Devi Ahilya Vishwa Vidyalaya
Syllabus for B.Sc.
Subject: Life Science (As one Subject)

B.Sc. I Year

Semester I

Paper I: Cell Biology and Biostatistics	50 Marks
Paper II: Diversity of Cryptogams and Gymnosperms	50 Marks
Practicals	50 Marks

Semester II

Paper I: Taxonomy Anatomy and Embryology of Angiosperms	50 Marks
Paper II: Comparative Morphology and Developmental Biology of Animals	50 Marks
Practicals	50 Marks

B.Sc. II Year

Semester III

Paper I: Biochemistry	50 Marks
Paper II: Plant Physiology	50 Marks
Practicals	50 Marks

Semester IV

Paper I: Environmental Biology and Evolution	50 Marks
Paper II: Animal Physiology	50 Marks
Practicals	50 Marks

B.Sc. III Year

Semester V

Paper I: Microbiology and Fermentation Technology	50 Marks
Paper II: Immunology and Animal Tissue Culture	50 Marks
Practicals	50 Marks

Semester VI

Paper I: Genetics and Molecular Biology	50 Marks
Paper II: Genetic engineering and Plant Tissue Culture	50 Marks
Practicals	50 Marks

Life Science

Semester I

Paper I

Cell Biology and Biostatistics

MM: 50 **Hours: 30**

Unit I

Microscopy: Principles and Applications of Simple and Compound Microscope. Phase Contrast, Fluorescence, Scanning and Transmission Electron Microscopy.

Unit II

Ultra Structure of Prokaryotic and Eukaryotic Cell.

Structure and Function (outline) of Cell Organelles: Plasma Membrane (Fluid Mosaic model.), Endoplasmic Reticulum, Golgy apparatus, Lysosome, Peroxisome, Ribosome.

Unit III

Structure and Function(outline) of Cell Organelles: Chloroplast, Mitochondria, Nucleus.

Cell Cycle.

Cell Division (Mitosis, Meiosis).

Unit IV

Structure of chromosome – Prokaryotic and Eukaryotic Chromososme.

Nucleosome model, euchromatin and heterochromatin, karyotype. Special types of Chromososmes (Polytene and Lampbrush Chromosome.)

Unit V

Biostatistics: Measures of central tendency- Mean, Median, Mode.

Standard deviation.

Chi square test.

Recommended Books
Cell Biology and Biostatistics

1. Molecular Biology of Cell- Bruce Alberts et al, Grand publications.
2. Animal Cytology& Evolution- MJD, White Cambridge University Publications.
3. Molecular Cell Biology- Daniel, Scientific American Books.
4. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications.
5. Cell Biology- Ambrose & Dorouthy Masty, ELBS Publications.
6. Fundamentals of Cytology- Sharp, Mc Graw Hill Company.
7. Cytology- Wilson & Marrison, Reinform Publications.
8. Cell Biology and Molecular Biology- EDP Robertis and EMF robertis, Sauder College.
9. Bliss, C.J.K. (1967) Statistics in Biology, Vol. I Mc graw Hill, New York.
10. Campbell, R.C. (1974) Statistics for Biologists, Cambridge Univ. Press, Cambridge.
11. Arora, P.N. Malhan P.K. : Biostatistics. Himalaya Publishing House.
12. Khan(1999)Fundamentals of Biostatistics. Publishing Corporation.
13. Cell Biology, Genetics and Evolution & Ecology P.S. Verma and Agrawal.
14. Cell Biology : A lab manual. Shanmucan. Mc Millan India Ltd.
15. Cell Biology , genetics and Ecology. P.J. Bentley. S.Chand Publications.

Life Science

Semester I

Paper II

Diversity of Cryptogams and Gymnosperms

MM: 50 **Hours: 30**

Unit I

Algae

General Characteristics of Algae.

Importa nt Features of Chlorophyceae, Pheaophyceae and Rhodophyceae. - Life Cycle of Spirogyra, Ectocarpus, Polysiphonia.

Economic Importance of Algae.

Unit II

Fungi

General Characteristics of Fungi.

Out line of Structure, Mode of Nutrition and Life History of Zygomycetes (*Mucor*), Ascomycetes (*Peziza*), Basidiomycetes (*Ustilago nuda*, *Puccinia graminis*), and Deuteromycetes (*Alternaria solani*) .

Economic Importance of Fungi.

Unit III

Bryophyta

General Characteristics of Bryophytes.

Comparative study of sporophytes of Bryophytes.

Life Cycle of Marchantia and Polytrichum.

Unit IV

Pteridophyta

General Characterstics of Pteridophytes.

Stelar organization.

Homospory and Heterospory.

Life cycle of Pteris.

Unit V

Gymnosperms

General Characterstics of Gymnosperms.

Resemblances and differences of Gymnosperms with Pteridophytes and Angiosperms.

Life Cycle of Pinus.

