

# Devi Ahilya Vishwavidyalaya, Indore

## Syllabus for B.Sc. Part-I, II and III (Optional subject- Life Science) 2011 Onwards

Semester	Course title	Distribution of marks			
		CCE	Semester Exam	Practical Exam	Total
Sem-I	Biochemistry and Cell biology	15	85	50	150
Sem-II	Environmental biology, Genetics and Evolution	15	85	50	150
Sem-III	Morphology, Developmental Biology and Physiology of Angiosperms	15	85	50	150
Sem-IV	Morphology, Developmental Biology and Physiology of Mammals	15	85	50	150
Sem-V	Microbiology, Immunology and Animal cell culture	15	85	50	150
Sem-VI	Molecular biology, Genetic engineering and Plant tissue culture	15	85	50	150

### Scheme of practical examination in each semester

<b>Total marks- 50</b> <b>Duration- 5 Hrs.</b>	1. Major exercise-1 2. Major exercise -2 3. Minor exercise 4. Spotting 5. Viva-voce 6. Practical record 7. Project	12 Marks 12 Marks 06 Marks 05 Marks 05 Marks 05 Marks 05 Marks
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**Devi Ahilya Vishwavidyalaya, Indore**  
**B.Sc. Part- I (Life Science) Semester-I**

<b>Semester-I</b>	<b>Biochemistry and Cell Biology</b>	<b>CCE- 15 Marks</b> <b>End Exam. - 85 Marks</b>
<b>Unit-I</b>	Carbohydrates: Classification, structure and function Lipids: Structure and function Vitamins: Structure and function.	
<b>Unit-II</b>	Proteins: Classification, structure and function Nucleic acids: Structure and function Enzymes: Types and Factors affecting enzyme activity.	
<b>Unit-III</b>	Structure of prokaryotic and eukaryotic cells. Structure and function of Plasma membrane, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Microtubule, Microfilaments and Intermediate filaments.	
<b>Unit-IV</b>	Structure and function of following organelles: Mitochondria, Chloroplast, Nucleus. Structure of Chromosomes, Polytene and Lampbrush Chromosome. Nucleolus and nucleolar organizing regions. Cell cycle and cell division (Mitosis and Meiosis).	
<b>Unit-V</b>	Elementary idea of techniques: Microscopy: Light (bright field, dark field), Phase contrast, Fluorescence, Electron (SEM and TEM) Chromatography: Paper, Thin layer, Ion exchange and Gel filtration Spectroscopy: Beer Lambert's Law, UV and Visible spectroscopy Electrophoresis: Agarose gel, SDS PAGE and Native PAGE.	
<b>List of Practicals</b>	<ol style="list-style-type: none"> <li>1) Qualitative tests for carbohydrates, lipids and proteins.</li> <li>2) Quantitative estimation of starch and protein.</li> <li>3) Effect of temperature, pH and concentration on enzyme activity.</li> <li>4) Chloroplast isolation from spinach leaves and demonstration of Hill's activity.</li> <li>5) Study different stages of mitosis and meiosis.</li> <li>6) Study of special types of chromosomes.</li> <li>7) Paper chromatographic separation of amino acids.</li> <li>8) Thin layer chromatographic separation of plant pigments.</li> <li>9) Demonstration of Gel electrophoresis.</li> </ol>	
<b>Recommended Books</b>	<ol style="list-style-type: none"> <li>1. Principles of Biochemistry. Lehninger, 3<sup>rd</sup> edition by Nelson and Cox (Worth) 2000</li> <li>2. Biochemistry Stryer 5<sup>th</sup> edition W.H. Freeman 2001.</li> <li>3. Harper's Biochemistry, 1999 (McGraw-Hill).</li> <li>4. Zubey GL. Parson WW and Vance DE (1994) Principles of Biochemistry – W.M.C. Brown Publishers, Oxford, England.</li> <li>5. Cell Biology, Powar C.B. Himalaya Publishers, Students Edition</li> <li>6. Cell Biology, Rastogi, S.C. (Edn. 3) New Age International, 2007.</li> <li>7. Essential Cell Biology (2nd Ed) by B. Alberts et al, Taylor &amp; Francis Group; 2 edition.</li> <li>8. Fundamentals of Biochemistry, Jain, J.L.</li> <li>9. Cytology and Genetics, Sen, S., Kar, D.K., Johri, B.M. Narosa Publishing House.</li> <li>10. Biochemical Methods of Analysis: <i>Theory and Applications</i>, Saroj Dua, S., Garg, N. Narosa Publishing House</li> <li>11. Biochemistry, Sharma, D.K. Narosa Publishing House</li> <li>12. Cell Biology for Biotechnologists.- Shaleesha A. Stanley, Narosa Publishing House</li> </ol>	

