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# Curriculum for the Programmes under Autonomous Scheme

## Regulation
- **R 2007**

## Department
- **Department of Biotechnology**

## Programme Code & Name
- **23 : B.Tech. Biotechnology**

### Semester I

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<td>3 L</td>
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Objective(s):
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.

1 | GRAMMAR AND VOCABULARY | Total Hrs | 09 |

2 | LISTENING | Total Hrs | 09 |
Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker’s opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas – note-taking: guided and unguided.

3 | SPEAKING | Total Hrs | 09 |

4 | READING | Total Hrs | 09 |
 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 / inferring / Sequencing of sentences.

5 | WRITING | Total Hrs | 09 |
 Introductions to the characteristics of technical style – writing definitions and descriptions – paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – classifying the data – analyzing / interpreting the data – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar).

Total hours to be taught: 45

Textbook(s):

Reference(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.

### Objective(s)

1. **Matrices**
   - 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**
   - 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**
   - Functions of two variables
   - Partial derivatives
   - Total differential
   - Maxima and minima
   - Constrained maxima and minima
   - Lagrange’s multiplier method
   - Jacobians.

4. **Ordinary Differential Equations**
   - Linear differential equations of Second and higher order with constant coefficient when the R.H.S is $e^{ax}$, $x^n$, $\sin ax$, $\cos ax$, $e^{ax}x^n$, $e^{ax}\sin bx$, $e^{ax}\cos bx$, $x^n\sin ax$ and $x^n\cos ax$
   - Differential Equations with variable coefficients
   - Cauchy’s Form and Legendre’s Linear Equation.

5. **Differential Equations and its Applications**
   - 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):**


**Reference(s):**

<table>
<thead>
<tr>
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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


2 FIBER OPTICS AND APPLICATIONS:


3 QUANTUM PHYSICS AND APPLICATIONS


4 ULTRASONICS

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 Hours Taught 45

Text book(s): 1 APPLIED PHYSICS Authored by dept. of physics KSRCT.

Reference(s):

5 Feynman, ”Lecturers in Quantum Mechanics” Narosa Publication, Delhi 2003.
## Course Details

### Semester I

<table>
<thead>
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### Objectives
- The student should be conversant with the principles involved in electrochemistry, 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.

### Courses

1. **WATER TREATMENT**
   - Total Hrs: 9

2. **ELECTRO CHEMISTRY**
   - Total Hrs: 9

3. **CORROSION & CORROSION CONTROL**
   - Total Hrs: 9

4. **FUELS & COMBUSTION**
   - Total Hrs: 9

5. **POLYMERS**
   - Total Hrs: 9

**Total hours to be taught**: 45

**TEXT BOOK :**

**REFERENCES :**
<table>
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<th>Hours/Week</th>
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</table>

1 COMPUTER BASICS
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
Introduction to C- Constants- Variables- Data types- Operators and Expressions- Managing Input and Output operations- Decision Making and Branching- Looping.

3 ARRAYS AND FUNCTIONS
Arrays- Character Arrays and Strings- User defined functions- Storage Classes

4 STRUCTURES AND FILES
Structures- Definition- Initialization- Array of Structures- Structures within structures- Structures and Functions- Unions- File Management.

5 POINTERS

Total hours to be taught 45

Text book (s) :
1. ITL Education Solutions Limited, “Introduction to Information Technology”, Pearson Education (India), 2005. (Unit I)

Reference(s):
<table>
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<td>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</td>
<td>L 3</td>
<td>T 1</td>
<td>P 0</td>
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Objectives
After the completion of this course, students gain knowledge in fundamentals of electrical engineering and the operational design aspects of DC and AC motor drives.

1. **DC AND AC CIRCUITS**
   - Total Hrs: 9
   - Construction and principle of operation of Moving Coil and Moving iron instruments (only Voltmeter and ammeters) - dynamometer type wattmeter- Induction type energy meter- Megger.

2. **DC MACHINES & TRANSFORMERS**
   - Total Hrs: 9
   - Construction and principle of operation of transformers- types- emf equation- transformation ratio.

3. **INDUCTION MACHINES**
   - Total Hrs: 9
   - Construction of three phase motors –operating principles- types of three phase motors- torque equation-speed torque characteristics. Single phase motors- types- capacitor start capacitor run motors- shaded pole.
   - (Qualitative analysis only)

4. **ELECTRONIC COMPONENTS AND DEVICES**
   - Total Hrs: 9
   - Active and passive components, basic principles and characteristics of PN diode, zener diode, bipolar junction transistors-CC, CB, CE configuration. Symbol, truth table and circuit of basic logic gates- universal gates.

5. **POWER SUPPLIES**
   - Total Hrs: 9
   - Operating principles of Half wave and full wave rectifier, Bridge rectifier, ripple factor, transformer utilization factor, rectifier efficiency, Voltage regulator-types. Introduction to SMPS and UPS.

Total hours to be taught
- Theory :45, Tutorial : 15
- Total: 60

Text books:

References:
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**Objective:**
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

   Total Hrs 3

7. Determination of thickness of fiber by air wedge method.
   Total Hrs 3

   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

    Total Hrs 3

**Total hours to be taught**
30

**Lab Manual:**

**Reference(s):**
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<th>Course Code</th>
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</table>

**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:

Reference (s):
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**Objective (s):** At the end of (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):

### K.S. Rangasamy College of Technology - Autonomous Regulation  R 2007

| Department | Biotechnology | Programme Code & Name | 23: B.Tech. Biotechnology |

#### Semester I

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**Objective(s)** To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical Engineering.

1. **PLUMBING**
   - Total Hrs 9

2. **SHEET METAL**
   - Study of Tools, Equipments and Safety precautions, Drawing of tools and accessories, Different types of joints making - knocked up, double grooving joints, Model making – Trays, Baskets and Funnels.
   - Total Hrs 12

3. **ELECTRICAL WIRING**
   - Safety aspects of Electrical wiring, Safety aspects of Electrical wiring, Wiring circuit for a lamp using single and Stair case switches, Wiring circuit for fluorescent lamps, Calculation of power and energy.
   - Total Hrs 12

4. **WELDING AND SOLDERING**
   - Total Hrs 12
## Semester II

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**Objective(s)**

To equip students with effective speaking and listening skills in English. To help them 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

- 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


### 3. CONVERSATION SKILLS


### 4. REMEDIAL GRAMMER & VOCUBULARY


### 5. WRITTEN COMMUNICATION & CAREER SKILLS

- 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):**


**Reference(s):**

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**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

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 – Cauchy’s residue theorem – Contour integration – Circular and semi-circular contours (excluding poles on real axis).

5. **LAPLACE TRANSFORM**
   - Total Hrs: 09

**Total hours to be taught:** 45

**Text book(s):**

**Reference(s):**
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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


2. SEMICONDUCTING MATERIALS

Elemental and Compound Semiconductors-Intrinsic and Extrinsic Semiconductors-Properties-Carrier Concentration in intrinsic and Extrinsic semiconductors(Derivation)-Fermilevel-Variation of fermilevel with Temperature and impurities-Hall effect-Hall Coefficient-Experimental Determination of Hall Coefficient.Applications.

3. MAGNETIC MATERIALS


4. DIELECTRIC MATERIALS


5. NEW ENGINEERING MATERIALS


Total hours to be taught 45

Text book(s):

1. Material Science-Authored by dept. of Physics KSRCT.

Reference(s):

## K.S. Rangasamy College of Technology - Autonomous Regulation

### Course Code: 07230204G
### Course Name: ENVIRONMENTAL SCIENCE

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### Objectives
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
- The significant international conventions and protocols for the protection of environment.

### 1. ATMOSPHERE AND ECOSYSTEM


### 2. WATER RESOURCES AND ITS TREATMENT


### 3. LAND RESOURCES AND ITS DEGRADATION


### 4. FUTURE POLICY AND ALTERNATIVES


### 5. BIO DIVERSITY AND HUMAN POPULATION


Total hours to be taught: 45

**Textbook:**
- Environmental Science by R. Palanivelu, R. Parimalam, and B. Srividhya

**References:**
2. G. Tyler Miller, JR – “Environmental Science “, Thomson, 2004
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Objective(s):
- To impart basic knowledge in biology
- Introduction to various subjects like biochemistry, microbiology
- To focus on fundamentals as a prerequisite for the forthcoming semester.

1. **ORIGIN**
   - Total Hrs: 09
   - 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.

