

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
DEPARTMENT OF P.G. STUDIES AND RESEACH IN BIOTECHNOLOGY
JNANA SAGARA CAMPUS, VINAYAKANAGARA, CANTONMENT,
BALLARI – 583 105



SYLLABUS

DEPARTMENT OF P.G. STUDIES AND RESEACH IN BIOTECHNOLOGY

POST GRADUATE DIPLOMA IN BIOTECHNOLOGY (PGDBT)

(I and II Semester)

**CHOICE BASE CREDIT SYSTEM
WITH EFFECTIVE FROM 2019-20
(CBCS Regulation)**

POST GRADUATION DIPLOMA IN BIOTECHNOLOGY

Everyone wants to work in biotechnology nowadays, and with its exponential growth and number of available jobs, it's the smart career choice in the sciences. To meet this demand, almost all universities in India now offer bachelor's degrees in various fields of biotechnology. From that starting point, graduates can go on to complete more specialised master's and doctoral programmes, which are essential to secure top jobs in research. If you have already obtained another B.Sc. degree with chemistry and biochemistry courses, you can still enter the world of biotechnology by completing an advanced postgraduate diploma in biotechnology. This will qualify you for working in a biotechnology laboratory, where you can splice genes and mess with DNA to your heart's content.

One such postgraduate diploma programme is the advanced biotechnology course at VSK University, Ballari. In course students will learn all sorts of lab skills and other useful information, such as protein techniques, cell biology, spectroscopy, chromatography, microbiology, DNA techniques, bio-regulations, bio-processing. Students can bag this diploma in one year of full-time study, over two semesters.

Course Description

- The program provides students with the transferable skills needed to build successful careers in a variety of biotechnology and research sectors
- Diploma in Biotechnology balances theoretical understanding with hands-on practice in specific laboratory skills needed by employers
- It provides a valuable specialization to students interested in life sciences programs without having to go elsewhere for practical laboratory skills training
- The program prepares students to move into entry-level laboratory science positions in diverse bio-based sectors such as agriculture, health, bioinformatics, food and beverage bioprocesses.

Eligibility: Candidate with Degree and Masters Degree in Nanotechnology/Botany/ Applied Botany/Biotechnology/ Microbiology/Biochemistry/ Plant Science/ Agriculture/ Sericulture/ Food and Nutrition/ home science/ Life Science and allied sciences.

Duration: One year (Two Semesters of four months each)

**COURSE STRUCTURE FOR ONE YEAR POST GRADUATE DIPLOMA IN
BIOTECHNOLOGY**

(APPROVED IN BOS-PG MEETING)

I SEMESTER

Paper code	Title of the Paper	Credits	Internal Assessment	Theory/ Practical	Total Marks
PGDBTH1.1	Biological chemistry	04	30	70	100
PGDBTH1.2	Microbial biotechnology	04	30	70	100
PGDBTH1.3	Recombinant DNA technology	04	30	70	100
Total Hard core credits		12			
PGDBTS1.4	Immunobiology	04	30	70	100
PGDBTS1.5	Analytical techniques in Biotechnology	04	30	70	100
Total Soft core credits		04			
PGDBTP1.6	Biotechnology laboratory I	02	15	35	50
PGDBTP1.7	Biotechnology laboratory II	02	15	35	50
Total Credits		20			500

II SEMESTER

Paper code	Title of the Paper	No. of Hours/ Week	Internal Assessment	Theory/ Practical	Total Marks
PGDBTH2.1	Fermentation technology	04	30	70	100
PGDBTH2.2	Plant Biotechnology	04	30	70	100
PGDBTH2.3	Animal Biotechnology	04	30	70	100
Total Hard core credits		12			
PGDBTS2.4	Environmental Biotechnology	04	30	70	100
PGDBTS2.5	Nanobiotechnology	04	30	70	100
Total Soft core credits		04			
PGDBTP2.6	Project work and viva- voce	04	Both internal and external examiners shall evaluate the Project Work Project Guide and external examiner shall conduct the viva-voce examination		100
Total Credits		20			500
Total Marks for One year					1000

I SEMESTER

PGDBTH1.1

BIOLOGICAL CHEMISTRY

CREDIT-4

UNIT-I

10h

Biochemical basis of life. Significance of macromolecules - Carbohydrates, proteins, lipids and nucleic acids.

UNIT-II

10h

Carbohydrates - Structure and function of monosaccharides, Oligosaccharides and Polysaccharides; Description and integration of major metabolic pathways.

