# Bachelors of microbiology (four years) program:

# First year

**Semester I course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 111 | Functional English | 3 | 100 |
| MB112 | Islamiyat | 2 | 50 |
| MB113 | Computers for the beginners | 2 | 50 |
| MB 114 | Fundamentals of Microbiology | 3+1 | 75+25 |
| MB 115 | Biochemistry -1 | 2+1 | 100 |
| MB 116 | Mathematics | 3 | 100 |
| **1st semester total** |  | **17** | **500** |

**Semester II course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 121 | Pakistan studies | 2 | 50 |
| MB122 | Biostatistics | 2 | 50 |
| MB123 | Principles of genetics | 3+1 | 75+25 |
| MB 124 | Biodiversity of plants | 2+1 | 75+25 |
| MB 125 | Biodiversity of animals | 2+1 | 75+25 |
| MB 126 | Biochemistry-II | 2+1 | 75+25 |
| **2nd semester total** |  | **17** | **500** |

**Total credit hours: 138**

# Semester I Course

**MB 111 Functional English 1** **Cr.Hr 3**

As per approval for the curriculum of BSC English course no 114

**MB 121 Islamiyat** **Cr. Hr 2**

As per approval of the curriculum of BSC Pk. St/Islamiyat No 115

**MB 113 Computers for the beginners** **Cr. Hr 2**

Introduction to computer and Windows 98/2000. Word processing (Microsoft word), Spread Sheets (Microsoft Excel) and other related software packages (at least 2), Internet access and different data bases available on the internet.

**MB 114 Fundamental of Microbiology** **Cr. Hr** **3+1**

History of Microbiology, methods of microbiology, bacterial morphology, ultra structure of bacteria, microbial cultivation, microbial nutrition, microbial reproduction and growth control, classification of microorganisms/bacteria, metabolic characteristic roles, symbolic relationships.

***Practical:*** A laboratory studies of the properties of bacteria + related microorganisms including techniques of culturing, techniques of transforming bacteria identification of morphological, physiological and biochemical attributes of bacteria.

***Books recommended***

1. M. J. Peiczar, E.C.S. Chan, N.R. Krieg: microbiology, 5th ed. MC. G. Hill, 1986.
2. B. L. Batling: Microbiology: an introduction, 2002.
3. K.P .Talaro and T. Arthur: Foundations in Microbiology, Wm C Brown, 1986.
4. J. G. Holt, N. R. Krieg, P.H.A, Sneath. J.T. Staley and ST. Williams, Bergey’s Manual of determinative Bacteriology, 9th e.d, Williams and Wilkins, 1994.

**MB 115 Biochemistry -1** **Cr. Hr** **3+1**

Structure and properties of proteins, enzymes, nucleic acids, carbohydrates, lipids, alkaloids, terpenoids, vitamins.

***Practical***: a laboratory study including identification and estimation of proteins, carbohydrates, nucleic acid, lipids, enzymes, alkaloids and vitamins.

***Recommended books***

1. A. L. Lehninger, D. L. Nelson and M. N. Cox; Principles of biochemistry, worth Pub.2000
2. E. E. Conn and P.K .Stumf: Outlines of biochemistry, john Wiley and sons, N.Y, 2002.

**MB 116 Mathematics** **Cr. Hr 2**

Matric spaces, equivalent spaces, Classification of subsets. The space of fractals, transformation on metrix species, contraction, mappings and the construction of fractals, chaotic dynamics of fractacls, fractals dimension, fractals interpolation, Julia sets. Parameter spaces and Mandebort sets, measure on fractals, recurrent iterated function system.

# Semester II Course

**MB 121 Pakistan Studies** **Cr. Hr 2**

**MB 122 Biostatistics** **Cr. Hr 2**

Definition, characteristics, importance and limitations, population and samples, frequency distribution and probabilities, formation of frequency table from raw data, histograms, applications of probabilities to simple events, measure of central tendencies and dispersion, arithmetic means, median, mode range variance and standard error of the mean, mean deviation, semi interquartiles range, standard distribution (binomial, poison and normal distributions, properties and application), normality, test of sign 1 icance (t-test, X2-Test, L.S.D test), design of experiment, brief account of correlation and regression.

**Books recommended**:

1. N.T.J. Bailey, Statistical methods in biology, Cambridge University Press, 1991.
2. T. H. Wonnacott and R. J. Wonnacott, Introductory statistics, J.W & Sons, 1990.
3. J .H .Zar; Biostatistical analysis, fourth edn, Prentice Hall, 1998.

**MB 123 Principles of Genetics** **Cr. Hr 3+1**

Introduction to genetics, cell division, mendelism, gene interaction, gene and environment, linkage and crossing over, multiple alleles, sex linkage, cytogenetics, population genetics.

