



Five Year Plan

[2016 – 2020]



Developed by
Central Department of Biotechnology
Tribhuvan University, Kirtipur
Established. 2008
[Updated in 2016]

Background

The development of Biotechnology is embracing almost every sector of human civilization. All the developed and developing countries are heading towards this diverse discipline in a very short span of time which has created unique opportunities not only for the exploitation of biological systems for the benefit of mankind, but also for undertaking research to explore the fundamental life processes. Presently it has found wide applications in the areas as diverse as agriculture, animal husbandry, medicine, pharmacology, environmental management, Biosensors, Bioelectronics and diagnostics, Bioinformatics and Computational Biology, Biomedical Engineering, Body's and Cell's Biosignatures, Microarray Technologies, Prediction and Molecular Simulation, Drug Discovery, Gene Regulation and Transcriptomics, Bioinformatics and computational biology and in industries making biotechnological products. In a country like Nepal, where the concept of biotechnology based industries is limited and biotechnology is immature with limited number of skilled human resources making it difficult to develop biotechnological research and industries. Furthermore, analysts have predicted that biotechnology will be one of the most important applied sciences of the 21st century. Industrialized countries and even some developing countries have already benefited from the advancement of Biotechnology improving production and environment friendly products from plants, animals and microorganism; producing cost effective new pharmaceuticals; using more efficient disease diagnosis and treatment; effective criminal investigation methods etc. Nepal being rich in natural resources has all possibilities to break the ice. So with the joint hands of efficient manpower in the field of biotechnology and proper national strategies along with enthusiasm of using the knowledge acquired in this field can make it possible to harness the benefit of the accumulated knowledge.

Tribhuvan University (TU) is the premier university in Nepal, which provides courses in diverse disciplines at various levels. Considering the potentialities of modern biotechnology, TU established Central Department of Biotechnology in 2008, anticipating leading role in the fulfillment of national demand on the manpower and also to start innovative researches in various fields of biotechnology. The course curriculum of master level in biotechnology has been formulated considering the need of the current nation's requirement as well as to meet the international standard in the subject under the Institute of Science and Technology.

The aim of this program is to produce high level manpower in the field of biotechnology required in the country and at global level. Yearly hundreds of biotechnology undergraduates and graduates leave Nepal for higher studies. If the nation or government could make an effort on setting up a biotechnology based laboratory and industry, not only the student but also those who are abroad will be benefited in the sense that they will have enough space to come back here, thus making an attempt in brain gain rather than brain drain and of course the national economy and development will be flashed up.

Institution Vision

"World class Biotechnology institute for serving lives and nature".

- Central Department of Biotechnology as the Academic Centre of Excellence particularly in the field of medical, agricultural, animal and food biotechnology.
- Equipped biotechnology laboratory in Nepal as a academic height of SAARC region with skilled human resources.
- Produce salable manpower from Central Department of Biotechnology in national and international market.

Institution Mission

- Facilitate advance teaching- learning to produce qualified and skilled manpower (scientist/experts) in their respective area of specialization in biotechnology.
- Explore the new fields including very specific to our Nepalese context to conduct research and give message to scientific community of the world.
- Emphasize on the application oriented research for commercialization such as medicinally important phytochemical compound identification, antibody production, transgenic plant, vaccine production, and animal production, medical diagnostic tools, food technology etc.
- Establish the department with all types of essential, general and sophisticated scientific instruments and tools suitable for academic and innovative researches.
- Launch programs/projects for international affiliations and get high impact factor publications.
- Attract SAARC/international students for academic degree on biotechnology.

Goal

- To establish CDBT as the first choice of bioscience study which directly contribute for the welfare of Nation and people through biotechnology.

Objectives

- Equip biotechnology laboratory with general and sophisticated instruments through internal (TU/UGC/Government/NGO) and external (international grants/iNGOs/institutes) resources.
- Insist the University for a Center Laboratory Facility as a model research facility center of the SAARC.
- Categorize the required fields of biotechnology for the nation and module them to international trend for national and international collaborative applications.
- Encourage the M.Sc. students, Ph.D. scholars, post doctorate degree and faculties to give high degree performances utilizing the facilities available in the Department.
- Allow the students/faculties to participate international seminars and conferences to lure the international students towards CDBT.
- Develop the best examination system for proper evaluation and degree award.

