	100	00	100
07230611P	Career competency Development IV	0	0	2	0	100	00	100
Total		18	2	14	26			1100

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Semester VII								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
	THEORY							
07230701G	Total Quality Management	3	0	0	3	50	50	100
07230702C	Down Stream Processing	3	1	0	4	50	50	100
07230703C	Plant Biotechnology	3	0	0	3	50	50	100
07230704C	Animal Biotechnology	3	0	0	3	50	50	100
072307**E	Elective IV	3	0	0	3	50	50	100
072307**E	Elective V	3	0	0	3	50	50	100
	PRACTICAL							
07230707P	Down Stream Processing Laboratory	0	0	3	2	50	50	100
07230708P	Plant and Animal Biotechnology Laboratory	0	0	3	2	50	50	100
07230709P	Project Work - Phase I	0	0	4	2	100	00	100
072307010P	Career competency Development V	0	0	2	0	100	00	100
	Total	18	1	12	25			1000
Semester VIII								
Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
	THEORY							
07230801C	Biopharmaceutical Technology	3	0	0	3	50	50	100
072308**E	Elective VI	3	0	0	3	50	50	100
	PRACTICAL							
07230803P	Project Work - Phase II	0	0	30	20	50	50	100
Total		6	0	30	26			300

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Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
Electives I								
07230541E	Environmental Biotechnology	3	0	0	3	50	50	100
07230542E	Genomics and Proteomics	3	0	0	3	50	50	100
07230543E	Virology	3	0	0	3	50	50	100
07230544E	Molecular Biophysics	3	0	0	3	50	50	100
Electives II								
07230651E	Food Science and Technology	3	0	0	3	50	50	100
07230652E	Marine Biotechnology	3	0	0	3	50	50	100
07230653E	Metabolic Engineering	3	0	0	3	50	50	100
07230654E	Chromatographic Separations	3	0	0	3	50	50	100
Electives III								
07230661E	Immunotechnology	3	0	0	3	50	50	100
07230662E	Dairy and Bakery Technology	3	0	0	3	50	50	100
07230663E	Nanoscience and technology	3	0	0	3	50	50	100
07230664E	Biotechnology of Stem cell	3	0	0	3	50	50	100
Electives IV								
07230771E	Tissue Engineering	3	0	0	3	50	50	100
07230772E	Molecular Phylogeny	3	0	0	3	50	50	100
07230773E	Cancer Biotechnology	3	0	0	3	50	50	100
07230774E	Systems biology							
Elective V								
07230781E	Developmental Biology	3	0	0	3	50	50	100
07230782E	Food Biochemistry and Nutrition	3	0	0	3	50	50	100
07230783E	Bioinstrumentation	3	0	0	3	50	50	100
07230784E	Clinical Trial Management	3	0	0	3	50	50	100
Elective VI								
07230891E	Molecular Medicine	3	0	0	3	50	50	100
07230892E	Biodiversity and bioresource Management	3	0	0	3	50	50	100
07230893E	Bio- business	3	0	0	3	50	50	100
07230894E	Principles of Biomedical Engineering	3	0	0	3	50	50	100

<table>
<tr><td colspan="5">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="4">R 2007</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="4">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">Semester I</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>07230101G</td><td colspan="2">TECHNICAL ENGLISH</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">To help learners improve their skills in vocabulary and to enable them to use words appropriately in different academic and professional contexts, familiarize with different rhetorical functions of technical English, develop strategies that could be adopted while reading texts, acquire the ability to speak effectively in English in real life and career related situations and organized academic and professional writing.</td></tr>
<tr><td>1</td><td colspan="5">GRAMMAR AND VOCABULARY</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="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 misspelt words – British and American vocabulary.</td></tr>
<tr><td>2</td><td colspan="5">LISTENING</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>3</td><td colspan="5">SPEAKING</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>4</td><td colspan="5">READING</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>5</td><td colspan="5">WRITING</td><td>Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="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).</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">Rizvi M Ashraf, “Effective Technical Communication”, 1st Edition, Tata McGrawhil Publishing Company td., New Delhi, 2005.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="8">Dr.M.Balasubraminian and Dr.G.Anbalagan, “Performance in English” Anuradha Publications, Kumbakonan, 2007.</td></tr>
<tr><td>2.</td><td colspan="8">Sharon J. Gerson, Steven M. Gerson, “Techinical Writing – Process & Product”. 3rd Edition, Pearson Education (Singapore) (p) Ltd., New Delhi, 2004.</td></tr>
<tr><td>3.</td><td colspan="8">Mitra K. Barun, “Effective Techinical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230102G	ENGINEERING MATHEMATICS I	3	1	0	4	50	50	100
Objective(s)	The course aims to develop the skills of 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	MATRICES				Total Hrs	09		
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	09		
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	09		
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	09		
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, $e^{ax} x^n$, $e^{œx}$ Sin ßx, $e^{œx}$ Cosß x, x^n Sinœx and x^n Cosœx – Differential Equations with variable coefficients (Cauchy's Form and Legendre's Linear Equation).								
5	DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS				Total Hrs	09		
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						45		
Text book (s) :								
1.	Veerarajan. T., "Engineering Mathematics (for first year), Fourth Edition Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.							
2.	Grewal. B.S., "Higher Engineering Mathematics", Thirty Eighth Edition, Khanna Publishers, Delhi, 2004.							
Reference(s) :								
1.	Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – S.Chand and Co. – New Delhi 2007.							
2.	Kreyszig. E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.							
3.	Venkataraman.M.K, "Engineering Mathematics, Volume I & II Revised Enlarged Fourth Edition", The National Pub. Co., Chennai, 2004.							

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		L	T	P	C	CA	ES	Total
07230103G	APPLIED PHYSICS	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 Application of Lasers in Engineering and Technology.							

1	LASERS	Total Hrs	09
Introduction – principles of spontaneous emission and stimulated emission and stimulated emission-Population inversion,Pumping-Types of Lasers:He-Ne,Co2,Nd-YAG,Ruby Lasers,Semiconductor Laser- Applications: asers in Microelectronics,Welding,Heat Treatment and Cutting-Holography.			
2	FIBER OPTICS AND APPLICATIONS:	Total Hrs	09
Principles-Modes of Propagation-Crucible-Crucible Technique-Classification based on materials, refractive index and modes of propagation-Splicing-Losses in Political fiber-Light Sources for fibre optics-Detectors-Fiber optical Communication Links-Fiber optic Sensors:Temprature, Displacement Measurement.			
3	QUANTUM PHYSICS AND APPLICATIONS	Total Hrs	09
Introduction to quantum theory-Dual Nature of Matter and Radiation-De-Broglie wavelength-Uncertainity principle and its applications-Compton effect-Expression for Compton Shift-Experimental Verification-Schordinger's Equation(Time dependent and time Independent)-Particle in a box-Electron microscope-Scanning electron microscope.			
4	ULTRASONICS	Total Hrs	09
Introduction of Ultrasonics 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-Resonance system.			
5	ACOUSTICS	Total Hrs	09
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 Taught			45

Text book (s) :

1	APPLIED PHYSICS Authored by dept. of physics KSRCT.

Reference(s) :

1	Jayakumar S,"Engineering Physics",R K Publishers,Coimbatore,2003.
2	Dr.Arumugam.M,"Engineering Physics", 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"Narosa Publication, Delhi 2003.

