

Deccan Education Society's  
**FERGUSON COLLEGE, PUNE**  
**(AUTONOMOUS)**

**SYLLABUS UNDER AUTONOMY**

**THIRD YEAR B.Sc. VOCATIONAL BIOTECHNOLOGY**  
**SEMESTER - V**

**Academic Year 2018-2019**

**Deccan Education Society's  
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004  
Scheme of Course Structure (Faculty of Science)**

**2018-2019**

**T. Y. B. Sc. - Vocational Biotechnology**

<b>Particulars</b>	<b>Theory (T) / Practical (P)</b>	<b>Code</b>	<b>Course Title</b>	<b>Exam (I / E)</b>	<b>Credits</b>	<b>Marks (50 / 50)</b>
<b>T.Y. B.Sc. Sem. V</b>	T	VBT3501	Plant and Animal Biotechnology	I / E	3	50 / 50
	T	VBT3502	Microbial Biotechnology and Fermentation	I / E	3	50 / 50
	P	VBT3511	Vocational Biotechnology Practical - I	I / E	2	50 / 50
<b>T.Y. B.Sc. Sem. VI</b>	T	VBT3601	Environmental Biotechnology and Bioinformatics	I / E	3	50 / 50
	T	VBT3602	Entrepreneurship Development	I / E	3	50 / 50
	P	VBT3611	Vocational Biotechnology Practical - II	I / E	2	50 / 50

**T.Y. B.SC. (VOCATIONAL BIOTECHNOLOGY) SEMESTER - V**  
**VOCATIONAL BIOTECHNOLOGY PAPER - I:**  
**TITLE: PLANT AND ANIMAL BIOTECHNOLOGY**  
**PAPER CODE: VBT3501**

[CREDITS - 3]

**Learning Objectives:**

1. The basics of plant and animal cell culture
2. Concepts in plant and animal tissue culture

Unit No.	Title and Contents	No. of Lectures
<b>UNIT - I</b>	<b>ORGANOGENESIS</b> i) Introduction to organogenesis ii) Direct and indirect organogenesis iii) Rhizogenesis and Caulogenesis	04
<b>UNIT - II</b>	<b>EMBRYO CULTURE</b> i) History and methodology ii) Embryo rescue after wide hybridization iii) Applications	02
<b>UNIT - III</b>	<b>SOMATIC EMBRYOGENESIS</b> i) Induction of somatic embryos ii) Artificial seed production	02
<b>UNIT - IV</b>	<b>SOMACLONAL VARIATIONS</b> i) Causes of somaclonal variation ii) Selection and multiplication of somaclones iii) Advantages and disadvantages	04
<b>UNIT - V</b>	<b>PRODUCTION OF HAPLOIDS</b> i) Importance of haploids ii) Anther culture and ovule culture, iii) Detection of haploids, iv) Uses of haploid in plant breeding	04
<b>UNIT - VI</b>	<b>GENE TRANSFER METHODS IN PLANTS</b> i) Physical methods ii) Biological methods	04
<b>UNIT - VII</b>	<b>SECONDARY METABOLITE PRODUCTION</b> i) Hairy root culture ii) Production of hairy root and precursors used iii) Advantages and limitation	04

<b>UNIT 8</b>	<b>ANIMAL CELL CULTURE</b> i) Established animal cell lines ii) Commonly used cell lines: origin and characteristics iii) Growth kinetics and cells in culture iv) Bioreactors for large scale culture of cells v) Transplantation of cultured cells (Grafting)	06
<b>UNIT 9</b>	<b>TRANSGENIC AND EMBRYONIC STEM CELL TECHNOLOGY</b> i) Introduction to stem cells ii) Methods to generate transgenic using stem cell iii) Applications iv) Limitations and ethical issues	07
<b>UNIT 10</b>	<b>APPLICATIONS OF ANIMAL BIOTECHNOLOGY</b> i) Production of special secondary metabolites/ products (insulin, growth hormone, interferon, plasminogen activator, factor VIII etc) ii) Harvesting and purification of products. iii) Production of monoclonal antibodies and its applications iv) Production of vaccines using animal cell culture v) In vitro fertilization	08

**References:**

1. Razdan, M. K. and Bhojwani, S.S. Plant tissue culture Elsevier (1983)
2. Kumar, H.D. Plant Tissue Culture
3. Freshney, R. I. Culture of Specific Cell Types. Culture of Animal Cells Animal (2005)
4. Biotechnology by U. Satyanarayan
5. Animal tissue culture - John Paul.