M.Sc. Biotechnology program

The M. Sc. in biotechnology, a four semester (2 years) program of 60 credit hours, initiated by the Tribhuvan University emphasizes both theoretical and practical aspects of different fields of Biotechnology. Research work for M. Sc. Thesis (6 credit hours) is assigned to each student under the supervision of a faculty member and to be completed in the fourth semester. In addition to thesis work, students will be encouraged to work in research institutions and industries to acquire practical knowledge needed for their future careers in the field of Biotechnology. Students are encouraged to send universities and research institution abroad like: Jawaharlal Nehru University (JNU), Centre for Cellular and Molecular Biotechnology (CCMB), Baul Hebert Research Center for DNA Barcoding and Biodiversity (PHRDBB), Institute of Genomics and Integrated Biology (IGIB), Malaysia Saint University (MSU), University of Adelaide Australia (UAA) and so on.

Course Structure for M. Sc. Biotechnology

Course Structure 2071 (2015) for M.Sc. Biotechnology

First semester

Course Code	Course Title	Credits	Evaluation (40% internal)
BT 511	Cell Biology and Genetics	3	75 (45+30)
BT 512	Molecular Biology	3	75 (45+30)
BT 513	Molecular Biochemistry	2	50 (35+15)
BT 514	Microbiology	3	75 (45+30)
BT 515	Bioprocess & Biochem. Technology	3	75 (45+30)
	Practical Courses (L) (40% internal)		
BT 511L	Cell Biology and Genetics	1	25
BT 512L	Molecular Biology	1	25
BT 513L	Biochemistry	1	25
BT514L	Microbiology	1	25
BT 515L	Bioprocess & BT	1	25
Total		19	475

Second Semester

Course Code	Course Title	Credits	Evaluation (40% internal)
BT 521	Genetic Engineering	2	50 (35+15)
BT 522	Immunology and immunotechnology	3	75 (45+30)
BT 523	Plant Biotechnology	3	75 (45+30)
BT 524	Bioinformatics	2	50 (30+20)
BT 525	Biophysical Chemistry	2	50 (35 + 15)
BT 526	Metabolic Biochemistry and	2	50 (35+15)
	Practical Courses (L) (40% internal)		
BT 521L	Genetic engineering	1	25
BT 522L	Immunology	1	25
BT 523L	Plant biotechnology	1	25
BT524L	Bioinformatics	1	25
BT 526L	Metabolic Biochemistry and	1	25
Total		19	475

Third Semester

Course Code	Course Title	Credits	Evaluation (40% internal)
Courses 611 to 615 select any three			
BT 611	Food Biotechnology	3	75 (45+30)
BT 612	Medical and Pharmaceutical	3	75 (45+30)
BT 613	Environmental Biotechnology	3	75 (45+30)
BT 614	Agriculture Biotechnology	3	75 (45+30)
BT 615	Animal Biotechnology	3	75 (45+30)
BT 616	Biostatistics and Research methodology	2	50 (30 + 20)
BT 617	IPR, Biosafety and Bioethics	1	25 (15+10)
BT618	Elective 1 (non credit)	2	50#
Select any three practical courses (Courses 611L to 615L) according to the theory courses (40%internal)			
BT 611L	Food biotechnology	Select any three each	2
BT 612L	Medical and pharmaceutical		5
BT613L	Environmental Biotechnology		2
BT 614L	Agriculture Biotechnology		5
BT 615L	Animal biotechnology		2
BT619L	Project practical/internship (3 weeks)	1	25
Total		16 +	400

#All non credit electives are extra credit

Fourth Semester

Course Code	Course Title	Credits	Evaluation (40% internal Assessment)
BT 621	Thesis	6	150
BT 622	Seminar	0	Attendance
BT 623	Elective 2: Management of	2	50#
Total		6+	150

Laboratory Facilities

The CDBT, though a lately established department of Tribhuvan University, is at its initial stage equipped with the facilities necessary to run the basic practical and research works on the different disciplines of biotechnology.

Departmental library:

The departmental library of the Central Department of Biotechnology has a collection of 500 volumes of best updated reference books on biotechnology on various topics. But it has to be enriched more to meet the growing demands of students and faculties. In addition, the Department has subscribed some International journals in the field of biotechnology.

The Department has also communicated for the subscription of HINARI and ORE like international e-journal for access to bioscience journals.

Faculties

Presently the department has 12 faculties and 12 administrative staffs.

S.N.	Faculties	Specialization
1	Prof. Krishna Das Manandhar (PhD) Head of Department	Immunology
2	Prof. Ganga Kharel (PhD,)	Food Biotechnology
3	Prof. Tribikram Bhattarai (PhD)	Plant Biotechnology
4	Prof. Rajani Malla (PhD),	Microbiology, immunology
5	Associate Professor Dr. Giri Raj Tripathi	Plant Biotechnology
6	Lecturer Jarina Joshi (M.Sc.) (PhD registered at TU)	Bioprocess
7	Lecturer Bal Hari Poudel (M.Sc.)	Bioinformatics
8	Lecturer Smita Shrestha (B.V.Sc/M.Sc.) (PhD registered at TU)	Medical Biotechnology
9	Lecturer Pragati Pradhan	Biochemistry
10	Lecturer Dr.Suresh Subedi	Bioprocess
11	Lecturer Priti Regmi	Biotechnology
12	Lecturer Alina Sapkota	Biochemistry

Besides these faculties, visiting faculties are being hired from outside according to need of specific subjects teaching.