Recommended Books

Diversity of Cryptogams and Gymnosperms

1. Chapman V.J & Chapman D.J, The Algae, Macmillan India Ltd.
2. Fritsch F. B 1945, Structure and Reproduction of Algae Vol.I & II.Cambridge University Press.
3. Bilgrami, K.S. and Saha, L.C., 2001, A text Book Of Algae, CBS, Publishers, New Delhi.
4. Kamat, N.D. , 1982, Topics in algae, Sai Kripa Prakashan, Aurangabad.
5. Kumar, H.D. 1999, Introductory Phycology, East West Press, New Delhi.
6. Smith G.M 1955, Cryptogamic Botany Vol.I, McGraw Hill.
7. Vashishta B.R 1990, Botany for Degree Students, Algae, S.Chand & Co.
8. Singh V., Pandey P.C and Jain D.K 1998, A Text book of Botany for Undergraduate Students, Rastogi Publications.
9. Alexopoulos C.J & MIMS C.V 1988. Introductory Mycology, John Wiley & Sons. Smith G.M 1955, Ciyptoganiic Botany, Vol.I McGraw Hill.
10. Vashishta B.R. 1990, Botany for Degree Students, Fungi, S.Chand & Co. Webster J 1970, Introduction to Fungi, Cambridge University Press.
11. Sharma P.D.;The Fungi:Rastogi and company.,Meerut.
12. Parihar N.S 1967, An Introduction to Embryophyta Vol I & II, General Book Depot.
13. Prempuri 1973, Bryophytes - A Broad perspective. Atmaram & Sons.
14. Smith G.M 1955, Cryptogamic Botany Vol.II. McGraw Hill.
15. Sporne K.R 1976, Morphology of Pteridophytes, B1 Publications.
16. Vashista B.R 1978, Bryophytes, S.Chand & Co.
17. Vashista P.C 1976, Botany for Degree Students Vol IV. S.Chand & Co.
18. Vashista P.C, Pteridophyta: S Chand publications.
19. Vashista P.C, Gymnosperms: S Chand publications.
20. Vashista P.C, Bryophyta: S Chand publications.
21. Biodiversity and Quality of Life. Sengupta. Mc Millan India Pvt. Ltd.
22. Lee.R.E.,1999, Phycology,Cambridge University Press, Cambridge.
23. A.J.,Lack and D.E.Evans:Plant Biology:Viva books Pvt.Ltd.
24. Sharma O.P: Text book of Pteridophyta II edition:McMillan India Ltd.
25. Bhatnagar, S.P. and Moitra1996. Gymnosperms. New Age International Limited, New Delhi.

Practicals for I Semester

1. Microscopic Preparation and Study of Thallus structure and reproduction in Algae through Class work Material.
2. Section cutting of the diseased material and identification of the pathogen (Mucor , Peziza , Ustilago nuda, Puccinia graminis, Alternaria solani)
3. Study of the morphology reproductive structures and anatomy of Bryophytes. (Marchantia and Polytrichum).
4. Study of the morphology reproductive structures of Pteridophytes.(Lycopodium, Selaginella, Equisetum , Pteris etc.)
5. Related Permanent Slides of the Morphology and anatomy of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
6. Study different stages of Mitosis using Onion root tip.
7. Study different stages of Meiosis using Onion bud/ Tradescantia Flower.
8. Study of different stages Mitosis and Meiosis through Permanent Slides.
9. Calculate Mean, Median, Mode of the given data.

Scheme of Practical Examination
I Semester

Max. Marks: 50	**Time: 4 hrs.**
1. Preparation of Temporary mount of Algae/ Fungi	08 Marks
2. Preparation of Temporary mount of Bryophytes/Pteridophytes.	08 Marks
3. Prepare a temporary mount of different stages of Mitosis/Meiosis, Identify and comment.	06 Marks
4. Calculate Mean/Median/ Mode of the given data.	08 Marks
5. Spotting.	05 Marks
6. Viva.	05 Marks
7. Practical Record.	05 Marks
8. Project	05 Marks

Life Science
Semester II
Paper I
Taxonomy, Anatomy and Embryology of Angiosperms

MM: 50 **Hours: 30**

Unit I
Principles of ICBN and Binomial Nomenclature.
Introduction to Natural and Phylogenetic system of Classification
Bentham and Hooker and Engler and Prant'l System of Classification.
Numerical Taxonomy, Chemotaxonomy, Cytotaxonomy of Plants.

Unit II
The Root System: Organization of Root apex.
Anatomy of Root in Monocotyledons and Dicotyledons.
The Shoot System: Organization of Shoot apex.
Anatomy of Shoot in Monocotyledons and Dicotyledons.
Anatomy of Leaf in Monocotyledons and Dicotyledons.

Unit III
Secondary Growth in Dicotyledons.
Anamolous Primary and Secondary growth in Plants.(Achyranthes, Salvadora, Boerhaavia, Tinospora.)

Unit IV
Morphology of Flower.
Microsporogenesis: Formation of Pollen grains. (Male gametophyte)
Megasporogenesis: Development of Embryo Sac. (Female Gametophyte)

Unit V
Pollination: Types, Carriers and Development of Pollen Tube, Division of Male Nucleus.
Double fertilization.
Types of Endosperm and Development of Embryo.