**T.Y. B.Sc. (VOCATIONAL BIOTECHNOLOGY) Semester - V**  
**VOCATIONAL BIOTECHNOLOGY PAPER - II:**  
**Title: MICROBIAL BIOTECHNOLOGY AND**  
**FERMENTATION**  
**PAPER CODE: VB5102**

[Credits -: 3 No. of Lectures: 45]

**Learning Objectives:**

**The students should acquire the knowledge about:**

- The basics of fermentation.
- Understand the physiology, nutrition and growth of microorganisms that are important to various industries.
- Understand how to control of microbial growth in industrial production process.
- Understand the application of microorganisms in production of cells, primary and secondary metabolites
- Theory behind various techniques to produce industrially important microorganisms.
- Exploitation of microorganisms in industries as a viable alternative to the use of chemicals to the production of useful products. <sup>TM</sup>
- Skills of identifying community concerns and solving problems through the application of microorganisms at a local as well as an industrial level. <sup>TM</sup>

UNIT. No	Title and Contents	No. of Lectures
<b>Unit I</b>	<b>MICROBIAL BIOTECHNOLOGY</b> i) Definition ii) Principles of microbial technology iii) scope and importance iv) historical development	01
<b>Unit II</b>	<b>MICROBIAL GROWTH</b> i) Microbial growth ii) Microbial growth kinetics iii) Batch ,fed batch and continuous culture iv) growth linked and non growth linked products v) diauxic growth vi) yield coefficient	06
<b>Unit III</b>	Extremophiles- Acidophiles, basophiles, Psychrophiles, Thermophiles, Halophiles, Barophiles, Obligate anaerobes and their adaptations.	03
<b>Unit IV</b>	<b>IMMOBILIZATION</b> i) Whole cell Immobilization- Methods, advantages ,	02

	<p>disadvantages,          applications and properties          ii) Enzyme Immobilization-Methods, advantages ,          disadvantages, applications          and properties</p>	
<b>Unit V</b>	<p><b>APPLICATIONS OF MICROBIAL BIOTECHNOLOGY</b>          i) Bioleaching, MEOR, Biosensors,          ii) Applications in the field of medicines and Environment          iii) Biopolymers and Bioplastics          iv) Bio-fertilizers and Bio-pesticides          v) Oriental fermented foods –Soy sauce, Tempeh          vi) Bioremediation (any one example)          vii) Applications of GMO’s in agriculture , industry and medicine. (one example of each)</p>	08
<b>Unit VI</b>	<p><b>FERMENTATION</b>          i) Definition, history and importance          ii) Layout of typical fermentation unit          iii) Concepts of primary and secondary metabolites,          iv) Fermentation media          v) Types of fermenters          vi) Screening (Primary and secondary)          vii) Strain improvement and Medium optimization (Plackett-Burman; other systems; Use of software)          viii) Methods for preservations          ix) Inoculum build up (Bacteria, fungi, yeast)</p>	9
<b>Unit VII</b>	<p><b>FERMENTER DESIGN, OPERATION and DOWNSTREAM PROCESSING</b>          i) Design of typical batch fermenter          ii) Fermenter types (Batch, continuous , Fed batch, bubble column, air lift, packed bed, fluidized bed)          iii) Measurement and control of different parameters during fermentation.          iv) Downstream processing          -General strategy of product recovery          -Precipitation (agents used :salts, organic solvents,          - polyelectrolytes, acids and bases)          -Filtration (Plate Frame. Rotary Vacuum, Filter aids, Flocculating agents)          - Centrifugation (types used in Industry-basket, tubular bowl          - Cell Disruption (Physico – mechanical and chemical Methods).          - Liquid- Liquid extraction(Principle, Co and counter current extraction)          -Chromatography( one example each of use of Adsorption,</p>	08

