

**SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE, UJIRE-574240**

**(Autonomous)**

**(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)**



# **DEPARTMENT OF BIOTECHNOLOGY**

*Syllabus of*  
**Bachelor's Degree in  
BIOTECHNOLOGY**

**(CREDIT BASED SEMESTER SCHEME)  
2016 – 2017 onwards.**

**Approved by the BOS meeting held on 3<sup>rd</sup> Sept. 2015  
Approved by the Academic Council meeting held on 05.03.2016**



## **BIOTECHNOLOGY AS A DISCIPLINE**

Biotechnology is the controlled and deliberate manipulation of biological systems (whether living cells or cell components) to understand various processes in the living systems and the efficient manufacture or processing of useful products. The fact that living organisms have evolved such an enormous spectrum of biological capabilities means that by choosing appropriate organisms it is possible to obtain a wide variety of substances, many of which are useful to man as food, fuel and medicines. Biotechnologists have increasingly applied the methods of physics, chemistry and mathematics in order to gain precise knowledge, at the molecular level, of how living cells make these substances. By combining this newly-gained knowledge with the methods of engineering and science, the concept of biotechnology has arisen, which embraces all of the above-mentioned disciplines.

Biotechnology has already begun to change traditional industries such as food processing and fermentation. It has also given rise to the development of a whole new technology for industrial production of hormones, antibiotics and other chemicals, food and energy sources and processing of waste materials. This industry must be staffed by trained biotechnologists who not only have a sound basis of biological knowledge, but a thorough grounding in engineering methods. The degree programme in Biotechnology also places a major emphasis on practical work and on developing a wide range of analytical and manipulative skills, including pilot plant operational skills appropriate to the biotechnologist. Graduates will be in an ideal position to exploit the opportunities for biotechnology, in established or developing companies.



## Course Objectives

This course will provide students with a strong basis in Biotechnology to enable them to work on various applications in biotechnology according to the industry standards, and also to pursue a career in research.

- This course will prepare the students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology, Molecular biology and plant tissue culture to enable them to understand emerging and advanced concept in modern biology and help them to take up their carrier in this field.
- The course will also provide a better understanding of the modern biotechnological techniques in the field of genetic engineering, protein engineering, and Bioprocess engineering and associated downstream processing enabling their application through Bioprocess technology
- This course will aid the students to learn the recent developments in the field of Genomics, Proteomics, Cancer Biology and modern drug discovery approach. It will also empower the students to have advanced focus on the molecular basis of diseases and development of advanced therapeutics.
- The course will equip the students in Drug design and development providing a solid background in pharmacology, chemistry and biochemistry, appropriate for a career in the pharmaceutical industry.
- This course will teach students the importance of Bioinformatics, pharmacokinetics, drug development methods and phytochemistry.
- The students gain knowledge on Gene technologies which are used to develop improved plants for more nutritious foods, and as renewable biofactories, allowing the production of sustainable industrial products and inexpensive drugs for medical and veterinary use.



### PAPER DESCRIPTION

Sl.No	Semester	Paper		Title
		Theory	Practical	
1.	I Sem	<b>BT-1T</b>		Biochemistry & Biophysics
			<b>BT-1P</b>	Biochemistry & Biophysics
2.	II Sem	<b>BT-2T</b>		Cell biology & genetics
			<b>BT-2P</b>	Cell biology & genetics
3.	III Sem	<b>BT-3T</b>		Microbiology & Immunology
			<b>BT-3P</b>	Microbiology & Immunology
4.	IV Sem	<b>BT-4T</b>		Molecular Biology and Recombinant DNA Technology
			<b>BT-4P</b>	Molecular Biology and Recombinant DNA Technology
5.	V Sem	<b>BT-5T</b>		Medicinal Plant Diversity
		<b>BT-6T</b>		Medicinal Plant Tissue Culture & Envio. Biotech
			<b>BT-5P</b>	Medicinal plant taxonomy and Tissue Culture
6.	VI Sem	<b>BT-7T</b>		Animal Cell Culture & Bioinformatics
		<b>BT-8T</b>		Phytochemistry & Drug Development
			<b>BT-6P</b>	Phytochemistry & Drug Development

### SCHEME OF EXAMINATION

Sl.No	Semester	Paper	Credits	Marks		
				IA	Sem End	Total
1.	I Sem	BT-1T	2	20	80	100
		BT-1P	1	10	40	50
2.	II Sem	BT-2T	2	20	80	100
		BT-2P	1	10	40	50
3.	III Sem	BT-3T	2	20	80	100
		BT-3P	1	10	40	50
4.	IV Sem	BT-4T	2	20	80	100
		BT-4P	1	10	40	50
5.	V Sem	BT-5T	2	20	80	100
		BT-6T	2	20	80	100
		BT-5&6P	2	20	80	100
6.	VI Sem	BT-7T	2	20	80	100
		BT-8T	2	20	80	100
		BT-7&8P	2	20	80	100
Total			24	240	960	1200



**I SEMESTER - Paper BT-1T**  
**BIOCHEMISTRY & BIOPHYSICS**  
**Teaching Hours : 3+3 per week**

**Rationale /Learning Objectives:**

- Understanding structure and characteristic of Biomolecules.
- Understanding the structure and application of enzymes.
- Imparting skills of instrument in assay of biological molecules.

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**Unit I**

- Aims & scope of Biochemistry & biophysics
- General classification, structure & functions of biomolecules (carbohydrates, proteins, lipids & nucleic acids)
- Detailed structure of monosaccharide, glycosidic bonds, structural polysaccharides (cellulose & peptidoglycons), storage polysaccharide (starch)
- Classification of standard amino acids, peptide bonds, primary, secondary & quaternary structure of proteins, non-covalent bonds in protein structure
- Enzymes: nomenclature, classification & active site, Michelis -Menton's equation, allosteric enzymes-general properties.
- Types of reversible inhibition: Competitive, Non-competitive and Uncompetitive with examples.
- Application of enzymes in industry (Medicine, Food ,Textile & biomass conversion).
- Enzymes in clinical applications (In diagnosis)
- Enzymes as analytical tools (Glucose oxidase).