***Practical***: numerical problems of topics outlined in the course, blood grouping and Rh factor, culturing of drosophila and yeast.

***Books recommended***:

1. M.W. Stickberger: Genetics, 3rd ed. Macmillan Publishing, N.Y, 1985.
2. L.G. Griffiths; Modern Genetics Analysis, W.H, Freeman, 2000.
3. D. l. Harti and E. w Jones; essentials Genetics, Jones and Bartlett Pub, 2002.

**MB 124 Biodiversity of plants Cr. Hr 2+1**

Introduction, diversity of life, arranging the diversity of life into kingdoms, prokaryotes and origin of metabolic diversity, the origin of eukaryotic diversity, eukaryotic origin by Symbiosis among prokaryotes, eukaryotic Algae as key producers in aquatic ecosystem, major characteristics of phyla of kingdom, plant and colonization of land, plant diversity and evolutionary history of plant kingdom, structural and reproductive adaptation for colonization of land, plant structure and growth, reproduction and no development, life cycle of plant mechanism in plant, control systems of plants to cope with environmental stresses.

***Practical:*** sturdy of morphology and reproductive structures of eukaryotes and prokaryote specimens mentioned in course outline, identification of various types mentioned from prepared slides and fresh collection, collection of specimens of plants and their identification.

***Books recommended***:

1. S.A Larid; biodiversity and traditional Knowledge, 1st edition, stylus Pub, 2002.
2. T. greenway: the plant Kingdom, A guide to plant classification and biodiversity (Classification) Raintree/Stecjk Vaughn, 1999.

**MB 125 Biodiversity of animals**  **Cr. Hr 2+1**

Classification of animal kingdom, characterization, diagnostic features and general organization of all major animal groups, concept of animal’s structure with reference to adaptation to environment and interrelationship based on evolution.

***Practical:*** study on morphology and diagnostic features of various major groups of animals, identification of various types mentioned from prepared slides and fresh collection, collection of specimens of animals and their identification.

***Books recommended***:

1. B. Taylor and S. Pollock; Diversity Plus; animal kingdom, Spiral ed, silver Dolphin, 2000.
2. A. P. Kinzig, S. W. Pacala, D. Tilrnan and G. D Tilman; the functional consequences of Biodiversity: empirical progress and Theoretical Extensions, Princeton Uni Press, 2001.

**MB 126 Biochemistry- II Cr. Hr 2+1**

Metabolic of proteins, carbohydrates, lipids and Nuceic acids, integration of various metabolic processes.

***Practical:*** lab techniques for analysis of biochemical materials including biological activity assays, Chromatographic and electrophoretic separation of macromolecules.

***Books recommended***:

1. A. L. Lehninger, D. L. Nelson: Principles of biochemistry, Worth Publishers, 2000.
2. E. E. Conn and P. K. Stumpf: Outlines of biochemistry, John Wiley and Sons, N.Y, 2002.

# Second year

**Semester III course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 231 | Ecosystem | 2+1 | 75+25 |
| MB 232 | Cell Biology- I | 3+1 | 75+25 |
| MB 233 | Microbial Genetics | 3+1 | 75+25 |
| MB 234 | Human genetics | 2+1 | 75+25 |
| MB 235 | Environmental Microbiology | 2+1 | 75+25 |
| **3rd semester total** |  | **17** | **500** |

**Semester IV course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 241 | Microbial Physiology | 3+1 | 75+25 |
| MB 242 | Microbial Ecology | 3+1 | 75+25 |
| MB 243 | Cell Biology-II | 3+1 | 75+25 |
| MB 244 | Immunology | 2+1 | 75+25 |
| MB 245 | Bacterial Metabolism | 3+1 | 75+25 |
| **4th semester total** |  | **19** | **500** |

# Semester III Course

**MB 231 Ecosystem** **CR. Hr 2+1**

Concept, structure and components of ecosystems, energy flow in ecosystems and energy transformation in nature, food chain, food webs, food cycle, trophic levels, ecological pyramids, biogeochemical cycles (carbon, nitrogen, phosphorus), productivity of ecosystems, impact of man on ecosystem, fundamentals of population ecology.

***Practical***: study of pond fresh water ecosystem, study of vegetation profile grassland and forest, study of some biotic and by different methods, study of decomposition of leaf litter by organisms.

***Books recommended***:

1. E .L. Newman: Applied Ecology, Blackwell. UK, 2001.
2. E. D. Eugene and B. F. Smith: Environmental Science, A study relationships, McGraw Hill, USA, 2000.