Recommended Books

Taxonomy, Anatomy and Embryology of Angiosperms

1. Bhojwani, and Bhatnagar: 1992, The Embryology of Angiosperms, Vikas Publishing House, New Delhi.
2. Johri, B. M. (Ed.), 1984, Embryology of Angiosperms, Springer- Verlag, Berlin.
3. Maheshwari, P., 1950, An Introduction to the embryology of Angiosperm, Mc Graw Hill Inc. New York.
4. Sachdeva, S.K. 1990, Angiosperms, kalyani Publishers, new Delhi.
5. B.P. Pandey: Text book of Botany :Angiosperms: S Chand Publications.
6. B.P. Pandey: Plant Anatomy: S Chand Publications
7. B.P. Pandey: An Introduction to Plant Anatomy: S Chand Publications
8. Davis,P.H. and Hey Wood. V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
9. Jeffery, C. 1982. An introduction to Plant taxonomy. Cambridge University Press. Cambridge, London.
10. G;fford. E.M. and Foster, A.S. 1988. Morphology and Evaluation of Vasular Plants.. W.H. freeman& Company, New York.

Life Science

Semester II

Paper II

Comparative Morphology and Developmental Biology of Animals

MM: 50 **Hours: 30**

Unit I

Comparative morphology of Digestive System: Outline of Morphological and anatomical Structure of Digestive System of Fish(Scoliodon), Amphibians(Frog), Reptiles(Lizard), Birds(Pigeon) and Mammals (Rabbit).

Unit II

Comparative morphology of Respiratory System: Outline of Morphological Structure of Respiratory System of Fish (Scoliodon), Amphibians(Frog), Reptiles(Lizard), Birds(Pigeon) and Mammals (Rabbit).

Unit III

Comparative morphology of Blood Circulatory System: Outline of Morphological and anatomical Structure of Blood Circulatory System of Fish (Scoliodon), Amphibians(Frog), Reptiles(Lizard), Birds (Pigeon) and Mammals (Rabbit).

Unit IV

Comparative morphology of Urinogenital System: Outline of Morphological and anatomical Structure of Urinogenital System of Fish (Scoliodon), Amphibians(Frog), Reptiles(Lizard), Birds(Pigeon) and Mammals (Rabbit).
Morphology and anatomy of Reproductive System of Mammal. (Rat)

Unit V

Ultra structure of Testis and Ovary in mammals.
Spermatogenesis, Ultrastructure of Sperm.
Oogenesis in mammals. Typical egg structure .
Fertilization in Mammals- Sperm egg encounter, Capacitation and Sperm transport, Acrosomal reaction, Ovum activation and amphimixis.
Clevage- Salient features and Types of Clevage
Types of Placenta in mammals.

Recommended Books

Comparative Morphology and Developmental Biology of Animals

1. R.L. Kotpal: Textbook of Zoology: Vertebrates: Rastogi Publications.
2. R.C. Dalela and S.R. Verma: Book of Chordate Embryology: Jai prakash Nath & Co.
3. Dr. H. N. Baijal: Zoology: Arun Prakashan.
4. Biodiversity and Quality of Life. Sengupta. Mc Millan India Pvt. Ltd.
5. H. Lister: Introduction to Zoology: Abhishek Publication.
6. Jordan & Smith: Chordate Zoology.
7. Verma ,Tyagi and Agrawal: Chordate Embryology.

Practicals for II Semester

1. Study and identify the given plant material by Section Cutting and double staining of Monocot and Dicot - Stem, Leaf and Root.
2. Study of Floral Organs by dissection of Flower and representing it by Floral diagram and Floral Formula.
3. Study of Anamolous Primary and Secondary growth in Achyranthes, Salvadora, Boerhaavia, Tinospora.
4. Comparative study of Morphological and Anatomical features of Reptiles, Fish, Amphibians, Reptiles, Birds and Mammals through Charts and Models.
5. Study and comment on related Slides of Morphology and anatomy of Embryology in mammals and different Systems of Reptiles, Fish, Amphibians, Reptiles, Birds and Mammals.

Scheme of Practical Examination

Max. Marks: 50 **Time: 4 hrs.**

1. Preparation and Identification of Temporary mount of Plant Parts. (Monocot and Dicot- Stem, Root, Leaf.)	08 Marks
2. Study of Floral Organs by dissection of Flower and representing it by Floral diagram and Floral Formula.	08 Marks
3. Prepare a temporary mount of Stem Showing anamolous growth. (Comments with Outline Diagram)	08 Marks
4. Spotting.	10 Marks
5. Viva.	06 Marks
6. Practical Record.	05 Marks
7. Project	05 Marks

Life Science
Semester III
Paper I
Biochemistry

MM: 50 **Hours: 30**

Unit I
Water- as universal solvent, Weak interaction in aqueous system, Ionization of water.
Buffer- Introduction to buffer concept, Relation of pH, pK and buffer concentration.

