

STUDY AND EVALUATION SCHEME FOR
ONE YEAR POST GRADUATE DIPLOMA IN BIO TECHNOLOGY (Tissue Culture)
(Effective From)

I Year

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory				Practical				Grand Total
Le	Tut	Dr	Lab	Work	Tot		Examination	Sess.	Total	Examination	Sess.	Total	Tot		
c.	ori	aw	Shop	al		Dur.	Marks	Marks	Dur.	Marks	Marks	Marks	al		
3	1	-	4	-	8	1.1 Bio Chemistry & Cell Physiology	3.0	75	25	100	3.0	30	20	50	150
3	1	-	4	-	8	1.2 Molecular Biology and Genetic Engineering	3.0	75	25	100	3.0	30	20	50	150
3	1	-	4	-	8	1.3 Microbiology	3.0	75	25	100	3.0	30	20	50	150
3	1	-	4	-	8	1.4 Plant Tissue Culture Technology	3.0	75	25	100	3.0	30	20	50	150
3	1	-	4	-	8	1.5 Green House Technology	3.0	75	25	100	3.0	30	20	50	150
2	-	-	-	-	2	1.6 Environmental Education(*) And Disaster Management	2.5	50	-	-	-	-	-	-	-
-	-	-	6	-	6	1.7 Project Work	-	-	-	-	120	80	200	200	
17	5	-	26	-	48	<-----TOTAL----->	-	375	125	500	-	270	180	450	950
												Games/NCC/Social and Cultural Activity Community Development Work+Discipline (30 + 20)		50	
												Aggregate		1000	

- NOTE:-
- (1) Each period will be of 50 minutes duration.
 - (2) Each session will be of 32 weeks.
 - (3) Effective teaching will be at least 25 weeks.
 - (4) Remaining periods will be utilised for revision etc.
 - (5) Structured and supervised task oriented project work to be organised during teaching. Student will submit a report there will be 200 marks for this project. Each marks will be awarded by the examiner (examination Marks 120 : Sess. Marks 80)
 - (6) Environment Awareness Camp :To be organised at a stretch for 3 days. No Examination. Entrepreneurship Camp : To be organised at a stretch for 1 week No examination.
 - (7) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

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1. SALIENT FEATURES OF THE COURSE

- 1.1 Name of the Course : Post Graduate Diploma in Biotechnology
(Tissue Culture)
- 1.2 Entry Qualification : B.Sc (Biology With Chemistry/Bio Chemistry)
- 1.3 Duration : One Year
- 1.4 Type of Course : Full Time
- 1.5 Pattern of Course : Annual System
- 1.6 Intake of Students : 60 Students
- 1.7 Mode of Admission : Through Entrance Examination

NEED ANALYSIS

Technological advancements have brought revolutionary changes in the world of work. The need for reevaluation of the availability and use of existing natural resources is essential in view of the onset of the energy, environmental and economic crisis whose dents have begun to appear on our National Budget. The interaction of biological, physical and chemical engineering sciences have produced a great quantum of new knowledge in the integrated stream of biotechnology. These integrated efforts, through living organisms can provide for the solution of many of our problems like food, energy, health care and environmental pollution etc. The broad areas of the application of biotechnology are agriculture/forestry/ horticulture, medicine and health, food, chemical and other industry, environment/ecology and energy production. Wide scope and applications of biotechnology require trained manpower.

The present curriculum is an effort to meet the need in the coming years, of such personnels having studied the course, the students will be able to :-

1. Work as Assistant Biotechnologist in research lab, educational institute, chemical and pharmaceutical industries.
2. Can start his own testing lab.

PROLOGUE TO REVISION

It was considered essential to revise the curriculum of Post Graduate Diploma In Bio Technology (Tissue Culture) to accommodate new areas of technology as well as update and modernize the existing course contents so as to make it more relevant to the need of the world of work. The world of knowledge is ever growing and their always remains something to aid to make the students update, So it is imperative to make relevant changes in the curriculum in the form and contents both. Accordingly a work shop was held to look into the gaps in existing curriculum and revise the same. A number of professionals, representing various fields, organization, higher technological institute and polytechnic were involved in updating the contents and upshots of these work shops have been properly arranged to systematised classroom teaching.