2. **DIVERSITY OF LIFE ON EARTH**
   - Total Hrs: 09
   - Systematics and Diversity; Prokaryotes; Protists; Fungi; Higher Plants; Coelomate and Noncoelomate Invertebrates; Vertebrates; Viruses.

3. **STRUCTURES**
   - Total Hrs: 09
   - Microbes & Plants: Vegetative development; Reproduction; Transport; Nutrition Animals; Development; Digestion; Circulation; Respiration; Reproduction; Nervous System; Sensory System; Endocrine system.

4. **FUNCTIONS**
   - Total Hrs: 09
   - Cell Structure; Membranes; Cell-Cell Interactions; Energy and Metabolism; How Cells Harvest Energy; Photosynthesis; How Cells Divide; Laws of inheritance – Mendelian and Non-Mendelian laws.

5. **ECOLOGY AND BEHAVIOR**
   - Total Hrs: 09
   - 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.

Total hours to be taught: 45

Reference(s):
## Course Details

**Code**: 07230206C  
**Name**: OBJECT ORENTED PROGRAMMING  
**Credit**: 4  
**Maximum Marks**: 50  
**Total**: 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.

### Course Content

1. **INTRODUCTION TO C++**
   - Software evolution, OOP programming paradigms, Basic concepts and benefits of OOP, Application of OOP, Structures, tokens, keywords, identifiers, Basic data types, symbolic Constants, dynamic initialization, reference variables, scope resolution operator, type casting, operators and control statements, input and output statements in C++.
   - Total Hrs: 09

2. **CLASSES AND OBJECTS**
   - 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.
   - Total Hrs: 09

3. **CONSTRUCTOR, DESTRUCTOR AND OVERLOADING**
   - Total Hrs: 09

4. **INHERITANCE**
   - Defining derived classes, Single inheritance, Protected data with private inheritance. Multiple inheritances, Multi level inheritance, Hierarchical inheritance, Hybrid inheritance, Abstract Classes, Virtual Functions.
   - Total Hrs: 09

5. **STREAMS AND FILE HANDLING**
   - 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 Hrs: 09

**Total hours to be taught**: 45

**Textbook(s)**:

**Reference(s)**:
<table>
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</table>

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 freehand sketches of simple engineering objects and computer 2D and 3D modeling techniques. Use of drawing board and mini drifter is not at all required.

1. CURVES AND SHAPES USED IN ENGINEERING PRODUCTS
   
   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
   
   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
   
   Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones - freehand sketching practices - simple exercises to practice.

4. 2D DRAFTING
   
   Importance of 2D drafting – sketching, mirroring, scaling, copying (simple and multiple) dimensioning - wiring diagram and piping layout drawings - Practice of Computer Aided Drafting and dimensioning using appropriate software packages.

5. SOLID MODELING
   
   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):

Reference(s):
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):
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
</tr>
</thead>
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<tr>
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<td>OBJECT ORIENTED PROGRAMMING LABORATORY</td>
<td>0 0 4 3 50</td>
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</table>

**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

   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):**

Objective(s)

1. To improve the skill level of Engineering, Technology and Applied Science students.
2. 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.
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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

<table>
<thead>
<tr>
<th>Week No</th>
<th>Duration: 1½ period Subject No (No of units)</th>
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<tbody>
<tr>
<td>W1</td>
<td>S1(3)</td>
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<td>W2</td>
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<td>W3</td>
<td>S5(3)</td>
<td>S6(3)</td>
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<tr>
<td>W4</td>
<td>Test-I (Portion: 3 units in each subject)</td>
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<tr>
<td>W5</td>
<td>S1(2)</td>
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<td>W6</td>
<td>S3(2)</td>
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<tr>
<td>W7</td>
<td>S5(2)</td>
<td>S6(2)</td>
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<tr>
<td>W8</td>
<td>Test-II (Portion: 2 units in each subject)</td>
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</tr>
<tr>
<td>W9</td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>W10</td>
<td>Test-III (All 5 units and all the subjects)</td>
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</table>
## Course Code: 07230301G
### Course Name: ENGINEERING MATHEMATICS III

<table>
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<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
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<td>T</td>
<td>P</td>
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<td>3</td>
<td>1</td>
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</table>

### 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

- 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

- 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

- 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

- Fourier transform pair
- Sine and Cosine transforms
- Properties
- Transforms of simple functions
- Convolution theorem
- Parseval’s identity
- Problems.

### 5. Z-TRANSFORM AND DIFFERENCE EQUATIONS

- 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

<table>
<thead>
<tr>
<th>Total Hrs</th>
<th>09</th>
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</thead>
</table>

### Text book (s):


### Reference(s):


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<th>Maximum Marks</th>
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<tbody>
<tr>
<td>07230302C</td>
<td>BIOORGANIC CHEMISTRY</td>
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</table>

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

2. **STEREOCHEMISTRY OF ENZYMATIC REACTIONS**
   - Total Hrs: 09

3. **CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM**
   - Total Hrs: 09

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

Total hours to be taught: 45

Text book(s):

Reference(s):
<table>
<thead>
<tr>
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<th>Credit</th>
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<td>4 1 0 4</td>
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</table>

**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.

<table>
<thead>
<tr>
<th>Semester III</th>
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</table>

| **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 |
| **2** | MICROBES-STRUCTURE AND MULTIPLICATION | Total Hrs | 12 |
| **3** | MICROBIAL NUTRITION AND GROWTH | Total Hrs | 8 |
| **4** | CONTROL OF MICROORGANISMS | Total Hrs | 8 |
| **5** | INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY | Total Hrs | 7 |

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<th><strong>Text book(s):</strong></th>
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<th><strong>Reference(s):</strong></th>
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<tbody>
<tr>
<td>Course Code</td>
<td>Course Name</td>
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<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>07230304C</td>
<td>PRINCIPLES OF CHEMICAL ENGINEERING</td>
</tr>
</tbody>
</table>

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):**


**Reference(s):**

## Semester III

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Hours / Week</th>
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<td>BIOCHEMISTRY</td>
<td>3 0 0 4</td>
<td>50 50 50 100</td>
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</tbody>
</table>

**Objective(s)**
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.

1. **BIOMOLECULES - INTRODUCTION**

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<th>Total Hrs</th>
<th>09</th>
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</table>

**Carbohydrates**: Introduction, Classification: Monosaccharides, Disaccharide, polysaccharides. **Lipids**: Introduction, classification, Saturated and Unsaturated fatty acids. **Nucleic acid**: Nucleotide and Nucleoside – structure.

2. **CARBOHYDRATES & LIPID METABOLISM**

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<th>Total Hrs</th>
<th>09</th>
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</thead>
</table>

Biosynthesis of Fatty acids, cholesterol, Tri acyl glycerol and oxidation of fatty acids. Biosynthesis and degradation of Starch and Glycogen. Glycolysis, TCA cycle Intermediary Metabolism: HMPshunt and Gluconeogenesis.

3. **AMINO ACIDS & NUCLEIC ACID METABOLISM**

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<th>Total Hrs</th>
<th>09</th>
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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.

4. **Protein**

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<th></th>
<th>Total Hrs</th>
<th>09</th>
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</table>


5. **ENZYMES**

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<th></th>
<th>Total Hrs</th>
<th>09</th>
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</thead>
</table>


**Total hours to be taught**: 45

**Text book (s)**:

**Reference(s)**:
### INSTRUMENTATION TECHNIQUES

- **Course Code:** 07230306C
- **Course Name:** INSTRUMENTATION TECHNIQUES
- **Credit:** 4
- **Maximum Marks:** 50
- **Total:** 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.

**Hours / Week:**
- L: 3
- T: 1
- P: 0

**Total Hrs:** 05

**Buffers:**
- Bicarbonate-buffere buffer systems, Principles of redox reaction, Glass electrode for pH measurements. Centrifugation-Basic principles, centrifuge and their uses. Types- Preparative, analytical ultracentrifuge – applications.

**Radiosotopes:**
- 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.

**Chromatographic Techniques:**
- Classification- Principles-adsorption chromatography- column, partition chromatography-paper, size exclusion. Ion exchange chromatography- Types of ion exchangers, affinity-GLC-HPLC Principle and application.