Unit II
Carbohydrates - Classification, Structure and Function.
Protein- Classification,Structure and Function.

Unit III
Lipid- Structure and Function.
Nucleic Acid- Structure and Function.

Unit IV
Vitamins- Structure and Function.
Enzymes- Major Groups and Nomenclature of Enzymes. Coenzymes and Prosthetic Group.
Factors affecting Enzyme activity. Michaelis Menton Equation

Unit V
Chromatography- Paper, Thin layer, Ion Exchange, Gel Filtration.
Spectroscopy- Beer Lambert's Law. UV and Visible Spectroscopy.
Electrophoresis- Agarose gel Electrophoresis, SDS PAGE, Native PAGE.

Recommended Books
Biochemistry

1. Principles of Biochemistry. Albert L. Lehninger. CBS Publishers and Distributors.
2. Biochemistry- Lubert Stryer Freeman International Edition.
3. Biochemistry- Keshav Trehan. Wiley Eastern Publications.
4. Fundamentals of Biochemistry- J. L. Jain, S .Chand & Company.
5. Biochemistry- Prasarnaga, Bangalore University.
6. Fundamentals of Biochemistry- Dr. A.C. Deb.
7. Essentials of Biophysics. Narayana, P. (2000) .New Age International Publisher New Delhi.
8. A text book of Biophysics. Roy, R.N. (1999). New Central Book Agency.

Life Science
Semester III
Paper II
Plant Physiology

MM: 50 **Hours: 30**

Unit I

Plant water relations – Diffusion and Osmosis: Water potential and Chemical Potential.
Absorption of water; transpiration pull and ascent of Sap.
Transpiration and its significance.
Factors affecting Transpiration.
Mechanism of stomatal movement.

Unit II

Photosynthesis: Photosynthetic apparatus, photosynthetic pigments, photochemical reactions, electron transport chain in chloroplast membranes, photophosphorylation, Calvin cycle, carbon fixation in C3 and C4 plants, Photorespiration, Factors Affecting Photosynthesis.

Unit III

Respiration- Glycolysis, TCA Cycle, Electron transport in Mitochondria: Pentose Phosphate Pathway.

Unit IV

Nitrogen Metabolism - Biological Nitrogen Fixation. Nitrate reduction and its regulation.
Ammonia Assimilation.
Elementary idea of *nif* genes and Role of Leghaemoglobin.

Unit V

Growth and Development- Structure and functions of Plant growth hormones.(Auxins, Cytokinins,Gibberellins, Abscicic acid and ethylene.)
Concept of photoperiodism and vernalization.
General idea of Phytochrome.

Recommended Books
Plant Physiology

1. Salisbury F.B and Ross C.W 1991, Plant Physiology, Wassworth Publishing Co, Belmont.
2. Bidwell R.G.S 1974, Plant Physiology. Macmillan Publication Co, New York.
3. Rama Rao A.V.S.S 1988, Text Book of Biochemistry, L.K & S Publishers.
4. Rao K.N Sudakar Rao G and Bharathan S 1987, The Functioning of Plant. S.Viswanathan Pvt Ltd.
5. Ting I.P 1982, Plant Physiology, Addison Wesley Publication Co. Philippines.
6. Hopkins, W.G. (1995) Introduction to Plant Physiology. John Wiley and Sons Inc. New york USA
7. Shukla Chandel, Fundamentals of Plant Physiology. S Chand Publications.
8. Pandey & Sinha . Plant Physiology, Vikas Publishing House Pvt. Ltd.

Practicals for Semester III

1. Qualitative tests for Carbohydrates, Protein and Lipid.
2. Quantitative Estimation of Protein by Folin Lowry's Method.
3. Quantitative Estimation of Sugar by Nelson Somoguii Method.
4. Paper chromatography of Pigments.
5. TLC of Amino Acids.
6. Effect of Temperature, pH , Enzyme concentration, Substrate concentration on Amylase activity.
7. Preparation of Buffer- Phosphate and Tris acetate Buffer.
8. Chloroplast Isolation from Spinach Leaves, and demonstration of Hill' s Activity.
9. Study of Plasmolysis and deplasmolysis using Tradescantia Peel.
10. Experiment to show rate of transpiration by Ganong's Potometer.
11. Effect of Auxin, Cytokinin, Giberrilic acid on plant growth.
12. Demonstration of Photosynthesis.

Scheme of Practical Examination

Max. Marks: 50 **Time: 4hrs.**

1. Qualitative test for Carbohydrate/ Protein/Lipid	05 Marks
2. Quantitative estimation of Protein/Sugar	10 Marks
3. TLC/ Paper Chromatography	07 Marks
4. Extraction of Chloroplast from Spinach leaves and Estimation of Total Chlorophyll content by Arnon's method.	08 Marks.
5. Spotting.	05 Marks
6. Viva.	05 Marks
7. Practical Record.	05 Marks
8. Project	05 Marks

Life Science

Semester IV

Paper I

Environmental Biology and Evolution

MM: 50 **Hours: 30**

Unit I

Ecosystem concept- structure and function, ecological pyramids, energy flow in ecosystem, food chain, food web, and trophic levels.
Ecological Factors. (Abiotic and Biotic factors)

Unit II

Ecological Adaptation of plants and animals- Aquatic and Desert.
Ecological succession- Hydrosere and Xerosere.