The important features of the presently proposed curriculum are as given below -

1. Bio chemistry and Cell Physiology paper has been redesigned and irrelevant portion deleted
2. Microbiology paper has been redesigned and some new portion is added.
3. Molecular cell biology paper has been redesigned and named as Molecular Biology and Genetic Engineering
4. Animal Tissue Culture has been deleted
5. Plant Tissue Culture paper has been redesigned and some irrelevant portion deleted and some new portion added.

LIST OF EXPERTS

List of experts whose deliberation helped the revision of curriculum for One Year Post Graduate Diploma In Bio Technology (Tissue Culture) in a workshop held on 28.01.2002 at I. R. D. T.,U. P., Kanpur are honourably named below -

1. Dr. G. S. Randhawa
Professor
Bio Sciences and Bio Technology Deptt.
I. I. T., Roorkee
2. Dr. Shubhjit Dutta
Scientist
Bio Technology Center
Indian Institute of Pulse Research, Kanpur
3. Mrs. Shikha Sharma
Lecturer -Bio Technology
D. N. Polytechnic, Meerut
4. Dr. Har Govind Singh
Lecturer - Chemistry
Government Polytechnic, Faizabad
5. Er. Gurdeep Singh
Director
Institute of Research, Development & Training, U. P., Kanpur
6. Dr. Anita Bajpai
Asstt. Professor
Institute of Research, Development & Training, U. P., Kanpur

List of experts whose deliberation helped the revision of curriculum for One Year Post Graduate Diploma In Bio Technology (Tissue Culture) in a workshop held on 28.11.2007 and 08.02.2008 at I. R. D. T.,U. P., Kanpur are honourably named below -

1. Dr. P. Singh
Professor
Plant Breeding and Genetic Engineering Deptt.
C. S. A., Kanpur

2. Dr. Gauri Shanker
Retd. Professor
Bio Technology Department
H.B.T.I., Kanpur
3. Dr. H. M. Shukla
Associate Professor
Horticulture
C. S. A., Kanpur
4. Dr. S. P. Singh
Associate Professor
Animal Science & Husbandary Department
C. S. A., Kanpur
5. Dr. Mukesh Mohan
Assistant Professor
Bio Chemistry Department
C. S. A., Kanpur
6. Mr. Brijesh Singh Katiyar
Assistant Professor
Bio Technology Department
H.B.T.I., Kanpur
7. Mr. Arun Kumar
Lecturer
Bio Tech.
D. N. Polytechnic, Meerut
8. Shri Dhruv Narayan
Assistant Professor
I. R. D. T. U. P., Kanpur

PROFILE DEVELOPMENT

A tool in the form of questionnaire for getting information about job potential, job opportunity and manpower requirement and job activities of diploma holder in bio technology.

The draft curriculum has been finalised and validated by sending a copy of it to various experts and teaching institutions. The comments received from them have been duly incorporated in the final curriculum document which contains following elements:

1. Employment opportunities and activity profile of diploma in Biotechnology (Tissue Culture)
2. Broad Curriculum Objectives and learning experiences to be provided to the students by offering various subjects
3. Detailed time distribution in terms of lectures, tutorial and practical for each subject.
4. Study and Evaluation Scheme
5. Detailed Content details of various curriculum areas.
6. Resources and infrastructure required for effective implementation

In order to expose the students to field practices and develop problem solving abilities in them, elements of project work of 6 period in a week has been kept in the curriculum. The Curriculum Development Centre of this Institute wishes to thank all those, who helped in designing the curriculum. It is hoped that this curriculum will be implemented in the spirit it has been designed and the teachers will provide appropriate learning experiences to students for the fulfillment of stated objectives and developing relevant competencies in the students.