Existing facilities:**Physical facilities**

The department is currently running in some rooms provided in a building where other three Central Departments for Physics, Computer Science and Chemistry are homed. The newly established Central Department of biotechnology has miser physical facilities with only one class room, three practical rooms, one combined computer-library-staff room and two administrative rooms. All these infrastructures are constructed for different purposes and do not meet the bio-safety regulation needed for biotechnology laboratories.

Instrument facilities:

The department is equipped with all basic equipments necessary for M.Sc. biotechnology practical works. Some major equipment installed in the department are ELISA plate reader and washer, Thermal cycler, Spectrophotometer, Gel documentation set, CO2 incubator, Laminar flows, Growth chambers, Electrophoresis set, Homogenizer, Fermenter, Phase Contrast Microscope, Fluorescent microscope with photograph facility, inverted microscope, -80, -40, and -20° C refrigerator, general microscope with photograph facility, Nanodrop, RT-PCR machine, Lyophilizer and many more (Table, Equipments).

Classroom-Teaching Facilities

In order to provide effective teaching and learning environment, class room is equipped with audio-visual (power-point projection) facilities and Video conferencing facility, in addition internet facility is provided individually in computer laboratory. Following are the teaching tools available in a lecture room.

- LCD-Projector
- Overhead Projectors
- Internet
- White board – Marker
- Video conferencing facility

Sufficiency of the existing facilities

The department has some basic facilities needed to run the program. Still we lack required space, equipment, energy supply according to the minimum need to run M.Sc. biotechnology course. The space now occupied by the department is not sufficient to run the theory and practical classes; however, it is being managed by adjustment of classes even in morning shift.

For comfortable running of classes Department needs minimum two class rooms more and three more practical laboratories. The Department has already started the construction of new own building at the site provided by TU authorities. The location of the building is not at appropriate area. Even the roadmap constructed by TU for way to building has not yet started. Similarly, the laboratory is yet to be furnished and equipped with advanced equipments necessary for the higher level research and innovations. These are the dire need of the department.

Needs of Electricity, Water supply and Security

The department, when run in full-fledged, requires 24 hour electricity facility. Since the department aims to be the center of excellence, it requires the 24 hour electricity and water supply. The students have to do their practical and thesis research till late hour, sometimes till eight evening. This requires tight and prompt security in the lab and in library. The available security is very poor in their performance.

International support in equipment:



Alexandar von Humboldt Foundation, Germany has approved and processed for equipments for research activities of Dr. Tribikram Bhattarai and other faculties equivalent to 20,000.00 Euro.



Third World Academy of Science (TWAS), Italy, has approved and processed for necessary equipments and chemical for research in Engineering of yeast to produce of CCR negative yeast strain for the production of ethanol from lignocellulosic biomass.



Second higher education project (SHEP) funded equipment for the regular practical and research work

Equipments funded by CDBT-KRRIB bio prospecting collaborative project

Research achievements:**Projects:****International:**

- Engineering of yeast to produce of CCR negative yeast strain for the production of ethanol from lignocellulosic biomass. TWAS
- Development of Recombinant *Sacharomyces cervicae* by expressing xylose transporter and xylose isomerase for efficient multiple sugar metabolism. 2013 June – 2014 July. Norwegians
- Design of microbial fuel cell to produce ethanol from lignocellulosic biomass and greenery waste and hence to produce electricity from fuel cell. 2013 June – 2014 July. Norwegians
- Bioprospecting of Biological materials of Nepal. Korea Research Institute of Bioscience and Biotechnology.
- Study of asymptomatic cases of *L. donovani* in Nepalese population by nested PCR. Supported by Institute de Recherche pour le Developpement (IRD), Montpellier, France.
- Expression analysis of FMR1 gene in fragile X patient. Institute of Genetics and Hospital for genetic analysis, Osmania University, Hyderabad.