**Unit II**

- Structure & function of water
- Impact of pH on biomolecular reactions, application of Handerson & Hasselbalch's equation, buffers.
- Bioenergetics: Free energy, Enthalpy & Entropy. ATP as biological energy currency.
- Beer Lambert law, absorption spectrum & its specificity for a substance, chromophores, UV-visible & infrared spectrophotometry; application
- Fluorescence, phosphorescence instrumentation & its applications
- Methods employed to understand the structure of molecules: X-ray crystallography & NMR

**Unit III**

- Microscopy, optical (bright field, dark field, phase contrast & fluorescence) and electron microscopy (TEM &SEM)



- Partition coefficient, significance of R<sub>f</sub>-value, Adsorption chromatography (paper chromatography & TLC), Gel filtration chromatography, affinity chromatography.
- Agarose , polyacrylamide gel electrophoresis, SDS PAGE; its principle & application.
- Principles of Centrifugation; differential, density gradient & ultra centrifugation.

Student Activities: Seminar, Assignments, Quiz.

**Practical: B.Sc. I-Semester**  
**Subject: BIOCHEMISTRY & BIOPHYSICS**  
**Paper Number: BT-1P**

1. Qualitative test for Carbohydrates
2. Qualitative test for Proteins
3. Qualitative test for Lipids
4. Assay of enzymes (Salivary amylase and urease)
5. Estimation of Carbohydrates (DNS & Somayaji methods)
6. Estimation of proteins (Biuret method, Lowry's method)
7. Lambert Beer law
8. Absorption maximum of solution.
9. Agarose gel Electrophoresis – demonstration.
10. Amino acid separation by Paper chromatography (ascending & circular).
11. Thin layer chromatography for separation of chlorophyll pigment.
12. Demonstration of ultra-centrifugation technique.



### **Books for Reference- Basic Reading List**

1. Nelson, D.L Cox., M.M., 2008. Lehninger Principles of Biochemistry 5th ed: Illustrated W.H. Freeman and Company,: New York
2. Berg, JM, Tymocozo JL, Stryer L, 2006. Biochemistry, 6 th ed,: WH. Freeman and Company, New York.
4. Palmer, t (2001), Enzymes: biochemistry, biotechnology and clinical chemistry. Horwood Publishing limited Wilson.k and Walker J., 2000
5. Wilson.K and Walker.J., 2010. Principles and Techniques of Biochemistry and molecular biology, &th Ed. Cambridge University Press, New York USA
6. Practical Biochemistry-Principle and techniques, 5th Ed. The Press of University of Cambridge, Cambridge, U.K.

### **Additional Reading List**

1. Murray R.K, Granner D.K, Mayes P.A and Rodwell V.W, 2006. Harper's Illustrated Biochemistry (Harper's Biochemistry).
2. Nicholas C.P. and Lewis Stevens, 1982. Fundamentals of Enzymology. Oxford
3. Hames B.D. Hooper, N.M and Houghton, J.D. Biochemistry –Instant notes. Viva Books Pvt Ltd., New Delhi 19984.
4. Rajeshwari.S. Shetty and V. Shree Krishna, Biotechnology 1 , New age publication.
5. Upadhyay .A and Upadyay.K., and Nath, N., 2007, Biophysical chemistry, Third edition , Himalaya Publication house, Mumbai



**II SEMESTER - Paper BT-2T**  
**CELL BIOLOGY & GENETICS**  
**Teaching Hours : 3+3 per week**

**Rationale /Learning objectives:**

- Understanding the structure of cell organelles.
  - Understanding the structure of genes and inheritance of genetic pattern.
  - Understanding the genetic disorder.
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**Unit I**

- Cell theory, levels of organization in cell biology
- Classification of cell types; Cell, tissue, organ & organism.
- Prokaryotic & eukaryotic cells; ultra structure, cell membrane & cell wall.
- Cell organelles: Ribosomes, endoplasmic reticulum, mitochondria, Golgi complex, chloroplast, lysosomes, peroxysomes, interphase nucleus
- Cell locomotion (amoeboid, flagellar, ciliary)
- Cytosol & cytoskeletal structures: (ex-microfilaments, intermediate filaments & microtubules)

**Unit II**

- Cell division (mitosis & meiosis), cell cycle, cell synchrony & its importance
- Cell to cell interactions & signal molecules.
- Cell differentiation in plants(e.g.: Arabidopsis) & in animals (e.g. Drosophila)
- Cell senescence & programmed cell death (apoptosis).
- Chromosomes : Structure, chemical composition, structural organisation of chromatids, centromeres, telomeres, chromatin, nucleosome organisation, euchromatin & heterochromatin.
- Special chromosomes ( lampbrush & polytene), banding patterns in human chromosomes.
- Mendelian laws of inheritance.
- Concept of gene (recon, muton & cistron)
- Bacterial conjugation, transduction, & transformation.
- Sex determination in plant & animals, sex linkage, non disjunction, chromosomal theory of inheritance & gene mapping.





- Extra chromosomal inheritance, mitochondria & chloroplast genetic systems

### **Unit III**

- Structural and numerical aberrations of chromosomes
- Hereditary defects: Klinefelter, Turner, Cri-du-chat & Down's syndrome
- Spontaneous & induced mutations, chemical & physical mutagens, induced mutations in plants, animals & microbes and its applications.
- Analysis of mutation in biochemical pathways, one gene-one enzyme hypothesis.
- Evolution of crop plants with examples of wheat, cotton & rice.

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Student Activities: Seminar, Assignments, Quiz, handling of drosophila cultures.

### **Practical: B.Sc. II Semester**

#### **Subject: CELL BIOLOGY & GENETICS**

#### **Paper Number: BT -2P**

1. Study of mitosis by staining onion root tip squash
2. Study of meiosis by using permanent slides.
3. Preparation of permanent slide for Mitosis Division.
4. Microtome: Preparation of blocks for staining.
5. Study of cell organelles.(Isolation and staining of mitochondria and chloroplast)
6. Study of Drosophila (wild type and mutant).
7. Separation of Drosophila's eye pigments by paper chromatography.
8. Sex comb mounting of Drosophila.
9. Salivary gland chromosome isolation and staining
10. Counting of total RBC by Haemocytometer method.
11. Counting of total WBC by Haemocytometer method.
12. Micrometry: Measuring plant & animal cells & their organelles.
13. Karyotyping analysis in man.
14. Genetics problems.