EMPLOYMENT OPPORTUNITIES

Micropropagation of true to type and disease free ornamental plants, fruit and forest trees in large number through tissue culture throughout the year has already been highly commercialized into multi million dollar industry in India and abroad. Various techniques of plant tissue and cell cultures viz; wide hybridization through embryo rescue, somatic cell hybridization, callus cultures from another culture, genetic engineering and genetic transformation are being extensively used for plant improvement synthetic/artificial seeds are being produced through somatic embryogenesis. The plant cells are grown in bioreactors for production of secondary plant metabolites and bioprocessing. The plants multiplied or regenerated through tissue cultures have to be suitably acclimatised and hardened for long distance transportation and field plantation, in green houses with controlled temperature, humidity and light regimes. Both imported and indigenously developed green house technology is in great demand for production of high valued ornamental and off season vegetables for export. Bioreactors and fermentors are being used for bulk production of biopesticides, biofertilizers, antibiotics, vitamins, amino acids, enzymes, and food processing using various micro-organisms. Animal cell culture has vast application and potential in human and animal health care diagnostic and pharmaceutical industries for production of diagnostic kits, antibodies, vaccines, drug testing embryo transfer technology and genetic engineering.

Keeping in view the application of tissue culture in various biotechnological approaches for plant, animal and microbial improvement, production and utilization, considerable number of trained technicians are required to meet the research and development and industrial manpower requirements. It is anticipated that the technicians trained under this programme will find wage and self-employment opportunities in the following areas:

1. Plant propagation and improvement
2. Green house fabrication installations, operation and maintenance
3. Research and Development Activities in Universities and Institutes
4. Health care and pharmaceutical industries
5. Biopesticides and biofertilizer industries
6. Development departments and corporations of agriculture, horticulture and forestry etc.
7. Food industry

COMPETENCY PROFILES

- a) Basic understanding of bio technology and emphasis on specially on tissue culture
- b) Competency in establishment and maintenance of different related bio technology tissue culture laboratory, instruments, chemicals and different specialised techniques and green house
- c) Knowledge and skills in handling cell/tissue cultures in septic environment, instruments, chemicals and different specialised techniques.
- d) Competency for large scale production and utilization of plants, microbes and animal cells
- e) Ability to handle sophisticated instruments like fermentors, ELISA reader, fluorescent and phase contrast microscopy ultra centrifuges, UV/visible/ spectro photometer, HPLC and electrophoresis etc.

1.1 BIOCHEMISTRY AND CELL PHYSIOLOGY

	L	T	P
Periods/week	3	1	4

RATIONALE

Basic knowledge about bio-chemistry and cell physiology is essential for the students of diploma in Biotechnology (Tissue Culture). The elements of biomolecules, carbohydrate metabolism, lipid metabolism, enzymes, nitrogen metabolism, photosynthesis and physiology are important part of biochemistry which shall be taught to the students through this subject besides introduction about spectrophotometry, microscopes etc.

DETAILED CONTENTS

1. Introduction to biomolecules: Concept of ionization, pH, buffers and their application. Biological properties of water
2. Structure, function and metabolism of carbohydrate, proteins and lipids.
3. Nitrogen Metabolism and Urea Cycle.
4. Occurrence and role of tannins, alkaloids, lectins, lignins, flavonoids and steroids.
5. Plant Bio-regulators : Synthesis and action of hormones.
6. General properties and mode of action of enzymes, co-enzymes and cofactors, Enzyme activity and factors affecting enzyme activity.
7. Biochemistry of Nitrogen fixation
8. General aspects of photosynthesis: Calvin cycle, C-4 and CAM modes of photosynthesis, Photorespiration.
9. Principles of spectrophotometry, Chromatography, spectrofluorometry, radio-isotope techniques and electron microscopy.

PRACTICALS

1. To prepare various buffer solutions required for tissue culture and bio-chemical work.
2. To evaluate max value for Biuret peptide complex and quantitative analysis of protein.
3. To determine acid value of an oil.
4. Quantitative analysis of protein sample by Follin's reagent.
5. Quantitative and qualitative analysis of carbohydrates.
6. To evaluate V max for enzymes and construction of saturation curve.
7. Separation of Amino Acids.
8. Separation of Photo Synthetic Pigments.

1.2 MOLECULAR BIOLOGY AND GENETIC ENGINEERING

L T P
Periods/week 3 1 4

RATIONALE

The course will deal with the knowledge of types of cells, composition, function and genome organization of various cell types and an acquaintance with manipulation of DNA.

