



**Department of Biotechnology**

**Strategic Plan (2020-2025)**



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## **I. Key Policy Recommendations and Interventions**

NAAC and UGC assign the responsibility on the IQAC for planning, guiding and monitoring Quality Assurance (QA) and Quality Enhancement (QE) activities of the institution. With this background, the Faculty IQAC has undertaken the task of designing a Perspective Plan for the period of five years commencing from academic year 2020-21 to academic year 2025-26 for a balanced growth. The quality indicators of different criteria determined by NAAC have been taken into consideration as the base to create Quality Radars and to make out milestones for the future.

In the preparation of the Perspective Plan, the Faculty IQAC has taken initiatives to obtain inputs from all stakeholders *viz*, the management, the faculty, the administrative staff, students of the Faculty, the parents and the peer colleagues. Stakeholder's expectations, management policies, goals and objectives and the vision and the mission statement of our Faculty and quality policy of the Faculty are also considered as a base for formulation of the perspective plan.

The prime role of IQAC is to suggest quality measures for the betterment of an institution. While preparing a road map for future growth, the members of the IQAC have considered Feedback from all the stakeholders and the recommendations specified in the meetings of the IQAC. Besides, innovative ideas as suggested by all the stakeholders are also carefully incorporated in perspective plan. Student feedback mechanism, self appraisal and job satisfaction record of teachers, faculty training programs arranged by the Faculty as well as attended by teachers, faculty improvement programs, introduction of Research committee to play a proactive role in encouraging teachers for research are some of the measures initiated with priority

A midterm review is proposed to be conducted by the end of the 1<sup>st</sup> and 3<sup>rd</sup> years 2020-21 and 2022-23 respectively to appraise the extent to which goals have been achieved. In addition, keeping a scope for midterm correction, the IQAC also proposes an idea of reviewing the perspective plan if needed. This will enable the Faculty to take stock of the accomplishments and to relook into the action plans and untouched/ newer areas to lay stress upon. We hope this will facilitate the Faculty to realign the road map to reach the expectations of stake holders in a harmonious way.

### **1.1 Vision**

Our vision is to train qualified biotechnologists who can use advanced processes and applications that will profoundly affect existing paradigms in agriculture, industry, healthcare and environmental restoration, thereby providing sustainable competitive advantages for today's society.

### **1.2 Mission**

- A. Provide motivation for biotechnology education programs to cultivate a high-quality workforce.
- B. Raise awareness of bioethical potential with social ethics.
- C. Inspiring innovation and creativity to young people with good research skills.
- D. Cultivate self-confident people who are making effective contributions to national development.

### 1.3 Objectives

For improvement of our department, we need to produce high-quality students so that they are able to cope with all the professional and personal challenges that are prevalent around the world and be able to do their respective jobs and contribute to the overall growth of their respective employment providers and countries and the world. Graduates must also have the most advanced R & D skills in their field.

- A. Carry out engineering practice in a wide range of industrial, social and practical applications.
- B. Pursue higher education, research and development, and other creative and innovative efforts in science, engineering, technology, and other professional occupations.
- C. Act in a responsible, professional and ethical manner.

### 1.4 Action Plan

- A. Develop new methodologies for efficient learning and teaching
- B. Follow an inquiry-based lab curriculum, an inquiry-based curriculum offers many opportunities for active learning, creating an atmosphere in which students must take responsibility for their learning.
- C. Guiding students to a more research and thinking based approach.
- D. Engaging students with a collaborative and research-intensive education which includes defining clear and realistic goals of the course.
- E. Engaging students in project based lab.
- F. More hands-on experience of students in various experiments
- G. Signing MOU with national and international universities of high reputation.
- H. Enhancing collaboration with eminent scientists and industries across the world.
- I. To do research in the blooming research field areas.