### **Books for Reference- Basic Reading List**

1. Karp.G, 2009, Cell and Molecular Biology-Concepts and Experiments 6th Ed John Wiley and sons.
2. Cooper G.M 2007.The cell – A molecular Approach 2nd Ed SunderlandSinauer AssociatesInc
3. De Robertis , E.D.P andDe Roberties E.M.F., 1995 Cell and Molecular Biology 8Th Ed.,Waverly Pvt Ltd New Delhi B.I.
4. Ed: J.Gardner, 2003. Principles of genetics .Vii John Willey and sons, New York

### **Additional Reading List**

1. Lewin,B. 2003Gene VII Oxford Univ.Press Oxford
2. C.B Powar, 2001. Cell Biology , Himalaya Publication House, Mumbai
3. B.D.Singh.,Ed:. 2004.Biotechnology. Kalyani Publishers-2004
4. Rajeshwari.S.Shetty and V.Shree Krishna, 1998. Biotechnology-2 , New age publication, New Delhi.



**III SEMESTER - Paper BT-3T**  
**MICROBIOLOGY & IMMUNOLOGY**  
**Teaching Hours : 3+3 per week**

**Rationale/Learning objective:**

- To study the importance of microbiology and immunology.
  - To study the diversity of micro-organisms.
  - To study the techniques of identification and culture of micro-organisms under laboratory conditions.
  - Understanding the concept of immunity and its enhancement.
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**Unit I**

- Aim, scope and historical perspectives of microbiology
- Contribution of early microbiologists (e.g. Louis Pasteur, Robert Koch, Edward Jenner and Leeuwenhoek)
- Concepts of sterilization and disinfections (dry heat, moist heat, radiation, chemical and filtration)
- General classification of microbial kingdom (classical, nutritional and molecular approaches).
- Virus: Definition, structure and classification with examples.
- Bacteria: Morphology (Size, Shape & arrangement ), ultra structure, respiration & reproduction.
- Microbial cell components: Structure and function of cell wall, lipopolysaccharides, flagella, capsule, endospores, pili (fimbriae), cell membranes and cell inclusions.
- Structure and characteristics of eukaryotic microbes (*Plasmodium, Rhizopus, Penicillium, Aspergillus & Yeast*)

**Unit II**

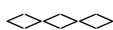
- Microbial culture: Nutrient media, their composition, types & culture techniques.
- Selective isolation of microorganisms (physical and chemical)
- Growth kinetics, Microbes in extreme environments (thermophiles and psychrophiles, acidophiles and alkalophiles, halophiles, barophytes).
- Microbial association: Symbiosis, mutualism and endophytism of microbes with plants, animals and microbes.



- Antibiotics: Definition, mode of action. & their classification with examples.
- Representative pathogenic microorganisms (e.g. *Protozoa*, *Candida*)

### Unit III

- Historical perspective in immunology and diversity of immune system.
- Classification of immunity- Innate ((mechanical & surface) & adaptive (cell mediated & humoral)
- Cells and organs of immune system, antigen presentation by MHC.
- Salient features of antigens.
- Structure, types and functions of antibodies.
- Antigen-antibody reactions (precipitation, agglutination, complement fixation)
- Immunological disorders: (e.g. autoimmune disease, acquired immunodeficiency syndrome) Hypersensitivity and allergy.
- Vaccines (classical and modern), vaccinations and immunization.
- Microbial defense mechanism. Steps in disease development in animals and plants (bacterial, fungal, protozoal and viral).



Student Activities: Seminar, Assignments, Quiz, blood grouping, handling of microbial culture.

### Practical: B.Sc. III Semester.

### Subject: MICROBIOLOGY & IMMUNOLOGY

### Paper Number: BT -3P

1. Instrumentation and Microscopy (w.r.t. microbiology and immunology)
2. Preparation of media (aseptic techniques & different types of media)
3. Isolation and characterization of micro-organisms (bacteria from water, soil, food, cow dung, plant sources etc.)
4. Isolation and characterization of micro-organisms(fungi from water, soil, food, cow dung, plant sources etc.)
5. Staining of microorganism (simple & differential staining, negative staining)
6. Biochemical activities of microorganisms (Indole, Methyl red, V.P, Catalase)
7. Antibiotic sensitivity test for micro-organisms.
8. Isolation of bacteriophages from sewage.
9. Effect of pH and temperature on Bacterial growth.
10. Blood grouping and Rh factor determination.
11. Study of different types of Leucocytes.
12. Immuno-diffusion studies.



### Books for Reference- Basic Reading List

1. *Aneja K.R., Jain P, Aneja R*, 2008. A Text book of Basic and Applied Microbiology, New Age International, New Delhi.
2. *Tortura, Funk, B, R., Case C L*. 2010. Microbiology – an introduction. 9<sup>th</sup> edition. Communing Publishing Company Inc.,
3. *R.C Dubey and D.K Maheshwari*. Practical Microbiology 2004. S.Chand & Co. Ltd, New Delhi.
4. *Pelczar M.J, RD*. Microbiology, Haricot Brace College Publishers, New Delhi. R.C Dubey . Microbiology 2004. S.Chand & Co. Ltd, New Delhi.
5. *Subba Rao*, 2006. Soil Microbiology, 4<sup>th</sup> ed. Oxoford & IBH publishing Co. PVT. New Delhi.

### Additional Reading List

1. Prescott, L. M., Harley, J.P and Klein, D.A 2007. Microbiology 6<sup>th</sup> ed, McGraw Hill, Boston
2. *Sullia S. B. & Shantharam S*. General Microbiology-cbPowar, hf Daginawala, Himalayan Publishing House (1998) General Microbiology.
3. *Goldsby R. A., Thomas J K, Osborne B.A.*, 2007. Kuby Immunology, W. H Freeman and Company, New York.
4. *Roitt, L., Brostoff, J. and Male*, 1990. Immunology, D. Grower Medical Publishing, London.