DETAILED CONTENTS

1. Introduction, Development, Present Status and Prospects of Molecular Biology and Genetic Engineering.
2. Replication of DNA, Types, Structure and Organisation of DNA and RNA and the genetic code.
3. Genome organization in viruses, bacteria, fungi, yeast and higher eukaryotes. Introduction to gene mapping, Genomics and Proteomics; RFLP, RAPD, PCR.
4. A brief account of repetitive DNA sequences, split genes, transposons.
5. Gene Expression; Central Dogma, Transcription, Translation, Regulation of Gene expression.
6. Fundamentals of recombinant DNA technology: DNA extraction, labelling of nucleic acids, Restriction endonucleases, cloning vectors, Isolation and cloning of genes, gene libraries.
7. Fundamentals of electrophoresis, its uses, Southern blotting and hybridization, Western Blotting.

PRACTICALS

1. Isolation of plasmid DNA from E. Coli. (Transformed) cells.
2. Quantitation of nucleic acids by gel electrophoresis and spectrophotometry.
3. Isolation of DNA from plant and microbial cells.
4. Southern Blotting
5. Spectrophotometric Determination of melting temperature of DNA.
6. Demonstration of digestion of DNA by restriction endonuclease and agarose gel electrophoresis.

1.3. MICROBIOLOGY

	L	T	P
periods/week	3	1	4

RATIONALE

In order to exploit medicinal and industrial application of cellular processes in tissue culture it is essential to understand the basic concepts of cell structure, function and interactions in microbes. This subject has been designed giving more emphasis on fundamentals of various principles involved. Students will be able to utilize their skill in the application of microbial techniques towards commercial application.

DETAILED CONTENTS

1. Introduction to microbiology and its relevance to biotechnology, diversity and ubiquity of microbes, structure of micro-organisms such as, bacteria, viruses, moulds, yeast, protozoa, algae.
2. Methods in Microbiology
Pure Culture techniques, maintenance, preservation, improvement and stability of biotechnologically relevant cultures
3. Microbial growth and concepts of energy generation. Elementary knowledge of industrial microbiology.
4. Microbial genetics:
Conjugation, transformation and transduction, Modes of recombination, construction of genetic maps, yeast genetics (Introduction only), Genome organization of E.coli., Bacteriophage Lambda.
5. Microbes in relation to agriculture and bio-fertilizer.
6. Environmental and Applied Micro-Biology; Waste treatment, Soil and Air microbiology
7. Commercial importance of Streptomyces, Bacillus Agrobacterium and yeast
8. Microbial Pathogenesis: types of microbial infections, host-microbes relationship, host system, mode, epidemiology, transmission control and prevention.

PRACTICALS

1. Sterilization of glasswares and preparation of culture media for microbial growth.
2. Morphological and biochemical characterization of microorganisms.
3. Simple and differential staining of different microorganisms.
4. Isolation, purification, maintenance and preservation techniques for aerobic and anaerobic cultures.
5. Microbial growth measurement by different techniques (Counting, O.D. measurement).
6. Determination of factors affecting growth of microorganisms
7. Fermentative production of alcohol.

1.4 PLANT TISSUE CULTURE TECHNOLOGY

	L	T	P
Periods/week	3	1	4

RATIONALE

Since the students will be engaged in the use of Tissue Culture in biotechnology, the fundamentals of Tissue Culture Technology will help them to gain knowledge and skill in Plant Tissue Culture which can be used for improvement of varieties of crops, e.g., grain quality, fibre quality, disease resistance insect resistance, herbicide resistance etc.

DETAILED CONTENTS

1. Introduction: Definition, history, present status, future prospects of tissue culture, Cell totipotency.
2. Composition of different culture Media, Role of chemicals and growth regulators in tissue culture.
3. Sterilization of media, tissues and other accessories, Inoculation of cultures.
4. Callus Induction and plant regeneration. Organogenesis and Embryogenesis.
5. Suspension culture, Protoplast isolation, culture and fusion.
6. Clonal propagation : Shoot-tip and axillary bud culture.
7. Techniques of cell and tissue culture: Preparation of explant materials, initiation of cultures, micropropagation through organogenesis and embryogenesis, artificial seeds.
8. Anther Culture: Development of haploids, diploidization and its applications.
9. Embryo culture.
10. Somaclonal variations and in vitro selections towards crop improvement.
11. Industrial application of plant tissue culture for production of Secondary metabolites.
12. Plant biotechnology and crop improvement for grain quality, fiber quality, disease resistance, insect resistance, herbicide resistance, stress resistance (basic outlines).