UNIT-III

10h

Lipids - Structure and functions of triglycerides, phospholipids, glycolipids. Significance of PUFA, Cholesterol and its derivatives; Fatty acids metabolism.

UNIT-IV

12h

Protein - Structure and properties of amino acids; transamination, oxidative deamination, decarboxylation, disposal of ammonia. Organization of protein structures; Enzyme classification, mechanism, Michealis - Menton kinetics and allosteric enzymes

UNIT-V

10h

Nucleic acids - Structure and function of DNA and RNA; Purine and Pyrimidine base structure, degradation and synthesis, inborn errors of nucleotide metabolism.

TEXT BOOKS:

1. Lehninger AL, Nelson DL and Cox MM (2002), Principles of Biochemistry. MacMillan Worth Publishers Inc. (CBS Pub. & Distributors, New Delhi)
2. Stryer L (2002). Biochemistry, Freeman & Co.

REFERENCE BOOK

1. Martin DW, Jr., Mayer, PA and Rodwell, VW (2002). Harper's Review of Biochemistry 25th Edition, Maruzen Asian Ed: Lange Med. Pub.
2. Sambrook, J., Fritsch, E.F., and T. Maniatis. Molecular Cloning. A Laboratory Manual. 2nd Ed. Cold Spring Harbor Laboratory Press, New York, 1989.

PGDBTH1.2**MICROBIAL BIOTECHNOLOGY****CREDIT-4****UNIT-I****10h**

History of Microbiology. Microscopy and applications. Microbial diversity – Bacteria, fungi, viruses, protozoa. Microbial nutrition and growth. Microorganisms as factories for the production of novel compounds.

UNIT-II**10h**

Biotechnological potentials of microalgae in food, feed, colorants and fuel. Cultivation methods of algae with reference to *Dunaliella*. Production of microbial biofertilizers – *Diazotrophs*, VAM and Cyanobacteria. Edible Mushroom cultivation.

UNIT-III**10h**

Microbial bioconversion of cellulosic and non-cellulosic wastes. Biopolymers and ioplastics. Bioremediation of wood, fuels, lubricants, rubber, Plastics. Microbiology of degradation of xenobiotics in environment: oil pollution, surfactants, pesticides.

UNIT-IV**11h**

Biological control of insects, bacterial, fungal and Viral diseases. Mode of action of biological control involved in different biocontrol agents. Genetics of antimicrobial metabolite production in biocontrol bacteria.

UNIT-V**11h**

Waste utilization: Waste water treatment - Aerobic and Anaerobic processes, Treatment schemes for waste waters of dairy, distillery, tannery, sugar, Antibiotic industries. Sewage disposal, compost making, methane generation.

TEXT BOOKS

1. Bernad R. Glick and Jack J. Pasternak. Molecular Biotechnology Principles and Applications of Recombinant DNA. WCB, 2002
2. Glazer, A.N. and Nikaido, H. Microbial Biotechnology: Fundamentals of Applied Microbiology 2nd edn. Cambridge University Press, 2007.
3. R.C. Dubey. Text Book of Biotechnology. S. Chand & Co., New Delhi. 2008.

PGDBTH1.3**RECOMBINANT DNA TECHNOLOGY****CREDIT-4****UNIT-I****10h**

Cloning Vectors: Plasmids, phages, cosmids, YACs. restriction enzymes, DNA polymerases, reverse transcriptase, ligases, polynucleotide kinase, alkaline phosphatase and nucleases.

UNIT-II**10h**

Transformation, transduction, electroporation, microinjection. *Agrobacterium* mediated gene transfer.

UNIT-III**12h**

Cloning strategies: Genomic libraries, cDNA Cloning, Subcloning, shot gun cloning. Cloning in *E. coli*, *Bacilli* and *yeast*. Yeast two hybrid system. cDNA phage display library. Recombinant clones: Detection of recombinant DNA and its Products.

UNIT-IV**10h**

Site-directed mutagenesis, DNA sequencing, design of PCR primers, RT-PCR, RACE, AP-PCR, PAF. Antisense and RNAi technology.

UNIT-V**10h**

Applications of genetic engineering in medicine, agriculture, veterinary and industry. Safety aspects, Intellectual property rights (IPR) and patents.

TEXT BOOKS

1. Primrose, S.B., Twyman, R.M., and R.W. Old. Principles of Gene Manipulation. Sixth Edition. Blackwell Science, 2001.
2. Lodish, H., Baltimore, D., and A. Berk. Molecular Cell Biology. W H Freeman & Co (Sd); 3rd edition, 1995.