**MB 232 Cell biology- I** **Cr. Hr 3+1**

Introduction to cell biology, different prokaryotes and eukaryotes, physiochemical properties of protoplasm, ultra-structure, chemical composition and functions of cell wall, cell membrane and cellular organelles, cytoskeleton, chemical composition and molecular structure of chromosomes, cell cycle, cell reproduction and chromosomal aberrations, replication, genetic code, transcription, translation, genetic engineering, animal cloning.

***Practicals***: study of different types of prokaryotes and eukaryotic cell, cell organelles, identification DNA, study of chromosome morphology and variation in chromosome number.

***Books recommended***:

1. Ep. De Rebertis and De Rebertis; Cell and Molecular biology, Lea & Feb, 2001.
2. L. G. Davis, W. M. kuchi: Basic Methods in Molecular Biology, 1995.

**MB 233 Microbial Genetics** **Cr. Hr 3+1**

Bacterial and viral chromosomes, mechanism of genetic exchange among prokaryotes, bacterial DNA, replication, transcription and translation, Genetic mapping, complementation analysis, mutations, genetic code, recombination and regulation of gene expression, bacteriphages and recombination, virulent and avirulent phages, transposons.

***Practical:*** methods of genetic exchange i.e. conjugation, transformation, transduction, chemical mutagenesis, trasnposons mutagenesis, genetic mapping experiments.

***Books recommended***:

1. W. Hayes; The genetics of bacteria and their viruses, studies in basic genetics and molecular biology, 2nd ed, Blackwell Scientific, 2001.
2. U. N. strieps and R. Y; modern microbial genetics, 2nd ed, J. Willey, 2002.

**MB 234 Human Genetics** **Cr. Hr 2+1**

Pattern of transmission of single gene traits, pedigree analysis with criteria for identification of various mode of inheritance, genetic defects in parental development, normal chromosome picture and numerical abnormalities in autosomes and sex chromosomes, congenital maltrasformations, metabolic variation and disease, in born error in amino acids, carbohydrates, lipids and nucleic acids metabolism, errors in transport system, inherited variations, genetic linkage, family milled, somatic hybridization, deletion mapping and duplication mapping, genetic counseling, eugenics, twin studies.

***Practical***: problems relating to pedigree analysis of various human genetics diseases, survey for study of inborn anomalies, structural and numerical abnormalities among human beings, problems related to sex linkage, inherited variations, deletion and duplication mapping.

***Books recommended***:

1. T. Steachan and A. P. Reed; Human molecular genetics, 2nd ed. J. Willey, 1999.
2. C. Danns, R. hallagherand, Watson; The human genome, 1st ed, 2000.
3. B. Lewein, Gene VII, oxford University press, Oxford, UK, 2000.

**MB 235 Environmental Microbiology** **Cr. Hr 2+1**

Effect of environmental factors on microbes, interaction of environmental pollutants with microorganisms, role of microorganisms and the underlying biological principles in elemental cycles, degradation of natural and manmade compounds, bioremediation.

***Practical***: study effects of environmental factors on biodegradation of fungicides/insecticides/pesticides/xenobioics compounds, detoxification of metals, microorganism’s interaction with different pollutants, use of bioremediation techniques, public health measures.

***Books recommended***:

1. R. M. Majer, I. L Pepper and C. P.G; environmental microbiology, Ac,2000.
2. D. R. Loviety; Environmental microbes-metal interactions, American Society for Microbiology, 2000.
3. R. Mitchell; environmental microbiology, J. Willey and sons, 1992.

# Semester IV Course

**MB 241 Microbial physiology**  **Cr. Hr 3+1**

Properties and behavior of bacteria with respect to their chemical as well as physical requirements for life and reproduction, metabolic pathways, protein export, chemiosmosis and multiple transport system, functions of bacterial membrane, principles of enzyme action, enzymatic reaction in organic media, fermentation respiration, unusual bacteria, pathways and biotransformation of environmentally significant materials, functions of bacterial membranes and its organization to antibiotic toxic compound resistance.

***Practical:*** cultivation of microorganism, nutritional requirements, media for routine cultivation of bacteria, determination of chemical requirements of a microbe, effect of physical factors on microbial physiology, techniques of cultivation of aerobic and anaerobic bacteria, effect of antibiotic and chemical compounds on bacterial physiology, isolation of cell wall polymers of bacterial cell wall.

***Books recommended***:

1. DRC; Microbial physiology and Metabolism, 2nd edition, Stat pud. Go, 1999.
2. A. G. Moat and J. W. Foster; Microbial physiology, 3rd ed, J. Willey and Sons, 1995.

**MB 242 Microbial Ecology Cr. Hr 3+1**

Distribution and activities of microorganisms in natural system, role of bacteria in elemental cycles and plant-microbe interaction, relationship between physical and ecological attributes of microorganism, development and interaction of microbial communities with their living and abiotic environment with specific reference to air, soil and water, microbial role in global carbon cycle, biodegradation of environmentally significant materials, techniques of study microbial ecology.