**Devi Ahilya Vishwavidyalaya, Indore**  
**B.Sc. Part- I (Life Science) Semester-II**

Semester-II	Environmental Biology, Genetics and Evolution	CCE- 15 Marks End Exam. - 85 Marks
<b>Unit-I</b>	Ecosystem concept- structure and function, ecological pyramids, energy flow in ecosystem. Food chain, food web and trophic levels. Ecological factors (Light, temperature, positive biotic interactions and negative biotic interactions) Ecological adaptation in plants and animals (aquatic and desert) Ecological succession: Hydrosere and Xerosere.	
<b>Unit-II</b>	Sources, nature and biological effects of air and water pollutants. Ozone layer depletion, acid rain and global warming (Green house effect). Biogeochemical cycles: Nitrogen, Carbon, Sulphur and Phosphorus cycles. Biofertilizers: <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azolla</i> , <i>Nostoc</i> , PSM and VAM Biopesticides: <i>Bacillus thuringiensis</i> , <i>Trichoderma</i> and their importance	
<b>Unit-III</b>	Mendelian Laws of inheritance, incomplete dominance, codominance, epistasis, Complementary ratio and supplementary ratio, Cytoplasmic inheritance; plastid and kappa particles. Linkage and crossing over (Coupling and repulsion hypothesis) Mechanism of crossing over and its significance. Mechanism of sex determination (Chromosomal theory), sex linked inheritance.	
<b>Unit-IV</b>	Structural and numerical chromosomal aberrations. Chromosome related disorders: Klinefelter's syndrome, Turner's syndrome, Down's syndrome and Cri-du-chat syndrome Mutations- Spontaneous and induced, Chemical and physical mutagens Molecular basis of mutation.	
<b>Unit-V</b>	Theories of Organic evolution: Lamarckism and Neo Lamarckism, Darwinism and Neo Darwinism, Germplasm theory, Mutation theory. Gene pool, Random genetic drift, Hardy Weinberg law. Isolation and types of isolating mechanisms (Pre mating and post mating) Instantaneous and gradual speciation.	
<b>List of Practicals</b>	1) Determine frequency, density and abundance of vegetation by quadrat method. 2) Study of ecological adaptations in hydrophytes and xerophytes. 3) Soil analysis (pH, temperature, moisture content and inorganic radicals). 4) Water analysis (pH, Dissolved oxygen and Carbon dioxide). 5) Working out the laws of inheritance. 6) Study of chromosomal aberrations using charts. 7) Study of biogeochemical cycles using charts.	
<b>Recommended Books</b>	1. Cytogenetics: Darbeshwar Roy, Narosa Publishing House 2. Environmental Science: <i>A New Approach</i> . Dahiya, P. and Ahlawat, M. Narosa Publishers 3. Ecology - Subrahmanyam, N.S. and Sambamurty, A. V. S. S. Narosa Publishing House 4. Fundamentals of Genetics : Miglani, Gurbachan S. Narosa Publishing House 5. Genetics: Sambamurty, A. V. S. S. Narosa Publishing House 6. Molecular Biology of Cell: Alberts, B.D., Levis, J.R., Ruberts, M. & Watson, Garland Pub. Co. 7. The Science of Genetics: Atherly, A.G., Girton, J.R. & McDonald, J.F. Saunders College Pub. 8. Environmental Studies: Basak, Pearson Publishers. 9. Principles of Cell and Molecular Biology: Kleinsmith, L.J. and Kish, V.M. Harper Collins Pub. 10. Concepts of Genetics: Klug, Pearson Publishers 11. Concepts of Ecology: Kormondy, E.J. Prentice-Hall India 12. A Text Book of Cell and Molecular Biology: Gupta, P.K., Rastogi Publications, Meerut 13. Genetics : Gupta, P.K., Rastogi Publications, Meerut 14. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology: Verma, P.S. & Agrawal, V.K. – S. Chand Publications. 15. Environmental Science: Palanisamy, Pearson Publishers	