National:

- Development of diagnostic tool for Neurocystocercosis disease. Collaboration with Annapurna Hospital, Putalisadak, Kathmandu. PI: Dr. Krishna Das Manandhar. Continuing from 2012.
- Retrospective analysis of EGFR mutation in lung cancer patient. Supported by UGC. PI: Prof. Mohan Kharel, 2011.
- Identification of antigenic protein from *Leishmania donovani* as marker for diagnosis of visceral leishmaniasis. Supported by UGC. PI: Dr Krishna Das Manandhar. Continuing from 2011.
- Morphogenic and Genotoxic Effects of Insecticides on *Vicia faba* and *Allium cepa* used by Farmers in Kathmandu Valley. Supported by UGC. PI: Dr Sampoorananda Jha. Continuing from 2011.
- Detection of BRCA1 mutation in breast cancer cases in Nepal: a pilot study. Supported by UGC. PI: Bal Hari Poudel. Accomplished.
- Screening of medicinal plants having antileishmanial property. Supported by National Academy of Science and Technology(NAST). PI: Dr Krishna Das

Manandhar. Continuing from 2012.

- Analysis of anticancer effect of different indigenous medicinal plants of Nepal. Supported by Ministry of Education PI: Bal Hari Poudel.
- Muscular Distrophy study on Nepalese patients by continuous PCR. Supported by Institute of Medicine, TUTH. PI: Dr. Smita Shrestha Chhetri. Continuing from 2012.
- Screening and characterization of myxobacteria for production of novel anti-microbial compounds. Supported by IOST, TU. PI: Pragati Pradhan.

Ph.D. theses:

1. Isolation and molecular characterization of probiotic microorganisms (*Lactobacillus* spp.) present in traditional of Nepal. Ranjan Koirala. 2012. Supervised by Dr. Rajani Malla.
2. Molecular genetics and histopathological studies of colorectal cancer among the clinically suspected Nepalese population. Nirajan Prasad Shah. 2013
3. Production of Bioethanol by electrochemical redox combination of microbial cells using Lignocellulosic Biomass. Jarina Joshi 2014. Supervised by Tribikram Bhattra
4. Characterization of Lignocellulosic Produced by Thermophilic Bacteria Isolated from Hot Spring of Myagdi, Nepal. Punam Yadav 2014. Supervised by Tribikram Bhattra.
5. Molecular Epidemiology and Complete genetic characterization of Dengue virus in Nepal. Birendra Prasad Gupta 2013. Supervised by Dr. Krishna D Manandhar
6. Immune Reconstitution Inflammatory Syndrome (IRIS) Development Among People Living with HIV/AIDS in Nepal. Shrawan Kumar Mishra 2013. Supervised by Dr. Krishna D Manandhar
7. Molecular and Immunological Characterization of Hepatitis-E Virus in Nepal. Smita Shrestha 2015. Supervised by Dr. Krishna D Manandhar.
8. Application of electric nose with nanowire technology for detection of microbial contamination of chicken meat and water. Manohar P. Bhandari 2015. Supervised by Dr. Rajani Malla.
9. Characterization of TNF-alpha gene polymorphism and its impact in Influenza A/Pandemic (H1N1) Patients in Nepal. Bimlesh Kumar Jha 2015. Supervised by Dr. Krishna D Manandhar.

Five-Year Plan

Strategy Plan:

1. Upgrade Central Department of Biotechnology as the Academic Centre of Excellence for the production of competent postgraduate/higher level human resource in the field of biotechnology.
2. Establish a sophisticated equipped academic Research Laboratory as a model biotechnology laboratory in Nepal
3. Conduct innovative national/international research projects in various fields of biotechnology according to specialization of faculties (at least one project-one faculty concept).

Objectives:

Major objectives:

- Complete the Construction of own building for Central Department of Biotechnology with all required spaces to develop it as Biotechnology Hub.
- Upgrade the quality of faculties to highly qualified and skilled manpower in their respective area of specialization in biotechnology.
- Instillation of 50 KW Solar power energy sources for continuous operation of all the equipment in the department. To conduct research and regular practical's efficiently.
- Provision for continues water supply for the fulfillment of water need by the master, PhD work and other research work
- Provision for the waste management of the research laboratory waste which may be very harmful to lives if not properly disposed.
- Construction of BSL-III [Bio-Safety Laboratory- Level III]
Equip the department with all types of essential instruments based on two categories;
 - o M.Sc. course Laboratory
 - o Highly sophisticated Research Laboratory.
- Proceed programs for international affiliations
- Explore the fields including very specific to our Nepalese context to conduct research and give message to scientific community of the world.

Emphasize on the application oriented research for commercialization such as treatment for multidrug resistance, vaccine production, anti-body production, transgenic plant and animal production, medical diagnostic tools, food technology bioremediation etc.