Unit III

Sources, nature and biological effects of air and water pollutants.
Ozone layer depletion, Acid rain and global warming (Green House Effect).

Unit IV

Biofertilizers : Rhizobium, Azatobacter, Azolla, nostoc, PSM, VAM.
Benefits of bioferlitlizers**.**
Biopesticides : Bacillus thuringiensis and its importance.
Advantages and Disadvantages of Biopesticides.

Unit V

Theories of organic evolution- Lamarckism and Darwinism.
Gene pool, genetic drift. Hardy Weinberg Law.
Types of isolation- Geographical, Ecological, Sexual, and Mechanical.

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Recommended Books

1. Shukla and Chandel, Plant Ecology. S.Chand Publicatiopns.
2. Sharma, P.D. Ecology and Environment. Rastogi Publications Meerut.
3. Chary, S.N. Environmental Studies. Mc Millan India Ltd.
4. Jha S. K. Genesis and Evolution. Mc. Millan India Ltd.
5. Ambasht , R.S. (1990) A Text book of plant Ecology. Students friends and Company, varanasi.
6. Text Book of Environment. Mc Millan Publication.
7. Agrawal, Sikder and Deb.,A text book of Environment. Mc millan India Ltd.
8. Kumar, H.D. (1997) Modern concepts of Ecology. Vikas Publishing House . New Delhi.
9. Newman, E.I. 1994. Applied Ecology. Blackwell Scientific Publications London.
10. Odum, E.P. Basic Ecology. Saunder's Philadelphia.
11. P.S. Verma and Agrawal.Cell Biology, Genetics and Evolution & Ecology
12. B.D. Singh Biotechnology .
13. Dubey, R.C. A text Book of Biotechnology. S.Chand Publications.
14. Patel, A.H. Industrial Microbiology. Mc Millan Publishers.

Life Science
Semester IV
Paper II
Animal Physiology

MM: 50 **Hours: 30**

Unit I
Secretory function of the Alimentary Canal
Digestion and absorption.(Carbohydrate, Lipid and Protein.)
Structure of Mammalian Kidney. Glomerular Filteration, Tubular secretion and Selective Reabsorption.
Ornithine Cycle.

Unit II
Blood, Components (RBC, WBC, Platelets and Plasma) and their general functions.
Respiration- Mechanism of breathing, Carriage of Oxygen by Blood, Carbon di oxide transport in the body.

Unit III
Muscles: Structure and types. Mechanism of Muscle contraction.
Structure of Neuron.
Conduction of nerve impulse and neuromuscular junctions.

Unit IV
Structure and function of thyroid and parathyroid gland.
Disorders of Thyroid gland: Cretinism, Myxoedema (Gull's Disease), Goitre, Graves Disease.
Structure and function of adrenal gland.
Disorders of Adrenal gland : Addison's Disease, Cushing Syndrome
Structure and endocrine function of Pancreas.
Disorders: Diabetes mellitus.

Unit V
Structure and functions of Pituitary Gland.
Functions of Hypothalamus.
Female reproductive Cycle - Menstrual cycle. Estrus cycle.

Recommended Books

1. Verma, P.S. and Agrawal, V. K. Chordate Zoology and Animal Physiology. S Chand Publications.
2. Pandey, B.P. Animal Physiology and Ecology. S Chand Publications.
3. Verma P.S. and Agrawal, V.K. Animal Physiology and Ecology.S Chand Publishers.
4. Chatterjee, C.C. Human Physiology. Medical Allied Agency.
5. Guyten. Human Physiology.

Practicals for Semester IV

1. Study and comment on Slides of - Organs of Digestive System of Mammals, Kidney of mammal, Endocrine Glands. (Adrenal gland , Pancreas, Testis and Ovary.), muscles and Nervous tissue.
2. Study of organs through Charts and Models.
3. Haematological Experiment-
   a) Differnetial Count of W.B.C.
   b) Ennumerationof R.B.C.
   c) Coagglution of Blood
   d) Clotting time
   e) Bleeding Time
   f) Estimation of Haemaglobin.
6. Test of Salivary amylase activity.
7. Quadrat Study - To determine the minimum size of the quadrate by species area curve method.
8. To determine the frequency/Density/ Abundance of vegetation in a community by quadrate method.
9. To study ecological adaptations in Hydrophytes and Xerophytes.
10. Determination of Physical Characteristics of Soil like pH, Temperature, and Moisture content.
11. To detect the presence of inorganic radicals in Soil sample.
12. Water Analysis. (Demonstration of Chlorine, Dissolved CO_2 and O_2 in water, and Measurement of ph)

Scheme of Practical Examination

Max. Marks: 50 **Time: 4Hrs.**

1. Ecological Study(Frequency, Density, Abundance)	10 Marks
2. Soil Study	08 Marks
3. Differnetial Count of W.B.C./ Ennumeration of R.B.C.	08 Marks
5. Spotting.	08 Marks
6. Viva.	05 Marks
7. Practical Record.	06 Marks
8. Project	05 Marks

Life Science

Semester V

Paper I

Microbiology and Fermentation Technology

MM: 50 **Hours: 30**

Unit I

Bacteria: Structure (External and Internal to Cell wall) and Classification (On the basis of Shape, Size and Flagella.) Nutritional Classes of bacteria. Extremophiles.