PRACTICALS

1. Orientation : Introduction to tissue culture laboratory; washing chamber, media preparation laboratory, transfer laboratory, sterilization laboratory inoculation laboratory, culture room.
2. Tissue culture requirements; glass ware, water distillation Unit, chemicals, instruments; Autoclave, pH meter, sterile air flow chamber (Laminar flow).
3. Preparation of Media.
4. Sterilization: Media, Explant, glassware.
5. Inoculation, Callus Induction and clonal propagation.
6. Subculturing and Regeneration of roots, shoots and plants.
7. Preparation of regenerated plants for hardening.
8. Protoplast Isolation and culture(demonstration).
9. Induction of embryogenic callus and encapsulation of artificial seeds.
10. Anther culture: Regeneration of plants from anthers/pollens.
11. Agrobacterium - mediated transformations (demonstration).

1.5 GREEN HOUSE TECHNOLOGY

	L	T	P
Periods/week	3	1	4

RATIONALE

After passing the programme the students will have to work in green house or some of them may opt to start their own green house. Appropriate knowledge and relevant skills are necessary in order to establish and maintain the green houses. The course will help to plan and fabricate suitable green house with controlled environmental parameters for different climatic zones to harden tissue culture derived plants and grow high value ornamentals, cut flowers and vegetables to meet market demand in off season and, export.

DETAILED CONTENTS

1. Environmental parameters for optimum plant growth.
2. Photoperiodism, vernalization.
3. Green House and polyhouse materials, designs & fabrication.
4. Cooling, shading, misting, drip irrigation, fertilization and fumigation.
5. Recording and Computerisation of environmental parameters and cultural operations.
6. Hydroponics.
7. Pots, potting mixtures and soil sterilization.
8. Cultivation of Horticultural plants.
9. Hardening of tissue culture derived horticultural plants.
10. Post harvest technology.
11. Packaging and transportation.
12. Intellectual Property Rights.

PRACTICALS

1. Raising of off-season nursery in poly houses.
2. Preparation of tissue culture derived plants for hardening.
3. Preparation of soil mix and sterilization.
4. Hardening of tissue culture derived plants.
5. Soil culture and hydroponics, sand culture of roses and selected vegetables in green house.
6. Harvesting, preparation, cooling of cut flowers and vegetables.
7. Packing and transportation (Demonstration only).

1.6 ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

L T P
2 - -

RATIONALE:

A diploma student must have the knowledge of different types of pollution caused due to industrialisation and construction activities, so as he may help in balancing of eco-system and control pollution by providing controlling measures. They should be also aware of the environmental laws for effectively controlling the pollution of environment. The topics are to be taught in light of legislation Para-3.

TOPIC WISE DISTRIBUTION OF PERIODS:

SL. NO.	TOPIC	L	T	P
1.	Introduction	6		
2.	Pollution	3		
2.1	Water Pollution	8		
2.2	Air Pollution	8		
2.3	Noise Pollution	3		
2.4	Radio Active Pollution	4		
2.5	Solid Waste Management	5		
3.	Legislations	3		
4.	Environmental Impact Assessment	4		
5.	Disaster Management	6		
TOTAL		50	-	-

DETAILED CONTENTS

1. INTRODUCTION :

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigation, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.
- Lowering of water level , Urbanization.
- Biodegradation and Biodegradability, composting, bio remediation, Microbes .Use of biopesticides and biofungicides.
- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc.

2. POLLUTION :

Sources of pollution, natural and man made, their effects on

living environments and related legislation.

2.1 WATER POLLUTION :

- Factors contributing water pollution and their effect.
- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.
- Physical, Chemical and Biological Characteristics of waste water.
- Indian Standards for quality of drinking water.
- Indian Standards for quality of treated waste water.
- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION :

Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, CO, CO₂, NH₃, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.
 - A. Settling chambers
 - B. Cyclones
 - C. Scrubbers (Dry and Wet)
 - D. Multi Clones
 - E. Electro Static Precipitations
 - F. Bog Fillers.
- Ambient air quality measurement and their standards.
- Process and domestic emission control
- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION :

Sources of noise pollution, its effect and control.

