

## **ST JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)**

VISAKHAPATNAM

### **Department of Biotechnology**

The Department of Biotechnology, St. Joseph's College for Women (A) seeks to serve BSc Programme students interested in careers related to Biotechnology. The department offers Biotechnology in only one combination i.e. BBC of BSc programme. In order to cater to the diverse interests of students and employers, a total of 07 theory and 07 practical courses are offered as part of Biotechnology domain in the combination.

### **Programme Specific Outcomes of BSc Programme with Biotechnology**

**PSOs :** Students after graduating with Biotechnology as one of the core subjects will:

**PSO 1:** Proficient to exhibit basic knowledge in the core areas of biotechnology (cell biology and genetics, techniques in biotechnology, molecular biology, microbiology, genetic engineering, plant and animal biotechnology, industrial, medical agricultural and environmental biotechnology).

**PSO 2:** Be versatile in classical laboratory techniques, use instrumental methods for analysis as well as synthesis and follow standardized procedures and regulations in handling and disposal of biological samples.

**PSO 3:** Be able to access, explore and use the standard biology manuals and also able to be a constituent of the team.

**PSO 4:** Proficient in knowledge generation and gained logical approach in Biotech filed of General education courses.

## **Assessment Methodology**

**PSO 1: Proficient to exhibit basic knowledge in the core areas of biotechnology (cell biology and genetics, techniques in biotechnology, molecular biology, microbiology, genetic engineering, plant and animal biotechnology, industrial, medical agricultural and environmental biotechnology).**

Direct method of computing PSO 1 attainment is based on the student performance in all assessment instruments namely online and offline - subjective and objective tests for all the courses offered (BTH 1701, BTH 2701, BTH 3701, BTH 4701, BTH 5701, BTH 5702, BTH 6701). These exams assess student's learning at knowledge, understanding and application

levels in the respective courses. Indirect method of computing PSOs is done through student's course exit survey wherein a structured questionnaire is administered to the students and their response is solicited on a 5 point scale. Responses are consolidated and students' satisfaction level with reference to course transaction is computed.

### **Level of attainment measurement**

Level of attainment of course outcomes includes both direct and indirect assessments. Direct assessment is done by testing the knowledge and/or skills of the student in that course by conducting standardised examinations. In indirect assessment we use the student feedback on course which is measured on 5 point scale. The sum of these two assessments is shown as the level of attainment of that course.

**Assessment of all the theory courses** is done in two parts, namely by formative assessment (40%) which is internal and summative assessment (60%) which is external. The evaluation of 100% of the assessment in each semester is distributed as follows:

Mid Semester Examination 1	15% (which is offline)	Mid Semester Examination 2	15%
(which is online)			
Accessory Assessment	5% (written quiz, Assignment etc.)	Attendance	5%
(above 75% attendance will be rewarded)		End semester examination	60%
(which is descriptive)			

**Level of attainment of PSO1 (all theory courses offered by the department): 85.43%**

**PSO 2: Be versatile in classical laboratory techniques, use instrumental methods for analysis as well as synthesis and follow standardised procedures and regulations in handling and disposal of biological samples.**

PSO 2 attainment level is ascertained based on summative assessment (at the end of) in every semester. This direct assessment involves testing student's knowledge on standardised procedures, their skill in executing them and their compliance with regulations in handling and disposal of biological samples in the conduct of all the laboratory courses (BTH 1751, BTH 2751, BTH 3751, BTH 4751, BTH 5751, BTH 5752, BTH 6751).

**Assessment of all the practical courses:** Assessment is done in two parts, namely by mid semester examination (40%) and end semester examination (60%). In mid semester examination, about 50% of practicals are being conducted to assess the student knowledge. Where as in end semester examination, the total portion of the practical will be conducted. Assessment of examinations will be based on the result oriented unknown sample analysis.

Further, written record of experimental work carried out throughout the semester is also assessed.

**Level of attainment PSO2 (all practical courses offered by the department): 89.65%**

**PSO 3: Be able to access, explore and use the standard biology manuals and also able to be a constituent of the team.**

Attainment of PSO 3 is ascertained through the practical course BTH 5751 by assessing summer project study as different areas of biotechnology. This summer project work provides an opportunity for the student to gain hands on experience in sophisticated instrumentation related to biotechnology theory and practical coursework. Students choose one topic for study, based on their own interest. Like minded students form teams of 4 to 5 members and plan & execute the task. The study is followed by collective report submission and individual seminar. Attainment of this learning outcome is ensured and assessed by the concerned faculty member at every stage through direct as well as indirect guidance and monitoring.

**Assessment of Project work:** Summer project work is being carried out as the students are sent to various industries/hospitals and R & D labs of nearby, as their choice as in BTH 5701 BTH 5702. The faculty members assess through direct and indirect guidance and monitoring (Content in the report and seminars).