Parallel Objectives

- ✚ Search for the alternative and continuous water resources to carry the research and practical in regularly basis.
- ✚ Preparation of 4 years Bachelor in biotechnology course for 8 semester and launching the course within 2 years (The outline of the course has already developed and forwarded to faculty board).
- ✚ Invitation of visiting professors for skill transfer.
- ✚ Invite biotechnology professionals like Professors/Researchers/Entrepreneurs from different programs like Fulbright for short/long term stay to deliver lectures/conduct workshops at regular intervals as visiting faculties.
- ✚ Regular revision of M.Sc. curriculum to cope with the fast growing development in biotechnology.
- ✚ Encourage the faculties to develop national and international research proposals on their specialization and conduct collaborative research projects.
- ✚ Organize national and international level seminars/ workshop and other programs for upgrading and refreshing the knowledge of the faculties.
- ✚ Organize training program for those faculties who are far apart from updated information in the field of research in biotechnology and other subjects. Contribute in the production of human resource for fulfillment of the manpower need of the country;

Develop scientific knowledge and innovative ideas leading to contribute in the economic upliftment of the nation.

Rationale

Nepal is very rich in its natural resources. Biotechnology is the subject which utilizes the resources for the betterment of nature and living kinds. So, there are plenty of rooms to execute researches and generate place to work for skilled manpower. Employment generating education is the indispensable at present time. The graduates of Biotechnology, if properly supported by nation, can create thousands of jobs and serve for the economic development of the nation. The process in future leads to inception of country based industries generating jobs to those youths of Nepal who are investing their strength outside the country for little money. **Yearly hundreds of biotechnology undergraduates/ graduates leave Nepal for higher studies.** If nation could make effort on setting up a biotechnology based laboratory and industries, those who are abroad will have enough space to come back here.

In addition it has been a bitter reality that biotechnology graduates are yet not recognized by governmental organizations. They are bound by one or other rules to obtain few jobs what so ever available in limited organized agencies. The product of the TU biotechnology is in the verge of expectation for their secure professional life in their field. CDBT feels relief if it could help them reaching their proper destination in a more justifiable manner.

The M. Sc. level students with Biotechnology will be major actors in different activities of the development that are concerned with human welfare. They can contribute in research and development areas of basic science and biotechnology which can play a role for economic growth of nation for the prosperity of the people. The students/ Ph. D scholars after completion of the course can contribute in various important fields like agriculture, medicine, Pharmaceuticals, forensic, animal science, forestry, food and bioinformatics based companies and in production and service industry.

In the same time necessary rules and regulations should be formulated for attracting biotechnology industries in the country. Tribhuvan University has tried to fill the void presence in Nepal by establishing the central department of Biotechnology that will enable students to continue education for Master Degree and PhD program. To accomplish that, the new goals of Department and the objectives are for the best establishment of Department by constructing its own building comprising all required facilities, skill development and knowledge advancement by establishing collaborations with both national and international academic and research institutions.

Implementation Plan

It has been seven years since the department's inception. During the period, this Department has been established to produce M. Sc. Biotechnology manpower though there are many lacunae. The head of the Department along with its faculties has envisaged a goal to develop this department as a Model Biotechnology Hub and put forth following three plans in order to materialize the dream. **In this dream the faculty team has more hope of internal support from Tribhuvan University and international donor agencies.**

Strategy plan I: Academic Centre of Excellence

1. Construction of Biotechnology Building

Tribhuvan University has allocated a token of budget equivalent to NRs. 20,000,000.00 (twenty million) for last fiscal year to initiate foundation. The cost for the construction of total building has been estimated to be approximately NRs. 300 million. There is a bulk of sum required for furnishing the building which has been estimated to NRs. 50,000,000.00. So this focused plan implementation is decided to present to different donor agencies for their kind consideration citing the importance of biotechnology in Nepal having huge natural resources.

Tribhuvan University has already started the construction of Building, with Developmental budget of Rs. 2,00,00000. The location of building is not so satisfied due to lack of road to reach the building. Orally, TU authorities gave words that the road will be constructed according to the road map developed by Registrar office. Till now the plan has not started. Department of Biotechnology has prioritized the construction of building as currently it is being run by occupying few rooms of Central Department of Physics temporarily.

Extension of physical facilities has been planned for the department to strengthen teaching the running courses and also various specialized courses those are planned for future. New Building construction considering the bio safety regulations and with sufficient rooms for lecture, practical laboratories, research laboratories, Computer facilities, stores and rooms for the administrative purpose is the dire need of present time. The new building will strengthen the department and help to start M.Sc.

specialization programs in new related subjects. The department needs modern equipments to provide the uptodate knowledge for the students and also to carry out research activities.