***Practicals***: techniques to study microbial ecology, distribution of microbes in different ecological niche and their enumeration role of microorganism in nitrification, identification, ammonification, nitrogen fixation and microbial activities of microbes in habitat, study of physical factors on distribution of resistant genes/ marker in environment, biodegradation by microorganism.

***Books recommended***:

1. R. M. Atlas and R. Bhartha; Microbial Ecology, fundamentals and applications, $th edition, Eddison-Wesley, Pub CO, 1997.
2. D. L. Kirchmaiv; Microbial Ecology of Ocean, 1st edition, welley-liss, 2000.

**MB 243 Cell Biology-II Cr. Hr 3+1**

E.coli and yeasts as representative prokaryotic and eukaryotic models of molecular biology studies, molecular mechanism of replication, DNA repair, transcription, translation, regulation of gene expression in prokaryotes and eukaryotes, transcriptional and translational regulation of gene expression, gene sequencing, yeast genetics, viruses ( life histories and regulation of gene expression), principles of recombinant DNA technology, role of recombinant DNA technology in economic development, Human Genome Project, Stem Cell research.

***Practical:*** experimental studies integrating genetics and biochemistry in the studies of molecular genetics in prokaryotic and eukaryotic cellular and viral system.

***Books recommended***:

1. H. Lardish, D. Baltimore, A. Berk, S. L. Zipursky, P. Matsurdaria; Molecular Cell Biology, $th Edition, W. H. Freeman and Co, 2001.
2. J. W. Lengeler, G. Drews and H. G. S; Biology of Prokaryotes, 1999.
3. G. M. Cooper; The Cell; A molecular Approach, 2nd Edition, Stnauer,2000.

**MB 244 Immunology Cr. Hr 2+1**

Basic immunological concepts, principles end techniques of serology, immunological response to foreign agents, nature of antigen and antibodies, antigen-antibody reaction, immunocompetent cells, allergic reaction, tumor transplantation and immunology, immunogenetics.

***Practical***: techniques used in serological studies RBC and WBC count, differential leukocyte count, blood grouping, an Ubody test.

***Books recommended***:

1. C. Janeway; Immunology, 5th edition, Garland Pub, 2001.
2. J. Kreir; Infection, resistance and Immunity, 2nd Ed, 2002.

**MB 245 Bacterial Metabolism Cr. Hr 3+1**

Chemical composition of bacterial cell, nutritional types among bacteria, growth factors and other nutritional requirements of microbial growth, cell metabolism including protein metabolism, nucleic acid metabolism, fat metabolism and carbohydrate metabolism, microbial enzymes.

***Practical:*** effect of heat, pH, osmotic pressure on bacterial enzymes, proteins, carbohydrates of enzyme catalyzed reaction, isolation and purification of enzymes.

***Books recommended***:

1. G. Gottschalk; Bacterial Metabolism, springer series in Microbiology, 2nd edition, 1986.

2. H. Hauska and R. Thauer; The Molecular Basis of Bacterial Metabolism, S.V, 1991.

# Third year

**Semester V course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 351 | Food and dairy microbiology | 2+1 | 75+25 |
| MB 352 | Recombinant DNA Technology | 2+1 | 75+25 |
| MB 353 | Medical microbiology | 2+1 | 75+25 |
| MB 354 | Microbial Diversity | 2+1 | 75+25 |
| MB 355 | Molecular Mechanism of Gene Expression | 2+1 | 75+25 |
| MB 356 | Soil and agriculture Microbiology | 2+1 | 75+25 |
| **5th semester total** |  | **18** | **600** |

**Semester VI course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 361 | Industrial Microbiology-I | 3+1 | 75+25 |
| MB 362 | Human Genetics diseases and their diagnosis | 2+1 | 75+25 |
| MB 363 | Plant pathology | 2+1 | 75+25 |
| MB 364 | Chromosomal Abnormalities and Genetic counseling | 2 | 50 |
| MB 365 | Virology | 2+1 | 75+25 |
| MB 366 | Seminar Credit | 1 | - |
| MB 367 | Biophysics/ Bioinformatics | 1 | 50 |
| **6th semester total** |  | **17** | **500** |

# Semester V Course

**MB 351 Food and Dairy Microbiology**  **Cr. Hr 2+1**

Food spoilage and preservation process, food preservation alternative, diseases and foods, food spoilage, microbiology of fermented foods, microorganisms as a source of food, sanitation and public health problems, microbiological examinations of food.

**Practical:** Microbiological analysis of various food products, enumeration and characterization of microbes, methylene blue reductase test, wine production and sauerkraut production, study of different preservatives efficiencies in preserving foods.