**Electrophoresis:**
- 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.

**Spectroscopic Techniques:**

**Total:** 45

**Textbook(s):**

**Reference(s):**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tr>
<td>07230307P</td>
<td>BIO ORGANIC CHEMISTRY LABORATORY</td>
<td>0 0 3 2</td>
<td>50</td>
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</tbody>
</table>

**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  
2. Hydrolysis of sucrose  
3. Preparation of pyruvic acid from tartaric acid  
4. Preparation of oleic acid from tartaric acid  
5. Preparation of alpha d-glucopyranose pentaacetate  
6. Isolation of lycopene from tomato paste  
7. Preparation of l-cysteine from hair  
8. Cellulase degradation by Acid Hydrolysis  
9. Isolation of Albumin from Egg  
10. Isolation and purification casein from milk.

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

**Reference(s):**
### Course Code: 07230308P
#### Course Name: MICROBIOLOGY LABORATORY

<table>
<thead>
<tr>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
</tr>
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<tbody>
<tr>
<td>L</td>
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<td>P</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>3</td>
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</tbody>
</table>

**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:**

**Reference(s):**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
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<tr>
<td></td>
<td>At the end of this laboratory course, the students would have learnt about spectroscopy, nephelometry &amp; chromatography. In addition the student will also gain knowledge of operating these equipments.</td>
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<tr>
<td></td>
<td>(Any 10 experiments)</td>
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<td></td>
</tr>
<tr>
<td>1.</td>
<td>Precision and validity in an experiment using absorption spectroscopy.</td>
<td>Total Hrs</td>
<td>3</td>
<td></td>
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<tr>
<td>2.</td>
<td>Validating Lambert-Beer’s law using kmno4</td>
<td>Total Hrs</td>
<td>3</td>
<td></td>
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<tr>
<td>3.</td>
<td>Finding the molar absorbptivity and stoichiometry of the Fe (1, 10 phenanthroline) 3 using absorption spectrometry</td>
<td>Total Hrs</td>
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<tr>
<td>4.</td>
<td>Finding the pKa of 4-niophenol using absorption spectroscopy.</td>
<td>Total Hrs</td>
<td>3</td>
<td></td>
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<tr>
<td>5.</td>
<td>UV spectra of nucleic acids.</td>
<td>Total Hrs</td>
<td>3</td>
<td></td>
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<tr>
<td>6.</td>
<td>Chemical actinometry using potassium ferri oxolate</td>
<td>Total Hrs</td>
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<tr>
<td>7.</td>
<td>Estimation of SO-4 by nephelometry.</td>
<td>Total Hrs</td>
<td>3</td>
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<tr>
<td>8.</td>
<td>Estimation of Al3+ by flourimetry</td>
<td>Total Hrs</td>
<td>3</td>
<td></td>
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<tr>
<td>9.</td>
<td>Limits of detection using aluminum alizarin complex</td>
<td>Total Hrs</td>
<td>3</td>
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<tr>
<td>10.</td>
<td>Chromatography analysis using TLC.</td>
<td>Total Hrs</td>
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<tr>
<td>11.</td>
<td>Chromatography analysis using column chromatography.</td>
<td>Total Hrs</td>
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<td>Lab Manual :</td>
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<tr>
<td>1.</td>
<td>Practical Biochemistry – Kieth Wilson and John Walker</td>
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<td></td>
<td>Reference (s) :</td>
<td></td>
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<tr>
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<td>Test-II (Portion: 2 units in each subject)</td>
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<tr>
<td>W9</td>
<td>Discussion</td>
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<tr>
<td>W10</td>
<td>Test-III (All 5 units and all the subjects)</td>
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### Course Code: 07230311P

**Course Name:** CAREER COMPETENCY DEVELOPMENT I

<table>
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<tr>
<th>Hours / Week</th>
<th>Credit</th>
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<td>0 0 3 2</td>
<td></td>
<td></td>
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<tr>
<td>100 00 100</td>
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</tbody>
</table>

**Objective(s):**
1. To improve the skill level of Engineering, Technology and Applied Science students.
2. To improve the employability of students in placement interviews

**Skills sets to be improved:**

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

**Execution**

- 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.

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).
<table>
<thead>
<tr>
<th>Schedule</th>
<th>Week</th>
<th>Activity</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>Training</td>
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<td>Evaluation I - Written</td>
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<td>6</td>
<td>Evaluation II - Written</td>
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<tr>
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<td>7</td>
<td>Evaluation II - Oral</td>
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<td></td>
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<td>Training</td>
</tr>
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<td>9</td>
<td>Evaluation III - Written</td>
</tr>
<tr>
<td></td>
<td>10 - 12</td>
<td>Evaluation III - Oral</td>
</tr>
</tbody>
</table>

<p>| Evaluation | Evaluation I | 60 marks (average of 3 tests) |
|           | Evaluation II | 20 marks                  |
|           | Evaluation III | 20 marks                  |
| Total     |                | 100 marks                 |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07230401C</td>
<td>PROBABILITY AND STATISTICS</td>
<td>L 3 T 0 P 0 C 4</td>
<td>CA 50 ES 50</td>
<td>Total 100</td>
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</tbody>
</table>

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
   - 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
   - Binomial Distribution
   - Poisson Distribution
   - Geometric Distribution
   - Negative Binomial Distribution
   - Normal Distribution
   - Exponential Distribution
   - Gamma Distribution
   - Weibull Distributions
   - Properties
   - Problems.

3. TWO DIMENSIONAL RANDOM VARIABLES
   - Marginal and Conditional Distributions
   - Covariance
   - Correlation and Regression
   - Transformation of random variables
   - Central limit theorem.

4. TESTING OF HYPOTHESIS
   - 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
   - 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):

Reference(s):
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07230402C</td>
<td>GENETICS</td>
<td>3 0 0 4</td>
<td>50 50</td>
<td>100</td>
</tr>
</tbody>
</table>

**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**

   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**

   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**

   Sex determination in plants and animals: Concepts of autosomes and allosomes, XX-XY, XX-XO, ZZ-ZO, ZZ-ZO Types; Sex differentiation; Dosage compensation; Sex linked inheritance, Sex influenced inheritance Mult Alleles; Lethality and Interaction of genes. Karyotyping- amniocentesis; banding techniques.

4. **CHROMOSOMAL ABERRATIONS & MUTATIONS**

   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**

   Population genetics: gene pool, gene frequencies, Hardy-Weinberg law and its applications, factors affecting allele frequencies- selection, mutation, migration and genetic drift; Inbreeding depression; Heterosis; speciation; pedigree analysis.

   Total hours to be taught: 45

**Text book(s):**


**Reference(s):**


<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07230403C</td>
<td>MOLECULAR BIOLOGY</td>
<td>3 1 0 4</td>
<td>50 50</td>
<td>100</td>
</tr>
</tbody>
</table>

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 |


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 |


5 | REGULATION OF GENE EXPRESSION | Total Hrs | 09 |


Total Hours Taught: 45

Textbook(s):

Reference(s):
### Course Code: 07230404C
#### Course Name: BASIC INDUSTRIAL BIOTECHNOLOGY

<table>
<thead>
<tr>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 3</td>
<td>T 1</td>
<td>P 0</td>
</tr>
<tr>
<td>CA 50</td>
<td>ES 50</td>
<td>Total 100</td>
</tr>
</tbody>
</table>

**Objective(s):**
At the end of the course the students would have learnt about production of primary & secondary metabolites, enzymes and single cell proteins on an industrial scale. This will be very beneficial for certain specialized courses & project work.

#### 1 INTRODUCTION TO INDUSTRIAL BIOPROCESS
Total Hrs 07

**Basis and Development of industrial fermentation processes** - Screening for new metabolites, stock cultures, substrates for industrial fermentation, media and inoculum preparation.

#### 2 PRODUCTION OF PRIMARY METABOLITES
Total Hrs 10

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

#### 3 PRODUCTION OF SECONDARY METABOLITES
Total Hrs 10

Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin), aminoglycosides (streptomycin) macroldes (erythromycin), vitamins-Vitamin B\textsubscript{12}, Riboflavin, gibberellins.

#### 4 PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS
Total Hrs 08

Production of industrial enzymes such as proteases, amylases, lipases. Production of Microbial insecticides, biofertilisers, biopreservatives (Nisin), biopolymers (xanthan gum).

#### 5 PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS
Total Hrs 10

Production of Single cell Proteins from Wood, Carbohydrates, Sewage and Alkanes. Microbial transformation-Transformation of steroids, ascorbic acid, antibiotics and pesticides.