**IV SEMESTER - Paper BT-4T**  
**MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY**  
**Teaching Hours : 3+3 per week**

**Rationale/Learning objective:**

- To study the molecular structure of genetic materials
- To study the central dogma of molecular biology in detail and in molecular levels.
- Learn to manipulate DNA for the production of Recombinant fruitful products.

**Unit I**

- Discovery, structure and types of DNA. Experiments on DNA as genetic material
- Replication of DNA in prokaryotes and eukaryotes.
- DNA repair mechanism- SOS, base excision & mismatch repair types
- Structure of prokaryotic and eukaryotic gene
- Prokaryotic and eukaryotic transcription and translation

**Unit II**

- Prokaryotic gene expression (e.g. lac, trip)
- Eukaryotic gene expression transcription factors (e.g. yeast)
- Mechanism of DNA recombination in prokaryotes and eukaryotes
- Discovery and types of transposons in eukaryotes
- Aims, objective and scope of gene cloning and recombinant DNA technology
- Isolation and purification of DNA from bacterial plant and animal cells

**Unit III**

- Tools of DNA modification restriction enzymes, ligation ,DNA modifying enzymes and DNA vectors(e.g. plasmids, bacteriophages, phagemids, cosmids and virus)
- Construction of genomic and cDNA libraries, screening and selection of recombinants by selection media probes, insertion inactivation and PCR
- Gene cloning and its applications in Agriculture (e.g genetically modified crops)
- Gene sequencing & its methods (Maxam & Gilbert method & Dideoxy nucleotide method ). Human Genome project.
- Hazards and bio-safety measures for recombinant DNA technology and GMO's



Student Activities: Seminar, Assignments, Quiz, molecular tools like DNA isolation, restriction digestion.

**Practical: B.Sc. IV Semester**

**Subject: Molecular Biology and Recombinant DNA Technology**

**Paper Number: BT –4P**

1. Separation and study of cell organelles
2. Isolation of RNA & DNA
3. Test for DNA/RNA/Proteins isolated from tissue
4. Estimation of total DNA / RNA / Protein from animal cells and plant cells
5. Agarose gel electrophoresis to separate DNA
6. SDS polyacrylamide gel electrophoresis (PAGE)
7. Agarose gel electrophoresis to separate serum proteins
8. DNA ligation
9. Restriction digestion
10. Bacterial transformation
11. Western blotting technique
12. Plasmid isolation

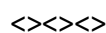


**Books for Reference- Basic Reading List**

1. *H., Berk, A., Zipursky et al.* 2008 Molecular Cell Biology, IV Ed. W.H. freeman & Co., New York.
2. *Watson J.D.* 2007. Recombinant DNA Technology: Genes & Genomes, III Ed., W.H. freeman & Co., New York.

**Additional Reading List**

1. *Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts et al.* 2008. Molecular Biology of cell, IV Ed., Garland Publishing, New York.
2. *Karp.G,* 2009, Cell and Molecular Biology-Concepts and Experiments 6<sup>th</sup> Ed John Wiley and sons.
3. *De Robertis , E.D.P and De Robertis E.M.F* 1995 Cell and Molecular Biology 8<sup>th</sup> Ed., Waverly Pvt Ltd New Delhi B.I.
4. *Lewin,B.* 2003. Gene VII Oxford Univ. Press Oxford



**V SEMESTER - Paper BT-5T**  
**MEDICINAL PLANT DIVERSITY**  
**Teaching Hours : 3+2 per week**

**Rationale/Learning objective:**

- Understanding the medicinal plant distribution at global, national and local levels.
- Learning identification, collection and preservation and field conservation techniques.
- Understanding the role of medicinal plants in different medicinal systems.
- Methodology of studying taxonomical, morphological, anatomical and phytochemical characters of herbal drugs.

**Unit-I**

- **Diversity of Plants:** The classification and distribution of plant kingdom with examples of medicinal plants from each group. (Algae, Bryophytes, Pteridophytes, Gymnosperms & Angiosperms)
- **Biosphere:** Definition, components, and significance.
- **Global Biodiversity:** Biomes, their characters & types with representative plant species.
- **Plant diversity of India. :** Biogeography regions, their salient features with representative medicinal plant species. Major Medicinal & Aromatic Plants of India.
- **Plant diversity of Karnataka:** Geology, Geomorphology and Plant distribution of Karnataka with representative medicinal plant species.
- **Traditional use of plant resources:** Traditional knowledge systems, Ethnobotany, its branches & significance, with examples on traditional use of plant resources in Agriculture, food & medicine. Traditional Medicinal Formulations.
- **Indian Systems of Medicine:** Salient features of Ayurveda, Unani, Siddha & Homeopathy and use of medicinal plants in them.
- **Introduction to Ayurvedic Pharmacognosy:** Concepts of *Panchamahabhuta*, *Saptapadartha*, *Ayurvedic* drug combinations & formulations.
- **Modern use of plant resources:** The role of plants in modern medicine.

**Unit-II**

- Key morphological features of plants used in plant taxonomy. (Leaf, Inflorescence & Flower)

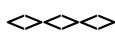




- Botanical classification systems of Angiosperms, with special emphasis on Bentham & Hooker system.
- Methods of surveying, collection, preservation of medicinal plants and their parts & products, Herbarium principles & techniques.
- Rare, endangered, threatened and endemic medicinal plants of *Western Ghats*
- Taxonomy of families: *Ranunculaceae*, *Myrsinaceae*, *Papilionaceae*, *Euphorbiaceae*, *Burseraceae*, *Ulmaceae*.

### Unit-III

- **Herbal Drugs:** Definition, significance & commercially important herbal drugs of India & Karnataka
- Oil yielding Plants with examples.
- Gums, Resins & latex yielding plants with examples
- Species and aromatic plants
- Poisonous plants of India
- Stimulant & hallucinogenic plant species.
- **Drug substitution:** Reasons, principles & examples.
- **Drug adulteration:** Reasons and impact with examples.
- Herbal drug processing & storage methods.
- Conservation strategies of medicinal plants (*In-situ*, *Ex-situ*, *In-Vitro*)



Student Activities: Seminar, Assignments, Quiz, identification of plants based on medicinal properties.