2.4 RADIOACTIVE POLLUTION :

Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT :

Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. LEGISLATION :

Preliminary knowledge of the following Acts and rules made thereunder-

- The Water (Prevention and Control of Pollution) Act - 1974.
- The Air (Prevention and Control of Pollution) Act - 1981.
- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.
 - # The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000
 - # The Hazardous Wastes (Management and Handling) Amendment Rules, 2003.
 - # Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.
 - # The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.
 - # Municipal Solid Wastes (Management and Handling) Rules, 2000.
 - # The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) :

- Basic concepts, objective and methodology of EIA.
- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

1.7 PROJECT WORK

L T P
- - 6

The purpose of introducing project work is to enable the students to apply the knowledge, skills and attitudes, acquired during the entire course, to the solution of specific problems related to practical world of work. It is expected that students will be sent to various organisations at a stretch for 8 weeks and be asked to take up any live problem of the organisation as project work. Students may also be given option to take up entrepreneurial projects and projects related to environment/ecology and waste management/utilisation. The project identification should be done by the students in consultation with teachers and personnel from the organisations where the student is going to undertake the project activity on the basis of basic principle; "problem needing to immediate solution". Each teacher should guide 3 - 4 students for project work throughout this activity. The students will have to go through all the steps of problem solving such as defining the problem, analysis of the problem, collection of required information and resources, formulating alternatives, selecting best solution and reduction in practice.

The project work aims at, besides developing problem solving abilities in the students, development of confidence and expertise in a particular field. The student may get training to analyse the problem, use of instruments, use of techniques and orientation of learning experiences towards their applications in the world of work. Some of the suggested projects are given below:

PLANT TISSUE CULTURE

Initiation of a culture and finally production of plant in tissue culture system

These are only some of the suggestive projects, infact, students can totally ignore this list and identify projects with the help of their teachers/personnel from industry/organisation.

Students will be assessed on the basis of the project report and viva voce examination by internal and external examiners on the pattern suggested below:

- | | |
|--|------------|
| 1. Punctuality and regularity | 15 percent |
| 2. Level/Proficiency of Practical Skills Demonstrated | 25 percent |
| 3. Sense of initiative and responsibility | 10 percent |
| 4. Interpersonnel skills/Human Relations/Behaviour during the project work | 10 percent |
| 5. Report Writing | 25 percent |

6.	Viva Voce	15 percent

	TOTAL	100 percent

ENVIRONMENTAL AWARENESS CAMP

RATIONALE

A post diploma holder in Bio-technology (Tissue Culture) must have the knowledge of different types of pollution caused due to industrialisation and construction activities so as he may help in balancing the eco system and control pollution by providing controlling measures. He should be also aware of the environmental laws for effectively controlling the pollution of environment.

DETAILED CONTENTS

This is to be organised at a stretch for two to three days. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land forms, preservation of species, prevention of advancements of deserts and lowering of water table.
3. Sources of pollution - Natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non living organisms
5. Pollution of air - causes and effects of man, animal, vegetation and on non-living organisms
6. Sources of noise pollution and its effects
7. Mining, blasting, deforestation and their effects
8. Legislations to control environment
9. Environmental Impact Assessment (EIA) Elements for preparing EIA statement.

ENTREPRENEURSHIP AWARENESS CAMP

RATIONALE

Besides finding employment in any organization there is a great scope for the students of post diploma in Biotechnology (Tissue Culture) to get self employed and establish their own units. For this purpose knowledge about feasibility report based on the market research, financial and other institutions which can provide different types of support/assistance to the entrepreneurs and management is very essential. It is proposed to organise an entrepreneurship awareness camp for one week at a stretch for the students toward the end of academic session.

DETAILED CONTENTS

1. Concept of entrepreneurship, need and development of entrepreneurial attitudes and qualities
2. Market research and feasibility report - methods for market research and preparation of feasibility report
3. Basic resources finance, infrastructure, manpower and training, technology and information resources - their sources, prominent procedure and budgeting etc
- *4. Assistance available from District Industries Centres, Commercial Banks, State Financial Corporation, Small Industries Service Institute, Research and Development Laboratories/Organisations and other Financial and Developmental Organisations
5. Book keeping and material inventory control
6. Quality management, sales and marketing techniques

NOTE: The students should be given at least one exercise for preparation of feasibility report for any product.