**Total hours to be taught** 45

**Text book(s):**


**Reference(s):**

### Course Code: CHEMICAL REACTION ENGINEERING
#### 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.

#### Broad outline of chemical reactors; 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.


#### 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.

#### 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.

#### 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.

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**Text book(s):**


**Reference(s):**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07230406C</td>
<td>CHEMICAL THERMODYNAMICS AND BIO THERMODYNAMICS</td>
<td>3 1 0 4</td>
<td>50</td>
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</tbody>
</table>

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
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
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

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

5 THERMODYNAMIC ANALYSIS OF PROCESSES
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):

Reference(s):
### 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

<p>| | | | | | | |</p>
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<tr>
<td>Total Hrs</td>
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</tr>
<tr>
<td>1</td>
<td>Agarose gel electrophoresis</td>
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</tr>
<tr>
<td>2</td>
<td>Extraction of plasmid DNA</td>
<td></td>
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<td>3</td>
<td>Extraction of genomic DNA from bacteria</td>
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<tr>
<td>4</td>
<td>Extraction of genomic DNA from plants</td>
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<td>5</td>
<td>Extraction of genomic DNA from animal cells</td>
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<tr>
<td>6</td>
<td>Extraction of total RNA</td>
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<tr>
<td>7</td>
<td>Gel elution</td>
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<td>8</td>
<td>Phage titration</td>
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Total hours to be taught: 24

### Reference(s):

### Course Code: 07230408P

#### CHEMICAL REACTION ENGINEERING LABORATORY

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</thead>
<tbody>
<tr>
<td>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.</td>
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</table>

#### Any Seven Experiments

<table>
<thead>
<tr>
<th></th>
<th>Course Name</th>
<th>Total Hrs</th>
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<tbody>
<tr>
<td>1</td>
<td>Performance characteristic of semi batch reactor-I</td>
<td>4</td>
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</tr>
<tr>
<td>2</td>
<td>Performance characteristic of semi batch reactor-II</td>
<td>4</td>
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</tr>
<tr>
<td>3</td>
<td>Kinetic study in batch Reactor -I</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kinetic study in batch Reactor –II</td>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td>RTD studies in mixed flow reactor</td>
<td>4</td>
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<tr>
<td>6</td>
<td>RTD studies in plug flow reactor</td>
<td>4</td>
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</tr>
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<td>7</td>
<td>Performance characteristic of mixed flow reactor</td>
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<tr>
<td>8</td>
<td>Performance characteristic of plug flow reactor</td>
<td>4</td>
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</table>

**Total hours to be taught**: 32

#### Reference(s):

### 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.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
</tr>
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<td>CHEMICAL ENGINEERING LABORATORY</td>
<td>0 0 3 2 50 50 100</td>
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Any Seven Experiments

<table>
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<tr>
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</thead>
<tbody>
<tr>
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<td>Flow measurement using Orifice meter</td>
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<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Pressure drop in pipes</td>
<td>Total Hrs</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Studies on packed columns</td>
<td>Total Hrs</td>
<td>4</td>
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<tr>
<td>4</td>
<td>Studies on Fluidization</td>
<td>Total Hrs</td>
<td>4</td>
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<tr>
<td>5</td>
<td>Studies on Filtration</td>
<td>Total Hrs</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Studies on Roll crusher</td>
<td>Total Hrs</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Studies on Simple distillation</td>
<td>Total Hrs</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Distillation in packed column</td>
<td>Total Hrs</td>
<td>4</td>
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<td>9</td>
<td>Liquid-liquid equilibria in extraction</td>
<td>Total Hrs</td>
<td>4</td>
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<td>10</td>
<td>Studies on Jaw crusher</td>
<td>Total Hrs</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Studies on Simple distillation</td>
<td>Total Hrs</td>
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</table>

Total hours to be taught: 48
### Course Information

**Department:** Biotechnology  
**Programme Code & Name:** 23: B.Tech. Biotechnology

#### Semester III

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>07230410P</td>
<td>COMPREHENSION III</td>
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<td></td>
<td></td>
<td>0 0 3 2 100 00 100</td>
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</tbody>
</table>

**Objective(s):**
1. To improve the skill level of Engineering, Technology and Applied Science students.
2. 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

<table>
<thead>
<tr>
<th>Week No</th>
<th>Duration: 1½ period Subject No (No of units)</th>
<th>Duration: 1½ period Subject No (No of units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>S1(3)</td>
<td>S2(3)</td>
</tr>
<tr>
<td>W2</td>
<td>S3(3)</td>
<td>S4(3)</td>
</tr>
<tr>
<td>W3</td>
<td>S5(3)</td>
<td>S6(3)</td>
</tr>
<tr>
<td>W4</td>
<td>Test-I (Portion: 3 units in each subject)</td>
<td></td>
</tr>
<tr>
<td>W5</td>
<td>S1(2)</td>
<td>S2(2)</td>
</tr>
<tr>
<td>W6</td>
<td>S3(2)</td>
<td>S4(2)</td>
</tr>
<tr>
<td>W7</td>
<td>S5(2)</td>
<td>S6(2)</td>
</tr>
<tr>
<td>W8</td>
<td>Test-II (Portion: 2 units in each subject)</td>
<td></td>
</tr>
<tr>
<td>W9</td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>W10</td>
<td>Test-III (All 5 units and all the subjects)</td>
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</tbody>
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K.S.Rangasamy College of Technology - Autonomous Regulation  
R 2007

BoS Chairman  
23 : B.Tech. BIOTECHNOLOGY - REGULATION 2007 - SYLLABUS
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
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**Objective(s)**

1. To improve the skill level of Engineering, Technology and Applied Science students.
2. To improve the employability of students in placement interviews.

**Skills sets to be improved**

- **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**
  - Adaptability
  - Creativity
  - Flexibility
  - Achievement orientation
  - Continuous learning
  - Hardworking nature
  - Decisiveness
  - Self development
  - Questioning

**Focus**

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).

**Execution**

- 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.
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<thead>
<tr>
<th>Schedule</th>
<th>Week</th>
<th>Activity</th>
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<tr>
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<tr>
<td>Evaluation II</td>
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<tr>
<td>Evaluation III</td>
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<tr>
<td>07230501G</td>
<td>PRINCIPLES OF MANAGEMENT</td>
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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

2. PLANNING
   - Total Hrs: 9

3. ORGANISING
   - Total Hrs: 9

4. DIRECTING
   - Total Hrs: 9

5. CONTROLLING
   - Total Hrs: 9

Total hours to be taught: 45

Textbook(s):

Reference(s):
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
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</table>

### Objective(s)

To develop skills of the students in the area of genetic Engineering. This will be a prerequisite 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, Restriction 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.

<table>
<thead>
<tr>
<th>Total Hours Taught</th>
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### Text book(s):


### Reference(s):

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</table>

**Course Details**

1. **INTRODUCTION TO BIOINFORMATICS**
   - Total Hrs: 08
2. **MANAGING BIOLOGICAL DATABASE**
   - Total Hrs: 10
3. **PATTERN MATCHING**
   - Total Hrs: 08
4. **MACHINE LEARNING AND PHYLOGENY**
   - Total Hrs: 13
5. **APPLICATION OF BIOINFORMATICS**
   - Total Hrs: 06

**Textbook(s):**

**Reference(s):**
Course Code: 07230504C  
Course Name: BIOPROCESS ENGINEERING

Objective(s): At the end of the course, the students would have learnt about fermentation process, Cell Disruption Methods and Purification processes. This will serve as an effective course to understand bioseparation process in detail.

1. INTRODUCTION
   Total Hrs: 09
   Historical development of Bioprocess technology, An overview of traditional and modern applications of Biotechnological processes. Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification, characterization of biomolecules, characterization of fermentation broth, morphology of cells, rheological behaviour, etc.

2. FERMENTATION PROCESSES
   Total Hrs: 09
   Techniques of enzyme immobilization, General requirements of fermentation processes; basic design and construction of fermenters and ancillaries; medium requirements for fermentation processes; various commercial media for industrial fermentation; Sterilization of air, liquid media.

3. PROCESS DESIGN AND OPERATION OF BIOREACTORS
   Total Hrs: 09
   Phases of Cell growth in batch cultures; Mass transfer in heterogeneous biochemical systems; O₂ transfer in submerged fermentation processes, Operational modes of bioreactors: batch, continuous, fed-batch, and continuous cultivation; recombinant cell culture processes; bioreactor strategies for maximizing product formation; bioprocess design considerations for plant and animal cell culture.