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<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">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>07230104G</td><td colspan="2">APPLIED CHEMISTRY</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">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 and polymer and engineering materials.</td></tr>
<tr><td>1</td><td colspan="5">WATER TREATMENT</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>2</td><td colspan="5">ELECTRO CHEMISTRY</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>3</td><td colspan="5">CORROSION & CORROSION CONTROL</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td>4</td><td colspan="5">FUELS & COMBUSTION</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="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 & LPG.</td></tr>
<tr><td>5</td><td colspan="5">POLYMERS</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="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.</td></tr>
<tr><td colspan="8">Total hours to be taught</td><td>45</td></tr>
<tr><td colspan="9">TEXT BOOK :</td></tr>
<tr><td>1.</td><td colspan="8">Applied Chemistry by R.Palanivelu, R.Parimalam, B.Srividhya, K.Tamilarasu and P.Padmanaban.</td></tr>
<tr><td colspan="9">REFERENCES :</td></tr>
<tr><td>1.</td><td colspan="8">Jain P.C. & Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co. New Delhi, 14th Edition, 2002.</td></tr>
<tr><td>2.</td><td colspan="8">Clair N Sawyer and Perry L Mc Carty,”Chemistry for Environmental Engineering”, TMH Book Company, New Delhi, 14th Edition, 2002.</td></tr>
<tr><td>3.</td><td colspan="8">Dara S.S. “A text book of Engineering Chemistry, S.Chand & Co. Ltd., 2003.</td></tr>
<tr><td>4.</td><td colspan="8">Uppal M.M. revised by S.C.Bhatia,”Engineering Chemistry”, Khanna Publishers, New Delhi, 6th Edition, 2001.</td></tr>
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Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230105G	FUNDAMENTALS OF PROGRAMMING	3	0	0	3	50	50	100
Objective(s)	To impart knowledge in the fundamentals of computer and programming language, storage devices.							
1	COMPUTER BASICS				Total Hrs	8		
Evolution of computers- Generations of computers- Applications of computers- - Computer Memory and Storage- Input Output Media - Algorithm- Flowchart- Pseudocode – 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.	ITL Education Solutions Limited, "Introduction to Information Technology", Pearson Education (India), 2005. (Unit I)							
2.	E.Balagurusamy, “Programming in ANSI C”, TMH, New Delhi, 2002.							
3.	Byron Gottfried, "Programming with C", II Edition, TMH, 2002.							
Reference(s):								
1.	Rajaraman V, “Fundamentals of Computers”, Fourth Edition, PHI 2006.							

<table>
<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2007</td></tr>
<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="3">Programme 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">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td><td></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>07230106S</td><td>BASICS OF ELECTRICAL AND ELECTRONICS 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="7">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.</td></tr>
<tr><td>1</td><td colspan="4">DC AND AC CIRCUITS</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>2</td><td colspan="4">DC MACHINES & TRANSFORMERS</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>3</td><td colspan="4">INDUCTION MACHINES</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="8">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)</td></tr>
<tr><td>4</td><td colspan="4">ELECTRONIC COMPONENTS AND DEVICES</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>5</td><td colspan="4">POWER SUPPLIES</td><td>Total Hrs</td><td colspan="3">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="6">Total hours to be taught</td><td colspan="2">Theory :45, Tutorial : 15
Total: 60</td></tr>
<tr><td colspan="8">Text books:</td></tr>
<tr><td>1.</td><td colspan="7">B.R.Gupta and V.Singhal,”Basics of Electrical and Electronics Engineering”, S.Chand & Co., New Delhi.</td></tr>
<tr><td colspan="8">References:</td></tr>
<tr><td>1.</td><td colspan="7">B.R.Gupta, “Principles of Electrical Engineering”, S.Chand & Co., 2002.</td></tr>
<tr><td>2.</td><td colspan="7">K.A.Muraleedharan, R.Muthusubramanian and S.Salivahanan, “Basic Electrical and Electronics and Computer Engineering, Tata McGraw Hill 1997.</td></tr>
<tr><td>3.</td><td colspan="7">V.K.Mehta,” Principles of Electrical Engineering and Electronics”, S.Chand & Co., New Delhi.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230107P	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 (s) :

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

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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
07230108P	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 (s) :	
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.

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Semester I								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
07230109P	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								
Reference (s) :								
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.							

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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>07230110P</td><td colspan="2">ENGINEERING PRACTICES LABORATORY</td><td>0</td><td>0</td><td>3</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="8">To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical Engineering.</td></tr>
<tr><td>I</td><td colspan="5">PLUMBING</td><td colspan="2">Total Hrs</td><td>9</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>2</td><td colspan="5">SHEET METAL</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>3</td><td colspan="5">ELECTRICAL WIRING</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>4</td><td colspan="5">WELDING AND SOLDERING</td><td colspan="2">Total Hrs</td><td>12</td></tr>
<tr><td colspan="9">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.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230201G	COMMUNICATION SKILLS	3	0	0	3	50	50	100
Objective(s)	To equip students with effective speaking and listening skills in English, To help they develop the soft skills and people skills which will make them to excel in their jobs, To enhance to students' performs at placement interviews.							

1	LISTENING	Total Hrs	09
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.			
2	COMMUNICATION	Total Hrs	09
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.			
3	CONVERSATION SKILLS	Total Hrs	09
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 answer Machines - Making / changing appointments - Making complaints – Reminding - Agreeing / disagreeing – Listening - Listening and taking messages - Giving instructions & responding to instructions.			
4	REMIDIAL GRAMMER & VOCUBULARY	Total Hrs	09
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.			
5	WRITTEN COMMUNICATION & CAREER SKILLS	Total Hrs	09
Writing e-mails - Writing Reports - Note – taking and note – making - Preparing curriculum vitae and cover – letters - Facing an interview - Presentation skills - Persuasion skills.			
Total hours to be taught			45

Text book (s) :	
1.	Rizvi M Ashraf, "Effective Technical Communication", 1st Edition, Tata McGrawhil Publishing Company Ltd., New Delhi, 2005.
Reference(s) :	
1.	Kiranmai Dutt P, Geetha Rajeevan and Prakash C L N, "A Course in Communication Skills", by Ebek – Cambridge University Press India Pvt. Ltd.
2.	Naterop, cup "Telephoning in English – Cambridge University Press India Pvt.Ltd., 2007.
3.	Richard, "New Interchange Services (Student's Book)" – Introduction, Level – 1, Level – 2, Level – 3, Cambridge University Press India Pvt.Ltd., 2007.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230202G	ENGINEERING MATHEMATICS II	3	1	0	4	50	50	100
Objective(s)	An aim of the course is to train the students in additional areas of engineering mathematics, necessary for grooming them into successful engineers.							