REFERENCE BOOKS

1. Sambrook, J., Fritsch, E.F., and T. Maniatis. Molecular Cloning. A Laboratory Manual. 2nd Ed. Cold Spring Harbor Laboratory Press, New York, 1989.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and P. Walter. Molecular Biology of the Cell, Fourth Edition. Garland & Co. 2002.

PGDBTS1.4**IMMUNOBIOLOGY****CREDIT-4****UNIT-I****10h**

Introduction to the study of Immunology, Historic perspective, Cellular and Humoral mediated immune response. Innate and adaptive immunity, Cells, tissue and organs of immune system

UNIT-II**12h**

Antigens and Immunogenicity. Antigens and Antibodies, B- cell generation and diversity, Immunoglobulins and subtypes of Ig's, Antigen - Antibody interactions, Cross reactivity, Precipitation and Agglutination reactions

UNIT-III**10h**

Immunological assays - Agglutination tests, Complement fixation tests, Neutralization tests, Immunodiffusion, Immunoelectrophoresis, Radioimmunoassays, Immunoblotting and ELISA.

UNIT-IV**10h**

Preparation and purification of Antigens and antibodies, Hybridoma technology and Monoclonal antibodies. Productions of Mab's in ascites and cell culture. Antibody labeling.

UNIT-V**10h**

Role of Complement in immune response. Hypersensitivity and Different Types of Hypersensitivity, Immunodeficiency, Immunosuppression and Autoimmunity

TEXT BOOKS

1. Goldsby RA, Kindt TJ, Osborne BA. Kuby Immunology, Sixth Ed, W.H. Freeman and company, New York, 2005.
2. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.

REFERENCE BOOKS

1. Kenneth M. Murphy, Paul Travers and Mark Walport. Janeway's Immunology. Taylor Publications, 2008.
2. Peter J. Delves, Ivan M. Roitt, Seamus J. Martin. Roitt's Essential Immunology. Blackwell publishers, 2006.

PGDBTS1.5 ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY**CREDIT-4****UNIT-I 12h**

Microscopic techniques: Principle and application of light, Phase contrast, Dark field, Fluorescence microscopy, Scanning and Transmission Electron Microscopy, Negative staining Centrifugation: Principle, techniques of preparative, analytical and ultracentrifuges, molecular weight determination, sedimentation analysis, RCF.

UNIT-II 10h

Chromatography techniques: Principle and application of paper chromatography, TLC, Gel filtration, chromatography, Ion –Exchange chromatography, Affinity chromatography, Gas-liquid chromatography, HPLC.

UNIT-III 10h

Electrophoresis techniques: Principle and application of PAGE, SDS-PAGE, Iso-electric focusing, 2D electrophoresis, Agarose gel electrophoresis, capillary electrophoresis, Immunoelectrophoresis, Southern, Northern and Western blotting.

UNIT-IV 10h

Spectroscopic techniques: Principle and application of UV, Visible luminometry and IR spectroscopy, Fluorescence spectroscopy, ESR, NMR, Atomic absorption spectroscopy, Mass spectroscopy, Raman spectroscopy, X-ray crystallography, Flow cytometry.

UNIT-V 10h

Radio-isotopic techniques: Measurement of alpha, beta and gamma radiations., Radioactive isotopes and half life of isotopes, Autoradiography

REFERENCE BOOKS

1. Practical Biochemistry, Vth edition, Keth, Wilson and Walker.
2. Protein Purification by Robert Scopes
3. Springer Verlag Publication, 1982.
4. Tools in Biochemistry David Cooper.
5. Methods of Protein and Nucleic acid Research, Osterman Vol I – III.
6. Principle of Instrumentation analysis, Skoog & West Biophysical Chemistry, Upadhyay & Nath
7. Physical Biochemistry: Application to Biochemistry and Molecular Biology, Freilder.