**Books recommended:**

1. V. K. Juneja and J. N. Sofos; Control of food borne Microorganisms, Culinary and hospitality industry publication services, 2001.
2. W. F. Harringtan; Laboratory methods in Food Microbiology, Ac, Press, 1998.

**MB 352 Recombinant DNA Technology**  **Cr. Hr 2+1**

History, tools of recombinant DNA technology, restriction endonuleases, vectors, transformations, cloning strategies, site-directed mutagenesis, sequencing strategies, transgenesis, implications in economic developments.

**Practical:** Experiments BRP will include plasmid phase propagation, nucleic acid purification, DNA protein manipulation and gene analysis, use of restriction enzymes, de derivatives construction.

**MB 353 Medical Microbiology** **Cr. Hr 2+1**

Infection and diseases, host parasite relationship, establishment of diseases, resistance to diseases, microbes and diseases, transmission of pathogen, epidemiology of infectious diseases, diagonistic methods for the identification of microorganisms, culturing techniques, host resistance and control.

***Practical:*** lab techniques to study and identifications of medically important microorganisms, techniques including methods of culture, microscopy and staining, biochemical properties, identification and diagnosis of enteric bacteria by enterotube system and analytical profile index system.

***Books recommended:***

1. Medical microbiology by Samuel Baron, Paula M. Jennings, Johnny W. Peterson, 1991.
2. Medical Microbiology; Ashort course by Ellen Jo Baron, 1994.
3. Medical Microbiology by Fritz H. Kayser, 2004.
4. Medical Microbiology by Geo. F. Brooks, Janet, Stephen A. Morse, Ernest Jawetz, 2004.

**MB 354 Microbial Diversity** **Cr. Hr 2+1**

Diversity of organisms found in microbial world, metabolic diversity of microorganism, major groups of bacteria, bacterial taxonomy rules, introduction to current concept and methods in microbial evolution/phylogeny, evolution of eubacteria, archaebacteria and eukaryotic microorganism, nature of progene and precursors, prebiotic evolution, molecular mechanisms by which select organisms adapt or modify the environment.

***Practical:*** Isolation, characterization and identification of microbial diversity present in soil, water, plants rhizosphere, rhizoplane and histoplane of plants and bio films, use of differential/selective media for different of microbial diverse types.c Pub Co, 2001.

***Books recommended:***

1. D. Alospp, R. Rolwell; Microbial Diversity and Ecosystem, 1999.
2. B. H. Nga, H. M. Tan, K. Suzuki and B. Nga; Microbial diversity in Asia; Technology and prospects, world scientific Pub Co, 2001.

**MB 355 Molecular Mechanism of Gene Expression Cr. Hr. 2+1**

Prokaryotes gene expression as depicted by various operons, methods of study of gene expression, eukaryotic gene expression, transcription factos, cell cycle and gene regulation, tumor genesis.

***Practicals:*** Techniques will be sued to explore molecular aspects of gene expression and regulation, Experiments will include plasmid, phage propagations, DNA and protein manipulation, and gene analysis.

**MB 356 Soils and Agriculture Microbiology**  **Cr. Hr 2+1**

Elements of soil formation and conservation, soil microbial population and methods of study with their advantages and disadvantages, role of microorganism in mineral transformations with special and detailed emphasis on carbon and nitrogen transformations, brief introduction to sulphur and phosphorus transformation, introduction to soil fertility, biotechnological potential of soil microorganisms, importance of the subject in the agricultural development of Pakistan, problems of salinity and water-logging and the methods of their reclamation, microbial activities in saline soil, biochemical, physiological, genetic, ultra-structural and molecular aspects of interaction between plants and their beneficial and harmful symbionts, microbe’s role in regulatory mechanism of plant gene expression.

***Practical:*** Study of role of microbes in soil structure and improvement, symbiotic and antagonistic effects of microbes, reclamation of saline and waterlogged soils, determination of genetic and biochemical molecular aspects of microbial interaction with plants, use of Azospirillum and Azospirillum as natural fertilizers.

***Books recommended:***

N. S. S. Rao and V. A. Dommergues; Microbial interactions in Agriculture and forestry, Vol 2, Science Publishers, 2001.

# Semester VI Course

**MB 361 Industrial Microbiology – I Cr. Hr 3+1**

Fundamentals of modern fermentation technology and industrial microbiology with emphasis on product formation, culturing techniques, the food processing, food manufacture, preservation and environmental quality and sanitation, general survey of biotechnologically important microorganism., outlines of isolation, cultivation and maintenance of biotechnologically important microorganism, microbial fermentations (Organic acids-Citric, lactic and acetic acid, organic solvents: Acetone, butanol and ethanol. Microbial enzymes: amylases. Amino acids: Lysine and glutamic acid), scope of fermentation biotechnology in Pakistan.