	Ion exchange, Gel and Affinity) - Drying (Drum and Spray Drying) and Whole broth Processing. v) SOP,GMP,QA and QC functions	
<b>Unit VIII</b>	<b>APPLICATIONS OF FERMENTATION:</b> Production and recovery of industrially important products) i)Antibiotics- Penicillin and Streptomycin ii) Biomass- Baker’s yeast , Spirulina iii) Vitamin B12 iv) Enzymes –Proteases, amylases v) Beverages-Wine, Beer vi) Vaccines- DPT vii) Organic acids- Citric acid, vinegar viii) Biotransformation	08

### Reference Books:

1. Stanbury, P. F. and Whittaker, A.; Principles of Fermentation technology; 3<sup>rd</sup> edition (1984); Delhi.
2. Butterworth Heinemann, Pepler, H. L. Microbial Technology, Vol I and II, 2<sup>nd</sup> Edition , (1979), Academic Press. New York
3. Casida, L. E., Industrial Microbiology, (1986), John Wiley Easterbs
4. Prescott. S.C and Dunn, C. G.; Industrial Microbiology, Reed G.;5<sup>th</sup> edition (1983), AVI tech books.
5. Patel, A. H., Industrial Microbiology, 1<sup>st</sup> edition, (2007), Macmillan India Ltd.
6. Patel, A. H., Industrial Microbiology, 2<sup>nd</sup> edition, (2016), Laxmi Publications, New Delhi.
7. Crueger, W. and Crueger, A.; A Text Book of Industrial Biotechnology, (2005) Panima, New Delhi.
8. Schuler,M. and Kargi,F. Bioprocess Engineering -Basic Concepts,2<sup>nd</sup> edition,(2002) , Prentice Hall.
9. Pauline Doran, Bioprocess Engineering Principles, 2<sup>nd</sup> Edition,(2012), Academic Press, New York
10. Butter worth, Heinemann,Operational Modes of Bioreactors, (1992), BIOTOL Aiba,S., Humphrey,A.L. and Miles, N.F. Biochemical Engineering, 2nd Edition (1973) , Academic Press, New York.

<p style="text-align: center;"><b>T.Y. B.Sc. (VOCATIONAL BIOTECHNOLOGY) Semester - V</b>  <b>VOCATIONAL BIOTECHNOLOGY PAPER - III:</b>  <b>Title: Practicals in Plant and Animal Biotechnology and Microbial biotechnology</b>  <b>PAPER CODE: VB5103</b>  <b>[Credits - 2: No. of practicals - 10]</b></p>		
<p><b>Learning outcomes</b>            At the end of the semester; students should understand:</p> <ol style="list-style-type: none"> <li>1. Basic techniques in animal and plant tissue culture</li> <li>2. Get an idea of how to work and handle things while performing tissue culture experiments.</li> <li>3. Technique of isolation of industrially important microorganism</li> <li>4. Quality control of different products</li> </ol>		
UNIT. No	Title and Contents	No. of Lectures
<b>Unit I</b>	Laboratory design and equipments in animal tissue culture facility.	1x3
<b>Unit II</b>	a. Working and principles of different instruments- i) Autoclave, ii) Laminar air flow, iii) pH meter, iv) Water distillation unit. b. Methods of sterilization of apparatus and glasswares for plant tissue culture.	1x3
<b>Unit III</b>	a. Preparation of nutrient media for plant cell and tissue culture with emphasis on composition and calculation of concentration of ingredients for callus b. Study of effects of auxins and cytokinins on explants.	2X3
<b>Unit IV</b>	Monitoring of contamination in media /reagents in animal cell culture	1x3
<b>Unit V</b>	a. Isolation of lymphocytes from blood/tissue sample and staining b. Initiation of primary animal cell culture	3X3
<b>Unit VI</b>	<b>Microbial biotechnology</b>	
<b>Unit VII</b>	Study of growth curve of Bacteria by Turbidometry	1X3
<b>Unit VIII</b>	Screening of antibiotic producers from soil samples	
<b>Unit IX</b>	Quality assurance test: Antibiotic assay (agar gel diffusion technique)	2X3
<b>Unit X</b>	Production and purification of antibiotics and Determination of potency of antibiotics	3X3
<b>Unit X1</b>	Immobilization of yeast on calcium alginate	1x3