New building with following rooms are planned for the department

SN		Room specification	Number(size)	Area(sq.ft.)
1	Class Room			
		Animal Biotechnology	1 (26' X 36')	936
		Agricultural	1(26' X 36')	936
		Medical Biotechnology	1(26' X 36')	936
		Plant Biotechnology	1(26' X 36')	936
		Food and industrial	1(26' X 36')	936
			Sub total	4680
2	Laboratories	Practical laboratories	4 (60' X 26')	6240
3	Research			
		Biochemistry	1(60' X 26')	1560
		Molecular Biology	1(60' X 26')	1560
		Immunology	1(60' X 26')	1560
		Cell & Tissue culture	1(60' X 26')	1560
		Plant and Agriculture	1(60' X 26')	1560
		Bioprocess and Enzyme	1(60' X 26')	1560
		Food and Industrial	1(60' X 26')	1560
		Environment Biotech	1(60' X 26')	1560
		Medical Biotechnology	1(60' X 26')	1560
		Cell Biology	1(60' X 26')	1560
		Microbiology	1(60' X 26')	1560
		Animal Biotechnology	1(60' X 26')	1560
			Sub-Total	18720
4	Computer	Server room	1(10' X 26')	260
		Practice room	1(50'X 26')	1300
			Sub-Total	1560
5	Library	Library with attached	1 (60'X26')	1560
6	Central Instrumental			
		Balance room	1(13'X13')	169
		Microscopy	1(13'X13')	169
		Microtomy	1(13'X13')	169
		Autoclave room	1(13'X13')	169
		Media preparation room	1(13'X13')	169
		Dark room	1(13'X13')	169
		Isotope laboratory	1(13'X13')	169
		Distillation/Deionization room	1(13'X13')	169
		Cold room	1(13'X13')	169

		Culture room	1(13'X13')	169
			Sub-Total	1690
7	Store Room			
		Chemical store room	1(13'X13')	169
		Bio-specimen room (4 ⁰ C	1(13'X13')	169
		Glassware store room	1(13'X13')	169
		General store	1(13'X13')	169
			Sub-Total	676
8	Administrative			
		Head of Department	1(15'X30')	450
		Account	1(12'X15')	180
		Administration	1(12'X15')	180
		Common room	1(15'X18')	180
		Seminar Hall	1(30'X70')	2100
		Canteen	1(20'X40')	800
		Guest Room	2(12'X15')	180
		Guard room	1(12'X15')	180
		Rest Room	8(8'X12')	768
			Sub-Total	5018
9	Open spaces	Corridor, ladder etc.	--	5000
10	Other spaces			
		Incineration House	1(10'X26')	260
		Animal House	1(15'X40')	600
		Green House	2(15'X40')	1200
			Subtotal	2060
Total				47204

(Design and budget estimation in Annex)

2. Upgrade the quality of existing faculties

This Department is equipped with faculties from different subject matters and specializations. It is necessary to update their skill and knowledge. Their upgraded knowledge ultimately will be shared with students who are the future biotechnologist. To gain this achievement, Department will plan to put forth the following actions:

1. Regular interaction programs with specific concerned research institutions
2. Faculty exchange program to international academic/research institutions

3. Recruit efficient new faculties

This department served by 10 full time faculties is not sufficient. There are still other vacancies to be fulfilled by university. So, Department will use its effort to recruit those vacancies by full time efficient faculties with PhD and with advanced knowledge and study.

4. Visiting faculties

This Department had history of visiting faculties Ms. Alenka from USA and Prof. Dr. Laxmaia Sri Rama from St. Cloude State University, USA who had already contributed a lot to improve the academic quality of this department for longer time. Furthermore, many of specialized and skilled professors, researchers, entrepreneurs etc are carrying theoretical and practical classes of this department. This trend of working will be strengthened further in the days to come.

5. Regular revision of curricula

Recently the curricula of all semesters have been revised after a long interactive seminars and collection of opinions from experts. This kind of activity will be continued in future as well.

6. Master program in different discipline of Biotechnology

The department aims to extend its programs in new related fields. M.Sc programs with specialization on Biotechnology related fields are planned to run in the Department in near future. The following fields are being planned to run in the department phase wise if proper financial support for faculties and infrastructure could made available:

- Biochemistry
- Immunology
- Genetics
- Molecular and cell Biology
- Agriculture Biotechnology
- Animal Biotechnology
- Microbial Biotechnology
- Medical Biotechnology

Strategy plan II: A model Biotechnology Laboratory

1. Installation of M.Sc. based laboratory equipments

This department is running well with its capacity of 24 M.Sc. students in each batch per year and ultimate strength is of 48. Since the students of fourth semester doing thesis work spend their most of whole day time in laboratory, there are number of instruments which are to be added for smooth conduction of practical classes. The number of students is quite high to put their hands in every experiment during laboratory work. Some instruments need in multiple numbers. Besides, due to lack of some instruments, Department is unable to include new experimental designs. Therefore, Department is

planning to setup a M.Sc. biotechnology central laboratory where the fourth semester students shall work for research purposes. For this purpose, Department will request TU and use its own fund in order to materialize the plan.