4. PRIMARY SEPARATION
   Total Hrs: 09
   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.

5. FINAL PURIFICATION
   Total Hrs: 09
   Precipitation, adsorption, Principles of chromatographic separation, various chromatographic separations, Electrophoretic separation processes; dialysis, reverse osmosis, Ultrafiltration, cross flow ultrafiltration and Electro dialysis, crystallization, lyophilisation and drying.

Total hours to be taught: 45

Text book(s):

Reference(s):
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
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</table>

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

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):

Reference (s):
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<th>Course Name</th>
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</table>

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
2. Ligation of DNA
3. Transformation and screening for recombinants
4. Conjugation
5. PCR
6. Gel Elution
7. SDS PAGE
8. Western Blot
9. Southern Blotting

Total hours to be taught: 27

Lab Manual:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
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<td>0 0 3 2 50 50 100</td>
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</table>

Objective(s): Educate the theoretical concepts of Bioseparation experimentally to the students

(Any 7 experiments)

1. Media Optimization – Plackett Burman design
2. Media Optimization – Response surface methodology
3. Preparation of bioreactor, utilities of bioreactor operation
4. Thermal Death Kinetics
5. Batch Sterilization
7. Fed Batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
8. Total cell retention Cultivation, exhaust gas analysis – carbon balancing, gas balancing

Total hours to be taught: 24

Lab Manual:
<table>
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<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
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Objective(s): To develop skills of the students in the area of Enzyme Engineering

(Any 9 experiments)

1. Isolation of Intracellular Enzyme from Fungi
2. Isolation of Extracellular Enzyme from Bacteria
3. Enzyme Assay - Protease
4. Enzyme Kinetics - Michaelis-Menton parameters
5. Acid phosphates activity – Effect of different temperature and pH
6. Acid phosphates activity – Effect of different substrates
7. Enzyme immobilization - Gel entrapment by sodium alginate
8. Enzyme immobilization - Cross Linking
9. Enzyme inhibition Kinetics
10. Production of α amylase, Invertase and Cellulase

Total hours to be taught: 30

Lab Manual:

# K.S.Rangasamy College of Technology - Autonomous Regulation R 2007

## Department
Biotechnology

## Programme Code & Name
23: B.Tech. Biotechnology

### Semester V

<table>
<thead>
<tr>
<th>Course Code</th>
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<td>COMPREHENSION IV</td>
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**Objective(s)**

1. To improve the skill level of Engineering, Technology and Applied Science students.
2. 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

<table>
<thead>
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<tr>
<td>W10</td>
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<td>S2(3)</td>
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</table>

- Test-I (Portion: 3 units in each subject)
- Test-II (Portion: 2 units in each subject)
- Discussion
- Test-III (All 5 units and all the subjects)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
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<tr>
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Objectives:
1. To improve the skill level of Engineering, Technology and Applied Science students.
2. To improve the employability of students in placement interviews

Skills sets to be improved:
- **Aptitude skills**
  - Arithmetic ability
  - Verbal Reasoning
  - Non verbal Reasoning
- **Programming skills**
  - C language
  - OOPS concepts and C++ (BT, EEE, ECE, CSE, IT)
  - Data Structures (BT, EEE, ECE, CSE, IT)
- **Written Communication Skills**
  - Comprehension
  - Grammar
  - Essay Writing
  - Technical Report Writing
  - Technical paper Writing
- **Oral Communication Skills**
  - News Reading
  - Informing a News item
  - Self introduction
  - 2 minutes talk – Informed
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- **Technical Paper Presentation**
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  - Debate
  - Group Discussion – Informed Topic
  - Group Discussion – Topic on the spot
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  - Basic MPC knowledge
  - Broad Knowledge of the branch
  - Indepth knowledge on specific subjects of interest
- **HR Interview Skills**
  - Adoptability
  - Creativity
  - Flexibility
  - Achievement orientation
  - Continuous learning
  - Hardworking nature
  - Decisiveness
  - Self development
  - Questioning

Focus:
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).

Execution:
- 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.
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<td>Evaluation III - Oral</td>
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</table>

<p>| Evaluation | Evaluation I   | 60 marks (average of 3 tests) |
|    | Evaluation II | 20 marks                   |
|    | Evaluation III | 20 marks                  |
| Total |                  | 100 marks                 |</p>
<table>
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</table>

Objectives: To create an awareness on Ethics and Human Values and instill Moral and Social Values in Students.

1 INTRODUCTION

2 ENGINEERING AS SOCIAL EXPERIMENTATION

3 ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

4 RESPONSIBILITIES AND RIGHTS

5 GLOBAL ISSUES

Text book:


References:


### IMMUNOLOGY

**Course Code**: 07230602C  
**Course Name**: IMMUNOLOGY  
**Credit**: 4  
**Maximum Marks**: 50  
**Total**: 100

**Objective(s)**: To introduce the concept of immune response in a mammalian host thereby emphasize their significance in innovation in developing therapeutic modalities for immunological disorders of humans, to orient the students to the biology of the immune system.

#### 1. THE CELLS OF IMMUNE SYSTEM

- 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.

**Total Hrs**: 09

#### 2. HUMORAL IMMUNITY

- 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.

**Total Hrs**: 09

#### 3. CELLULAR IMMUNITY

- 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.

**Total Hrs**: 09

#### 4. IMMUNITY TO INFECTION AND HYPERSENSITIVITY REACTIONS

- 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.

**Total Hrs**: 09

#### 5. IMMUNOLOGY OF TUMORS, AUTOIMMUNITY AND TRANSPLANTATION

- Transplantation: types, immunological mechanisms of graft rejection- immunological strategies to prevent graft rejection- role of immuno-suppressive drugs. 
- Auto-immunity: HLA alleles and disease susceptibility- an overview of the immuno-pathogenic mechanisms of auto-immunity- therapeutic approaches. 
- Tumors: Immune response to tumors- type of tumor antigens.

**Total hours to be taught**: 45

**Text book(s)**:


**Reference(s)**:

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Hours / Week</th>
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<tbody>
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</tbody>
</table>

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 delocalised $pi$ 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) :

Reference(s) :
### K.S. Rangasamy College of Technology - Autonomous Regulation

**R 2007**

**Department**: Biotechnology  
**Programme Code & Name**: 23 : B.Tech. Biotechnology

### Semester VI

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>07230604C</td>
<td>PROTEIN ENGINEERING</td>
<td>3 0 0 3</td>
<td>50 50</td>
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</table>

| 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  

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  

4. **STRUCTURE-FUNCTION RELATIONSHIP**  
   Total Hrs 15  

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):**


**Reference(s):**

## Course: IMMUNOLOGY LABORATORY

### Course Code: 07230607P

**Course Name:** IMMUNOLOGY LABORATORY

<table>
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<tr>
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<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum marks</th>
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### Objective(s)

1. To develop skills of the students in the area of Immunology
2. 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)

## BIOINFORMATICS LABORATORY

### Course Code: 07230608P
### Course Name: BIOINFORMATICS

<table>
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<tr>
<th>Hours / Week</th>
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### Objective
At the end of the course, the student would have gained knowledge about the various aspects of Bioinformatics.

(Any 10 experiments)

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<thead>
<tr>
<th>Experiment</th>
<th>Total Hrs</th>
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<tbody>
<tr>
<td>1. Office Automation</td>
<td>3</td>
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<tr>
<td>a. Newspaper Printing.</td>
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<tr>
<td>b. Course Details – Power Point Presentation.</td>
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<td>c. Chat handling.</td>
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<tr>
<td>2. Basic Unix Commands</td>
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<tr>
<td>3. Biological database.</td>
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<tr>
<td>4. Sequence Alignment.</td>
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<tr>
<td>a. Pairwise Alignment</td>
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<td>b. Multiple sequences Alignment.</td>
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<td>Clustal X</td>
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<td>5. Phylogenetic Analysis</td>
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<td>Phylip.</td>
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<td>6. Structure Visualization Tools.</td>
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<tr>
<td>Rasmol, SPDB Deep Viewer.</td>
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<tr>
<td>7. Structural Alignment.</td>
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<td>8. Homology Modeling</td>
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<td>SPDB Deep Viewer.</td>
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<td>9. Structure Prediction.</td>
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<td>Modeller 7v7</td>
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<td>10. Docking</td>
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<tr>
<td>Hex Tool.</td>
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Total hours to be taught: 33
### K.S. Rangasamy College of Technology - Autonomous Regulation

<table>
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</table>

#### Objective (s)

Educate the theoretical concepts of Bioseparation experimentally to the students

(Any 10 experiments)