### Books for Reference- Basic Reading List

1. *Kokate & Gokale*, 2004. Text book of pharmacognosy, Nirali publication, Pune
2. *Kirthikar & Basu*, 1995. Indian medicinal plants, (volume I to IV, Chowkamaba Pub., Dehradun.
3. *Father Saldhana*, 1990. Flora of Karnataka, central college, Bangalore
4. *Kaveriappa & G.K. Bhat.*, et al. 2004. Plant resources of Dakshina Karnataka, Pilikula, Mangalore

### Additional Reading List

1. *Pande*, b.p. 2005. Economic botany, Chand pub., New Delhi
2. *Albert, H.N.*, 1979. Economic botany, Tata Mc-Graw Hill pub., New Delhi.
3. Major Medicinal Plants of India, 1990. CSIR Publication., New Delhi.



**V SEMESTER - Paper BT-6T**  
**MEDICINAL PLANT TISSUE CULTURE &**  
**ENVIRONMENTAL BIOTECHNOLOGY**  
**Teaching Hours : 3+2 per week**

**Learning objective:**

- To learn the *in vitro* methods of culturing plant cells, tissues and organs.
- Practical knowledge of tissue culture media preparation and different culture techniques.
- Knowledge about the transgenic plants.
- Learn the biotechnological processes of environmental cleanup.
- Practical exposure to estimation of the water quality.
- Understanding the significance of biofuel and biofertilizers.

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**Unit I**

- Introduction, history and scope of plant cell and tissue culture, terms and definitions. Sterilization technique,
- **Plant tissue culture media** - Types, role of macro & micro nutrients, pH, gelling agents, and growth regulators (MS media as example).
- Cellular totipotency and its significance.
- **Micro-propagation techniques** -meristem culture (axillary bud, shoot-tip, internodal culture).
- **Callus culture** and its application.
- **Organs cultures & their application** - Ovary and ovule culture, *in-vitro* pollination and fertilization, Embryo culture, embryo rescue, Endosperm culture and production of triploids.
- **Organogenesis and somatic embryogenesis** – Techniques and applications
- Somoclonal variation and their significance.

**Unit II**

- **Cell Culture:** cell suspension culture, Growth kinetics, growth measurements, Single cell suspension culture methods and their applications.
- **Haploid cultures:** direct and indirect androgenesis, anther culture and pollen culture. Gynogenesis and its application. Diploidization of haploid plants, application of haploids.



- **Protoplast culture:** Introduction of protoplast isolation (Mechanical and Enzymatic). Testing of viability of isolated protoplast.
- **Somatic hybridization:** different methods of protoplast fusion, selection of hybrid Cells, cybrids, Protoplast regeneration techniques.
- **Transgenic plants:** Agrobacterium mediated transformation
- **Cryopreservation:** Technique and application.
- Examples for practical applications of tissue and organ culture in Agriculture, Horticulture & Pharmaceutical industry.

### Unit III

- Introduction to environmental biotechnology, Scope and applications.
  - **Microbial treatment of liquid waste-** Municipal and Industrial waste water. Treatment of solid waste - Composting, its types, application.
  - **Bioremediation:** introduction, types (phytoremediation, microbial remediation, Biosorption), *in-situ* and *ex-situ* bioremediation.
  - **Bioleaching of metals:** Definition, process and significance (e.g: Biomining of Cu & Fe)
  - **Biofuels:** Principle & significance, (e.g: *Pongamia sp.* & *Jatropha sp.*).
  - **Biofertilizers** – Principle & production methods of biofertilizer ( e.g: *utilization of Rhizobium sp. & Mycorrhizae* ).
  - **Biopesticides** : Principle & production methods . (e.g.: *Bacillus thuringensis*)
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Student Activities: Seminar, Assignments, Quiz, tissue culture techniques.

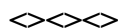


**Practical: B.Sc. V Semester**

**Subject: Medicinal plant Tissue culture and environmental Biotechnology**

**Paper Number: BT –5P**

1. Plant Tissue culture laboratory organization
2. Methods of sterilization. (Wet heat, Dry heat, Chemical & radiations)
3. Preparation of plant tissue culture media- Stock & final ( MS & Nitsch media)
4. Callus and multiple shoot culture.
5. Micro-propagation: Shoot culture, subculture for rooting and hardening & establishing plants in green house
6. Anther and pollen culture
7. Establishing cell lines by suspension cell culture.
8. Protoplast isolation and culture
9. Isolation of Agro bacterium from plant or soil sources
10. Culture of Agro bacterium in-vitro
11. Synthetic seeds
12. Water analysis: Estimation of oxygen & CO<sub>2</sub>
13. Water analysis: BOD & COD
13. Filed visit for study of Biofertilizers & Biopesticides



### Books for Reference- Basic Reading List

1. *Bhojwani S.S and Razdan M.K*, 2004 Plant tissue culture, Panima Publishing Corporation, Delhi.
2. *Chawla H.S* 2004, Plant Biotechnology Oxford and IBH Publishing Co, Pvt.
3. *Ramawath K.G*, 2004 Plant Biotechnology ., Chand Publication, Delhi
4. *Chawla, H.S.*, 2003, Plant Biotechnology: A Practical Approach. Oxford and IBH.
5. *Kalyan Kumar D.E.*, 2000. Plant Tissue Culture., New Age Book Agency Kolkata.
6. *Giri C C and Giri A.*, 2007. Plant Biotechnology Practical Manual, I K International Publishing House Pvt. Ltd.
7. *Srivatsa PS*. 1998. Plant tissue culture and Molecular Biology: Application and Prospects. Narosa Publishing House New Delhi.
8. *Sathynaraya U.*, 2011, Biotechnology, Books and Allied (P) Ltd.
9. *R. C .Dubey*, 2003. A text Book of Biotechnology, S Chnad & Co. Ltd, New Delhi.
10. *Purohit* , 1998. Agricultural Biotechnology, Biotechnology of Higher Plants. Pub: Russel G. E.