**Devi Ahilya Vishwavidyalaya, Indore**  
**B.Sc. Part- II (Life Science) Semester-III**

Semester-III	<b>Morphology, Developmental Biology and Physiology of Angiosperms</b>	CCE- 15 Marks End Exam. - 85 Marks
<b>Unit-I</b>	<p>The Root system: Organization of root apex. Anatomy of root in monocotyledons and dicotyledons.</p> <p>The Shoot system: Organization of shoot apex. Anatomy of shoot in monocotyledons and dicotyledons.</p> <p>Anatomy of leaf in monocotyledons and dicotyledons.</p> <p>Stomata: Mechanism of stomatal movement.</p> <p>Secondary growth in dicotyledons.</p>	
<b>Unit-II</b>	<p>Morphology of flower. Microsporogenesis, Megasporogenesis, Pollination. Fertilization.</p> <p>Endosperm. Development of embryo in dicotyledons and monocotyledons.</p>	
<b>Unit-III</b>	<p>Plant Water Relations: Absorption of water, transpiration, ascent of Sap.</p> <p>Photosynthesis: Photosynthetic apparatus and photosynthetic pigments.</p> <p>Photochemical reactions: Electron transport chain, photophosphorylation, Calvin cycle, Carbon fixation in C<sub>3</sub> and C<sub>4</sub> plants. Factors affecting photosynthesis.</p>	
<b>Unit-IV</b>	<p>Respiration: Glycolysis, TCA cycle, Electron transport in Mitochondria, Pentose-phosphate pathway.</p> <p>Nitrogen metabolism: Biological nitrogen fixation. Nitrate reduction and its regulation. Ammonia assimilation. Elementary idea of <i>nif</i> genes and role of leghaemoglobin.</p>	
<b>Unit-V</b>	<p>Growth and development: Structure and functions of growth regulators. (Auxins, Cytokinins, Gibberelins, Ethylene and Abscicic acid).</p> <p>Concept of photoperiodism and vernalization. General idea of phytochrome.</p> <p>Plant movements: Autonomic or spontaneous movements, paratonic or induced movements.</p>	
<b>List of Practicals</b>	<ol style="list-style-type: none"> <li>1) Perform histological study of root, stem and leaf for identification of monocotyledonous and dicotyledonous plant system.</li> <li>2) Study of floral organs, representation of floral parts by floral diagram and floral formula.</li> <li>3) Absorption spectra of chlorophylls.</li> <li>4) Separation and identification of plant pigments by paper chromatography.</li> <li>5) Isolation of viable chloroplast from spinach and demonstration of Hill's activity.</li> <li>6) Study of plasmolysis and deplasmolysis using <i>Tradescantia</i> peel.</li> <li>7) Effect of auxin, cytokinin and gibberellins on plant growth.</li> </ol>	
<b>Recommended Books</b>	<ol style="list-style-type: none"> <li>1. Embryology of Angiosperms- Bhojwani, S.S. and Bhatnagar, S.P.</li> <li>2. An Introdyction to Embyology of Angiosperms- Maheshwari, P. , McGraw Hill Inc., N.Y.</li> <li>3. Anatomy- Singh V., Pandey P.C. and Jain, D.K.</li> <li>4. Modern Plant Physiology- Sinha, R.K. Narosa Publishing House.</li> <li>5. Textbook of Plant Physiology - Verma V., Ane books Publishers</li> <li>6. An Introduction to Plant Anatomy-B.P. Pandey, S.Chand Publications.</li> <li>7. Morphology and Evolution of Vascular Plants- Gfford, E.M. and Foster, A.S., Freeman &amp; Co.</li> <li>8. Introductio to Plant Physiology- Hopkins W.G. John Wiley &amp; Sons. N.Y.</li> <li>9. Embryology of Angiosperms- Johri, B.M., Springer Verlag, Berlin</li> <li>10. Plant Physiology- Padey &amp; Sinha, Vikas Publishing House.</li> <li>11. Plant Physiology- Salisbury and Ross, C.W., Wadsworth Pub. Co. Calofornia.</li> <li>12. Fundamentals of Plant Physiology- Shukla Chandel, S. Chand Publications.</li> </ol>	