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**THIRD YEAR B.Sc. VOCATIONAL BIOTECHNOLOGY**  
**SEMESTER –II**

**Academic Year 2018-2019**

**T.Y. B.Sc. (VOCATIONAL BIOTECHNOLOGY) Semester - V****VOCATIONAL BIOTECHNOLOGY PAPER - I:****Title: Environmental Biotechnology And Bioinformatics****PAPER CODE: VBT 5201****[Credits - 3: No. of lectures - 45]****Learning outcomes**

At the end of the semester; students should understand:

1. Global Environmental Problems and Environmental toxicants
2. Role of environmental biotechnology in management of environmental problems.
3. Biodegradation, Bioremediation, Phytoremediation
4. Ecofriendly alternatives to pesticides and fertilizers.
5. Waste management methods
6. Quality control of different products

<b>UNIT. No</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit I</b>	<b>ENVIRONMENTAL BIOTECHNOLOGY</b> i) Introduction, Scope and Importance	01
<b>Unit II</b>	<b>WASTE WATER TREATMENT</b> i) Microorganisms used in waste water treatment, ii) Bioaugmentation, iii) Biostimulation, iv) Bioreactors in waste water treatment	06
<b>Unit III</b>	<b>XENOBIOTIC DEGRADATION</b> i) Pesticide degradation by microbes ii) Herbicide degradation by microbes	04
<b>Unit IV</b>	<b>BIOFUELS</b> i) Biogas production using methanogenic bacteria ii) Microbial hydrogen gas production iii) Ethanol production and its use as fuel, eg. Gasohol iv) Cellulose degradation for combustible fuel v) Photosynthetic pigments as solar energy convertors vi) Plant based petroleum industry	06
<b>Unit V</b>	<b>BIOFERTILIZERS</b> i) Nitrogen fixing microorganisms enriching the soil with assimilable nitrogen ii) Phosphate solubilizers iii) Plant growth promoting rhizobacteria	04
<b>Unit VI</b>	<b>BIOREMEDIATION AND PHYTOREMEDIATION</b> i) Bioremediation In –situ bioremediation Ex –situ bioremediation ii) Phytoremediation	06

	Phytosequestration Rhizodegradation Phytohydraulics Phytoextraction Phytovolatilization Phytodegradation iii) Bioleaching: Enrichment of ores by microorganisms	
<b>Unit VII</b>	<b>APPLICATIONS OF ENVIRONMENTAL BIOTECHNOLOGY</b> i) Biotechnology applications to Hazardous waste management ii) Biotechnological applications to pesticide, tannery, paper, food and related industries	05
<b>Unit VIII</b>	<b>BIOINFORMATICS</b> i) Introduction and Definition ii) History and Scope iii) Application in various fields iv) Biological Databases	03
<b>Unit IX</b>	<b>OPEN ACCESS BIBLIOGRAPHIC RESOURCES AND LITERATURE DATABASES</b> i) PubMed, ii) BioMed Central, iii) PubMed Central, iv) Public Library of Sciences (PloS).	04
<b>Unit X</b>	<b>DATABASE SEARCHES</b> i) Basic concepts of sequence similarity, identity and homology, definitions ii) of homologues, orthologues, paralogues. iii) Keyword-based Entrez and SRS, Sequence-based: -BLAST & FASTA, -Use of these methods for sequence analysis including the on- line use of the tools and interpretation of results from various sequence and structural as well as bibliographic databases	06