Virus: General Characteristics, Structure of TMV and Bacteriophage.
Lytic and Lysogenic Cycle of Bacteriophage.

Unit II

Different methods of Cultivation of microorganisms.
Types of Media.
Diauxic and Synchronous Growth.
Measurement of Bacterial Growth.

Unit III

Sterilization: Principles and applications of -
Physical Methods: Autoclave, Hot air oven, Laminar air flow.
Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens.
Radiation Methods: UV and Gamma rays.

Unit IV

Isolation of microorganism from natural resources.
Design of typical fermentation equipment.
Industrial sterilization of equipment, media and air.
Principle types of fermentation process- Batch and continuous.
Monitoring and Control of fermentation parameters.

Unit V

Downstream Processing of fermentation product.
Production of Solvent- Ethyl Alcohol
Importance of Single cell Protein and its Production.

Recommended Books
Microbiology and Fermentation Technology

1. Microbiology – pelezar, chan, krieg Tata McGraw Hill Publications.
2. Microbiology – concepts and application . Paul A.Ketchum, Wiley Publications
3. Fundaments of Microbiology- Frobisher, Sauders & toppan publications.
4. Microbiology - Ronald M.Atlas
5. Introductory Biotechnology – R.B. Singh C.B.D. India (1990)
6. Industrial Microbiology – casidal.E.Wiley Eastern Ltd.
7. Fundamentals of Bacteriology – Salley.
8. Fontiers in Microbial technology – P.S.Bisen, CBS Publishers
9. Biotechnology: International Trends of perspectives A.T.Bull, G.Holl M.D.Lilly Oxford & TBH publishers.
10. Industrial Microbiology . A.H. Patel. Mc Millan India Ltd.
11. General Microbiology-C.B.Powar, H.F. Daginawala, Himalayan Publishing House.
12. General Microbiology. Sullia S. B& Shantharam S: (1998), Oxford & IBH Publishing Co. Pvt. Ltd.
13. Microbial Biotechnology Glaser A.N & Nilaido.H (1995) Microbial Biotechnology,W.H Freeman & Co.
14. Industrial Microbiology 4th Edition .Prescott & Dunn (1987), CBS Publishers & Distributors.
15. Industrial Microbiology .Prescott & Dunn (2002), Agrobios (India) Publishers.
16. A text of Industrial Microbiology, 2nd Edition, Crueger W. & Crueger A. (2000) Panima Publishing Corp.
17. Priciples of Fermentation Technology Stanbury P.F, Ehitaker H, Hall S.J (1997)., Aditya Books (P) Ltd.
18. Microbial Biotechnogy (1995) Alexander n. Glazer Hiroshi Nikaido W.H.Freeman and Company.
19. Text Book of Microbiology. Anant Narayan .

Life Science

Semester V

Paper II

Immunology and Animal Tissue Culture

MM: 50 **Hours: 30**

Unit I

Bacterial Diseases: Tetanus, Tuberculosis, Cholera, Pneumonia.
Viral Diseases: Polio, Small Pox, AIDS.
Types of Immunity - Innate and Acquired Immunity.

Unit II

Primary and Secondary Immune response.
Humoral and Cell Mediated Immunity.
Cells and Organs of Immune System and their Functions

Unit III

Antigens: Types, Haptens, Epitopes and factors influencing antigenecity.
Antiody: Structure, Types, properties and functions of immunoglobulins.
Antigen Antibody reaction

Unit IV

Immunological; Techniques: Immunoprecipitation, Immunoelectrophoresis, Haemagglutination, RIA, ELISA and Immunofluoroscence.
Vaccines and Immunization.

Unit V

Animal Tissue Culture; Culture Media, Primary Culture, Secondary Culture, Cell Lines, Transfection of animal cell lines, HAT selection and selectable markers..
Elementary idea of Transgenic Animals.

Recommneded Books

Immunology and Animal Tissue Culture

1. Ian Freshney (4th Edition)
2. William, E. Paul (1989) fundamental immunology, 2nd Edition Raven Press, New York.
3. William, R. Clark(1991) the Experimental Foundtions of Modern Immunoogy (4th Edition)
4. John Wiley and Sons, New York.
5. Ivan, M, roitt (1994) Blackwell Scientific Publications, London.
6. Kuby. Immunology.
7. A Text Book of Biotechnology. R.C. Dubey. S.Chand Publications.
8. A Text Book of Biotechnology. B.D. Singh.
9. Mammalian Cell Culture. Davis.
10. Principles of gene Manipulations- Old & Primrose Blackwell Scientific Publications.