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<tr>
<th>Experiment</th>
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<td>1. Production of Citric acid</td>
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<td>2. Production of ethanol from yeast</td>
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<td>3. Production of wine from black grapes</td>
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<td>4. Production of Bear from cereals</td>
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<td>5. Production of Protease</td>
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<tr>
<td>6. Production of Antibiotics using Streptomycin species</td>
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<td>7. Production of Vitamins</td>
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<td>8. Production of growth regulators</td>
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<tr>
<td>9. Production of Biofertilizers(N – Fixers &amp; P - Solubilizers)</td>
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<td>10. Production of Biocontrol Agents</td>
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<td>11. Production of Single cell Protein (Spirulinea)</td>
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<td>12. Production of Vermicompost</td>
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Total hours to be taught: 36

#### Reference (s)

<table>
<thead>
<tr>
<th>Week No</th>
<th>Duration: 1½ period Subject No (No of units)</th>
<th>Duration: 1½ period Subject No (No of units)</th>
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<td>W3</td>
<td>S5(3)</td>
<td>S6(3)</td>
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<td>W4</td>
<td>Test-I (Portion: 3 units in each subject)</td>
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<td>W5</td>
<td>S1(2)</td>
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<td>W7</td>
<td>S5(2)</td>
<td>S6(2)</td>
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<td>W8</td>
<td>Test-II (Portion: 2 units in each subject)</td>
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<td>W9</td>
<td>Discussion</td>
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<td>W10</td>
<td>Test-III (All 5 units and all the subjects)</td>
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</table>
### Semester VI

<table>
<thead>
<tr>
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</tbody>
</table>

#### Objective(s)

1. To improve the skill level of Engineering, Technology and Applied Science students.
2. To improve the employability of students in placement interviews.

#### Skills sets to be improved

- **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

### Focus

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).

### Execution

- 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.
<table>
<thead>
<tr>
<th>Schedule</th>
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<th>Activity</th>
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<tr>
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<td>6</td>
<td>Evaluation II - Written</td>
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<td>Evaluation II - Oral</td>
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<td>Training</td>
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<td></td>
<td>9</td>
<td>Evaluation III - Written</td>
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<td>10 - 12</td>
<td>Evaluation III - Oral</td>
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</table>

| Evaluation | Evaluation I | 60 marks (average of 3 tests) |
|           | Evaluation II | 20 marks                     |
|           | Evaluation III | 20 marks                    |
|           | Total          | 100 marks                    |
## Course Code: 07230701G
### Course Name: TOTAL QUALITY MANAGEMENT

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**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.

### 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.**

### TQM PRINCIPLES

- **Total Hrs:** 9

### 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.**

### TQM TOOLS

- **Total Hrs:** 9

### QUALITY SYSTEMS

- **Total Hrs:** 9

### Total hours to be taught: 45

**Text book (s):**

**Reference(s):**
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Hours / Week</th>
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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 Solubilization, 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

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):

Reference(s):
### PLANT BIOTECHNOLOGY

<table>
<thead>
<tr>
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<td>PLANT BIOTECHNOLOGY</td>
<td>3 0 0 3</td>
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</table>

**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

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

**Total Hrs:** 08

#### 2. CHLOROPLAST & MITOCHONDRIA

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

**Total Hrs:** 10

#### 3. NITROGEN FIXATION

Nitrogenase activity, nod genes, nif genes, bacteroids.

**Total Hrs:** 10

#### 4. AGROBACTERIUM & VIRAL VECTORS


**Total Hrs:** 09

#### 5. APPLICATION OF PLANT BIOTECHNOLOGY

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

**Total Hrs:** 08

**Total hours to be taught:** 45

### Textbook(s):


### Reference(s):

### ANIMAL BIOTECHNOLOGY

#### Course Code: 07230704C

**Course Name:** ANIMAL BIOTECHNOLOGY  
**Credit:** 3  
**Total Hrs:** 08

**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.

**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.**

---

### 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.**

---

### 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.**

---

### 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.**

---

### 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):**


**Reference(s):**

## DOWN STREAM PROCESSING LABORATORY

**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

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Total hours to be taught **24**

### Reference(s):**

### K.S. Rangasamy College of Technology - Autonomous Regulation R 2007

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Hours / Week</th>
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</table>

**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 diagnosis 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):**

## Objectives

1. To improve the skill level of Engineering, Technology and Applied Science students.
2. To improve the employability of students in placement interviews.

### For each subject

- 200 Keywords/important words or terms (5 units x 40 words) are to be prepared using the students.

### 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.

### The staff who handled the subject in the previous semester will handle their discussion period

- As given below.

### The staff will question the students using ‘W’ and ‘H’ type questions linking the keywords.

### 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.

## Schedule for Conduct of Comprehension Subject

<table>
<thead>
<tr>
<th>Week No</th>
<th>Duration: 1½ period Subject No (No of units)</th>
<th>Duration: 1½ period Subject No (No of units)</th>
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<tr>
<td>W1</td>
<td>S1(3)</td>
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<td>W2</td>
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<td>W3</td>
<td>S5(3)</td>
<td>S6(3)</td>
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<tr>
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<td>W5</td>
<td>S1(2)</td>
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<td>W8</td>
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<td>Test-II (Portion: 2 units in each subject)</td>
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<tr>
<td>W9</td>
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<td>Discussion</td>
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<tr>
<td>W10</td>
<td></td>
<td>Test-III (All 5 units and all the subjects)</td>
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</tbody>
</table>
### 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.

### Skills sets to be improved

#### 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

### Focus

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).

### Execution

- **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.

### Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1</td>
<td>Training</td>
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<td>3</td>
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<td>4</td>
<td>Evaluation I - Oral</td>
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<tr>
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<tr>
<td>6</td>
<td>Evaluation II - Written</td>
</tr>
<tr>
<td>7</td>
<td>Evaluation II - Oral</td>
</tr>
<tr>
<td>8</td>
<td>Training</td>
</tr>
<tr>
<td>9</td>
<td>Evaluation III - Written</td>
</tr>
<tr>
<td>10-12</td>
<td>Evaluation III - Oral</td>
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</tbody>
</table>

Evaluation:
- Evaluation I: 60 marks (average of 3 tests)
- Evaluation II: 20 marks
- Evaluation III: 20 marks
- Total: 100 marks
## Course Code: 07230801C
### Course Name: BIOPHARMACEUTICAL TECHNOLOGY
<table>
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<tr>
<th>Hours / Week</th>
<th>Credit</th>
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**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.

<table>
<thead>
<tr>
<th>1</th>
<th>INTRODUCTION TO PHARMACOLOGY</th>
<th>Total Hrs</th>
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<tr>
<td>2</td>
<td>DRUG DISCOVERY</td>
<td>Total Hrs</td>
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<tr>
<td>3</td>
<td>PHARMACOKINETICS AND BIOTRANSFORMATION</td>
<td>Total Hrs</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>PHARMACEUTICAL DOSAGE FORMS AND APPLICATIONS</td>
<td>Total Hrs</td>
<td>08</td>
</tr>
<tr>
<td>5</td>
<td>BIOPHARMACEUTICALS</td>
<td>Total Hrs</td>
<td>09</td>
</tr>
</tbody>
</table>

- **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.**
- **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.**
- **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.**
- **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**
- **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):**

**Reference(s):**
## Course Code: 07230541E
### Course Name: ENVIRONMENTAL BIOTECHNOLOGY

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**Objective(s):** To develop skills of the students in the area of Environmental Biotechnology and its prerequisite for PG studies in Biotechnology.

### ENVIRONMENTAL POLLUTION

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.

<table>
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<tr>
<th>Total Hrs</th>
<th>09</th>
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</table>

### SOIL FORMATION

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.

<table>
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<tr>
<th>Total Hrs</th>
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</table>

### SOIL MICROBIOLOGY

Microbial Flora of Soil-Microbial Growth-Ecological Adaptations of Microorganisms-Soil enzymes(Phosphatase,Cellulase,Urease and Dehydrogenase)and their role in nature-Soil microbial population and their importance.

<table>
<thead>
<tr>
<th>Total Hrs</th>
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### BIODEGRADATION


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<th>Total Hrs</th>
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</table>

### BIOREMEDIATION

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):**


2. Foster, C.F., John Ware, D.A. 1987. Environmental Biotechnology, Ellis Horwood Ltd.

**Reference(s):**


<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>07230542E</td>
<td>GENOMICS AND PROTEOMICS</td>
<td>L 3  T 0  P 0  C 3  CA 50  CA 50  ES 50  ES 100</td>
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</table>

**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):**


**Reference(s):**


### Course Code: 07230543E

**Course Name:** VIROLOGY

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#### Objective(s)

At the end of the course the students should have the complete knowledge of Viruses, its classifications and infections caused by viruses.