PGDBTP1.6**BIOTECHNOLOGY LABORATORY I****CREDIT-2**

1. Absorption spectrum and dissociation constant determination
2. Isolation and estimation of protein by Lowry's method
3. Purification of enzyme from microbes
4. Antimicrobial susceptibility assays
5. Isolation and estimation of nucleic acids
6. UV-induced mutants and their effect on growth
7. Double diffusion method of immunoelectrophoresis
8. Blood group testing

PGDBTP1.7**BIOTECHNOLOGY LABORATORY II****CREDIT-2**

1. Competent cell preparation and transformation of plasmid DNA
2. Restriction enzyme digestion and cloning of gene
3. Comparison of the product obtained by immobilization of *Lactobacillus subtilis* by using alginate and acrylamide
4. Determination of COD/BOD value of a given solution
5. Silk work rearing- Protein profile of silk gland and haemolymph of larval forms of Silk worm
6. Molecular detection of blue tongue disease in cattle
7. Heterologous expression of plant protein in *Escherichia coli* and analysis of protein by electrophoresis
8. Genetic engineering of plants by *Agrobacterium*-mediated gene transfer using antifungal protein

PGDBTH2.2**PLANT BIOTECHNOLOGY****CREDIT-4****UNIT-I****10h**

Plant cell -Plant cell and tissue and organ culture, principle - historical background. Plant tissue culture practical application and conventional plant breeding. Tissue culture media - composition and preparation- solid media and liquid media. Micro propagation of plants- initiation and maintenance of callus and suspension cultures- single cell clones.

UNIT-II**12h**

Organogenesis and somatic embryogenesis in plant tissue culture- development of whole - plants - Root formation, transfer of plant lets to the soil, hardening. Advantages of micropropagation in agriculture and horticulture. Shoot-tip meristem culture - raising virus free plants for rapid clonal multiplication of agricultural and horticultural plants

UNIT-III**10h**

Cell suspension cultures and its application in the production of secondary metabolites and single cell clones. Embryo culture and embryo rescue. Protoplast technology -protoplast isolation, fusion, protoplast culture, somatic hybridization, selection of somatic hybrid cells, culturing and development of somatic hybrid plants, symmetric and asymmetric hybrids, cybrids - Application of somatic hybridization plant improvement and breeding

UNIT-IV**10h**

Somaclonal variation- significance in plant breeding. Production of haploid plants - anther and pollen culture, homozygous plants and its importance in genetics and plant breeding. Cryopreservation of plant cells, tissues and organs for germplasm conservation

UNIT-V**10h**

Plant genetic engineering - transgenic plants and its application in agriculture, different methods of plant genetic transformation. Agrobacterium mediated genetic engineering of plants, Agrobacterium tumifaciens, infection and molecular mechanism of tumor formation , Ti plasmids and RI plasmids, binary vectors, genetic markers, reporter genes and its application in genetic engineering. Other methods of plant genetic transformation

TEXT BOOKS:

1. Biotechnology by Singh, B.D

REFERENCE BOOKS:

1. Plant Tissue Culture: Theory & practice a revised edition(2004) Bhojwani & Rajdan
2. Plant Biotechnology (2000),Hammond et al
3. Plant Tissue Culture –Bhojwani, S.S.
4. Plant Cell & Organ culture(2004) Gamberg, O.L
5. Principles of Plant Biotechnology, Montell, et al
6. Plant Cell Culture (2003) Evans D.A.
7. Plant Molecular Biology- vol.I and II, Gimartin & Bowler

PGDBTH2.3 ANIMAL BIOTECHNOLOGY**CREDIT-4****UNIT-I****10h**

Animal cell - structure and organization, animal physiology. Animal cell culture- Equipments and facilities for animal cell culture. Media and its preparation, pH and pH maintenance in culture media, role of carbon dioxide, serum and- serum free media, artificial media

UNIT-II**12h**

Types of animal cell culture- primary and secondary cell culture, development cell lines or established cultures. Biological characterization of cell cultures, contact inhibition, cell transformation, cancer cells, indefinite cell lines. Measurement of cell viability, cytotoxicity. Screening of cytotoxic compounds and its importance.

UNIT-III**10h**

Basic techniques of mammalian cell culture, methods of sub culturing. 8. Scaling up of cell cultures, bioreactors for animal cell cultures.

UNIT-IV**10h**

Application of animal cell culture- industrial application, and clinical application production. Stem cell research- types of stem cells, application of stem cells. Somatic cell genetics, animal cloning and micromanipulation, apoptosis.

UNIT-V**10h**

Genetic engineering of farm animals - cloning vectors, viral vectors. Methods of genetic transformations. Transgenic animals and its uses.

TEXT BOOKS:

1. Animal Tissue Culture by Aruni, A.Wilson
2. Biotechnology by Dubey, R.C

REFERENCE BOOKS:

1. Culture of Animal Cells by RI Freshney
2. Animal Cell Culture: Practical Approach John R W Masters
3. Animal Cell Culture Techniques by Ed. Martin Clynes
4. Methods in Cell Biology Vol. 57, Animal cell culture methods
5. Animal cell culture & Technology- Basis from background to bench (2004) Taylor & Francis.