Practicals for Semester V

1. Study of Instruments- Compound Microscope, Autoclave, Hot air oven, pH Meter,laminar air Flow, Laboratory Centrifuge.
2. Staining Techniques- Monochrome Staining, Gram's Staining, Negative Staining, Endospore Staining, Fungal Staining.
3. Media Preparation- Nutrient Agar and Broth.
4. Cultivation techniques- Ennumeration (Streak Plate method, Pour Plate Method) and Lawn Formation.
5. Isolation of Microorganism from Soil, Air and Water.
6. Isolation of Amylase/Protea se Producer from Soil.
7. UV as Mutagen.
8. Antibiotic Sensitivity test.
9. Blood Grouping.
10. WIDAL Test.
11. VDRL Test.
12. Dot Elisa Test.
13. Ouchterlony Double Diffusion (ODD)
14. Radial Immuno Diffusion.(RID)

Scheme of Practical Examination
Semester V

Max. Marks: 50 **Time: 4hrs. (Two days)**

1. Staining Technique	05 Marks
2. Cultivation techniques	05 Marks
2. WIDAL /VDRL Test	05 Marks
3. Antibiotic Sensitivity test/ UV as Mutagen.	06 Marks
4. Dot ELISA/ODD/RID	08 Marks
5. Spotting.	05 Marks
6. Viva.	05 Marks
7. Practical Record.	06 Marks
8. Project	05 Marks

Life Science

Semester VI

Paper I

Genetics and Molecular Biology

MM: 50 **Hours: 30**

Unit I

Mendelism- Monohybrid and Dihybrid cross, Back cross and Test cross.
Linkage and Crossing over. (Coupling and repulsion hypothesis. Mechanism of crossing over and its importance)
Sex linkage and Chromosomal Theory of sex determination.

Unit II

Structural and Numerical chromosomal aberrations.
Chromosome related disorders: Klinefelter's syndrome, Turner's syndrome, Down Syndrome and Cri du Chat Syndrome.
Gene Mutation: Types (Spontaneous and Induced). Molecular basis and its significance. Physical and Chemical Mutagens.
DNA damage and Repair: Ccauses and Mechanisms- Photoreactivation, excision repair, mismatch repair, SOS repair.

Unit III

Conjugation (F- mediated Conjugation, Merozygotes)Transformation and Transduction (general and specialized) in bacteria .
Cytoplasmic Inheritance: Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa Particles in Paramecium.

Unit IV

Nature of genetic material.Nucleic acids: DNA and RNA.
Experimental proof of DNA as genetic material.
Semiconservative nature of DNA replication in prokaryotes and Eukaryotes.

Unit V

Transcription in Prokaryotes and Eukaryotes.
Modification in RNA-5'-cap formation, Transcription termination 3'-end processing, polyadenylation and splicing. Genetic code- Important characterstics.
Prokaryotic and Eukaryotic Translation (Mechanism of initiation, elongation and termination).
Regulation of gene Expressions in Prokaryotes.Operon Concept.(Lac and Trp.)

Recommended Books
Genetics and Molecular Biology

1. Gene VII . Benjamin Lewin.
2. Gene VI. Benjamin Lewin. New York Oxford University Press, USA.
3. Elements of Molecular Biology. Sandhya Mitra. Mc. Millan India Ltd.
4. Text Book of Molecular Biology. Sastry. Mc Millan India Ltd.
5. Principles of Genetics. Robert H Tamarin..
6. Genetics. LR Patki. B.L .Bhalchandra and I. H. Jeewaji. S.Chand Publications.
7. Principles of Genetics. Gardner, E.J., Simmons. M.J. and Snustad, D.P., John wiley and Sons.
8. Molecular Biology of Cell. Bruce-Alberts et al . Garland Publications.
9. Molecular Cell Biology- Daniel., Scientific American Books.
10. Principles of Gene Manipulations. Old and Primrose. Blackwell Scientific Publication.
11. Cell Biology. Ambrose and Dorouthy M. Easty. ELBS Publications.
12. Fundamentals of Cytology. Sharp, Mc Graw Hill Company.
13. Molecular Biology. Smith Faber & Faber Publications.
14. Cell Biology and Molecular Biology. EDP Robertis & EMF Robertis Sauder College.
15. Cell Biology and Genetics. P.S. Verma and Agrawal.
16. Molecular Biotechnology. Principles and applications of Recombinant DNA .Glick BT and JJ Pasternaik. Washington DC ASM Press.
17. Howe, C. Gene Cloning and Manipulation. Cambridge University Press. USA
18. Molecular Biology and Biotechnology (Indian Edition.) Walker J.M. and Gingold E.B. Royal Society of Chemistry. UK.
19. Cell and Molecular Biology. Karp G. 3rd Edition.John Wiley and Sons; INC.
20. Genetics. Rastogi V.B.