### Semester III

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<tr>
<th>Course Code</th>
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<th>Hours / Week</th>
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<tbody>
<tr>
<td>07230543E</td>
<td>VIROLOGY</td>
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</table>

#### INTRODUCTION

Total Hrs: 9

- General properties
- Classification
- Cultivation
- Isolation and Identification of viruses
- Serodiagnosis and Molecular diagnosis of viral infection.

#### VIRAL VACCINES

Total Hrs: 9

- Pox viruses – Variola, vaccines. Herpes viruses – Herpes simplex, Varicella zoster, Cytogaloivirus, Epstein Barr virus.
- Adeno viruses – Hepatitis viruses, Papova viruses – Papiloma, Polyoma – Parvo virus.

#### VIRUSES DIFFERENT TYPES

Total Hrs: 9


#### PATHOGENIC VIRUSES

Total Hrs: 9


#### MODERN METHODS OF ANIMAL CARE

Total Hrs: 9

- Morden methods of care, management, breeding and maintenance of lab animals – rabbits, mic, rats, guinea pigs. Laboratory uses of animlas with reference to Microbiology, anybody production. Gnotobiatic animals. Disposal of animal house wastes.

Total hours to be taught: 45

#### Text book(s):


#### Reference(s):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
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Objective(s)

At the end of the course, the student would have learnt about molecular structures of biological systems, cell permeability and conformation of protein and nucleic acid. This course facilitates the students to take specialization in computational biology.

**1 MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEM**

Total Hrs: 9


**2 CONFORMATION OF NUCLEIC ACID**

Total Hrs: 9


**3 CONFORMATION OF PROTEINS**

Total Hrs: 9


**4 CELLULAR PERMEABILITY AND ION TRANSPORT**

Total Hrs: 9


**5 ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS**

Total Hrs: 9


Total hours to be taught: 45

Text book(s):


Reference(s):

## K.S.Rangasamy College of Technology, Autonomous Regulation R 2007


#### Semester VI

<table>
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<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
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<td>FOOD PROCESSING TECHNOLOGY</td>
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**Objective(s)**

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

1. **PRINCIPLES OF FOOD PROCESSING**  
   Total Hrs 9
   - Scope and importance of food processing - Principles and methods of food preservation – Types of Sterilization, Pasteurization, Canning, and blanching - Freezing, Refrigeration, dehydration, additives, and irradiation

2. **TYPES OF FOOD PROCESSING AND PRESERVATION**  
   Total Hrs 9
   - Fruit and vegetable Technology – Preservation of fruits and vegetables by heat, chemicals, sugar, salt, fermentation, drying etc.; Technology of milk and milk products - processing of market milk, Milk product processing - cheese, butter, ice cream - Processing of meat and meat product. cereal and legume technology – rice, wheat - products – bread making etc.,

3. **FOOD BIOTECHNOLOGY**  
   Total Hrs 9
   - Current status of food processing industries- application of Biotechnology to food production. Genetically modified foods; microorganisms as food - Single cell protein - Technological aspects of industrial production of beer and wine, Applications of enzymes in food processing industry.

4. **FOOD MICROBIOLOGY**  
   Total Hrs 9
   - Microbial growth pattern, Factors influencing the growth of microorganisms. Types of microorganism normally associated with food, mold, yeast and bacteria. Food spoilage -Factors responsible for food spoilage; food infections and food intoxication

5. **FOOD QUALITY ASSURANCE**  
   Total Hrs 9
   - Food safety - Agencies that control food supply; National and International guidelines. Food adulteration and food safety. Sensory analysis in quality control, Food laws and standards, Safety measures.

Total Hours to be Taught 45

**Text book (s):**


**Reference(s):**

### MARINE BIOENGINEERING

#### 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.

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<th>Course Code</th>
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<td>MARINE BIOTECHNOLOGY</td>
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</table>

#### INTRODUCTION TO MARINE MICROBES IN THE OCEAN

- 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 mitigate environmental deterioration.

#### BIOTECHNOLOGY OF AQUATIC ANIMALS

- Shellfish and Crustacean Culture: Aquaculture - shrimps, edible mussels, pearl oyster, crabs
- Fish Physiology - reproductive genetics: gynogenesis, androgensis, polyploidy, control of sex, artificial insemination, eye stalk ablation
- Development of Healthy Fish Diets, Disease Prevention in Fish and GM fish and shellfish - Disease resistance in marine animals and DNA Vaccine development for aquacultured fish - gene banks, cryopreservation
- Isolation and characterization of biosynthetic gene clusters, the cloning and expression of the genes in recombinant systems, mariculture and aquaculture of marine invertebrates such as bryozoans, sponges, and tunicates
- Isolation, cultivation and fermentation of microorganisms from their invertebrate hosts.

#### BIOMEDICAL IMPORTANCE OF MARINE ORGANISMS

- 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

#### BIOMATERIALS AND BIOPROCESSING

- Polymers & biomaterials: agarose, agar, alginate, carrageenans, chitin, chitosan, carotenoids, heparin, marine flavourants: environmentally friendly anti-fouling compounds Biopotential uses of halophilic organisms
- Role of halophilic bacteria and archaea in salt purification.

#### ENVIRONMENTAL IMPACTS OF AQUATIC BIOTECHNOLOGY

- Control of oil spills and bioremediation - viral therapy
- Genetically Engineered Marine Organisms: Environmental and Economic Risks and Benefits

Total hours to be taught: 45

Textbook(s):

Reference(s):
<table>
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<tr>
<th>Course Code</th>
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<td>07230653E</td>
<td>METABOLIC ENGINEERING</td>
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</table>

**Objective(s)**
The student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.

1. **INTRODUCTION**

Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feedback regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feedback regulation, cumulative feedback regulation, amino 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**

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

3. **BIOSYNTHESIS OF SECONDARY METABOLITES**

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

4. **BIOCONVERSIONS**

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

5. **REGULATION OF ENZYME PRODUCTION**

Strain selection, improving fermentation, recognising growth cycle peak, induction, feedback repression, catabolite repression, mutants resistant to repression, gene dosage.

**Total hours to be taught**: 45

**Textbook(s)**:


**Reference(s)**:

K.S.Rangasamy College of Technology - Autonomous Regulation  
Department: Biotechnology  

Course Code: 07230654E  
Course Name: BIOTECHNOLOGY OF STEM CELLS

<table>
<thead>
<tr>
<th>Hours / Week</th>
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<td>3 0 0 3 50 50 100</td>
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Objective(s): At the end of the course the students will have enough knowledge about the stem cell research methodologies.

1. ORIGIN OF HUMAN STEM CELLS  
Origin and characterisation of human stem cells and potential applications for stem cell research. Origin and characterisation of human stem cells, plasticity of human somatic stem cell research, novel stem cell based therapies, scientific and technical obstacles to overcome before realising the potential clinical use of novel human stem cell based therapy, cord blood, stem cell marker

2. HUMAN EMBRYONIC STEM CELL RESEARCH  
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.

3. PROTOCOLS FOR ISOLATION AND IDENTIFICATION OF STEM CELLS  
Preparation of complete neuroculture, culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astrocytes and oligodendrocytes; Immuno labeling procedure

4. GENE THERAPY  
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.

5. TISSUE ENGINEERING  
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

Total hours to be taught: 45

Textbook(s):  

Reference(s):  
# CHROMATOGRAPHIC SEPARATIONS

<table>
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<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
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### 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.

### Course Content

1. **INTRODUCTION**
   - 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.
   - Total Hrs: 12

2. **CLASSICAL CHROMATOGRAPHY**
   - Stationary and mobile phases, applications of ion exchange size exclusion, Thin layer chromatography (TLC), High performance thin layer chromatography (HPLC) and HPTLC.
   - Total Hrs: 07

3. **HIGH PERFORMANCE LIQUID CHROMATOGRAPHY**
   - Total Hrs: 10

4. **GAS CHROMATOGRAPHY**
   - Total Hrs: 10

5. **TYPES OF CHROMATOGRAPHY**
   - Total Hrs: 12

### Textbooks


### References

## Course Details

**Course Code**: 07230656E  
**Course Name**: DEVELOPMENTAL BIOLOGY

<table>
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<tr>
<th>Hours / Week</th>
<th>Credit</th>
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**Objective(s)**: At the end of the course the student will have enough knowledge about theoretical embryology and practical embryology.