### Additional Reading List

1. *R A Dixon and R A Gonzates* 1993. Plant cell culture: A practical approach..
2. *Alexander, G and Nikaido, H.* 2006. Microbial Biotechnology: Fundamentals of Applied Microbiology. W H Freeman and Company.
3. *Chatterji A K.*, 2002.Introduction to Environmental Biotechnology. Prentice – Hall of IndiaPvt. Ltd., New Delhi
4. *Foster C.F., Wae J. D. A*, Environmental Biotechnology, Ellis Horwood Ltd.
5. *Sathynaraya U.*, 2011., Biotechnology, Books and Allied (P) Ltd.
6. *Slater, A., Scott, n AND Flower, M*, 2008. Plant Biotechnology The Genetic manipulation of Plants. Second Edition, Oxford University Press, NY.

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**VI SEMESTER - Paper BT-7T**  
**ANIMAL CELL CULTURE BIOTECHNOLOGY & BIOINFORMATICS**  
**Teaching Hours : 3+2 per week**

**Rationale/Learning objectives:**

- Understanding the laboratory organization and animal tissue culture techniques.
- Studying the methods of culturing animal cells, tissues and organs invitro.
- Understanding the importance of secondary metabolites and its production by rDNA technology.
- Knowledge on transgenic animals, stem cells, gene therapy.
- Understanding the importance of Bioinformatics in life sciences.

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**Unit I**

- History of development of cell cultures, organization of animal cell culture laboratory.
- Cell culture media- components, types (Natural & Artificial), Role of growth factors for proliferation of animal cells ( EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin etc.)
- Metabolic capabilities of animal cells
- Natural factors stimulating growth of animal cells,
- Primary cultures- Cell (Enzymatic & Mechanical disintegration) & Explants culture techniques, Anchorage dependent & independent cells.
- Cell line- finite & continuous, commonly used cell lines, their origin and characteristics.
- Bioreactors for large scale culture of cells
- Growth kinetics of cells in culture
- Organ culture
- Transfection of animal cells: Physical & chemical methods.
- Selective markers, HAT selection, antibiotic resistance.

**Unit- II**

- Introduction to animal metabolism- Anabolic & catabolic.
- Secondary metabolism and production of secondary metabolites (insulin, growth hormones, Interferon, t-plasminogen, activator factor VIII etc.)



- Expression of cloned proteins in animal cells. (e.g. Alpha-1 anti-trypsin)
- Production of vaccine in animal cells. (e.g. Hepatitis B)
- Somatic cell fusion techniques, Production of monoclonal antibodies
- Stem cell culture (embryonic & non-embryonic ) and it's applications.
- Applications of animal cell culture: Transgenic animals ( e.g. Dolly the sheep), Tissue engineering (e.g. Artificial skin) & Gene therapy.

### Unit-III

- Introduction to bio-informatics: Definition, scope and relevance
- Biological database & data tools, types of database, database software.
- Tools for genomics & proteomics, genome data visualization tools
- Annotations, genome comparison, sequence analysis & alignment.
- Application of bioinformatics in pharamcogenomics, agriculture & aquaculture

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Student Activities: Seminar, Assignments, Quiz, proteomics and genomics.

### Books for Reference- Basic Reading List

1. *Shashidara R.*, Animal Biotechnology.
2. *Portner R.*, 2007. Animal Biotechnology: Methods and Protocols, 2<sup>nd</sup> ed., Humana press.
3. *P.K. Gupta*, Elements of Biotechnology, Rastogi publishers, Meerut.
4. *B.D.Singh*, Biotechnology- Kalyani Publishers, Ludhiana .

### Additional Reading List

1. *Freshney I. R.*, Wiley – Liss. 2000. Culture of Animal Cells: A Manual of Basic Technique 4<sup>th</sup> edition.
2. *Davis J. .M*, 2002. Basic Cell Culture: A Practical approach, 2<sup>nd</sup> edition, Oxford University Press, Oxford.

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**VI SEMESTER - Paper BT-8T**  
**PHYTOCHEMISTRY & DRUG DEVELOPMENT**  
**Teaching Hours : 3+2 per week**

**Learning objectives:**

- Understanding the structure, function and diversity of plant metabolites.
- Understanding the physiological reasons behind the unique chemical nature of a plant.
- Knowledge the major principal and techniques used analyzing the plant chemicals.
- Understanding how pharmaceutical products can be developed from different plant sources.

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**Unit I**

- Primary metabolism in plants.
- Role of analytical chemistry in phyto-chemistry and instrumentation
- Isolation and purification of plant compounds: Principles and techniques
- Principles and working modes of Chromatography, Spectrophotometry & radioisotope labeling
- Different models of Chromatography: Paper. TLC. HPLC, HPTLC, GLC
- Different models of Spectrophotometers: Visible, UV-Visible, IR.

**Unit-II**

- Secondary metabolism in Plants; Principles, functions & significance
- Major metabolic pathways leading to production of secondary metabolic products: Glycolysis , Citric Acid pathway, Shikmic Acid pathway & Pentose-Phosphate pathway
- Structure and functions of Isoprenoid compounds, Alkaloids, Glycosides and Phenolic compounds.
- Biosynthesis of Alkaloids and steroids
- Distribution of Volatile oils, Steroids, growth Regulators in plants
- Therapeutic applications of phytochemicals.

**Unit III**

- Plant compounds as drug candidates, Identification & chemical evaluation of New Chemical Entities (NCE) for therapeutic properties, High Throughput Screening.
- Principles & approaches of Pharmaceutical chemistry
- Pharmacokinetics & pharmacodynamics





- Drug modulators & drug intermediates
  - Drug administration
  - Ethno-pharmacognosy & Bioprospecting.
  - Drug development protocol
  - Clinical trial and legal framework for the drug screening
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Student Activities: Seminar, Assignments, Quiz, extraction of plant compounds and TLC.