1	MULTIPLE INTEGRALS	Total Hrs	09
Double integration in Cartesian and Polar coordinates – Change of order of integration – Area between two curves – Area as double integrals – Triple integration in Cartesian coordinates – Volume as Triple integrals (Simple problems only).			
2	VECTOR CALCULUS	Total Hrs	09
Gradient, divergence and curl – Line, surface and volume integrals – Green's, Gauss divergence and Stoke's theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.			
3	ANALYTIC FUNCTIONS	Total Hrs	09
Function of a complex variable – Analytic function – Necessary conditions – Cauchy– Riemann equations – Sufficient conditions (excluding proof) – Properties of analytic function – Harmonic conjugate – Construction of Analytic functions -Conformal mapping: w = z+a, az, 1/z and bilinear transformation.			
4	COMPLEX INTEGRATION	Total Hrs	09
Cauchy's theorem (without proof) – Cauchy's integral formula – Taylor and Laurent series (without proof) – Singularities – Classification – Cauchy's residue theorem –Contour integration – circular and semi-circular contours (excluding poles on real axis).			
5	LAPLACE TRANSFORM	Total Hrs	09
Laplace Transform – Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of unit step function – Transform of periodic functions. Inverse Laplace transform – Convolution theorem – Solution of linear ODE of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transformation.			
Total hours to be taught			45

Text book (s) :

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

Reference(s) :

1. Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – S.Chand and Co. New Delhi 2007.
2. Venkataraman.M.K, "Engineering Mathematics, Volume I & II Revised Enlarged Fourth Edition", The National Pub. Co., Chennai, 2004
3. Widder. D.V., "Advanced Calculus", Second Edition, Prentice Hall of India, New Delhi, 2000.

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Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230203G	MATERIALS SCIENCE	3	0	0	3	50	50	100
Objective(s)	Impart fundamental knowledge in various engineering subject and applications. Application of conducting, Superconducting and Magnetic Materials, dielectric, New engineering Materials and Nanomaterials in Modern Technology.							
1	CONDUCTING AND SUPERCONDUCTING MATERIALS				Total Hrs	09		
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	09		
Elemental and Compound Semiconductors-Intrinsic and Extrinsic Semiconductors-Properties-Carrier Concentration in intrinsic and Extrinsic semiconductors(Derivation)-Fermilevel-Variation of fermilevel with Temprature and impurities-Hall effect-Hall Coefficient-Experimental Determination of Hall Coefficient,Applications.								
3	MAGNETIC MATERIALS				Total Hrs	09		
Classification of Magnetic materials-properties-Heisenberg and Domain theory of ferromagnetism-Hystersis-Hard and Soft magnetic materials-Ferrites-Structure,prepration and Applications-Magnetic Recording and read out-Bubble memory-Magnetic Tape-Floppy Disc and Magnetic hard disc.								
4	DIELECTRIC MATERIALS				Total Hrs	09		
Introduction-Polarisation: Electronic, ionic, orientational and space charge-frequency and Temprature dependence of polarization-Active and Passive Dielectirc-internal field-Clasius –mosotti relation(Derivation)-Dilectric Losses-Dilectric breakdown Mechanism-Ferroelectric materials:properties and applications.								
5	NEW ENGINEERING MATERIALS				Total Hrs	09		
Shape Memory Alloy(SMA):Characteristics,properties of NiTi alloy,Applications,Metallic glasses:Prepration,properties and application.Nanomaterials:Fabrication methods-Topdown process:Ball milling,Nanolithography-Bottom up process:Vapor Phase deposistion method(PVD and CVD)-Carbon nanotubes:Fabrication and Applications.								
Total hours to be taught						45		
Text book (s) :								
1.	Material Science-Authored by dept. of Physics KSRCT.							
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-"Material Science"-Sri Krishna Publications (2007).							

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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
07230204G	ENVIRONMENTAL SCIENCE	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, focuses on the various natural resources and the current threats to their sustainability, significance and protection of bio diversity and various forms of environmental degradation and the 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.
Biogeographical 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 :

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

References :

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

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<tr><td colspan="8">Semester II</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>07230205C</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>09</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>09</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>09</td></tr>
<tr><td colspan="8">Microbes & Plants: Vegetative development; Reproduction; Transport; Nutrition Animales; Développement; 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>09</td></tr>
<tr><td colspan="8">Cell Structure; Membranes; Cell-Cell Interactions; Energy and Metabolism; How Clells 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>09</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="6">Total hours to be taught</td><td colspan="2">45</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 2007
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
07230206C	OBJECT ORENTED PROGRAMMING	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, OOProgramming 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.							

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Semester II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230207P	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	8		
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	7		
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	20		
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 usingppropriate software packages.								
5	SOLID MODELING				Total Hrs	20		
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						60		
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.							

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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
07230208P	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.							

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

Reference (s) :

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.

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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
07230209P	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.							

(Any 9 experiments)			
1	Programs Using Functions: Functions with default arguments, Implementation of Call by Value, Call by Address and Call by Reference.	Total Hrs	4
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.	Total Hrs	4
3	Compile time Polymorphism: Operator Overloading including Unary and Binary Operators, Function Overloading.	Total Hrs	4
4	Runtime Polymorphism: Inheritance, Virtual functions, Virtual Base Classes, Templates	Total Hrs	4
5	File Handling: Sequential access, Random access.	Total Hrs	4
6	Simple Java applications: For understanding reference to an instance of a class (object), methods, Handling Strings in Java.	Total Hrs	4
7	Simple Package creation: Developing user defined packages in Java.	Total Hrs	4
8	Interfaces: Developing user-defined interfaces and implementation, Use of predefined interfaces.	Total Hrs	4
9	Threading: Creation of thread in Java applications, Multithreading	Total Hrs	4
10	Exception Handling Mechanism in Java: Handling pre-defined exceptions, Handling user-defined exceptions.	Total Hrs	4
Total hours to be taught		40	

Reference (s) :

1.	E. Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw Hill, Second Edition
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.

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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
07230210P	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)	

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Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230301G	ENGINEERING MATHEMATICS III	3	1	0	4	50	50	100
Objective(s)	The course aims to develop the skills of 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	09		
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	09		
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	09		
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	09		
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	09		
Z-transform - Elementary properties – Initial and final value theorem – Inverse Z – transform – Convolution theorem – Solution of difference equations using Z - transform.								
Total hours to be taught						45		
Text book (s) :								
1.	Veerarajan. T., "Engineering Mathematics (for first year), Fourth Edition Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005.							
2.	Grewal. B.S., "Higher Engineering Mathematics", Thirty Eighth Edition, Khanna Publishers, Delhi, 2004.							
Reference(s) :								
1.	Kandasamy. P, Thilagavathy. K and Gunavathy. K, "Engineering Mathematics" – S.Chand and Co. – New Delhi 2007.							
2.	Kreyszig. E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.							

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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
07230302C	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 – multistate 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.	Structure And Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.							
Reference(s) :								
1.	Structure And Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.							
2.	Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.							

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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
07230303C	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, 3rd Edition, Wm. C. Brown Publishers, 1996.							
Reference(s) :								
1.	Ronald M. Atlas.1997. Principles of Microbiology. WCB McGraw-Hill.							
2.	Salle. A.J.1971 Fundamental Principles of Microbiology. TMH Edition.							

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Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230304C	PRINCIPLES OF CHEMICAL ENGINEERING	3	1	0	4	50	50	100
Objective(s)	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.							
1	OVERVIEW OF PROCESS INDUSTRY				Total Hrs	08		
Mass and energy conservation; process automation; environment; SI units; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration.								
2	MATERIAL BALANCES				Total Hrs	10		
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.								
3	FIRST AND SECOND LAWS OF THERMODYNAMICS				Total Hrs	09		
Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.								
4	FLUID MECHANICS				Total Hrs	10		
Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts; multiphase flow concepts.								
5	FLOW THROUGH PACKED COLUMNS				Total Hrs	08		
Fluidisation; centrifugal and piston pumps; characteristics; compressors; work.								
Total hours to be taught						45		
Text book (s) :								
1.	Bhatt B.I., Vora S.M. Stoichiometry. 3rd Edition. Tata McGraw-Hill, 1977.							
2.	McCabe W.L., Smith J.C, Harriot P. “Unit Operations In Chemical Engineering”, 5th Edition. McGraw-Hill Inc., 1993.							
Reference(s) :								
1.	Geankoplis C.J. “Transport Processes and Unit Operations”, Prentice Hall India, 2002.							