2. Installation of research based equipments

As most of the faculties have small research grants from University Grant Commission and National Academy of Science and Technology, Nepal, it has been indispensable to develop a research laboratory with required basic instruments for them. Besides, till date ten students have taken their enrollment for Ph.D. in different aspects like probiotics virology, biofuel and biosensor who require a sophisticated research laboratory to work. For these purposes, the support of TU budget will not be sufficient, so the department is planning to request the donor agencies to come up for their support.

Following equipments are needed for the department

S. No.	Items	Qty
1	-80C Deep Freeze	2
2	Table Top Cooling Centrifuge(with different rotors)	1
3	Epi Fluorescence Microscope with digital Imaging System	1
5	Electroporator	1
6	Rotary vacuum Evaporator	2
7	Biosafety Cabinet Class III	2
8	Scanning Electron Microscope	1
10	Flowcytometer	1
11	Sequencer	1
12	HPLC	1
14	Gene gun	1
15	Ultra Centrifuge	1
16	Confocal Microscopy	1
17	GCMS (Gas Chromatography Mass Spectrophotometer)	1
18	DNA Synthesizer (for Oligo Nucleotide preparation)	1
19	Protein Sequencer	1
20	Radio isotop scintillation Machine	1
21	Microinjection Machine	1
22	Phosphorimaging Machine	1

3. Construction of BSL-III [Bio-Safety Laboratory- Level III]

To our experience, there are many proposals coming up with contagious hazardous organisms of medical fields. For time being students are carrying those works in other national and international laboratories. For instance, the following research are being carried in other laboratories

a. Molecular Epidemiology and Complete genetic characterization of Dengue virus in Nepal.	National Public Health Laboratory, Teku, Kathamndu
b. Immune Reconstitution Inflammatory Syndrome (IRIS) Development Among People Living with HIV/AIDS in Nepal.	National Public Health Laboratory, Teku, Kathamndu and Infectious Disease Research
c. Molecular sub-typing of Cholera bacteria of Nepal	Centre for Molecular Dynamics CMDN, Thapathali, Kathmandu

This shows that it has been an indispensable aspect to establish a BSL-III within department to develop this department as a model biotechnology laboratory.

4. Resourcing Energy Power

Installation of Solar Power Energy source

Nepal is facing a huge hurdle of energy source. There is practice of power cut off to 18 hours a day which is beyond imagination for the biotechnology research laboratory. This Department is therefore, hardly managing the lacunae with a very small scale solar and Battery backup system and is completely incapable to conduct the experiments which seeks continuous power supply. For this envisaged plan after the appointment of new head of the department, the department has planned to go for alternative energy power, selectively solar power energy. According to this plan, if 50% of required power supply is being supported by Electricity, the solar power should meet department needs around 50 kW extra power to run basic equipments for conduction of M.Sc. practical classes. For the first phase, it is planning to go for basic requirements as mentioned below:

Continuous power supply required for regular class:

	Power Required (KW)	Required time per day(Hrs)	Power Require for continuous run(KW)
Laboratory 1 (Room 1)			
1. Laminar Hood	1	6	6.0
2. Spectrophotometer	0.3	4	1.2
3. Centrifuge (Eppendorf)	0.2	4	0.8
4. Transilluminator	0.2	2	0.4
5. PCR	0.55	6	3.3
5 RT-PCR	0.55	6	3.3
Sub Total	2.25 KW		15.0 KW
Laboratory 2 (Room 2)			
6. -20 ⁰ C Freezer	0.15	12	1.8
7. -40 ⁰ C Freezer	0.3	12	3.6
8. -80 ⁰ C Freezer	0.4	12	4.8
9. 4 ⁰ C Cabinet	0.3	12	3.6
10. Out-swing Centrifuge	0.45	4	1.8
Sub Total	1.5 KW		15.6 KW
Cell Culture Room (Room 3)			
10. CO2 Incubator	0.5	12	6
11. Normal Incubator	0.5	12	6
Sub Total	2.75 KW		12.0 KW
Class Room	0.5	6	3
Extra point	1	12	12
Grand Total	8.0 KW		57.6 KW

9. Laboratory waste management

There are lots of Biological component like Bacteria and other forms of life and chemical components like ethidium bromide, polyacrilamides etc. which are health hazardous even carcinogenic. Such chemicals need to be disposed properly. Department is planning to install a DISPOSAL PLANT for the waste products and byproducts of this department.