### Reference Books:

1. Suchandra Choudhury; An Introduction To Geographic Information Technology (2009) I K International Pvt. Ltd., New Delhi.
2. Sharma PD; Ecology and environment (2005) Rastogi Publication, New Delhi
3. Saha; Ecology and environmental biology (2011) T K Books & Allied (p) Ltd, Kolkata
4. Faurieet al ; Ecology science and practice (2001) Oxford & IBH Publ. Co. Pvt. Ltd, New Delhi
5. J. L. Chapman, M. J. Reiss; Ecology: Principles and Applications (1998) Cambridge

7. Asthana & Asthana ; Environment Problems & Solutions (2001) S. Chand Limited, New Delhi
8. Varma & Agarwal; Environmental Biology (2000) S. Chand Limited, New Delhi
9. Sharma PD ; Environmental biology and toxicology (2011) Rajpaland Sons Publishing, Delhi
10. Rana Rastogi; Environmental biotechnology (2010) Publications, New Delhi
11. A. K. De; Environmental chemistry (2003) 5 Delhi edition, New Age International Ltd, New
12. B.K. Sharma; Environmental Chemistry (2007) 11th edition, Goel Publishing House, Delhi
13. Ram Kumar ; Environmental pollution and health hazard in India (1987) Ashish Pub. House, New Delhi
14. Susan Cutter ; Environmental risks and hazards (1994) Prentice Hall, Inc., New Jersey
15. G. TyMiller, Jr.; Environmental Science (2010), Scott Spoolman Brooks and Coel, Cengage Brain learning, USA
16. Santra S.C; Environmental Science (2011). New Central Book Agency, Kolkata
17. Eugene Pleasants Odum, Gary ; Fundamentals of Ecology (2005) W. Barrett Brooks and Coel, USA
18. Dash; Fundamentals of Ecology (2009) 3 edition, Tata McGraw-Hill Education, New Delhi
19. Chattergy; Introduction to Environmental Biotechnology (2007) PHI Learning Pvt. Ltd, Delhi
20. P. Venugopala; Text book of Environmental Engineering (2005) Rao PHI learning Pvt Ltd, Delhi
21. Erach Bahrucha; Textbook of environmental studies for undergraduate courses (2005) Universities Press, Hyderabad
22. R. J. Seviour; The Microbiology of Activated Sludge (2010) IWA publication, UK
23. Ronald M. Atlas Principles of microbiology(1997 ) Wm. C. Brown Publishers, McGraw-Hill Higher Education,  
[US https://www.google.co.in/search?tbo=p&tbm=bks&q=subject:%22Science%22&source=gb\\_s\\_ge\\_summary\\_r&cad=0](https://www.google.co.in/search?tbo=p&tbm=bks&q=subject:%22Science%22&source=gb_s_ge_summary_r&cad=0)

**T.Y. B.Sc. (VOCATIONAL BIOTECHNOLOGY) Semester - V**  
**VOCATIONAL BIOTECHNOLOGY PAPER - II:**  
**Title: ENTREPRENEURSHIP DEVELOPMENT**  
**PAPER CODE: VBT 5202**

[Credits - 3: No. of lectures - 45]

**OBJECTIVES:**

1. To create awareness about self-employment and motivate the students to go for self employment.
2. To study entrepreneurship concepts and their applicability.
3. To familiarize the students to the practical world of enterprise/business

UNIT. No	Title and Contents	No. of Lectures
<b>Unit I</b>	<b>INTRODUCTION:</b> Concept of entrepreneurship, Historical background, need and scope of entrepreneurship in modern society, Entrepreneurial behavior, attributes and skills. Key elements of entrepreneur, Entrepreneurial process, Entrepreneurial culture, Environment of Entrepreneurship, Socio economic origins of Entrepreneurship, Barriers of Entrepreneurship and means to reduce those, types of Entrepreneurs, Characteristics of Entrepreneur.	08
<b>Unit II</b>	<b>BUSINESS ORGANIZATIONS:</b> Forms of business organizations such as sole proprietorship, partnership, Joint Stock Company, cooperative organization etc. Meaning and definition , Relative merits and demerits of each form, Types of Small Scale Industry.	03
<b>Unit III</b>	<b>3. Study of organizations promoting Entrepreneurship</b> Sources of Information: Where to go for what? a) District Industry Centre (DIC) b) Maharashtra Industrial Development Corporation (MIDC) c) Maharashtra State Small Industries Development Corporation (MSSI DC) d) Small Industries Services Institute (SISI) e) National Institutes of Entrepreneurship and Small business Development (NIESBUD) f) National Entrepreneurship Development Board (12) (NEDB) g) Entrepreneurship Development Institute of India	03