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2007</td></tr>
<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="9">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="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>07230305C</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="8">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="5">BIOMOLECULES- INTRODUCTION</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">Carbohydrates: Introduction, Classification: Monosaccharides, Disaccharide, poly saccharides. Lipids: Introduction, classification, Saturated and Unsaturated fatty acids. Nucleic acid: Nucleotide and Nucleoside – structure.</td></tr>
<tr><td>2</td><td colspan="5">CARBOHYDRATES &LIPID METABOLISM</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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="5">AMINO ACIDS & NUCLEIC ACID METABOLISM</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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="5">Protein</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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="5">ENZYMES</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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="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">”Fundamentals Of Biochemistry”, J.L.Jain, S.Chand and company publication.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="8">Leinnger “Principles Of Biochemistry”, Nelson & Fox Maxwell publication pvt ltd.</td></tr>
</table>

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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
07230306C	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,Turbidometryand Nephlomerty- Vibrational spectroscopy and nuclear spin orientation in magnetics fields-IR,Raman,NMR,ESR,Mass spectroscopy.								
Total						45		
Text book (s) :								
1.	Principles of Instrumental analysis, V edition- Skoog, Holler, Nieman.							
2.	Biophysical chemistry – Upadhaya Upadhaya Nath.							
Reference(s) :								
1.	Practical Biochemistry – Kieth Wilson and John Walker.							
2.	Chromotography-K.H.Kaur.							

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Semester III								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
07230307P	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(s) :

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 2007
Department	Bio Technology			Programme 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
07230308P	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		39	

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 2007
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
07230309P	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 2007
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
07230310P	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="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2007</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 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>07230311P</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="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 2007
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
07230401C	PROBABILITY AND STATISTICS	3	1	0	4	50	50	100
Objective(s)	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.							
1	PROBABILITY AND RANDOM VARIABLES				Total Hrs	09		
Axioms of probability – Conditional probability – Total probability – Baye's theorem – Random variable – Probability mass function – Probability density function – Moments – Moment generating function – Properties.								
2	STANDARD DISTRIBUTIONS				Total Hrs	09		
Binomial Distribution – Poisson Distribution– Geometric Distribution – Negative Binomial Distribution– Normal Distribution - Exponential Distribution – Gamma Distribution – Weibull Distributions – Properties – Problems.								
3	TWO DIMENSIONAL RANDOM VARIABLES				Total Hrs	09		
Marginal and Conditional Distributions - Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.								
4	TESTING OF HYPOTHESIS				Total Hrs	09		
Test of significance of small samples – Students 't' test – Simple 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.								
5	DESIGN OF EXPERIMENTS AND QUALITY CONTROL				Total Hrs	09		
Analysis of variance – One way classification – CRD – Two way classification – RBD – Latin square – Control charts – X chart – R chart – C chart.								
Total hours to be taught						45		
Text book (s) :								
1.	Kapur J.N. and Saxena H.C., "Mathematical Statistics", S Chand, NewDelhi, 1997.							
2.	Gupta S.C. and Kapur J.N., "Fundamentals of Mathematical Statistics", S Chand, Ninth Edition, New Delhi, 1996.							
Reference(s) :								
1.	Walpole R.E. Myers R.H. Myers R.S.L. and Ye K., "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.							
2.	Mille I.R.and Freund J.E., "Probability and Statistics for Engineers", Prentice Hall, 1995.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230402C	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 lawand its applications, factors affectin 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. 2002. “Principles of Genetics”, Tata McGraw Hill, New Delhi.
2.	Verma, P.S. and Agarwal, V.K. 1991. “Cell Biology, Genetics & Evolution & Ecology”, S.Chand & Co., New Delhi.
Reference(s) :	
1.	Gardner, E.J, Simmons, M.J, and Snustad, D.P. 1991. “Principles of Genetics”, John Wiley & Sons, New Delhi.
2.	Strickberger, M.W. “Genetics”, Prentice Hall of India, New Delhi. 1996.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230403C	MOLECULAR BIOLOGY	3	0	0	3	50	50	100
Objective(s):	To develop skills of the Students in the area of Molecular Biology, 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 (1999). Molecular Biology, Narosa Publication House. New Delhi.							
2.	Benjamin Lewin (2000). Gene VIII, Oxford University Press. New Delhi.							
Reference(s) :								
1.	Watson J.D., Hopkins, W.H., Roberts J. W., Steitz, J.A., and Weiner A.M (1987). Molecular Biology of the Gene. The Benjamin/Cummings Publication Company, California, USA.							
2.	Old, B., Richard, M.T., and Primrose, S.B (2001).Principles of Gene Manipulation: An introduction to Genetic Engineering. Black Well Science Publication, Malden, USA.							

<table>
<tr><td colspan="8">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2007</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">Semester IV</td></tr>
<tr><td colspan="2" 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 colspan="2">07230404C</td><td colspan="2">BASIC INDUSTRIAL BIOTECHNOLOGY</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 colspan="2">Objective(s)</td><td colspan="7">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.</td></tr>
<tr><td>1</td><td colspan="6">INTRODUCTION TO INDUSTRIAL BIOPROCESS</td><td>Total Hrs</td><td>07</td></tr>
<tr><td colspan="8">Basis and Development of industrial fermentation processes-Screening for new metabolites, stock cultures, substrates for industrial fermentation, media and innoculum preparation</td></tr>
<tr><td>2</td><td colspan="6">PRODUCTION OF PRIMARY METABOLITES</td><td>Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">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)</td></tr>
<tr><td>3</td><td colspan="6">PRODUCTION OF SECONDARY METABOLITES</td><td>Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>4</td><td colspan="6">PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS</td><td>Total Hrs</td><td>08</td></tr>
<tr><td colspan="8">Production of industrial enzymes such as proteases, amylases, lipases, Production of Microbial insecticides, biofertilisers, biopreservatives (Nisin), biopolymers (xanthan gum).</td></tr>
<tr><td>5</td><td colspan="6">PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS</td><td>Total Hrs</td><td>10</td></tr>
<tr><td colspan="8">Production of Single cell Proteins from Wood, Carbohydrates, Sewage and Alkanes. Microbial transformation-Transformation of steroids, ascorbic acid, antibiotics and pesticides.</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">Wulf Cruger and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, Panima Publishing Corporation, New Delhi.</td></tr>
<tr><td>2.</td><td colspan="7">Casida Jr, L.E., “Industrial Microbiology”, New Age International (P) Ltd. New Delhi.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Murrey Moo & Young, D. 1998. “Comprehensive Biotechnology”, Pergamon. New Delhi</td></tr>
<tr><td>2.</td><td colspan="7">Presscott, D. 2002. “Industrial Microbiology”, CBS Publishers, New Delhi.</td></tr>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230405C	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.1999. “Chemical Reaction Engineering”, 3rd Edition. John Wiley, New Delhi.							
2.	Gavhane, K.A. 2000. “Chemical Reaction Engineering “Vol I & Vol II, Nirali Prakashan Publisher, New Delhi.							
Reference(s) :								
1.	Missen, R.W., Mims, C.A. and Saviile B.A.1999. “Introduction to Chemical Engineering and Kinetics”; John Wiley, New Delhi.							
2.	Fogler, H.S. 2002. “Elements of Chemical Engineering” Prentice Hall India, New Delhi.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230406C	CHEMICAL THERMODYNAMICS AND BIOTHERMO DYNAMICS	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. 2001. "Chemical Engineering Thermodynamics". 6th Edition McGraw-Hill, New Delhi.		
2.	Narayanan, K.V. 2002. "A Text Book of Chemical Engineering Thermodynamics". Prentice Hall India, New Delhi.		
Reference(s) :			
1.	Sandler, S.I. 1989. "Chemical and Engineering Thermodynamics." John Wiley, New Delhi.		
2.	Bevan Ott, J. Juliana Boerio Goats., 2000."Chemical Thermodynamics" Elsevier Ltd., USA.		