- * Experts from various organisations/Institutions may be invited to explain the type of facilities available and procedures for availing these facilities from their prospective organisations/institutions

STAFF STRUCTURE

1.	Head of Department	1	M.Sc.(Biotechnology) with minimum 8 years experience as Lect./Sr. Lecturer OR M.Sc.(Life Science) inclusive of Plant Science Animal Science & Bio-Chemistry preferably specialisation in tissue culture with minimum 8 years experience as Lect./Sr. Lecturer
2.	Lecturer	4	M.Sc.(Biotechnology) or M.Sc.(Life Science)
3.	Technician	2	B.Sc.(Life Science) or Diploma in Agriculture or Diploma in Biotechnology
4.	Lab Attendent	3	10+2 with science sub.
5.	Green House Attendent	1	10+ (Matric Pass)

SPACE REQUIREMENT

Following workshops/laboratories are recommended to setup. Space requirement of laboratories/workshop is given below (for space requirements for other purpose, please see AICTE norms) :

1.	Molecular and cell Biology Laboratory (with 7X14 sq.m instrumentation dust free AC room)	10 X 20 Sq.m
2.	Plant Tissue Culture Technology Laboratory (with 7X14 sq.m instrumentation dust free AC room)	10 X 20 Sq.m
3.	Microbiology and Industrial Bio Technology (with 7X14 sq.m instrumentation dust free AC room)	10 X 20 Sq.m
4.	General Instrumentation room (with some work benches)	15 X 25 Sq.m
5.	Green house and Environmental Chamber (In the field)	10 X 20 Sq.m

LIST OF EQUIPMENT

Sr. No.	Item	Qty	Cost
1.	Dissecting Microscopes	4	40,000
2.	Microtome with accessories	1	40,000
3.	Light Microscopes	10	2,50,000
4.	Fluorescence and phase contrast microscope	2	8,00,000
5.	Refrigerator(double door 165 Lit. each)	2	30,000
6.	CO2 incubator with accessories (Cylinders)	1	3,00,000
7.	Autoclave Horizontal (Large) Approx. 200 lit. capacity	1	2,50,000
8.	Autoclave Vertical (Small) Approx. 20 lit. capacity	4	60,000
9.	Laminar Air flow Benches(3X4 Sq.ft each)	4	3,00,000
10.	Liquid nitrogen cylinder with supply	1	75,000
11.	DNA Transilluminator	1	2,00,000
12.	BOD incubators with light (NSW India, Max Size)	4	2,00,000
13.	Incubator Shaker	1	4,00,000
14.	DNA Thermal cycler	1	1,50,000
15.	HPLC, High pressure liquid	1	2,00,000
16.	Centrifuges(Coolings REMI C-24)	2	2,50,000
17.	Freezer(-) 20oC(210 Lit. horizontal)	1	40,000
18.	Freezer(-) 80oC(210 Lit. horizontal)	1	4,00,000
19.	Water Bath	4	60,000
20.	Drying and Sterilizing ovens		
21.	Water Purification System (Millipore) approx. 40-50 lit. Water with accessories A. Pre filtration system B. Reverse osmosis system C. Ion Exchangers	1	4,50,000
21A.	Glass Water Distillation Unit	4	50,000
22.	pH meters	4	50,000
23.	Ordinary centrifuge Speed 5000 rpm, 8 tubes each	4	40,000