### 1.5 Research Development Strategy

All the management comes with setting up of a research facility

The current blooming research areas includes:

- A. Food Biotechnology
- B. Environment Biotechnology
- C. Bioenergy
- D. Biomaterials for betterment of life
- E. Vaccine, and Drug discovery & development
- F. More researches in the said field will magnify the chance of getting Government grants, filling patents.
- G. Focus on research and creative efforts, and promote interdisciplinary and emerging research.
- H. Integrate research experiences into the undergraduate curriculum and provide faculty with resources and recognition for their contributions
- I. Identifies the obstacles that impede the implementation of its research policy plan and undertakes appropriate action as and when required.



### **1.6 Admission**

- A. Frequent department and lab visit of higher secondary students and motivate them to choose Biotechnology as their career.
- B. Renovation of lab infrastructure and instruments for providing better research facility will attract students for doing M.tech. and Ph.D. as well.
- C. Advertising throughout India regarding the Biotechnology course of Rama University.

### **1.7 Placement**

- A. Inviting core biotechnology companies
- B. Motivating students for certification courses in various biotechnology industries will attract the core companies for better recruitment.

### **1.8 Society Benefit**

- A. Students leave either the lab or classroom with the ability to discuss and develop ideas to address several issues in the biological spectrum.
- B. Students as a leader to participate in their areas of expertise and activities that support global services and economic development.

## **II. Strategic Focus Areas**

The Department of Biotechnology offers Bachelor (B.Tech and B.Sc.), Masters (M.Tech and M.Sc.) and Ph.D. Degree Programs in Biotechnology. The Department aims to generate trained manpower in the areas of Biotechnology and attempts to integrate research and teaching to harness maximum potential and has emerged as a centre of excellence in imparting quality teaching and training at under graduate, Post-graduate level and propagating research activities in diverse field of this important science. The course curriculum will not only equip the student with sound knowledge and expertise in relevant areas but will also create avenues for research and job opportunities in future and for self-employment. Department is equipped with ultra-modern equipments with state of the art laboratory facilities and has dedicated faculty engaged in the genetic improvement of Industrially, Agriculturally and medicinally important Plant & Microbes through recombinant DNA technology as well as in understanding Genetic diversity using DNA based Molecular markers techniques. The department plans to focus in following five areas for next five years:

### **2.1 Food Biotechnology**

Biotechnology refines and extends methods that produce new plants and animals. Biotechnology has a long history of use in food production and processing. For ten thousand years fermentation, a form of biotechnology has been used to produce wine, beer and bread. Selective breeding of animals such as horses and dogs has been going on for centuries. Selective breeding of essential foods such as rice, corn and wheat have created thousands of local varieties with improved yield compared to their wild ancestors. Biotechnology applications in the food-processing sector, therefore, target the selection and manipulation of micro-organisms with the objective of improving process control, product quality, safety, consistency and yield, while increasing process efficiency. In an effort to address the future expectations of stakeholders in post-harvest management and food processing sector through food biotechnological research and development innovations, it becomes necessary to build trained and expert work force in area. Department aims to bridge this gap by training and creating trained manpower and promote research activities especially in probiotics area.

### **2.2 Environmental biotechnology**

Environmental biotechnology is a system of scientific and engineering knowledge related to the use of microorganisms and their products in the prevention of environmental pollution through bio-treatment of solid, liquid, and gaseous wastes, bioremediation of polluted environments, and biomonitoring of environment and treatment processes. Given the limitations of current chemical and mechanical processes, the world is turning towards greener option of biotechnological interventions. The department of biotechnology aims to promote teaching, training and research activities in the areas relevant to waste management & environmental improvement, development & demonstration of wastewater specific effective bioremediation options like natural attenuation to bio-stimulation, bio-augmentation or a combination of filtration, phytoremediation and microbial degradation, Bio-restoration technologies for

restoration of degraded ecosystems.

### **2.3 Bioenergy**

Bioenergy is one of many diverse resources available to help meet our demand for energy. It is a form of renewable energy that is derived from recently living organic materials known as biomass, which can be used to produce transportation fuels, heat, electricity, and products. Abundant and renewable bioenergy can contribute to a more secure, sustainable, and economically sound future by: reducing dependence on foreign oil, supplying domestic clean energy sources and revitalizing rural economy. With this in mind Department of Biotechnology aims to expand teaching and research activities in biodiesel production, enhancing oil content of oil crops through genetic engineering and process optimization for improving yield and reducing cost.