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230407P	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			
1	Agarose gel electrophoresis	Total Hrs	3
2	Extraction of plasmid DNA	Total Hrs	3
3	Extraction of genomic DNA from bacteria	Total Hrs	3
4	Extraction of genomic DNA from plants	Total Hrs	3
5	Extraction of genomic DNA from animal cells	Total Hrs	3
6	Extraction of total RNA	Total Hrs	3
7	Gel elution	Total Hrs	3
8	Phage titration	Total Hrs	3
Total hours to be taught			24

Reference(s) :

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

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230408P	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								
1	Performance characteristic of semi batch reactor-I				Total Hrs	4		
2	Performance characteristic of semi batch reactor-II				Total Hrs	4		
3	Kinetic study in batch Reactor -I				Total Hrs	4		
4	Kinetic study in batch Reactor –II				Total Hrs	4		
5	RTD studies in mixed flow reactor				Total Hrs	4		
6	RTD studies in plug flow reactor				Total Hrs	4		
7	Performance characteristic of mixed flow reactor				Total Hrs	4		
8	Performance characteristic of plug flow reactor				Total Hrs	4		
Total hours to be taught						32		
Reference (s) :								
1.	Pauline M.Doran, 2003. “Bioprocess Engineering Principles”. Academic Press, New York, USA.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230409P	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.							
Any Seven Experiments								
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 2007
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
07230410P	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 2007</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>07230411P</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.
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

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230501S	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 2007
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
07230502C	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, 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- Sangers method, Maxam Gilbert, Automated sequencing method, Microarray 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.							

<table>
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<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="2">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester V</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td 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 colspan="2">07230503C</td><td>BIOINFORMATICS</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 colspan="2">Objective(s)</td><td colspan="6">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.</td></tr>
<tr><td>1</td><td colspan="3">INTRODUCTION TO BIOINFORMATICS</td><td colspan="2">Total Hrs</td><td colspan="2">08</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>2</td><td colspan="3">MANAGING BIOLOGICAL DATABASE</td><td colspan="2">Total Hrs</td><td colspan="2">10</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>3</td><td colspan="3">PATTERN MATCHING</td><td colspan="2">Total Hrs</td><td colspan="2">08</td></tr>
<tr><td colspan="8">Pairwise sequence alignment –Local Vs global alignment-dot matrix analysis- Substitution matrices- Dynamic programming: Needleman Wunch & Smith waterman method – BLAST- FASTA- Multiple sequence alignment.</td></tr>
<tr><td>4</td><td colspan="3">MACHINE LEARNING AND PHYLOGENY</td><td colspan="2">Total Hrs</td><td colspan="2">13</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>5</td><td colspan="3">APPLICATION OF BIOINFORMATICS</td><td colspan="2">Total Hrs</td><td colspan="2">06</td></tr>
<tr><td colspan="8">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.</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">S.C.Rastogi, ‘Bioinformatics –Concepts, skills& applications’ – CBS publishers & Distributors, New Delhi, 2003.</td></tr>
<tr><td>2.</td><td colspan="7">B.Bergeron, Bioinformatics computing, Prentice Hall of India, New Delhi, 2002.</td></tr>
<tr><td colspan="8">Reference(s):</td></tr>
<tr><td>1.</td><td colspan="7">C.Gibas and P.Jambeck, ’Developing Bioinformatics Skills ’’O’Reilly Shroff Publishers and Distributors Pvt,Ltd, New york,USA,1999.</td></tr>
<tr><td>2.</td><td colspan="7">Dan Gus field,’Algorithms and string, trees and sequences’, Cambridge University Press, New York, USA, 1997.</td></tr>
<tr><td>3.</td><td colspan="7">Attwood, T.K and parry Smith, D.J. ’Introduction to Bioinformatics’, Pearson Education Asia, New Delhi, 2001.</td></tr>
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<tr><td colspan="2">Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="2">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester V</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>07230504C</td><td colspan="2">BIOPROCESS 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="7">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.</td></tr>
<tr><td>1</td><td colspan="4">INTRODUCTION</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="8">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, rheological behaviour, etc.</td></tr>
<tr><td>2</td><td colspan="4">FERMENTATION PROCESSES</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>3</td><td colspan="4">PROCESS DESIGN AND OPERATION OF BIOREACTORS</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>4</td><td colspan="4">PRIMARY SEPARATION</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="8">Deadend 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.</td></tr>
<tr><td>5</td><td colspan="4">FINAL PURIFICATION</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="8">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.</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">Bailey, J. and Ollis, David F. “Fundamentals of Biochemical engineering”, Tata McGraw Hill, New Delhi, 1986.</td></tr>
<tr><td>2.</td><td colspan="7">Belter, P.A. and Cussler, E. Bioseparations, Wiley – Interscience Publication, Canada 1988.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Stanbury, F.P., Whitaker, A. and Hall, S.G “Principles of fermentation Technology”, Aditya Books, Pvt, Ltd, 1997.</td></tr>
<tr><td>2.</td><td colspan="7">Shuler,M.L. and Kargi, F.” Bioprocess Engineering Basic Concepts”, Prentice Hall of India, Pvt Ltd, New Delhi, 2003.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230505C	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 Book (s) :								
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.							
Reference (s) :								
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.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230507P	GENETIC ENGINEERING 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 Genetic Engineering.							

(Any 9 experiments)			
1	Restriction enzyme digestion	Total Hrs	3
2	Ligation of DNA	Total Hrs	3
3	Transformation and screening for recombinants	Total Hrs	3
4	Conjugation	Total Hrs	3
5	PCR	Total Hrs	3
6	Gel Elution	Total Hrs	3
7	SDS PAGE	Total Hrs	3
8	Western Blot	Total Hrs	3
9	Southern Blotting	Total Hrs	3
Total hours to be taught		27	

Lab Manual :

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

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230508P	BIOPROCESS ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective (s):	Educate the theoretical concepts of Bioseparation experimentally to the students							
(Any 7 experiments)								
1	Media Optimization – Plackett Burman design					Total Hrs		3
2	Media Optimization – Response surface methodology					Total Hrs		3
3	Preparation of bioreactor, utilities of bioreactor operation					Total Hrs		3
4	Thermal Death Kinetics					Total Hrs		3
5	Batch Sterilization					Total Hrs		3
6	Batch cultivation, Estimation kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing					Total Hrs		3
7	Fed Batch cultivation, exhaust gas analysis – carbon balancing, gas balancing					Total Hrs		3
8	Total cell retention Cultivation, exhaust gas analysis – carbon balancing, gas balancing					Total Hrs		3
Total hours to be taught						24		
Lab Manual :								
1.	Pauline M.Doran, 2003. “Bioprocess Engineering Principles”. Academic Press, New York, USA.							