# Devi Ahilya Vishwavidyalaya, Indore

## B.Sc. Part- II (Life Science) Semester-IV

<b>Semester-IV</b>	<b>Morphology, Developmental Biology and Physiology of Mammals</b>	<b>CCE- 15 Marks End Exam. - 85 Marks</b>
<b>Unit-I</b>	Digestive system of mammals: Structure and function; Digestion and absorption of Carbohydrates, Lipids and Proteins. Secretory function of alimentary canal. Excretory System of Mammals: Structure and function, Formation of urea (Ornithine cycle) and Urine (Glomerular filtration, Tubular secretion and Selective re-absorption).	
<b>Unit-II</b>	Respiratory system of mammals: Morphology of respiratory organs. Mechanism of respiration, transport of oxygen and carbon dioxide by blood. Circulatory system of mammals: Morphology of heart. Course of blood circulation. Composition of blood and its functions. Mechanism of blood clotting.	
<b>Unit-III</b>	Muscular system of mammals: Types of muscles; their structure and function. Mechanism of muscle contraction. Nervous system of mammals: Structure of nervous tissue (neurons, nerve fibres and neuroglia). Mechanism of nerve impulse transmission, reflex action and neuromuscular junctions.	
<b>Unit-IV</b>	Endocrine system of mammals: Structure and function of thyroid and parathyroid glands. Disorders; Cretinism, Myxoedema, Goitre, Graves disease and Osteoporosis. Structure and function of adrenal gland. Disorders; Addison's disease, Cushing syndrome. Structure and function of Pancreas. Disorder; Diabetes mellitus. Structure and function of pituitary gland. Function of hypothalamus. Reproductive system of mammals: Structure of male and female reproductive organs. Female reproductive cycles (Menstrual cycle and oestrous cycle).	
<b>Unit-V</b>	Gametogenesis (Spermatogenesis and oogenesis). Fertilization; mechanism of fertilization and its significance. Types and patterns of cleavage. Process of blastulation and formation of germinal layers. Extra embryonic membranes and placentation in mammals.	
<b>List of Practicals</b>	1) Study and comment on the histological slides and charts/models related to: Digestive system, Excretory system, Respiratory system, Circulatory system, Muscular system, Nervous system, Endocrine system, Reproductive system and Developmental biology. 2) Haematological experiments: a) Blood grouping b) Differential count of R.B.C and W.B.C. c) Clotting time and Bleeding time d) Estimation of haemoglobin 3) Study of different developmental stages of chick embryo.	
<b>Recommended Books</b>	1. Chordate Zoology and Elements of Animal Physiology, By Jaurdan, E.L. and Verma, P.S., S. Chand & Company Ltd, New Delhi. 2. An Introduction to Embryology. Balinsky, B.I. Saunders Co. USA. 3. Human reproductive and Developmental Biology. Bagley, D.J, Frith, J.A. and Houlst, J.R.S. Mac Millan Press, London 4. A text Book of Comparative Endocrinology. Gorbman, A and Bern, H.A.; Willy Estern, New Delhi. 5. Developmental Biology. Virbala Rastigi. 6. Animal Physiology - Sobti, R.C., Narosa Publishing House	