	<p>h) Commercial and Co-operative Banks  i) State Industrial Development Bank (SIDBI)  j) Pollution Control Board 3 Lectures  <b>Legal Aspects of Small Business:</b>  Elementary knowledge of Income Tax, Sales Tax, VAT, Service Tax, Patent Rules, Excise Rules, Factory Act and Payment of Wages Act, TDS act Procedures for registration of SSI, TDS no, PAN no.</p>	
<b>Unit IV</b>	<p><b>ENTREPRENEURSHIP DEVELOPMENT:</b>  Identification of opportunities for entrepreneurship, ideas to start new business, criteria for selection of new product or service, Market Survey as a tool, Technical and economic feasibility of a project, Role of consultancy organizations. 8 Lectures  Project formulation and project report preparation (Use guidelines given in Schedule II)</p>	04
<b>Unit V</b>	<p><b>FINANCIAL ASPECTS:</b>  <b>Govt/Public sources of finance</b>  Sources of finance, Role of various funding agencies, government and commercial Role of various funding corporations and funding institutes such as chamber of commerce, MSFC, MCED, NSSIDC, Banks, special institutes such as IDBI, MIDC, SICOM etc, Working capital, cash flow, fund flow, study of basic financial statements, costing and pricing, breakeven point, SWOT analysis.  <b>Private Sources</b>  1. Equity –Angel finance , Venture capital  2. Debt Finance – Loans from banks loan against co-lateral security, PMYR-Loans with subsidy from Central GOVT, State Govt , CGTSME(Central Grant For Small Medium Enterprise)</p>	08
<b>Unit VI</b>	<p><b>MARKETING ASPECTS:</b>  Meaning, scope and importance, Marketing strategy, Market segmentation, marketing channels.  Marketing mix and its effect.  Digital marketing through Web browsing, Face book , Google search engines SMS campaigns , Mailers , Hand bills etc</p>	06
<b>Unit VII</b>	<p><b>HUMAN RESOURCE ASPECTS: (H.R Policies)</b>  Concept and scope in modern industry,  Different modes of employment, Placement of proper person for a job, Interpersonal relations and communication skills, training of personnel, guidance for stress management, soft skills.  Drafting -Appointment letter, termination tenure , experience</p>	

	certificates , exit policies Legal liabilities of employees, Group insurance for factory workers, understanding WAC (Workers Accident Compensation )	
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The practicals to be conducted are with an objective to transform the knowledge gained by the students in their classes to real life experience. These practicals will be based on the vocational subject and the Principal subject  
a student has offered Internal assessment should carried out on the practicals/ assignments done by a student

Sr. No.	Title of Practical	Objective	Mode
<b>Unit I</b>	Role of District industry centre	Understand the working of District industry centre	Visit and report submission
<b>Unit II</b>	Visit to a small scale Industry	To understand plant location and plant layout and to submit a report on the guidelines given in <b>schedule I</b>	Visit and report submission
<b>Unit III</b>	Visit to a service unit	To study the legal aspects of a service unit and to submit a report	Visit and report submission
<b>Unit IV</b>	Entrepreneurial ideas	Describe in brief two entrepreneurial ideas of yours	Home assignment
<b>Unit V</b>	Project formulation	Prepare a preliminary document about an enterprise you want to start It should contain executive summary, customer/target market analysis and strategy (use guidelines given in <b>schedule II</b> )	Home assignment
<b>Unit VI</b>	Review business plans	For this Plans should be exchanged with other teams Submit a <b>review</b> of a business plan of <b>other team</b> . It should include critical and constructive comments	Home assignment
<b>Unit VII</b>	Drafting a business plan	It should contain executive summary, customer/target market analysis and strategy, marketing and operations, risks, management team and financial	Power Point Presentation

	projections	
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After completing the module, the students will gain knowledge about:

Entrepreneurship is a tremendous force that can have a big impact in growth, recovery, and societal

progress by fuelling innovation, employment generation and social empowerment.