***Practical:*** Current techniques of industrial and applied microbiology with emphases on continuous cultures and immobilized cell techniques, study of different types of fermentations by different microorganism, use of biotechnological techniques/biotechnologically important microorganism in fermentation of organic compounds.

***Books recommended:***

1. A. J. Barrett; Handbook of Proteolytic enzymes, Academic Press, 2002.
2. B. J. Wood and Warner; Genetics of Lactic acid bacteria, aspen Pub, 2001.

**MB 362 Human Genetics Diseases & their Diagnosis** **Cr. Hr 2+1**

Mapping genes for common diseases, human DNA sampling and banking, microsatellite genotyping, DNA fingerprinting, polymerase chain reaction and immobilized probes, special case of HLA genes, detection and resolution of multiple polymorphic sites in a single gene, microplate array diagonal gel electrophoresis, the use of sequence analysis of homozygote and heterozygote base variation.

***Practical:*** Human genetic disease and their diagnostics problems related to the genetic human disease, study of different symptoms in human produced by genetic diseases.

***Books recommended:***

1. M. Sussman; molecular medical Microbiology, Academic press, 2002.
2. P. M. Royce and B. Steinmann; Connective Tissue and its heritable disorders, molecular genetic and medical aspects, John Willey and Sons, 2002.

**MB 363 Plant Diseases**  **Cr. Hr 2+1**

Economics importance of plant diseases, concepts, definitions and development of plant diseases, pathogen effects, plant diseases control, diagnosis, morphology, taxonomy, ecology, symptology, physiology epidemiology and genetics of bacterial/viral plant pathogens.

***Practical:*** Survey of different types of plant diseases in nearby locality, study of different types of morphological as well as anatomical symptoms produce by plant pathogen, identification using morphological, physiological and genetical aspects of bacterial and viral plant pathogen.

***Books recommended:***

1. J. A. khan and J. Dijkstra; Plant viruses as Molecular pathogens, Food prod, press, 2001.
2. K. Maramorosch; Plant diseases of viral, viroid, mycoplasma and uncertain etiology, West view Press, 1993.

**MB 364 Chromosomal Abnormalities and Genetic Counseling** **Cr. Hr 2**

Medical cytogenetics, autosomal reciprocal translocations, sex chromosomes translocations, Robertsonian translocation, centromere fission, insertions, inversion, autosomal rings, parental sex chromosomes and autosomal aneuploidy, fragile X syndromes, down syndrome, XY Female, XX male, true hermaphrodite, pregnancy loss and infertility parental age counseling and screening for fetal trisomy, prenatal diagnostic procedures, chromosome abnormalities detected at prenatal diagnosis.

***Books recommended:***

1. D. L. Bakar, J. L. Schuette and W. R. Uihlmann; A guide to genetic counseling, john Willey and Sons, 1998.
2. A. R. J. M. Gardner, G. R. Sutherland and G. R Sutherland; Chromosome abnormalities and genetic counseling, Oxford university press, 1996.

**MB 365 Virology**  **Cr. Hr 2+1**

Basic principles of virology, structure/architecture of virus, characteristics of viruses, virus-host cell interaction, viral replication, genetics of viruses, transmission of viruses, classification of viruses, effects on the infected cell, mechanisms of pathogenicity, HIV, retrovirus infection, prions, hepatitis viruses, virus cultivation and propagation, viral oncogenes.

***Practical:*** Experiments on virus propagation, virus assay, in vitro cell cultivation, infectivity assays and cytopathic effects of virus, study of visual symptoms produced by virus on animals and plants.

***Books recommended:***

1. A. J. Cann; Principles of molecular Virology, 31st Edition, Acedamic press, 2001.
2. J. Strauss and E. G. Strauss; Viruses and human diseases, 1st edition, Ac, Press, 2001.

**MB 366 Seminar Cr. Hr 1**

**MB 367 Biophysics/Bioinformatics** **Cr. Hr 1**

Introductory course in the approach to biological phenomena from conceptual view point of physical sciences, molecular to organismic level of biological hierarchical structure, application of computational tools to the analysis of genome and their gene products.

***Books recommended:***

1. D. Schomburg and U. lessel; Bioinformatics from Nucleic acids and proteins to cell metabolism, john, Willey & Sons, 1995.
2. D. W. Mount; Bioinformatics; sequence and genome analysis, cold spring harbor laboratory press 2001.