**Level of attainment in all the projects done by the students: 95.0%**

**PSO 4: Proficient in knowledge generation and gained logical approach in Biotech filed of General education courses.**

Assessment of this learning outcome is largely done through the undergraduate general education course namely Environmental Science. These courses provide various approaches for the students to apply biological knowledge to understand the cause and identify the solution to environmental problems. Direct method of computing PSO 4 attainment is based on the student performance in all assessment instruments namely summative tests in course on environment as well as a report on the study on environmental issues. Average percentage of level of attainments of this course is given below.

**Assessment of Environmental Science:** The evaluation of 100% of the assessment in environmental science is distributed as follows:

Continuous assessment involving field study, written test, presentation of project findings etc. 30% Participation & Involvement in the course 10% (above 75% attendance will be rewarded)

End semester examination 60% (which is descriptive)

**Level of attainment in Environmental science done by the students: 88.5%**

Course outcomes of all the courses offered by biotechnology department

Code	Title of the paper	Outcomes
BTH 1701 (3) (Th.)	Cell biology and Genetics	<p><b>CO1:</b> Acquire the basic through knowledge in innovative approaches in Biotechnology.</p> <p><b>CO2:</b> Able to learn the principles and applications of microscopy, and their importance in enumeration of microbial life processes.</p> <p><b>CO3:</b> Obtain knowledge on the basic structure and all the way through morphological appendages of a microbial cell</p> <p><b>CO4:</b> Understand the structural rigidity of gram +ve &amp; gram -ve, as well as endospores.</p> <p><b>CO5:</b> Comprehensive insight about cell organelles and able to differentiate prokaryote and eukaryote.</p> <p><b>CO6:</b> Be aware of the concepts of cell cycle viz., stage of both mitosis &amp; meiosis.</p> <p><b>CO7:</b> Improve the classical genetics and modern genetics thorough Mendal principles.</p> <p><b>CO8:</b> Able to signify the deviated mendal ratios can influence the number of genes at single locus.</p> <p><b>CO9:</b> Be well-informed on recombination and sex determination; long chromosomes and jumping genes.</p> <p><b>CO10:</b> Well attentive of statistical population, sampling methods, data representation, measures of variability, standard deviation, standard error, range, mean, mode and median, ANOVA, Chi square test etc.</p>
Level of attainment of CO1 to CO10: 85.1%		
BTH 1751 (2) (Pr.)	Cell biology & Genetics	<p><b>CO1:</b> Be trained in Microscope usage and function.</p> <p><b>CO2:</b> Accomplish expertise in slide preparation and capable to study the karyotype.</p> <p><b>CO3:</b> Analyse hereditary data and apply fundamental coupling analyses and genetic calculations; Apply critical thinking and logical analysis in the assessment and</p>

		<p>evaluation of issues in cell biology and genetics.</p> <p><b>CO4:</b> Be able to integrate the statistical skill to any kind of population studies.</p>
Level of attainment of CO1 to CO4: 86.55%		
BTH 2701 (3)	Techniques in Biotechnology	<p><b>CO1:</b> Able to gain concept in electromagnetic radiation, absorption spectrum Beer's law and Lamberts's law.</p> <p><b>CO2:</b> Proficient to apply knowledge in identification of biomolecules.</p> <p><b>CO3:</b> Attain knowledge on characteristic separation and purification of variety of compounds.</p> <p><b>CO4:</b> Exert the knowledge to estimate the compounds quantitatively and qualitatively.</p> <p><b>CO5:</b> Able to illustrate the theoretical knowledge in chemistry of gels.</p> <p><b>CO6:</b> Knowledge in charge/mass ratio for the separation of various compounds.</p> <p><b>CO7:</b> Acquire the basic concepts in radio labelled compounds and their application.</p> <p><b>CO8:</b> Able to suggest the innovative methods for identification of clinical samples.</p> <p><b>CO9:</b> Well-informed to characterize the molecules and compounds based on their weight.</p> <p><b>CO10:</b> Through knowledge in concentrated molecule separation and preservation.</p>
Level of attainment of CO1 to CO10: 83.51%		
BTH 2751 (2) (Pr.)	Techniques in Biotechnology	<p><b>CO1:</b> Able to attain knowledge in quantitative estimation of biomolecules.</p> <p><b>CO2:</b> Catch up the expertise in separation of molecule size and shape.</p> <p><b>CO3:</b> Pick up the concept in dialysis.</p> <p><b>CO4:</b> Can get the proficiency in separation of molecules by</p>