### **Books for Reference- Basic Reading List**

1. *Kokate & Gokale*, 2004. Text Book Of Pharmacognosy, Nirali Publication, Pune
2. *Kirthikar & Basu*, 1995. Indian Medicinal Plants, ( Volume I To Iv, Chowkamaba Pub., Dehradun.
3. Major Medicinal Plants of India, 1990. CSIR Publication. NewDelhi.
4. *Kaveriappa & G.K. Bhat.*, et al. 2004. Plant Resources Of Dakshina Karnataka, Pilikula, Mangalore

### **Additional Reading List**

1. *Chatwal*, 2000. Chemistry of Natural Products
2. *J.Mann*, 2012. Secondary metabolism., Oxford Univ. Press, New Delhi.
3. *Pande, B.P.* Plant Physiology, S. Chand Publisgers., New Delhi.
4. *P.V. Sharma*, Dravyaguna Shastra, Chowkamaba Pub., Varansi.

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**Practical: B.Sc. Semester-VI.**  
**Subject: Phytochemistry & Drug Development Practical**  
**Paper Number: BT-6P**

1. Crude drug evaluation: Morphological
2. Crude drug evaluation: Anatomical
3. Crude drug evaluation: Chemical
4. Crude drug evaluation: Biological
5. Isolation of therapeutically active ingredients by Solvent extraction ( Two different organic solvents ) & centrifugation technique.
6. Qualitative analysis of plant extracts
7. Soxhlet extraction.
8. Spectrophotometric analysis of plant extract
9. Thin Layer Chromatography (TCC ) for separation of phytochemicals
10. Drug development protocol.
11. Basics of Bioinformatics
12. Basics of computational chemistry used in Pharmaceutical chemistry.

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## Question Paper Pattern

### BASIS OF INTERNAL ASSESSMENT, PATTERN OF THEORY QUESTION AND PRACTICAL EXAMINATION PAPER

#### **1. Basis for internal assessment in theory and practical:**

The internal assessment marks in the theory papers shall be based on two tests. The Tests shall be of at least 1 hour duration each and to be conducted after 6 and 12 weeks after the start of a semester. The average of the two tests shall be taken as the internal assessment marks in theory papers.

The practical internal assessment marks shall be based on one test and continuous evaluation during the practical. The practical test shall be conducted after 10 weeks after the start of a semester. The average of the test and continuous evaluation shall be taken as the internal assessment marks in practical.

#### **2. Theory question paper pattern:**

Theory question papers in science subjects with practical shall carry 80 marks.

The syllabus of each paper is grouped into three(3) units of 12 teaching hours each in the first 4 semesters and 10 teaching hours each in the 5th and 6<sup>th</sup> semesters for all science subjects with practical. The question paper shall consist of part A and B. Part A is an objective type compulsory question(Q.No.1) containing six(12)very short answer objective type questions/divisions, carrying 2 marks each drawn from all the three units of the syllabus(4 questions per unit).. Part B shall contain six (6) short and long answer questions(Q.Nos.2 to7) carrying 20 marks each drawn from all the three units of the syllabus. There shall be four divisions per questions. The marks splitting shall be 3+4+5+8 in even number questions(2,4,6) and 4+4+4+8 in odd number questions(Q.No.3,5,7). The students are required to answer 5 divisions in part A and 3 full questions from part B (Q.Nos.2to7),choosing one full question from each unit. The same is detailed as follows:



**Part A:**

Part A shall contain 12 objective type questions/divisions(Q.No.1) drawn from all the 3 units of the syllabus(4divisions per unit) carrying 2 marks each (i to vi),10 divisions are to be answered.

**10X2=20marks.**

**Part B:**

Part B shall contain (6) short and long answer questions(Q.Nos.2 to7) carrying 20 marks each drawn from all the 3 units of the syllabus(2questions per unit).There shall be four divisions per question. The students are required to answer 3 full questions,choosing one full question from each unit.

**3X20=60marks.**

UNIT I

Question No:2

with the marks splitting of 10+5+5 =20

**Or**

Question No:3

with the marks splitting of 10+5+5 =20

UNIT II

Question No:4

with the marks splitting of 10+5+5 =20

**Or**

Question No:5

with the marks splitting of 10+5+5 =20

UNIT III

Question No:6

with the marks splitting of 10+5+5 =20

**Or**

Question No:7

with the marks splitting of 10+5+5 =20

**Final Scheme:**

**Part-A. Q.1** 10 out 12 question (4 each from. Three units)

**10X2=20**

**Part-B.** Two questions from eaach unit. Only one has to be written. Each question having the sub question with the break up of **10+5+5=20.**

<b>Unit -I</b>	<b>Q.2</b>	<b>OR</b>	<b>Q.03</b>	<b>20</b>
<b>Unit -I</b>	<b>Q.4</b>	<b>OR</b>	<b>Q.05.</b>	<b>20</b>
<b>Unit -I</b>	<b>Q.6</b>	<b>OR</b>	<b>Q.07</b>	<b>20</b>

**3. The pattern of practical examinations:**

They shall be evolved by the HOD and Senior Faculty of the Department.



# S.D.M. COLLEGE -UJIRE

(AUTONOMOUS COLLEGE OF MANGALORE UNIVERSITY)

## CREDIT BASED SEMESTER DEGREE EXAMINATIONS - BIOTECHNOLOGY

### MODEL QUESTION PAPER

(Scheme for all semesters)

**Time: 3hrs**

**Max. Marks: 80**

1. Answer Part A and Part B
2. Answer 4 full questions from PART –B choosing one full question from each unit.
3. All questions in PART-B carry equal marks
4. Draw diagram wherever necessary.

#### PART-A

- I) **Answer any TEN of the following:** **2X10 = 20**  
(Minimum four from each unit)
1. Define carbohydrate. Give an example.
  2. Define active site of an enzyme.
  3. Expand ELISA . Write its application
  4. Define active site of an enzyme.
  5. Which are the different types of ribonucleic acids present in the living system? Write their functions.
  6. Which are the confirmations can be seen in the secondary structures of the
  7. Define active site of an enzyme Which are the confirmations can be seen in the secondary structures of the
  8. Which are the confirmations can be seen in the secondary structures of the
  9. Define active site of an enzyme
  10. Which are the confirmations can be seen in the secondary structures of the
  11. Define active site of an enzyme
  12. Define active site of an enzyme

#### PART-B

- II)
1. Define glycolysis? Explain the glycolytic cycle 10
  2. Explain Krebs cycle. 05
  3. Explain the quaternary structure of proteins 05