Life Science

Semester VI

Paper II

Genetic Engineering and Plant Tissue Culture

MM: 50 **Hours: 30**

Unit I

Genetic engineering- Basic requirements of genetic engineering- isolation of genomic and plasmid DNA from bacteria, plants and animal cells, enzyme required for recombinant DNA technology.

Unit II

Cloning vectors, nomenclature and properties of a good vector.
Construction of genomic and c-DNA libraries, Manipulation of purified DNA .
Introduction of DNA into living cell.

Unit III

Introduction to Blotting Techniques: Western, Southern, Northern Blot.
Introduction to PCR, RAPD and RFLP.

Unit IV

Terms and definition of plant tissue culture, Plant tissue culture medium (Macro and Micro nutrients, Role of Growth regulators (Auxins and Cytokinins). Initiation of callus, Cytodifferentiation, Organogenesis, Somatic embryogenesis.

Unit V

Micropropogation and its application in forestry and Horticulture.
Production of Haploid plants and its Application.
Production and Application of transgenic plants using Agrobacterium tumifaciens/ Agrobacterium rhizogenes.

Recommended Books

Genetic Engineering and Plant Tissue Culture

1. Glick, B.R & Pasternaik J.J (1994) Molecular Biotechnology, Princi[ples and Applicatiopns ofRecombinant DNA, American Society for Microbiology, Washington D.C
2. Christopler H. (1995) Gene cloning and Manipulating, Cambridge Universoty Press
3. Nicholl, D.S.T (1994) An Introduction of Genetic Engineering, Cambridge University Press.
4. Old. R.W. and Primrose, S.B. (186) Principles of Gene manipulation, An introduction to genetic engineering (3rd Edition) Black well Scientific Publications
5. Watson J.D. Hopins, N.H Roberts, J.W.Stectz J.A and Weiner A.M(1988). Molecular biology of society for Microbiology
6. Lewin b. (1994) Genes VI, New York,Oxford University Press.
7. Elements of Biotechnology – P.k. Gupta (1st Edition -2000) Rastogi Publications.
8. Ravishankar G.A and Venkataraman L.V(1997) Biotechnology applications of Plant Tissue & cell culture. Oxford & IBH Publishing co., Pvt Ltd.
9. Bhan (1998) tissue Culture, Mittal Publications, New Delhi.
10. Islan A.C (1996) Plant Tissue Culture, Oxford & IBH Publishing Co., Pvt. Ltd.
11. Lydiane Kyte & John Kleyn (1996) Plants from test tubes. An introduction to Micropropogation (3rd Edition) timber Press, Partland.
12. Kumar H.D (1991) A test book book on Biotechnology (2nd Edition). Affiliated East WestPress Private Ltd. New Delhi.
13. Chrispeel M.J. and Sdava D.E. (1994 Plants, Genes and agriculture, Jones and Barlett Publishers, Boston.
14. Reinert J. and Bajaj y.P.S (1997) Applied and fundamental Aspects of Plant Cell, Tissue, and Organ Culture, Narosa Publishning House. Genetic Engineering.
15. Rigby PWJ, Academic Press. Inc. Florida. USA.
16. Genetic Engineering. Mitra.S. Mc Millan India Ltd.
17. Bhojwani and Razdan. Essentials of Plant Tissue Culture. Kluwer Academic Press.
18. Bhojwani and Razdan. Theory and Practise, Elsevier .Amsterdam.Revised Edition.
19. Razdan M.K. Introduction to Plant Tissue Culture.(Indian Edition) Oxford and IBH.
20. Text Book of Biotechnology . R.C. Dubey.
21. Plant Biotechnology. B.D.Singh.
22. Plant Biotechnology. K.G. Ranawat. S.Chand & Company.

Practicals for VI Semester

1. Working out the laws of Inheritance using seed mixtures.
2. Isolation of DNA from bacteria and its analysis by agarose gel electrophoresis.
3. Isolation of DNA from plant leaves and its analysis by agarose gel electrophoresis.
4. Isolation of DNA from animal cell and its analysis by agarose gel electrophoresis.
5. Isolation of Plasmid DNA from E coli.
6. Restriction Digestion of Bacterial DNA by Restriction Enzymes EcoRI and Hind III and observe its restriction pattern by agarose gel Electrophorosis.
7. Bacterial Transformation (E coli)
8. Preparation and Sterilization of MS Media.
9. Germination of Seed *in vitro* for aseptic Collection of explant.
10. Primary establishment of Culture (Callus Induction) taking leaf/internode /root as explant.
11. Micropropagation.(Apical / Axillary Bud as explant)

Scheme of Practical Examination
Semester VI

Max. Marks: 50 **Time: 4 Hrs.**

1. Isolation of DNA from bacteria / Animal Cell and its analysis by agarose gel electrophoresis / Isolation of Plasmid DNA from E coli and its analysis by agarose gel electrophoresis.	12 Marks
2. Working out the laws of Inheritance from the given material	05 Marks
3. Plant Tissue Culture Experiment.	08 Marks
4. Spotting.	08 Marks
5. Viva.	06 Marks
6. Practical Record.	06 Marks
7. Project	05 Marks