		their charge / mass ratio.
Level of attainment of CO1 to CO4: 90.41%		
BTH 3702 (3) (Th.)	Molecular Biology	<p><b>CO1:</b> Get hold of through knowledge about gene and genome organization in variety of cell organelles/species.</p> <p><b>CO2:</b> Able to recognize and understand various proteins that associate the genomes.</p> <p><b>CO3:</b> Look up through various models of replication in both prokaryote and eukaryote organisms.</p> <p><b>CO4:</b> Achieve knowledge on the basic concepts of mutations and diverse modes of repair systems.</p> <p><b>CO5:</b> Comprehensive acquaintance about transcription process in both prokaryote and eukaryote systems. Be hold of promoters, exons and introns. <b>CO6:</b> Be attentive of the concepts in post transcriptional modifications and distinguish the reverse transcription with normal transcription.</p> <p><b>CO7:</b> Attain facts in relation to genetic code and revise the structural differences among RNA's.</p> <p><b>CO8:</b> Competent to contrast the translation process between prokaryote and eukaryote organisms.</p> <p><b>CO9:</b> Be well-informed variety of operon concepts in prokaryotes, know how gene regulations happen.</p> <p><b>CO10:</b> Conscious knowledge in a range of regulation of gene expression of eukaryotic organisms.</p>
Level of attainment of CO1 to CO10: 83.34%		
BTH 3751 (2) (Pr.)	Molecular Biology	<p><b>CO1:</b> Be skilled in isolation of genetic material from various sources.</p> <p><b>CO2:</b> Bring about expertise in evaluation of phosphorus content in genetic materials</p> <p><b>CO3:</b> Able to design a valid protocol for the isolation of chromosomal and plasmid DNA in bacteria.</p> <p><b>CO4:</b> Capable to assess the quantitative fraction of genetic</p>



		material by exclusive reagents.
Level of attainment of CO1 to CO4: 83.31%		
BTH 4701 (3)	Microbiology	<p><b>CO1:</b> Achieve comprehensive list of microbial diversity. Be hold in interchangeable modes of bacterial classification.</p> <p><b>CO2:</b> Versatile knowledge in Bergey's manual of classification.</p> <p><b>CO3:</b> Handle the septic and un hygiene conditions with a variety of sterilization techniques.</p> <p><b>CO4:</b> Can be hold of different kinds of organic and inorganic substances as potential agents in relation to asepsis.</p> <p><b>CO5:</b> Strong intuition will be developed in culturing various microorganisms.</p> <p><b>CO6:</b> Be hold in identification of bacteria by various staining methods. <b>CO7:</b> Able to enumerate the growth phases and development, learn the importance of batch and continuous culture systems.</p> <p><b>CO8:</b> Understand the significance of pure cultures in relation to produce economized products.</p> <p><b>CO9:</b> Realized to know the importance of viral classification and structure in relation to pathogenicity.</p> <p><b>CO10:</b> Through knowledge in replication of viruses and regeneration capacity of viral particles in an array of hosts.</p>
Level of attainment of CO1 to CO10: 88.52%		
BTH 4751 (2) (Pr.)	Microbiology	<p><b>CO1:</b> Able to attain knowledge in inspection of various microbial forms.</p> <p><b>CO2:</b> Catch up the expertise in equipments related to sterilization.</p> <p><b>CO3:</b> Know the importance of media in enumerating microbial forms. Can get the proficiency in identification of</p>

		<p>various microbial forms by culture methods and staining methods.</p> <p><b>CO4:</b> Hands on expertise in qualitative testing of water and milk</p>
Level of attainment of CO1 to CO4: 89.6%		
BTH 5701 (3) (Th.)	Genetic Engineering	<p><b>CO1:</b> Able to grasp the idea about the significance of recombinant molecules and their application in relation to live stock improvement.</p> <p><b>CO2:</b> Become skilled on function of restriction endonucleases.</p> <p><b>CO3:</b> Attain comprehensive knowledge on vectors systems and could have a concept on construction of genomic &amp; c-DNA libraries.</p> <p><b>CO4:</b> Can easily design a vector system that could express the gene of interest.</p> <p><b>CO5:</b> Could acquire the importance of restriction enzymes relevant to recombinant molecule construction.</p> <p><b>CO6:</b> Be aware of the concepts in varied gene transfer techniques as well as mechanisms.</p> <p><b>CO7:</b> Could learn unique models for the identification of unknown gene sequence.</p> <p><b>CO8:</b> Be holding the knowledge to generate number of copies as it available in low concentration. Able to identify the victim and criminal in a crime situation.</p> <p><b>CO9:</b> Be well-informed about the concepts in bioinformatics and had a chance to predict the exact interaction between ligand and enzyme.</p> <p><b>CO10:</b> Well attentive to predict the sequences of protein and gene through a variety of software.</p>
Level of attainment of CO1 to CO10: 86.0%		