# Fourth year

**Semester Vll course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 471 | Molecular genetics of yeast | 3+1 | 75+25 |
| MB 472 | Term paper/Techniques In Microbiology | 2 | 50 |
| MB 474 | Ethical issues of Genetics | 2 | 50 |
|  | **The students will opt three of the following courses** |  |  |
| MB 475 | Plant Molecular Genetics | 2+1 | 75+25 |
| MB 476 | Animal Biotechnology | 2+1 | 75+25 |
| MB 477 | Monoclonal antibodies | 2+1 | 75+25 |
| MB 478 | Microbiology and Environmental hazards | 2+1 | 75+25 |
| MB 479 | Probiotics | 2+1 | 75+25 |
| MB 4710 | Biodegradation and Bioremediation | 2+1 | 75+25 |
| MB 4711 | Biochemistry of nucleic acid | 2+1 | 75+25 |
| MB 4712 | Gene therapy | 2+1 | 75+25 |
| MB 4713 | Animal diseases | 2+1 | 75+25 |
| MB 4714 | Antiviral agents | 2+1 | 75+25 |
| **7th semester total** |  | **17** | **500** |

**Semester VIII course**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course No** | **Course title** | **Cr.hrs** | **Marks** |
| MB 481 | Industrial Microbiology-Il | 2+1 | 75+25 |
| MB 482 | Plant biotechnology or Advanced topics in Microbiology | 2+1 | 75+25 |
| MB 481 | Seminar/ Regulatory issues like biosafety and protection | 2 | 50 |
| MB 473 | Research | 8 | 150 |
| **8th semester total** |  | **16** | **500** |

# Semester VII Course

**MB 471 Molecular Genetics of yeast** **Cr. Hr 3+1**

**MB 472 Techniques in Microbiology**  **Cr. Hr 2**

**Course Contents:**

Ultra centrifugation, Sedimentation, density gradient and differential centrifugation, Electrophoresis, paper and gel Electrophoresis, Capillary and two dimensional electrophoresis, blotting techniques.

**Recommended Books:**

1. Campbell L, Durek, Braun B (1987) 1st edition, “Introduction to instrumental Analysis” Mc Graw Hill International editions, chemistry series.
2. Kenkel J (1994) 2nd edition, “Analytical Chemistry for Technicians” Lewis Publishers, BocaRaton.
3. Wilson K, Walker J (1994) 3rd edition, “Principles and Techniques of Practical Biochemistry” Cambridge University Press. Cambridge.

**MB 474 Ethical Issues of Genetics**  **Cr. Hr 2**

Moral responsibility and moral imagination, ethical issue, human genome project, justification, promotion and access to results, genetic knowledge, open access or private patents, gene hunting, genetic testing and genetically tailor-made drugs, genetic information in employment and insurance, eugenics and the long term goals of reprogenetic medicine, professional responsibility for applications of genetics, genotypic prevention vs. reproductive anatomy.

**Books recommended:**

1. Laurie, Lail; Ethics of genetic Privacy, Cambridge University Press, 2002.

**THE STUDENTS WILL OPT THREE OF THE FOLLOWING COURSE.**

**MB 475 Plant Molecular Genetics** **Cr. Hr 2+1**

The use of comparative genome mapping in the identification, cloning and manipulation of important plant genes molecular marker in plant conservation, identifying links between genotype and phenotype using marker loci and candidate gene, economic importance of plant molecular genetics, Arabidopsis and its importance in recent molecular genetic studies, Arabidopsis genome project, achievements and future projects, other genome projects.

***Practical:*** Experiments will include determination of molecular marker for plant biotechnology, identification of genes for phenotypic and genotype expression of plants, use of plant transformation techniques, determination of recombinant products.

***Books recommended:***

1. P. M. Gilmartin and C. Bowler; molecular plant Biology, A practical approach, oxford Uni Press 2002.
2. P. Westhof, Molecular Plant Development; from plant to genetics, Oxf uni Press, 1998.

**MB 476 Animal Biotechnology**  **Cr. Hr 2+1**

Synthetic peptides and animal health applications of monoclonal antibodies in animal health and reproduction by recombinant DNA technology, recombinant cytokines and their potential therapeutic value in veterinary medicine, nucleic acid hybridization, applications to diagnosis of microbial infection and to genotype analysis, the micromanipulations of farm animal embryos, the incorporation of biotechnological techniques in animal breeding strategies, gene transfer through embryo microinjection, biotechnology and genetics in Fisheries and Aquaculture.

***Practical:*** Aquaculture techniques, Various DNA recombinant techniques.

***Books recommended:***

1. N. Jenkins; Animal cell Biotechnology; methods and Protocol, 1st ed, Hurmana P, 1999.
2. R. Beaumont; Biotechnology and Genetics in fisheries and Aquaculture, I. S. U. P, 2002.

**MB 477 Monoclonal Antibodies**  **Cr. Hr 2+1**

Monoclonal and polyclonal antibodies, hybridoma technology, applications of monoclonal in research, diagnostics and therapeutics.