Through entrepreneurship education, young people, including those with disabilities, learn organizational skills, including time management, leadership development and interpersonal skills, all of which are highly transferable skills sought by employers.

The syllabus for T.Y.B.Sc., Vocational students thus is aimed at creating an awareness amongst the

students about the benefits of becoming an entrepreneur and at the same time equip them with information about a good and a viable opportunity; making a business plan by assessing the technoeconomic feasibility, seeking financial assistance, variety of procedures and formalities for setting up an Small Scale enterprise, taking decisions in such a manner so that entrepreneurship becomes a life time career goal.

### Schedule-I

#### Visit to a small scale Industry

1	Year of commencement of the project	
2	Work experience of the entrepreneur before starting the	
3	Project	
4	Detailed information of the product	
5	Type of customers using their product	
6	Pricing details of all the product range	
7	No. of workers/ Staff working in the Unit	
8	Turnover in the last three years	
9	Mode of Advt/Marketing adapted for promoting the products	
10	Investment done at the time of starting the project	



## Schedule II

### Project formulation

1	Product /services Selected its justification	
2	Capital investment required to start the Services /Product	
3	Minimum Infrastructure requirement	
4	Rent as per current rates for the same premises/ Office / Factory	
5	Various Competitors currently for the same product /Services	
6	Your unique selling proposition USP ie write down why your product will be preferred by the customer as against the present competition. 1) Features 2) Cost 3) Geographic location 4) service 5)durability	
7	Marketing Strategy used for Advertising your product	
8	Various digital marketing methods to be selected	
9	What will be your ROI(Return On Investment)	
10	What will be your Break even point	
11	How will you be raising the finance for the same	

12	Prepare a three years Balance sheet, / P/L statement taking help from a Third year commerce stream student.(optional)	

<b>T.Y. B.Sc. (VOCATIONAL BIOTECHNOLOGY) Semester - V</b> <b>VOCATIONAL BIOTECHNOLOGY PAPER - III:</b> <b>Title: Practicals in Environmental Biotechnology And Bioinformatics</b> <b>PAPER CODE: VBT 5203</b> <b>[Credits - 2: No. of practicals - 10]</b>		
<b>UNIT. No</b>	<b>Title and Contents</b>	<b>Practicals (Total 10 P)</b>
	<b>Environmental Biotechnology</b>	
<b>Unit I</b>	Qualitative analysis of water samples for microbial contamination	1X3
<b>Unit II</b>	Isolation of siderophore producing organisms. Estimation of siderophore by using suitable technique.	2X3
<b>Unit III</b>	Isolation of pesticides degrading microbes.	1X3
<b>Unit IV.</b>	Isolation and cultivation of <i>Rhizobium</i> , Production of Biofertilizers and check the efficiency of Biofertilizers	2X3
<b>Unit V</b>	Production, Recovery and Estimation of Ethanol from agricultural waste	3X3
	<b>Bioinformatics</b>	
<b>Unit I.</b>	Literature mining using pubmed, pubmed central and Medline	1X3
<b>Unit II</b>	Retrieving Protein and DNA Sequences using Entrez at NCBI, SRS at EBI	1X3
<b>Unit III</b>	Retrieving Protein and DNA Sequences using Entrez at NCBI, SRS at EBI	1X3
	<b>List of practicals for Entrepreneurship Development is separately given</b>	

**Note:**

- (i) Students must submit visit reports and home assignments at the time of examination.
- (ii) Students must present business plant as Power Point Presentation at final examination