### **2.4 Biomaterials and Tissue engineering**

Biomaterials serve as an integral component of tissue engineering. They are designed to provide architectural framework reminiscent of native extracellular matrix in order to encourage cell growth and eventual tissue regeneration. Tissue engineering is an interdisciplinary field dedicated to the regeneration of functional human tissues. Despite the body having intrinsic self-healing properties, the extent of repair varies amongst different tissues, and may also be undermined by the severity of injury or disease. Given the rapidly growing importance of field to society and its potential to treat many terminal diseases. Department of Biotechnology strives to promote research activities in creating new or modifying the functionality of existing materials for growing wide ranges of tissues and organs in laboratory. Department will train biomaterial and tissue engineer and scientist who can handle the challenge of working at interface of biology and material. The department also aims to develop tissue engineering & 3D bio printing lab for teaching and research purposes.

### **2.5 Vaccines, drug discovery & Drug development**

COVID-19 has once again highlighted the need of vaccines to prevent deadly viral infections and death. Currently, the world is craving to develop vaccines for SARS-CoV-2 but it is still elusive. Further, the world is also looking for various drugs that can treat COVID-19. Seeing the importance of this area, Department of Biotechnology aims to promote teaching and research activities in vaccine design, vaccine development approach and drug discovery using bioinformatics approach. The department aims to establish bioinformatics labs with open source software to carry out research and teaching activities.

### **2.6 Intellectual Property & Patent Law**

The development of capabilities for the effective management of Intellectual Property (IP) is an important element in securing the benefits of public and private sector research in biotechnology. In this context, filings of patents both in India and abroad are critical to the growth of the Department of Biotechnology.



**Strategic Actions:** Administration of the new intellectual property rights regime should be improved. This will be achieved by ·

- Encouraging science graduates to pursue law for better understanding of IPR related issues. ·
- Inclusion of IPR related issues in curriculum of biotechnology department for facilitating filing of international patents, license negotiation, dispute resolution etc. ·
- Training students and faculty in the strategy of intellectual property protection relating to assessment of patentability, prior art examination and technology transfer issues.

## **2.7 Clinical Biotechnology**

The cost of launching a new drug into the market is estimated to cost between \$300-500 millions of which the cost split between Research and Development is 25%: 75% which would translate to an approximate cost of US\$200-400 million for patient clinical studies and trials which form the main components of drug development. The potential of being a key player in this segment is high and remunerative. India has made tremendous progress in clinical biotechnology over the past few years. However, the infrastructure required to identify, document and monitor patients under clinical trials need to be first put in place before India can partake in this activity. There is also an exciting opportunity of conducting longitudinal studies in disease segments for prospecting new biomarkers and novel pharmacogenomic information both yielding high value Intellectual Property.

### **Strategic Actions:**

- Frame appropriate rules and procedures to support contract research services through stakeholder consultation. ·
- Harmonise and streamline the regulatory issues for import and export of biological materials.
- Review eligibility of virtual export of R&D services through contract research for fiscal incentives. ·
- Address the operational deficiencies through stakeholder consultations for conducting clinical trials. ·
- Develop a Good Clinical Trial Practice Manual taking into account international guidelines and disseminate these widely. ·
- Address issues and frame guidelines for patent protection including issue of liability. ·  
Strengthen institutional ethics committees to bring them at par with global benchmark.

## **2.8 Industrial Biotechnology**

At present, a third wave of biotechnology – industrial biotechnology – is strongly developing. Industrial biotechnology (also referred to as white biotechnology) uses biological systems for the production of useful chemical entities. This technology is mainly based on biocatalysis and fermentation technology in combination with recent breakthroughs in the forefront of molecular genetics and metabolic engineering. This new technology has developed into a main contributor to the so-called green chemistry, in which renewable resources such as sugars or





vegetable oils are converted into a wide variety of chemical substances such as fine and bulk chemicals, pharmaceuticals, bio-colorants, solvents, bio-plastics, vitamins, food additives, bio-pesticides and bio-fuels such as bio-ethanol and bio-diesel.