PGDBTS2.4**ENVIRONMENTAL BIOTECHNOLOGY****CREDIT-4****UNIT-I****10h**

Issues and scopes of environmental biotechnology. Pollution- types of pollution, methods for measurement of pollution, Environmental management-problem solving approaches- its limitations.

UNIT-II**10h**

Biological wastewater treatment- Waste water characterization: COD, BOD, Inorganic constituents, solids, biological components. Principles and aims of biological wastewater treatment processes, Biochemistry and microbiology of inorganic phosphorus and nitrogen removal.

UNIT-III**10h**

Suspended growth technologies: Activated sludge, oxidation ditches, waste stabilization ponds etc. Fixed film technologies: Trickling filters, rotating biological contactors, fluidized bed etc. Anaerobic waste water treatment systems: RBC, UASB, Anaerobic filters

UNIT-IV**10h**

Environmental problems and treatment of industrial waste waters: Distillery, tannery, paper pulp etc. Toxicity testing in waste water treatment plants. Solid waste management: Anaerobic digestion, Composting.

UNIT-V**12h**

Biodegradation of organic pollutants: Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides. Bioremediation: Biostimulation and bioaugmentation, In situ and ex situ bioremediation technologies for various pollutants and sites. Bioremediation of oil spills and heavy metal pollution.

TEXT BOOKS:

1. Biotechnology by Dubey, R.C

REFERENCE BOOKS:

2. Waste water treatment for pollution control. 2nd edition. Arceivala.
3. Environmental Microbiology. R. M. Maier, I. L. Pepper & G. P. Gerba
4. Comprehensive Biotechnology Vol. – 4. Murray Moo Young.
5. Biotechnology. Rehm and Reid.
6. Biotechnology . B.D.Singh.
7. Microbiology. P.D. Sharma.
8. Environmental chemistry. A.K.De, Wiley Eastern Ltd., New Delhi.
9. Introduction to Biodeterioration. D.Allsopp and Seal, ELBS/ Edward Arnold.
10. Environmental Biotechnologies and Cleaner Bioprocess by Eugenia J Olguin et al.
Environmental Science: Physical Principles and applications by Egbert Booker et al

PGDBTS2.5**NANOBIOTECHNOLOGY****CREDIT-4****UNIT-I****10h**

Basic biology principles and practice of micro fabrication techniques, Atomic force microscopy, biological production of metal nano particles, macro molecular assemblies.

UNIT-II**10h**

Application in Biomedical and biological research, nano particles, viruses as nano-particles, nano chemicals and application., tumor targeting and other diagnostic applications.

UNIT-III **10h**

Developing drug delivery tools through nano biotechnology, nano particle based immobilization assays, quantum dots technology and its application.

UNIT-IV **10h**

Synthesis and characterization of different classes of biomedical polymerstheir uses in pharmaceutical, cardiovascular ophthalmologic orthopedic areas.

UNIT-V **12h**

Biosensors and nano biotechnology principles used in construction of micro electronic devices sensors and macro mechanical structures.and their functioning, immunonanotechnology.

TEXT BOOKS:

1. Nano Biotechnology by Balaji, Subbaih.

REFERENCE BOOKS:

1. Nanobiotechnology- concepts, applications and perspectives, niemeyer, christofm. Mirkin, chad a., wiley publishers.
2. Nanobiotechnology of biomimetic membranes, martin, donald (edt), springer verlag publishers.

PGDBTP2.6 **PROJECT WORK AND VIVA- VOCE** **CREDIT-4**

The students shall undergo a project for 60 days as mentioned under course structure. He / She shall prepare a Professional work diary indicating the nature of work carried out. This shall be duly certified by the official of the organization where the student has done their project. This shall be evaluated for 80 marks. Further a viva-voce carrying 20 marks shall also be conducted.

**QUESTION PAPER FORMAT FOR CBCS POST
GRADUATE DIPLOMA IN BIOTECHNOLOGY
SEMESTER EXAMINATION**

I/II Semester

POST GRADUATE DIPLOMA IN BIOTECHNOLOGY (CBCS)

Paper Code (PGDBTH/PGDBTS): Course Title

Time: 3 Hours

Max. Marks: 70

Instruction: Answer all sections

SECTION-A

I. Write a short note any **Five** of the followings: (05x03=15)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

SECTION-B

II. Answer any **Five** of the followings: (05x05=25)

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.

SECTION-C

III. Answer any **Two** of the followings: (15x02=30)

- 15.
- 16.
- 17.
- 18.