**Devi Ahilya Vishwavidyalaya, Indore**  
**B.Sc. Part- III (Life Science) Semester-V**

<b>Semester-V</b>	<b>Microbiology, Immunology and Animal Cell Culture</b>	<b>CCE- 15 Marks End Exam. - 85 Marks</b>
<b>Unit-I</b>	Bacteria: Structure and classification ; Nutritional classes of bacteria. Staining techniques : Simple, structural, Gram's and acid fast staining. Plasmids: Definition, types, identification and classification of plasmids. Bacterial conjugation : F-mediated, merozygotes. Transformation and Transduction : ( General and specialized) in bacteria. Viruses: General characteristics, Classification and Replication of bacteriophages. Bacterial growth- Phases of growth cycle, measurement of bacterial growth.	
<b>Unit-II</b>	Design of typical fermentor and control of fermentation parameters. Principle types of fermentation process – batch and continuous fermentations. Down -stream processing of fermentation product. Production of solvent – ethyl alcohol. Production of antibiotic – Penicillin.	
<b>Unit-III</b>	Types of immunity: innate and acquired immunity. Primary and secondary immune responses. Humoral and cell mediated immunity Cells and organs of immune system and their functions.	
<b>Unit-IV</b>	Antigens: Types, haptens, epitopes. Antibody: Structure, types , properties and functions of immunoglobulins. Antigen – antibody reactions. Quantitative precipitin titration. Immunological Techniques: Haemoagglutination, ELISA and Ochterlony Double Diffusion (ODD) Radial Immunodiffusion. Vaccines and immunization.	
<b>Unit-V</b>	Animal Cell culture: Culture media, primary culture, secondary culture, cell lines, growth curve of animal cells in culture. Transfection of animal cell lines, HAT selection and selectable markers, Antibiotic resistance, Expressions of clone proteins in animal cells and its uses. Stem cell culture and its applications.	
<b>List of Practicals</b>	<ol style="list-style-type: none"> <li>1. Study and working of instruments : Compound Microscope, Autoclave, Hot air oven, pH meter, Laminar air flow bench, Laboratory centrifuge.</li> <li>2. Staining techniques: Monochrome staining, Gram's staining, Acid fast staining, Negative staining, Endospore staining.</li> <li>3. Media preparation: Nutrient agar and Nutrient broth.</li> <li>4. Cultivation techniques: Streak plate method, pour plate method.</li> <li>5. Isolation of microorganisms from soil, air and water.</li> <li>6. Isolation of amylase and protease producer from soil.</li> <li>7. Isolation of antibiotic producing microorganisms from soil.</li> <li>8. Physical and chemical control of microorganism (i) Effect of UV radiation on microorganisms (ii) Use of ethyl alcohol as sterilant.</li> <li>9. Antibiotic sensitivity test.</li> <li>10. Blood grouping.</li> <li>11. WIDAL, VDRL Test.</li> <li>12. Enumeration of RBC.</li> <li>13. Differential WBC count.</li> <li>14. DOT ELISA.</li> <li>15. Ochterlony double diffusion (ODD).</li> <li>16. Radial immune diffusion (RID).</li> </ol>	
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<b>Recommended Books</b>	<ol style="list-style-type: none"> <li>1. The genetics of Bacteria and their Viruses - William Hayes Blackwell Scientific Publishers, London.</li> <li>2. General Microbiology – Robert Boyd.</li> <li>3. Microbiology – Pelczar, M.J., Chan, E.C.S and Kreig, N.R. Mc Graw Hill</li> <li>4. General Microbiology – Stanier, R. Y, Ingharam, J.L. Wheelis, M.L. , McMillan Edu. Ltd.</li> <li>5. General Microbiology- Robert Boyd</li> <li>6. An Introduction to Microbiology - Tauro, P. Kapoor, K.K. and Yadav, K.S. New Age International (P) Ltd, New Delhi.</li> <li>7. Essentials of Immunology, Roitt, I.M., ELBS. Blackwell Scientific Publishers, London.</li> <li>8. Immunology II Edition, Author- Kuby, J. WH., Freeman and Company, New York.</li> <li>9. Immunology. Author- Klaus D. Elgert ,Wiley-Liss. NY.</li> <li>10. Fundamental Immunology. Author – W.E. Paul, Raven Press, New York.</li> <li>11. Immunology. Authors – D.M. Weir and J. Steward 7<sup>th</sup> Ed. (1993).</li> <li>12. Principals of Fermentation Technology, Stanbury PFA Whitaker and Hall 1995.</li> <li>13. Animal Cell Culture: <i>Concept and Application</i> - Sheelendra M. Bhat , Narosa Publishers.</li> <li>14. Immunology: <i>A Text Book</i> - Rao, . Narosa Publishing House.</li> </ol>
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**Devi Ahilya Vishwavidyalaya, Indore**  
**B.Sc. Part- III (Life Science) Semester-VI**