K.S.Rangasamy College of Technology, Tiruchengode - Autonomous Regulation								R 2007
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
07230509P	ENZYME ENGINEERING LABORATORY	0	0	3	2	50	50	100
Objective (s)	To develop skills of the students in the area of Enzyme Engineering .							
(Any 9 experiments)								
1	Isolation of Intra cellular Enzyme from Fungi				Total Hrs	3		
2	Isolation of Extra cellular Enzyme from Bacteria				Total Hrs	3		
3	Enzyme Assay - Protease				Total Hrs	3		
4	Enzyme Kinetics - Michaels Mendon parameters				Total Hrs	3		
5	Acid phosphates activity – Effect of different temperature and pH				Total Hrs	3		
6	Acid phosphates activity – Effect of different substrates				Total Hrs	3		
7	Enzyme immobilization - Gel entrapment by sodium alginate				Total Hrs	3		
8	Enzyme immobilization - Cross Linking				Total Hrs	3		
9	Enzyme inhibition Kinetics				Total Hrs	3		
10	Production of α amylase, Invertase and Cellulose				Total Hrs	3		
Total hours to be taught						30		
Lab Manual :								
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								R 2007
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
07230510P	COMPREHENSION IV	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="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2007</td></tr>
<tr><td>Department</td><td>Biotechnology</td><td colspan="3">Programme Code & Name</td><td colspan="3">23: B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Semester V</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>07230511P</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>
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• Informing a News item
• Self introduction
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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 2007
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
07230601S	PROFESSIONAL ETHICS	3	0	0	3	50	50	100
Objectives	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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<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="2">23:B.Tech. Biotechnology</td></tr>
<tr><td colspan="7">Semester VI</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>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>07230602C</td><td colspan="2">IMMUNOLOGY</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 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</td></tr>
<tr><td>1</td><td colspan="3">THE CELLS OF IMMUNE SYSTEM</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>2</td><td colspan="3">HUMORAL IMMUNITY</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">Elements of Humoral immunity- B lymphocytes: - role of surface immunoglobulin receptor in intracellular signaling and transcription to produce antibodies. Immunoglobulins- Classes and subclasses; antibody diversity- Clonal proliferation theory. Hybridoma technology for production of monoclonal.</td></tr>
<tr><td>3</td><td colspan="3">CELLULAR IMMUNITY</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>4</td><td colspan="3">IMMUNITY TO INFECTION AND HYPERSENSITIVITY REACTIONS</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>5</td><td colspan="3">IMMUNOLOGY OF TUMORS, AUTOIMMUNITY AND TRANSPLANTATION</td><td colspan="2">Total Hrs</td><td colspan="2">09</td></tr>
<tr><td colspan="8">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.</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">Kuby, J. H. “Immunology”, 5th Edn., W. H. Freeman Publication, New York, USA, 2002</td></tr>
<tr><td>2.</td><td colspan="7">Abbas, K. A., Litchman, A. H. and Pober, J. S. 2005. “Cellular and Molecular Immunology”, 4th Edn., W. B. Saunders Co., Pennsylvania, USA.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Roitt, I., Brostoff, J. and David, M. 2001. “Immunology”, 6th Edn., Mosby publishers Ltd., New York, USA.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230603C	MOLECULAR MODELING AND DRUG DESIGNING	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 Drug Designing. This will facilitate the student to take up higher studies in the area.							
1	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, van der 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 to be taught						45		
Text book (s) :								
1.	Andrew R. Leach “Molecular Modeling – Principles and Applications”; Second Edition, Prentice Hall, USA							
Reference(s) :								
1.	Fenniri, H. (2000) “Combinatorial Chemistry – A practical approach”, Oxford University Press, UK.							
2.	Lednicer, D. (1998) “Strategies for Organic Drug Discovery Synthesis and Design”; Wiley International							
3.	Gordon, E.M. and Kerwin, J.F. (1998) “Combinatorial chemistry and molecular diversity in drug discovery”; Wiley-Liss Publishers.							
4.	Swatz, M.E. (2000) “Analytical techniques in Combinatorial Chemistry”; Marcel Dekker Publishers.							

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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	
07230604C	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, Ramachandren 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 Book(s) :									
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.								
Reference(s) :									
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.								

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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
07230607P	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)			
1	Blood Grouping	Total Hrs	3
2	Separation of Blood serum	Total Hrs	3
3	Single Radial Immunodiffusion	Total Hrs	3
4	Immunoelectrophoresis	Total Hrs	3
5	Vineral Disease Research Laboratory(VDRL)Test	Total Hrs	3
6	Rapid Plasma Reagin (RPR)Test	Total Hrs	3
7	Pregnancy Slide Test	Total Hrs	3
8	ASO(Anti Strepto Lysine-O)test	Total Hrs	3
9	Rheumatoid Arthritis (RA) test	Total Hrs	3
10	Widal Tube agglutination	Total Hrs	3
11	ELISA-Sandwich	Total Hrs	3
Total hours to be taught			33

Reference (s) :

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

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Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum marks		
		L	T	P	C	CA	ES	Total
07230608P	BIOINFORMATICS LABORATORY	0	0	3	2	50	50	100
Objective	At the end of the course, the student would have gained knowledge about the various aspects Bioinformatics.							

(Any 10 experiments)

1.	Office Automation a. Newspaper Printing. b. Course Details – Power Point Presentation. c. Chat handling.	Total Hrs	3
2.	Basic Unix Commands	Total Hrs	3
3.	Biological database.	Total Hrs	3
4.	Sequence Alignment. a. Pairwise Alignment - Global & Local Alignment. b. Multiple sequences Alignment. - Clustal X	Total Hrs	3
5.	Phylogenetic Analysis - Phylip.	Total Hrs	3
6.	Structure Visualization Tools. - Rasmol, SPDB Deep Viewer.	Total Hrs	3
7.	Structural Alignment.	Total Hrs	3
8.	Homology Modeling - SPDB Deep Viewer.	Total Hrs	3
9.	Structure Prediction. - Modeller 7v7	Total Hrs	3
10.	Docking - Hex Tool.	Total Hrs	3
Total hours to be taught			33

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		L	T	P	C	CA	ES	Total
07230609P	INDUSTRIAL BIOTECHNOLOGY LABORATORY	0	0	3	2	50	50	100
Objective (s)	Educate the theoretical concepts of Bioseparation experimentally to the students.							