**or**



1. What are nucleic acids? Explain the Watson- Crick model of DNA 10
2. What are epimers classify the carbohydrates based on the optical isomerism 05
3. Write detailed classification of amino acids 05

III)

1. Derive Michelis –Menton’s equation 10
2. Explain Lineviewer –burk plot. And derive equation for velocity of reaction 05
3. Define and explain the principles of ELISA and Immunoblot. 05

**OR**

1. What are allosteric enzymes. write the characteristic features of allosteric enzymes. 10
2. What is enzyme inhibition? write different types of enzyme inhibition 05
3. Write the applications of enzymes in genetic engineering. 05

IV

1. What buffers? Derive Handerson –Hesselbalch equation and its application 10
2. Write note on fluorescent microscopy 05
3. What is the impact of pH on bimolecular reactions 05

**Or**

1. Write different laws of thermodynamics and explain 10
2. Write a note on X-ray crystallography 05
3. Write a note on impact of pH on bimolecular reactions 05

V)

1. Write the principle of electrophoresis. Write a note on agarose gel electrophoresis and PAGE 10
2. Write a note on working principle of microscope 05
3. Write the note on significance of R value. 05

**Or**

1. Write the principle of centrifugation. Write a note on differential and density gradient centrifugation. 10
2. b. Write a note on gel filtration and adsorption chromatography 05
3. c. Write a note on electrophoresis and chromatography techniques. 05

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240  
**Practical Examinations: Model Question Paper .**

**Class: I Semester B.Sc. Sub: Medicinal Plant Biotechnology**  
**Paper: BT-1P. Biochemistry & Biophysics**

**Time : 03 Hrs.**

**Max Marks: 40**

**QI. Major Experiment:** Write down the requirement, write down the procedure, conduct the experiment & show the results in **A.** (2 + 3+6+4) **15**

**Q.II. Minor Experiment / Procedure Writing:** Write down the requirement & procedure and / or conduct the experiment & give the inference in **B.** (2+3+3) . **08**

**Q.III. Spotters.:** Identify & give brief explanations in **C, D & E.** (1+2) **3X3=09**

**Q.IV. Records & Viva-voce .** (5+3)= **08**

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240  
**Practical Examinations: Model Question Paper**

**Class: II Semester B.Sc. Sub: Medicinal Pant Biotechnology**  
**Paper: BT -2P. Cell Biology & Genetics**

**Time : 03 Hrs.**

**Max Marks: 40**

**QI. Major Experiment:** Write down the requirement, write down the procedure, conduct the experiment & show the results in **A.** (2+3+6+4) **15**

**Q.II. Minor Experiment / Procedure Writing:** Write down the requirement & procedure and / or conduct the experiment & give the inference in **B.** ( 2+3+3) . **08**

**Q.III. Spotters.:** Identify & give brief explanations in **C, D & E.** (1+2) **3X3=09**

**Q.IV. Records & Viva-voce .** (5+3)= **08**

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240

## Practical Examinations. Model Question Paper

Class: III Semester B.Sc.

Sub: Medicinal Plant Biotechnology

Paper: BT-3P. Microbiology & Immunology

Time : 03 Hrs.

Max Marks : 40

**QI. Major Experiment:** Write down the requirement, write down the procedure, conduct the experiment & show the results in **A**. (2+3+6+4) 15

**Q.II. Minor Experiment / Procedure Writing:** Write down the requirement & procedure and / or conduct the experiment & give the inference in **B**. (2+3+3). 08

**Q.III. Spotters.:** Identify & give brief explanations in **C, D & E**. (1+2) 3X3=09

**Q.IV. Records & Viva-voce .** (5+3)= 08

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240

## Practical Examinations: Model Question Paper

Class: IV Semester B.Sc.

Sub: Medicinal Plant Biotechnology

Paper: BT-4P. Molecular Biology & Recombinant DNA Technology

Time : 03 Hrs.

Max Marks: 40

**QI. Major Experiment:** Write down the requirement, write down the procedure, conduct the experiment & show the results in **A**. (2+3+6+4) 15

**Q.II. Minor Experiment / Procedure Writing:** Write down the requirement & procedure and / or conduct the experiment & give the inference in **B**. (2+3+3) . 08

**Q.III. Spotters.:** Identify & give brief explanations in **C, D & E**. (1+2) 3X3=09

**Q.IV. Records & Viva-voce .** (5+3)= 08

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240  
**Practical Examinations: Model Question Paper**

Class: V Semester B.Sc.

Sub: Medicinal Plant Biotechnology

**Paper: BT-5P. Plant Tissue Culture & Environmental Biotechnology**

**Time : 03 Hrs.**

**Max Marks: 80**

**Q.I. Major Experiment:** Write down the requirement & procedure, conduct the experiment & show the results in **A**.  
**(8+ 12)= 20**

**Q.II. Minor Experiment:** Write down the requirement & procedure and conduct the experiment & give the inference in **B**.  
**(4+8) =12**

**Q.III. Procedure Writing:** Write down the requirement & procedure and give the expected inference in **C**.  
**12**

**Q.IV. Spotters.:** Identify & give brief explanations in **D, E, F, G & H. (1+3) 4X5=20**

**Q.V. Records & Viva-voce.** **(10+6)= 16**

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S.D.M. College (Autonomous), Ujire (D.K.), Karnataka-574240  
**Practical Examinations: Model Question Paper**

Class: VI Semester B.Sc.

Sub: Medicinal Plant Biotechnology

**Paper: BT-6P. Phytochemistry & Drug Development**

**Time : 03 Hrs.**

**Max Marks : 80**

**Q.I. Major Experiment:** Write down the requirement & procedure, conduct the experiment & show the results in **A**.  
**(8+ 12)= 20**

**Q.II. Minor Experiment:** Write down the requirement & procedure and conduct the experiment & give the inference in **B**.  
**(4+8) =12**

**Q.III. Procedure Writing:** Write down the requirement & procedure and give the expected inference in **C**.  
**12**

**Q.IV. Spotters.:** Identify & give brief explanations in **D, E, F, G & H. (1+3) 4X5=20**

**Q.V. Records & Viva-voce.** **(10+6)= 16**

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