The application of industrial biotechnology offers significant ecological advantages. Agricultural crops are used starting raw materials, instead of using fossil resources such as crude oil and gas. This technology consequently has a beneficial effect on greenhouse gas emissions and at the same time supports the agricultural sector producing these raw materials. Industrial biotechnology frequently shows significant performance benefits compared to conventional chemical technology.

**Strategic Actions:**

- Focus in industrial biotechnology will be on reducing chemical and toxic load in our effluent streams, developing non-fossil fuels that are ecofriendly and developing green technologies in Industrial processing.
- Encourage public-private partnership to promote investment in this sector.
- Promotion of industrial biotechnology in strategic areas of manufacturing and developing green technologies.



### III. Strategic Planning Goal

The faculty at Department of Biotechnology deliberated about five-year roadmap in an online meeting. The faculties gave various input regarding academics, assessment of students, student's learning trajectory, laboratory infrastructure, faculty loads, department visibility, quality research, teaching and learning activities, research activities, and entrepreneurship among students and consultancy projects. The faculty identified following areas which are: quality research and consultancy, quality teaching, department visibility, student satisfaction and competitiveness with leading institute as being critical to the department's future. These five items will be considered for department's strategic goals. The importance of each goal is explained below, along with specific objectives and action items to help the department achieve each goal.

<b>End state Outcomes for Research Excellence</b>			
Particulars	2021 Target	2023 Target	2025 Target
<b>1: Research Capacity / Centres of Excellence</b>			
No of Centre of Excellence	1	2	3
<b>2: Availability of Researcher Pool</b>			
Number of faculty with PhD	90%	100 %	100%
Number of PhDs	6	10	12
<b>3: Research Output</b>			
Average publications per faculty per year	2	2	2
Average Citations per publication	5	8	10
Patents filed per faculty per year	1	2	2
Revenue from industry projects/ grants (INR Lakh)	20	50	80
No. of startups incubated	1	2	3
<b>4 : Research Collaborations</b>			
% of research publications through international collaborations	5%	7%	10%

  
 Registrar  
 Rama University  
 Mandhana, Kanpur-209217



### 3.1 Goal 1: Quality research & consultancy

Quality research and consultancy is extremely crucial for growth of department. Research and consultancy activities will set the department in good stead and will help department to carve its own identity. The following strategies will be employed to achieve the desired goal:

**Strategy 1:** The department aims to focus on building laboratory infrastructure required for increasing the quality of research. The department is planning to apply for sponsorship to Department of Biotechnology, Department of Science & Technology, New Delhi for up gradation and setting up of research laboratories.

**Strategy 2:** Tapping the rich talent pool of M. Tech and Ph.D. students to pursue research at university laboratory only. This small change will help better control on their research data and curb plagiarism and data fabrication and improve quality of research. The rampant malpractice needs to go to protect image of university and supervisor.

**Strategy 3:** The existing faculty load will be relooked as this is most important aspect towards quality research. The faculty will be made free from unnecessary works to focus on research proposal, projects, books authoring. Further, they will be encouraged to utilize this time for consultancy work too to make department self-reliant. There is urgent need towards reworking faculty load given the existing talent pool available at department to promote research and consultancy.

**Strategy 4:** Promotion of research activities taken at department through various print and electronic media. Department plans to hold open day annually, where anyone from Kanpur region, especially students can visit and interact with faculty, departmental student and research activities being done at department. This will increase the visibility and helps in garnering much needed consultancy projects and student enrolment.

### 3.2 Goal 2: Quality Teaching

**Strategy 1:** The department is planning to establish teaching and learning cell to suggest innovative teaching methodology and faculty student engagement with faculty and students. This cell will also be responsible for assessing the quality of content being taught in the class. This cell will also suggest to enhance teaching experience in the present faculty load.