(Any 10 experiments)			
1	Production of Citric acid	Total Hrs	3
2	Production of ethanol from yeast	Total Hrs	3
3	Production of wine from black grapes	Total Hrs	3
4	Production of Bear from cereals	Total Hrs	3
5	Production of Protease	Total Hrs	3
6	Production of Antibiotics using Streptomycin species	Total Hrs	3
7	Production of Vitamins	Total Hrs	3
8	Production of growth regulators	Total Hrs	3
9	Production of Biofertilizers(N – Fixers & P - Solubilizers)	Total Hrs	3
10	Production of Biocontrol Agents	Total Hrs	3
11	Production of Single cell Protein (Spirulinea)	Total Hrs	3
12	Production of Vermicompost	Total Hrs	3
Total hours to be taught			36

Reference (s)

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

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Semester VI								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230610P	COMPREHENSION V	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.							
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W6	S3(2)	S4(2)
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<tr><td>07230611P</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.
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	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 2007
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
07230701G	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 2007	
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
07230702C	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 Solibilization, 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).

K. S. Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230703C	PLANT BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course the student would have learnt about the applications of Genetic Engineering in Plant and how to develop Transgenic plants. This will facilitate the student to take up project work in this area.							
1	ORGANIZATION OF GENETIC MATERIAL					Total Hrs		08
Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation								
2	CHLOROPLAST & MITOCHONDRIA					Total Hrs		10
Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.								
3	NITROGEN FIXATION					Total Hrs		10
Nitrogenase activity, nod genes, nif genes, bacteroids.								
4	AGROBACTERIUM & VIRAL VECTORS					Total Hrs		09
Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid – t-DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits.								
5	APPLICATION OF PLANT BIOTECHNOLOGY					Total Hrs		08
Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, therapeutic products.								
Total hours to be taught								45
Text book (s) :								
1.	Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.							
2.	Singh BD. Text Book of Biotechnology, Kalyani Publishers. 199.							
Reference(s) :								
1.	Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.							
2.	Ignacimuthu .S, Applied Plant Biotechnology, Tata McGraw-Hill. 1996.							

K. S. Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230704C	ANIMAL BIOTECHNOLOGY	3	0	0	3	50	50	100
Objective(s)	At the end of the course, the student would have learnt about animal cell culture, molecular diagnostic of animal diseases and Transgenic animal production. This will facilitate the student to undertake project work in this area.							
1	ANIMAL CELL CULTURE					Total Hrs		08
Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures- suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.								
2	ANIMAL DISEASES AND THEIR DIAGNOSIS					Total Hrs		10
Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, *in-situ* hybridization; northern and southern blotting; RFLP.								
3	THERAPY OF ANIMAL DISEASES					Total Hrs		10
Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.								
4	MICROMANIPULATION OF EMBRYO'S					Total Hrs		09
What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.								
5	TRANSGENIC ANIMALS					Total Hrs		08
Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.								
Total hours to be taught								45
Text book (s) :								
1.	Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002.							
2.	Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.							
Reference(s) :								
1.	Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press, 2000.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230707P	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			
1	Studies on Cell Disruption and Cell Separation by using Sonication method	Total Hrs	3
2	Separation of solid and liquid using Centrifugation method	Total Hrs	3
3	Studies on Sedimentation (sand type)	Total Hrs	3
4	Studies on Filtration using plate and frame filter press	Total Hrs	3
5	Aqueous two phase Extraction by using acetic acid and benzene	Total Hrs	3
6	Studies on simple Leaching	Total Hrs	3
7	Studies on Column Chromatography	Total Hrs	3
8	Studies on ammonium sulphite precipitation	Total Hrs	3
Total hours to be taught			24

Reference (s) :

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 2007
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
07230708P	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.							
Any 10 experiments								
PLANT BIOTECHNOLOGY								
1	Preparation of Media				Total Hours	3		
2	Surface sterilization				Total Hours	3		
3	In vitro seed germination				Total Hours	4		
4	Organ culture				Total Hours	4		
5	Haploid plant Production (Ovary and Pollen culture)				Total Hours	4		
6	Multiplication of plant through Micropropagation				Total Hours	4		
7	Callus culture				Total Hours	4		
8	Agrobacterium mediated gene transformation				Total Hours	4		
9	Preparation of synthetic Seed				Total Hours	4		
10	Somatic Embryogenesis				Total Hours	4		
	ANIMAL BIOTECHNOLOGY							
11	Preparation of tissue culture medium and Membrane filters				Total Hours	4		
12	Trypsinization of Monolayer and sub culturing				Total Hours	3		
Total hours to be taught						45		

Reference(s) :

1. Rama Dass, P.and MeeraRani, 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 2007</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>08230709P</td><td>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 Biotechnology 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>
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<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>072307010P</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
i. Arithmetic ability
ii. Verbal Reasoning
iii. Non verbal Reasoning
b. Programming skills
i. C language (All Branches)
ii. OOPS concepts and C++ (Circuit Branches - EEE, ECE,CSE,IT)
iii. Data Structures (Circuit Branches - EEE,ECE,CSE,IT)
c. Written Communication Skills
i. Comprehension
ii. Grammar
iii. Essay Writing
iv. Technical Report Writing
v. Technical paper Writing
d. Oral Communication Skills
i. News Reading
ii. Informing a News item
iii. Self introduction
iv. 2 minutes talk – Informed
v. 2 minutes talk - Extempore
e. Technical Paper Presentation
i. Presenting a paper on recent topics
f. Group Interaction
i. Debate
ii. Group Discussion – Informed Topic
iii. Group Discussion – Topic on the spot
g. Technical Interview Skills
i. Basic MPC knowledge
ii. Broad Knowledge of the branch
iii. Indepth knowledge on specific subjects of interest
h. HR Interview Skills
i. Adoptability
ii. Creativity
iii. Flexibility
iv. Achievement orientation
v. Continuous learning
vi. Hardworking nature
vii. Decisiveness
viii. Self development
ix. 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>
<tr><td>Schedule</td><td colspan="7"><table><tr><td>Week</td><td>Activity</td></tr><tr><td>1</td><td>Training</td></tr><tr><td>2</td><td>Training</td></tr></table></td></tr>
</table>

	3	Evaluation I - Written
	4	Evaluation I - Oral
	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 2007
Department	Biotechnology	Programme Code & Name			23: B.Tech. Biotechnology			
Semester VIII								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230801C	BIOPHARMACEUTICAL TECHNOLOGY	3	0	0	3	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="7">Semester VIII</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="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>07230803P</td><td>PROJECT WORK – PHASE II</td><td>0</td><td>0</td><td>30</td><td>20</td><td>50</td><td>50</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">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 2007
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	
07230541E	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.1989.General Microbiology, Mc Millan Publications.								
2.	Foster,C.f.,John Ware.,d.A.1987.Environmental Biotechnology, Ellis Hon wood Ltd.,								
Reference(s) :									
1.	Subba Rao,N.S.2004.Soil Microbiology, Oxford & IBH PublishersPvt.Ltd, New Delhi								
2.	Karnely,D.,Charbarty., K.,Omen .,G.S.,1989.Biotechnology and Biodegradation, Advances in Applied Biotechnology Series,Vol2,Golf Publishers Co, London								

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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
07230542E	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 2007
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
07230543E	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, anyibody 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.							