Strategy plan III Innovative national/international research projects

[One faculty - one project concept]

1. Explore country based researches

As mentioned in the introductory part of this plan, Nepal is one of the rich countries in the world in natural resources. Biotechnology is the branch of science which utilizes the nature and its organisms for the welfare of this planet and the living beings. Nepal can have many more micro and macro pitfalls to be explored in the field of biotechnology which not only uplift the economy of the nation but also can contribute for the human society remarkably. Now after inception of this department, it has felt responsibilities to explore such awaited resources for bioprospecting of natural resources in the field of medicine and industry.

2. Encourage relevant organizations of country to invest in researches

Due to political instability in the country, lots more trading business are being hampered and industrial development is being discouraged. In such scenario there are very few industries which can enhance their organizations applying biotechnological tools. This department had conducted an interaction program with industrialists in a seminar "Academia-Industrialist Dialogue" in support of UGC, Nepal. Such programs will be carried out in future with full strength so that the entrepreneurs will be attracted to invest in research part in their business.

Besides, there are many research companies, pharmaceutical companies and other biotechnology based industries coming up which can invest more in researches along with their income generating part. To name some of upcoming institution which are inspiration to the new products of biotechnology are Deurali Janata, Everest Biotech, Lotus Pharmaceutical etc. In addition the findings of research carried in CDBT may be implemented for commercialization.

3. Applying for national and international projects.

It is a pleasant news for people of biotechnology that though small but there are some regular grant applications are being called from different governmental organizations, like UGC, NAST, Ministry of Science and Technology, Ministry of Education etc. Because of it, faculties and students are benefited to be involved and contribute some for the nation.

Besides, there are many international donors, which can approve small to big grants if standard convincing proposals can be drafted. This department has already received a grant from TWAS, Norwegians and KRIBB. To add more, some projects are being running with collaboration of international organizations/researchers.

4. Researches on applied fields.

It is obvious that the problems of specific pocket area would be better solved by research product of the same area, whether that is of medical/environmental/agricultural or any other. Therefore, emphasis would be given to the area of applied research such as vaccine production, antibody production, transgenic plant production, medical diagnostic tool developments, food technology etc.

5. Inspiration to Faculties

[One faculty - one research concept]

On the basis of above all concepts and program for implication, full time faculties along with part-time faculties will be inspired for involvement in research project work. For which they will be insisted to explore possible area of research work in their specialization. The project would be national or international. More preference will be given to interdisciplinary faculty team project in the field of Biotechnology mentioned in this proposal. Within the Five-Year Plan period, department has envisaged for the project at least one with one faculty

**Financial Plan for Development of
Central Department of Biotechnology**

Summary of the Budget

S.N.	Particulars	Units	Rate	Cost in NRs.
Goal I: Academic Centre of Excellence				
1	Building construction	47204 Sq. ft.	-	200,000,000.00
2	Landscape management	--	--	5,000,000.00
3	Furnishing	30 Rooms	1,500,000.00	45,000,000.00
4	Provision of Visiting faculties	200000	8	1,600,000.00
5	Revision of curriculum	200000	1	200,000.00
6	Inception of M.Sc. specialization	6	2,000,000	12,000,000.00
Goal II: A model Biotechnology Laboratory				
1	Equipments	--	--	50,000,000.00
2	Construction of BSL-III laboratory	1		2,000,000.00
3	Solar power installation	50 kW	80,000.00	4,000,000.00
4	Laboratory Waste management			5,000,000.00
Goal III: Innovative national/international research projects [One faculty - one project concept]				
1	Research Development in the	9 faculties	20,000	180,000.00
			Total	324,980,000.00

Miscellaneous

Animal House

Construction of animal house is next part of the five year developmental plan of biotechnology central department. Once the department will be in fully functional phase with research/ innovation /discovery, the department need an entirely organized animal house to carry the animal based experiment and for trial of discovered products/medicine/ enzymes etc. The animal house will establish following the rules and regulation according to government policy.

The animal house will have animal like mice, mouse, rabbit, guinea pig; goat, if possible monkey.

For which the basic requirements are as follows.

1. Fully equipped animal house that includes:
 - a. ventilation and heating system
 - b. store room for feed stock and utensils
 - c. waste management system
 - d. system for management of animal Carcass
 - e. Animal/Bird rearing sheds
 - f. Animal breeding management
2. Veterinary Doctor
3. At least five staff members of farm workers and administrative team

Green House

Green house is important for the experiments dealing with plant biotechnology and Agriculture biotechnology. This part of biotechnology needs extra land of 5 ropanies for which the basic requirements are as follows:

1. Green house construction materials (Hydroponic System)
2. Temperature and moisture control system
3. Store room for utensils, pots and manure
4. At least five members of workers and administrative team