**Strategy 2:** In the post Covid-19 era, there is focus on online education. Therefore, department will provide quality teaching materials online through various existing platform. Introducing short term courses in phased manner in line with current industrial demand to enhance job related technical skills.

**Strategy 3:** In continuation of above strategy, the department will launch **eprayogshala** (virtual laboratory) specifically designed for students of university. This will enhance the laboratory skills of students which is one of the crucial and backbone of biotechnology studies.



### **3.3 Goal 3: Students satisfaction and success**

This is the most important metric that faculty at Department of Biotechnology recognizes. Student's satisfaction and success will help in creating brand RAMA University and will help in increasing enrolment and placement activities. The strategy that department of biotechnology will employ to create Brand RAMA are:

#### **Strategy 1: Improving Communication skills of students**

Strong communication skills, in particular written communication, are essential for student success. The faculty believes that student's communication skills should be improved. The following methodology can be applied:

- Investigate ways to better integrate core communications courses with each of our degree curricula. For example, align technical writing courses with biotechnological subject.
- Enhance curriculum so that communications skills are reinforced throughout the degree program. For example, ensure that there is a writing intensive (or presentation intensive) course each semester in a typical student's schedule. Ensure that written work products and presentations in these courses are rigorously evaluated and detailed feedbacks are provided to students.
- Investigate methods to track communications skills. The exam provides a great metric for disciplinary core knowledge but we currently have nothing similar for communications skills

**Strategy 2:** Enhancing technical skills of students- Biotechnology being a multidisciplinary field requires lot of effort both from faculty and students. There are two aspects of technical skills (1) Theoretical, and (2) Practical. Theoretical skills will be enhanced by giving quality notes, assessment through quizzes, surprise test and case studies, identifying non-performers and understand their problems, relating class room learning with example of real world to enhance their understanding of subjects. The faculty will be trained by teaching and learning cells to deliver this style of lecture for student satisfaction. Practical aspect will be taught through rigorous practical session with focus on each individual rather than group.

**Strategy 3:** In continuation of the above, a student group under the chairmanship of experience faculty will be setup to notify skill improvement courses, conferences and open challenges to students. The students will be encouraged to participate to hone their skills.

#### **Strategy 4: Training students in multidimensional field of biotechnology to become future leaders.**

As biotechnologist, challenges are immense not only at job front but also at research front. However, Biotechnology field is extremely wide and students can choose career as per their liking. Therefore, there is a need to train students in biotechnology as well as allied field such as patenting and liasoning, bioentrepreneurship, rural based technology development, bioethics expert etc. Our students can contribute to society not only through professional engineering or construction work but through leadership. Leadership may include engaging in



public policy formation, holding public office, creating innovative new technologies and start-up companies, and running a successful business.

**Strategy 5:** Setting up of bioentrepreneurship cell at department: Through this cell, department aims to encourage and inculcate entrepreneurship skills among students. The cell will organize lecture series; identify areas related to biotechnology having business potential, protecting intellectual property etc. This cell will create future bioentrepreneurs and will help in creating brand RAMA.

**Strategy 6: Metric for measuring student success**

Success is a subjective term and Faculty at Department of Biotechnology aims to shy away from the definition of success solely based on the marks. The department is planning to measure success on the basis of their idea generation, innovativeness and handling of challenging situation in biotechnology, participation in technical events will be given due weightage. The department should develop performance metrics and collect data that allow the faculty to judge the success or specific interventions, programs or the curriculum as a whole.



**Student Strength**

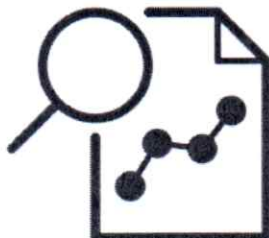


Total Student Enrollments	120
Total PhDs	6
Total PG Students	15

**Faculty**

Total Faculty	7
No. of Faculty with PhD	6
No. of Industry Faculty	0
No. of International Faculty	0

**Research**



Total Centers of Excellence	0
Total Publications	20
Patents filed	4
Number of startups incubated	0