<table>
<tr><td colspan="6">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2007</td></tr>
<tr><td colspan="2">Department</td><td>Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="3">23 : B.Tech. Biotechnology</td></tr>
<tr><td colspan="8">Elective I</td></tr>
<tr><td colspan="2" rowspan="2">Course Code</td><td 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 colspan="2">07230544E</td><td>MOLECULAR BIOPHYSICS</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 colspan="2">Objective(s)</td><td colspan="6">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.</td></tr>
<tr><td>1</td><td colspan="4">MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEM</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>2</td><td colspan="4">CONFORMATION OF NUCLEIC ACID</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>3</td><td colspan="4">CONFORMATION OF PROTEINS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Conformation of the Petide bond – secondary structures – Ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.</td></tr>
<tr><td>4</td><td colspan="4">CELLULAR PERMEABILITY AND ION TRANSPORT</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Ionic conductivity – transport across ion channels – mechanism – ion pumps – proton transfer – nerve conduction – techniques of studying ion transport and models.</td></tr>
<tr><td>5</td><td colspan="4">ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Concepts in Thermodynamics – force and motion – entropy and stability – analysis if fluxes – diffusional potential – basis properties of fluids and biomaterials – laminar and turbulent flows.</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">Springer, V., Glaser, R. “Biophysics”, 2000.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">Duane,R. “Biophysics : Molecules in motion”, Academic press,1999.</td></tr>
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<tr><td colspan="2" rowspan="2">Course Code</td><td 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 colspan="2">07230651E</td><td>FOOD SCIENCE AND TECHNOLOGY</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 colspan="2">Objective(s)</td><td colspan="6">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.</td></tr>
<tr><td>1</td><td colspan="3">PRINCIPLES OF FOOD PROCESSING</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>2</td><td colspan="3">TYPES OF FOOD PROCESSING AND PRESERVATION</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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.,</td></tr>
<tr><td>3</td><td colspan="3">FOOD BIOTECHNOLOGY</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>4</td><td colspan="3">FOOD MICROBIOLOGY</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>5</td><td colspan="3">FOOD QUALITY ASSURANCE</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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.</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">Frazier, W.C. and Westhoff, D.C., “Food Microbiology”, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 1995.</td></tr>
<tr><td>2.</td><td colspan="7">Sivasankar, B., “Food Processing and Preservation”. Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">James M .Jay, Modern Food Microbiology. Fourth Edition, CBS Publishing Company Ltd., New Delhi,2005.</td></tr>
<tr><td>2.</td><td colspan="7">Prescott and Dunn, Industrial Microbiology, Fourth Edition, CBS Publishing Company Ltd., New Delhi, 1987.</td></tr>
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K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230652E	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 aqua cultured 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

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Elective II								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230653E	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, permeability 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 sequential 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 Fermentation Technology”, Pergamon Press, 1984.							
Reference(s) **:**								
1.	Zubay G., "Biochemistry ", Macmillan Publishers, 1989.							

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Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230654E	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.							

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Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230661E	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.							

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<tr><td colspan="9">Elective 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>07230662E</td><td>DAIRY AND BAKERY TECHNOLOGY</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 would have learnt about Science of Technology of food processing particularly in Bakery and Dairy technology which could develop entrepreneurial strength among them.</td></tr>
<tr><td>1</td><td colspan="5">INTRODUCTION TO BAKERY AND DAIRY TECHNOLOGY</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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...</td></tr>
<tr><td>2</td><td colspan="5">TECHNOLOGY OF BREAD MAKING</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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.</td></tr>
<tr><td>3</td><td colspan="5">BAKERY PRODUCTS</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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</td></tr>
<tr><td>4</td><td colspan="5">MILK PROCESSING TECHNOLOGY</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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</td></tr>
<tr><td>5</td><td colspan="5">TYPES OF MILK PRODUCTS</td><td colspan="2">Total Hrs</td><td>09</td></tr>
<tr><td colspan="9">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</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">Cereals in Bread making: A molecular colloidal Approach by Ann-Charlotte Eliasson and Kare Larsson, CBS Publishers and Distributed, New Delhi.</td></tr>
<tr><td>2.</td><td colspan="8">Milk and Dairy product Technology by Edgar Spreer; 2005, CBS Publishers and Distributed, New Delhi.</td></tr>
<tr><td colspan="9">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="8">Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.</td></tr>
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Elective III								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
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07230663E	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- stratergies 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(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.							

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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>07230664E</td><td>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="7">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="4">ORIGIN OF HUMAN STEM CELLS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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 therpies,scientific and technical odstacles to overcome before realising the potential clinical use of novel human stem cell based theraphy.cord blood,stem cell marker</td></tr>
<tr><td>2</td><td colspan="4">HUMAN EMBROYONIC STEM CELL RESEARCH</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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="4">PROTOCOLS FOR ISOLATION AND IDENTIFICATION OF STEM CELLS</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">Preparation of cxomplete 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="4">GENE THERAPY</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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="4">TISSUE ENGINEERING</td><td>Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="8">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="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">Animal cell culture - A practical approach by John R.W. Master - Oxford University Press, 2004.</td></tr>
<tr><td colspan="8">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="7">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								R 2007
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
07230771E	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 2007
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
07230772E	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 morden 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 cholera, 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 2007
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
07230773E	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="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td colspan="3">R 2007</td></tr>
<tr><td>Department</td><td colspan="2">Biotechnology</td><td colspan="2">Programme Code & Name</td><td colspan="4">23:B.Tech..Biotechnology</td></tr>
<tr><td colspan="10">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="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>07230774E</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="9">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="5">PHYLOGENETIC ANALYSIS AND PARSIMONY ANALYSIS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">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="5">OPTIMIZATION ALIGNMENT</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">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="5">PARTITIONING OF MULTIPLE DATASETS IN PHYLOGENETIC ANALYSIS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">. 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="5">COMPARATIVE PHYLOGENOMICS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">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="5">COMPARATIVE METHODS AND ANALYSIS</td><td colspan="2">Total Hrs</td><td colspan="2">9</td></tr>
<tr><td colspan="10">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="8">Total hours to be taught</td><td colspan="2">45</td></tr>
<tr><td colspan="10">Text book (s) :</td></tr>
<tr><td>1.</td><td colspan="9">1. Techniques in molecular systematics and evolution, Rob Desalle, Gonzalo Giribet, Ward Wheeler, Springer.</td></tr>
<tr><td colspan="10">Reference(s) :</td></tr>
<tr><td>1.</td><td colspan="9">Gusfield ,Dan. “Algorithms on strings Trees and Sequences”,1st ed., Cambridge University Press,2005.</td></tr>
<tr><td>2.</td><td colspan="9">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 2007
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
07230781E	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						9		
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 "Developmental Biology", Sinauer Associates, Inc, Sunderland, Massachusetts, 2000.							

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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Elective V								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ES	Total
07230782E	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 flavours, 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 Taught			45

Text book (s) :	
1.	M. Swaminathan, “Essentials of Food and Nutrition Vol. I & II”, Ganesh and Company, Madras.
2.	N. Shakuntala Manay, N.Shadksharawamis , “Food :Facts and Principles”.
Reference(s) :	
1.	Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi. Potter, N.

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230783E	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 rotational 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 phosphorescence) 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 2007</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>07230784E</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">CLINICAL 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="8">Total Hours Taught</td><td>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>
</table>

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<tr><td colspan="7">K.S.Rangasamy College of Technology - Autonomous Regulation</td><td>R 2007</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>07230891E</td><td colspan="2">MOLECULAR MEDICINE</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 Hematology 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 signaling 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 the rapeutics; 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>
</table>

K.S.Rangasamy College of Technology - Autonomous Regulation								R 2007
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
07230892E	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 2007
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
07230893E	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 2007
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
07230894E	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 gastroenter ENVIRONMENTAL BIOTECHNOLOGY ology, 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, photodistruption, 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 processimg, 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 transdurcers; 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