BTH 5751 (2) (Pr.)	Part II – Genetic Engineering	<p><b>CO1:</b> Be trained in gene transfer methods, able to design a short protocol for isolating the gene from a plasmid.</p> <p><b>CO2:</b> Accomplish expertise in controlled usage of restriction enzymes to obtain recombinant molecules.</p> <p><b>CO3:</b> Gain the significance of enzymes involved in ligation.</p> <p><b>CO4:</b> Get hands on training in amplifying the gene of interest through PCR tool; Could predict the phylogenetic relationships among species.</p>
Level of attainment of CO1 to CO4: 88.91%		
BTH 5702 (3)	Plant and animal biotechnology	<p><b>CO1:</b> Bring about the nurturing capabilities in relation to plant tissue at laboratory conditions (<i>In vitro</i>). Gain knowledge about the significant role of growth regulators.</p> <p><b>CO2:</b> Proficient to maintain the initial callus cultures and able to rise single cell clones of economically important plant species.</p> <p><b>CO3:</b> Able to apply variety of applications for the production of virus free plants in agronomy; able to provide huge quantity of feed stock due to through knowledge.</p> <p><b>CO4:</b> Make use of the bioreactor in production of cell mass and could produce the commercially useful compounds.</p> <p><b>CO5:</b> Proficient to transfer genes in plants through <i>Agrobacterium</i> spp., Able to gain knowledge in contrasting products over classical varieties in food crops.</p> <p><b>CO6:</b> Knowledge in production of transgenic plants/traits.</p> <p><b>CO7:</b> Acquire the basic concepts in animal tissue culture and culture media preparation.</p> <p><b>CO8:</b> Able to understand the factors influencing the animal tissue culture and gain the knowledge in preservation of significant cell lines.</p> <p><b>CO9:</b> Well-informed to accomplish the concepts in <i>In vitro</i> fertilization and embryo transfer technology.</p> <p><b>CO10:</b> Attain basic information in relation to transgenic</p>

		animal production and synthesizing the products in animals (Molecular pharming).
Level of attainment of CO1 to CO10: 85.37%		
BTH 5752(2) (Pr.)	Part I – Plant and animal biotechnology	<b>CO1:</b> Able to acquire the techniques and inoculation methods in plant tissue culture in relation to production of commercially important plant products. <b>CO2:</b> Catch up the expertise in preparation of MS media. <b>CO3:</b> Pick up the knowledge in maintenance of cultures; know the importance of pollen and anther cultures. <b>CO4:</b> Can get the proficiency in production of novel qualities in seeds.
Level of attainment of CO1 to CO4: 92.41%		

BTH-E1-6701 (3)	Industrial, medical, agricultural and environmental biotechnology	<p><b>CO1:</b> Able to understand the significant role of biotechnology in industries.</p> <p>Be familiar with pure cultures of industrially important microorganisms. <b>CO2:</b> Be in line with the advent of fermentation technology and able to know the concepts in batch and continuous bioreactors.</p> <p><b>CO3:</b> Be familiar in production technology in relation to brewing industry. <b>CO4:</b> Make use of the bioreactor in production of organic acids and enzymes of amylase &amp; protease. Able to design a protocol for antibiotic production.</p> <p><b>CO5:</b> Demonstrate intellectual skills in relation to health care products. Able to exhibit rational expertise in production of <math>\alpha</math> and <math>\beta</math>- interferons and monoclonal antibodies</p> <p><b>CO6:</b> Understand principles underlying Quality Assurance, bio safety issues and bioethics. Gain knowledge about intellectual property rights.</p> <p><b>CO7:</b> Gain an understanding of the causes, types and control methods for Environmental Pollution. Application of different life forms in Environmental Remediation.</p> <p><b>CO8:</b> Able to discuss various aspects of municipal and industrial sewage treatment.</p> <p><b>CO9:</b> Critically evaluate the application of plant and microbial biotechnologies for sustainable agriculture</p> <p><b>CO10:</b> Able to explain the microbial degradation of pesticides and bioremediation. Discuss the role of genetically engineered microbes.</p>
Level of attainment of CO1 to CO10: 86.15%		
BTH-E1-6751 (2) (Pr.)	Industrial, medical, agricultural and environmental biotechnology	<p><b>CO1:</b> Demonstrate the production of industrial alcohols, biogas and hydrogen.</p> <p><b>CO2:</b> Exhibit the yield percentage of alcohol by colorimetry.</p> <p><b>CO3:</b> Pick up the knowledge in evaluating water parameters.</p> <p><b>CO4:</b> Illustrate the protocol for the isolation of <i>Rhizobium</i>.</p>
Level of attainment of CO1 to CO4: 91.36%		