Sr. No.	Item	Qty	Cost
24.	Horizontal and vertical electrophoresis apparatus and power supplies	2 each	1,00,000
25.	U.V/Vis Spectroscope with computers	1	3,00,000
26.	Shakers, Temperature Control Indigenous clamps with trays for flask holding	4	6,00,000
27.	Microfuges	2	1,20,000
28.	Cell counter	2	4,000
29.	Magnetic stirrer	4	12,000
30.	Pipette aids and automatic pipetting	LS	1,60,000
31.	Fraction collector complete unit with columns, U.V monitor Recorder, peristaltic Pump	1	4,00,000
32.	Filtration units (for medium Sterilization) with pump	3	90,000
33.	Top Pan Balances	5	50,000
34.	Colony counters		
35.	Dispensers and diluters	3	90,000
36.	Spectrophotometer	2	1,80,000
37.	Electronic Balance	1	1,00,000
38.	Chemicals	LS	2,00,000
39.	Glassware	LS	2,00,000
40.	Miscellaneous	LS	2,00,000
41.	Ovens	2	50,000
42.	Green house	1	4,50,000
43.	Pentium Server with Accessories Laser Printer and Colour Monitor	1	2,00,000
44.	Ocular and Stage Micrometer	20	20000
45.	Haemo Cytometer	20	20000
46.	Micro Pipette (Set of 3, 2-20 ul, 20-200ul, 200-1000ul)	10	100000
47.	Bio reactors For Plant Cell Culture	1	120000

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ANNEXURE- QUESTIONNAIRE

INSTITUTE OF RESEARCH,DEVELOPMENT AND TRAINING U.P.KANPUR -208024

SUBJECT: Questionnaire for ascertaining the job potential and activities of diploma holder in Biotechnology (Tissue Culture).

PURPOSE: To design and develop One Year diploma curriculum in Biotechnology (Tissue Culture)

NOTE: 1.Please answer the questions to the points given in the questionnaire.
2.Any other point or suggestion not covered in this questionnaire may be written on a separate paper and enclosed with the questionnaire.

1.Name of the organisation: _____

2.Name & Designation of the officer _____
filling the questionnaire _____

3.Name of the department/section/ _____
shop _____

4.Importent functions of the _____
department/section/shop _____

5.Number of diploma holder employees
under your charge in the area of _____
Biotechnology (Tissue Culture)

6.Please give names of modern equipments/machines handled by a
diploma holder in Biotechnology (Tissue Culture).

- | | | |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

7.What proficiencies are expected from a diploma holder in
Biotechnology (Tissue Culture).

- | | | |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

8.Mention the approximate percentage of the following desired in
Diploma teaching.

1. Theoretical knowledge -----%
2. Practical knowledge -----%
3. Skill Development -----%
9. Do you think " on the job training"/Industrial training should form a part of curriculum. (Yes/ No)
if yes then
- (a) Duration of training -----
- (b) Mode of training 1. Spread over different semesters
2. After completion of course
3. Any other mode
10. What mode of recruitment is followed by your organisation.
1. Academic merit
2. Written test
3. Group discussion
4. Interview
5. On the job test.
11. Mention the capabilities/ Qualities looked for while recruiting diploma holder in Biotechnology & Tissue Culture (Semester System).
- (a) Technical knowledge -----
- (b) Practical skill -----
- (c) Etiquettes and behaviour -----
- (d) Aptitude -----
- (e) Health habit and social background -----
- (f) Institution where trained -----
12. Does your organisation have Yes/No
any system for the survey of Home
articles of different countries/States.
13. Does your organisation conduct field Yes/No
survey to know users views regarding.
1. Home Articles for different
age groups and sex.
2. Effect of climatic conditions
3. Any other
- If yes ; Please give brief account of each.
14. Which type of assignment do you suggest for an entrepreneur
in Biotechnology (Tissue Culture).
15. In which types of organisations can a diploma holder in
Biotechnology (Tissue Culture) can work or serve.
- 1 2 3

4

5

6

16. Job prospects for the diploma holder in Biotechnology (Tissue Culture) the next ten years in the state / country.

17. In your opinion what should be the subjects to be taught to a diploma student in Biotechnology (Tissue Culture).

Theory

Practical

18. Kindly mention particulars regarding topics/areas which should be given more emphasis in the curriculum .

Theory

Practical

19. Kindly state whether your organisation can contribute towards improvement of curriculum in above field. Yes/ No
If yes : Please give names of experts in your organisation to whom contact.

20. Kindly give your valuable suggestions for being considered at the time of finalisation of curriculum.

21. What changes in technologies are to be incorporated in the development of curriculum in Biotechnology (Tissue Culture).

(Signature)

Kindly mail the above questionnaire duly filled to:-

Dhurv Narayan
Assistant Professor
Institute of Research, Development & Training, U.P.
Govt. Polytechnic Campus
Kanpur-208024

(Please note that all information in this survey is confidential for the use of curriculum design only)