Semester-VI	<b>Molecular Biology, Genetic Engineering and Plant Tissue Culture</b>	<b>CCE- 15 Marks End Exam. - 85 Marks</b>
<b>Unit-I</b>	DNA replication in prokaryotes and eukaryotes. Semi conservative nature of DNA replication. Transcription in Prokaryotes and Eukaryotes RNA processing – 5' cap formation, Transformation termination 3' - end processing, polyadenylation and splicing. Transposable elements: Definition, types of bacterial transposons and applications of transposons.	
<b>Unit-II</b>	Genetic code – Important characteristics. Prokaryotic and Eukaryotic Translation (Mechanism of initiation, elongation and termination). Regulation of gene expression in prokaryotes. Operon concept (Lac and Trp). Gene regulation in eukaryotic system – Promoters , enhancers elements and gene amplification.	
<b>Unit-III</b>	Genetic engineering: Isolation of genomic and plasmid DNA from bacteria, Isolation of genomic DNA from plant and animal cells. Recombinant DNA technology – cloning vectors (pUC 19, phage $\lambda$ , cosmid and M13); Restriction enzymes, introduction of DNA into living cells, methods of gene transfer, expression and detection of clones. Introduction to blotting technique: Western , Southern and Northern Blots. Introduction to PCR , RAPD and RFLP.	
<b>Unit-IV</b>	Terms and definition of plant tissue culture , Media ingredients (inorganic and organic nutrients, role of growth regulators – auxins and cytokinins) , Various media and sterilizing agents. Cell culture : Initiation of callus, isolation of single cells, suspension cultures, batch cultures. Cytodifferentiation , Organogenic differentiation, Somatic embryogenesis. Protoplast culture, cybrids. Application of tissue, cell and protoplast fusion in agriculture, horticulture and pharmaceutical industry.	
<b>Unit-V</b>	Clonal propagation : General techniques, factors affecting clonal propagation, Applications. Production of haploid plants, Factors affecting androgenesis, limitations and applications. Plant Transformation: methods of gene transfer, <i>Agrobacterium tumefaciens</i> mediated transformation, Direct gene transfer methods, selection and identification of transformed cells, Applications.	
<b>List of Practicals</b>	<ol style="list-style-type: none"> <li>1. Isolation of genomic DNA from bacteria, plant leaves, bacteria animal cells and its analysis by agarose gel electrophoresis.</li> <li>2. Restriction digestion DNA using restriction enzymes EcoRI and HindIII and observe its restriction pattern by agarose gel electrophoresis.</li> <li>3. Bacteria Transformation.</li> <li>4. Preparation and sterilization of MS media for explants culture.</li> <li>5. Germination of seed <i>in vitro</i> for axenic cultures.</li> <li>6. Primary establishment of culture (Callus induction from leaf and stem explants).</li> <li>7. Clonal propagation using apical or axillary buds as explants.</li> <li>8. Anther and pollen culture and check the viability of pollens.</li> </ol>	
<b>Recommended Books</b>	<ol style="list-style-type: none"> <li>1. Current protocols in molecular biology. 2000. Ausbel et. al.</li> <li>2. Principles of gene manipulation. 1994. Old and Primrose, Blackwell Scientific Publications.</li> <li>3. Molecular Cloning. 3 volumes. Sambrose and Russell, 2000. CSH Press. Genome analysis. Four volumes. 2000. CSH Press.</li> <li>4. Plant tissue culture : Theory and Practice, Bhojwani S.S. and Razdan, M.K. Elsevier, Holland.</li> <li>5. Plant cell and Tissue culture, Narayanswami, S. Tata McGraw Hill Co. New Delhi.</li> <li>6. An Introduction to Plant Tissue culture, Razdan, M.K., Oxford &amp; IBH Publ., New Delhi.</li> <li>7. Greenhouse Technology for Controlled Environment – Tiwari, G.N. Narosa Publishing House</li> <li>8. Plant Cell, Tissue and Organ Culture: <i>Fundamental Methods</i> Eds. Gamborg, O.L. and Phillips, G.C., Narosa Publishing House</li> <li>9. Molecular Biology - Sambamurty, A. V. S. S. , Narosa Publishing House</li> <li>10. Molecular Genetics- Sambamurty A.V.S.S., Narosa Publishing House</li> <li>11. Molecular Biology - Freifelder, D. , Narosa Publishing House</li> </ol>	