### 1. PRINCIPLES OF DEVELOPMENTAL BIOLOGY
- 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
- Fertilization; early development in invertebrates and vertebrates; case study: Drosophila, frog.

### 3. LATER EMBRYONIC DEVELOPMENT
- Ectoderm, Mesoderm, Endoderm, development of tetrapod limb, sex determination, metamorphosis, regeneration, ageing.

### 4. RAMIFICATIONS OF DEVELOPMENTAL BIOLOGY
- 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
- 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

**Textbook(s)**:

**Reference(s)**:
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credit</th>
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<tr>
<td>07230761E</td>
<td>IMMUNOTECHNOLOGY</td>
<td>L 3, T 0, P 0, C 3</td>
<td>CA 50, ES 50</td>
<td>Total 100</td>
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</table>

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 ferritin 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 idiotypic 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 |


Total hours to be taught 45

Text book(s):

Reference(s):
# K.S. Rangasamy College of Technology - Autonomous Regulation

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<table>
<thead>
<tr>
<th>Department</th>
<th>Biotechnology</th>
<th>Programme Code &amp; Name</th>
<th>23 : B.Tech. Biotechnology</th>
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### Syllabus

#### Semester VII

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours / Week</th>
<th>Credit</th>
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<tr>
<td>07230762E</td>
<td>DAIRY AND BAKERY TECHNOLOGY</td>
<td>3 L 0 T 0 P 3 C</td>
<td>50 CA 50 ES</td>
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**Objective(s)**
At the end of the course the students would have learnt about Science of Technology of food processing particularly in Bakery and Dairy technology which could develop entrepreneurial strength among them.

1. **INTRODUCTION TO BAKERY AND DAIRY TECHNOLOGY**
   - Total Hrs: 09
   - Current status, growth rate, and economic importance of Bakery and Dairy Industry in India. Product types, Equipments used, product quality characteristics, faults and corrective measures for Bakery and Dairy Technology - Defining and assessing quality of ingredients & products...

2. **TECHNOLOGY OF BREAD MAKING**
   - Total Hrs: 09
   - Plant layout of a bakery. Ingredients & processes for bread making - Characteristics of yeast; Wheat flour - treatments – Grade and ageing of flour – Tests for flour quality; Method and Steps involved in Processing – Characteristics of good bread; Defects, causes and remedies.

3. **BAKERY PRODUCTS**
   - Total Hrs: 09
   - Cakes-Different types of cake making processes; Sugar batter method; Flour batter method; Modified sugar batter method; Whipping and Blending method. Importance of baking time and temperature; Biscuits -Fermented dough biscuits, Cookies, Cream biscuits, Pastry-Short crust ; Puff Flaky, Defects, causes and remedies in Cakes .Biscuits and Pastry products

4. **MILK PROCESSING TECHNOLOGY**
   - Total Hrs: 09
   - Physicochemical characteristics of milk and factors affecting them. Production, collection, Standardization, processing, cooling, storage, transportation, of liquid milks. quality assessing of milk in dairy industry-detection of adulteration, determination of price of the milk

5. **TYPES OF MILK PRODUCTS**
   - Total Hrs: 09
   - Methods of preparation/production, quality grading parameters, packaging, storage characteristics, uses and shelf-life of cream, butter; evaporated , condensed and skimmed, instants milk powders, Ice-Creams, cheeses, and other milk products

**Total Hours Taught:** 45

**Text book (s):**

**Reference(s):**
1. Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.
## Course Details

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<th>Hours / Week</th>
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<td>07230763E</td>
<td>NANOSCIENCE AND TECHNOLOGY</td>
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### Objective(s)
At the end of the course, the students would have gained extensive knowledge in Nanobiotechnology, involvement macromolecules in nanobiotechnology, application in drug delivery, cancer treatment.

1. **INTRODUCTION TO NANOBIOTECHNOLOGY**
   - Total Hrs: 9
   - Introduction to nanobiotechnology-micro and nanosystems and technologies; overview of nanodevices and techniques. Synthesis and characterization of nanoscale materials-strategies for nanoarchitecture (topdown and bottom up approaches) - fabrication technologies and characterization – self assembly systems.

2. **SYNTHESIS OF NANOPARTICLES**
   - Total Hrs: 9

3. **NANOMOLECULES IN BIOSYSTEMS**
   - Total Hrs: 9

4. **USE OF MICROORGANISMS IN NANOBIOTECHNOLOGY**
   - Total Hrs: 9

5. **APPLICATION OF NANOBIOTECHNOLOGY**
   - Total Hrs: 9

### Total Hours Taught
- 45

### Textbooks
2. Bernard H.A Relim - Microbial Bionanotechnology

### References
## Course Code: 07230764E

### Course Name: FOOD BIOCHEMISTRY AND NUTRITION

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**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.

### Semester VII

#### 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.

**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.

**Total Hrs:** 09

#### Metabolism of Macronutrients

- **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.

**Total Hrs:** 09

#### Overview of Micronutrients

- **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, Ca) and those of unique interest (Al, Cr, Pb).

**Total Hrs:** 09

#### Nutrition & Disease

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):**

2. Food :Facts and Principles-N. Shakuntala Manay, N.Shadksharawamis

**Reference(s):**

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<td>BIOINSTRUMENTATION</td>
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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**
   - 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 ratio, 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**
   - Vibration (different models, di and poly atomic): frequency, wave number, Hook’s law, Instrumentation, vibration-rotation spectrum of CO₂, 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 Biomolecules.

3. **LIGHT WAVES**
   - 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**
   - 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**
   - 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).

Text book(s) :

Reference(s) :
## Semester VII

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<td>CLINICAL MANAGEMENT</td>
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### Objective(s)
At the end of the course the students will have a complete knowledge of Ethical guidelines, clinical trials and clinical researches.

1. **ETHICAL GUIDELINES**
   - 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.
   - Total Hrs 9

2. **STATISTICS AND PROBABILITY**
   - Total Hrs 9

3. **CONTACT RESEARCHES**
   - Total Hrs 9

4. **CLINICAL TRIALS**
   - Total Hrs 9

5. **TECHNICAL PRESENTATION**
   - 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 for conducting clinical – outsourcing trends.
   - Total Hrs 9

**Total Hours Taught**: 45

**Text book (s)**:

**Reference(s)**:
1. 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.
## Semester VIII

<table>
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<tr>
<th>Course Code</th>
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<td>TISSUE ENGINEERING</td>
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### Objective(s)
At the end of the course the students will have enough knowledge of tissue engineering.

1. **INTRODUCTION TO TISSUE ENGINEERING**
   - Basic definition; current scope of development; use in therapeutics and in vitro testing
   - Total Hrs: 9

2. **STRUCTURE AND ORGANIZATION OF TISSUES**
   - Epithelial, connective; vascularity, lymph. Basic developmental biology
   - Total Hrs: 9

3. **TRANSPORT PROPERTIES OF TISSUES**
   - Introduction to mass transfer, Diffusion of simple metabolites, Diffusion & reaction of proteins
   - Total Hrs: 9

4. **GENERAL ASPECTS OF CELLS IN CULTURE**
   - 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
   - Total Hrs: 9

5. **STEM CELLS**
   - 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 Hrs: 9

**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".
### Course Code: 07230882E

**Course Name:** MOLECULAR PHYLOGENY

**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.

**Total Hours:** 9

#### Course Details

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#### Overview

Historical perspective – discovery of microscope, Louis Pasteur’ contributions, Robert Koch’s postulates, early discoveries of microbial toxins, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, various pathogens types and modes of entry.

#### Host – Defense Against Pathogenesis and Pathogenic Structures

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.

#### Molecular Pathogenesis (with Specific Examples)

Virulence, virulence factors, virulence – associated factors and virulence life style factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio cholerae, cholera toxin, coregulated pili, filamentous phage, survival E.Coli, Pathogens: Enterotoxigenic E.Coli (ETEC) labile and stable toxins, Entero – pathogenic E.Coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment: Enterohaemorhogenic 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.

#### Experimental Studies on Host – Pathogenic Interactions

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

#### Modern Approaches to Control Pathogens

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

**Total hours to be taught:** 45

**Textbook(s):**


**Reference(s):**

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<td>CANCER BIOLOGY</td>
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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

3. **PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER**
   - Total Hrs: 09

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):

Reference(s):