***Practical:*** Synthesis of Monoclonal antibodies

**MB 478 Microbiology and Environmental Hazards**  **Cr. Hr 2+1**

Hazardous roles of microbes in the environmental, microorganism as a source of disease and other nuisances, solutions to various hazards, new trends n monitoring of toxic environmental hazards by microbes.

***Practical:*** Microbiological procedure that relate the hazards are demonstrated and evalutated in laboratory exercise. Demonstration of aseptic techniques, techniques to release/dispose off microbial cultures handling of pathogenic bacteria, hazards commonly found in microbiological laboratories and appropriate safety precautions and responses, includes hazards of working with bacteria, virus, parasites recombinant DNA procedures and regulation.

***Books recommended:***

1. S. L. Cutter; Environmental Risks and hazards, Prenties Hail, 1993.

**MB 479 Probiotics** **Cr. Hr 2+1**

Introduction, the intestinal flora, development of probiotics, probiotic usage, mechanism of working.

Practical: isolation, characterization and identification of intestinal flora, study of reaction produced by probiotics, methods for development of probiotics.

**MB 4710 Biodegradation & Bioremediation** **Cr. Hr 2+1**

The environment and pollution, environmental laws, treatment technologies, traditional approaches to pollution control, bio-treatment technologies for pollution control, biocatalyst selection and genetic modification, enrichment and screening strategies, design of enrichment strategies relating to the environmental sources, microbiological techniques for enrichment and selection, genetic approach, the carbon cycle and xenobiotic compounds, biodegradation and microbial technologies by microorganism, acclimation, detoxification, activation, sorption, bio-availability, sequestering and complexing, Co-metabolism, environmental effects, effects of metal and radio-nuclide on environment, metal and radionuclide microbial treatment, biotechnology for metal and radionuclide removal and recovery, Recalcitrant molecules.

***Practical:*** Survey of different type of pollutants present in nearby locality (especially industrial polluted localities screening of markers for pollutions & treatment, use of treatment technology in degradation and bioremediations of pollutants.

***Books recommended:***

1. R. Mitchell; environmental microbiology, Willey Liss, 19922.
2. R. K. Pool and G. M. gad; metal microbe interaction, IRL, PTess, 1989.
3. M. Alexander; Biodegradation and Bioremediation, Academic press, 1999.

**MB 4711 Biochemistry of Nucleic Acid** **Cr. Hr 2+1**

Various types of extra chromosomal elements, model sex factors, super infection immunity, entry exclusion, incompatibility and basis for incompatibility, curing with various chemical agents, significance of sex pill and sec specific phages in classification, constitution of an R-plasmid F factor and its restriction map, various types of bacteriocin plamids, an introduction to plasmids used in molecular cloning, role of extrachromosomal elements in bacterial evolution, repeated DNA sequences in plasmids, definitions of transposable elements in prokaryotes.

***Practical:*** Isolation of various types of extrachromosomal elements, curing experiments with different chemical agents, study of effects of media composition, starvation, pH temp on plasmid curing, isolation of different bacteriocin, demonstration of transposition in maize and drosophila.

***Books recommended:***

1. M. N. Chatterjea, Raana Shinda 5th ed
2. M. Butler; Mammalian Cell biotechnology; A practical approach, in press, 1991.

**MB 4712 Gene Therapy** **Cr. Hr 2+1**

Introduction, Germ line gene therapy, somatic gene therapy, viral and non-viral systems used for therapy, Cystic fibrosis, familial hypercholesterolemia, cancer, infectious diseases, Ada deficiency, human trail of gene therapy, ethical and regulatory considerations, future prospects.

**MB 4713 Animal Diseases**  **Cr. Hr 2+1**

Biochemistry of blood, urine, cerebrospinal fluid, bacterial and viral disease, kidney disorders and its diagnosis, liver disorders and their diagnosis, gastrointestinal tract disturbances with specific reference to normal and diseases condition, blood disorder including various types of leukemias in animals.

***Practical:*** Survey of different types of animal disease in nearby locality, study of bacterial and viral disease of animals, identification of casual agent and its morphological and physiological aspects, identification of bacterial/viral agents causing diseases in gastrointestinal tract, liver disorders and kidney disorders.

***Books recommended:***

1. S. J. Birchard and R. D. Sherdng; Saunders manual of small animals practice, W. B. Saunders Co, 2002.
2. C. L. Gyirs and Co theon, pathology of bacterialinfections in animals, 2nd edition,Lowa State Uni press, 1993.

**MB 4714 Antiviral agents**  **Cr. Hr 2+1**

Introduction to antiviral, antiviral therapy, problems of antiviral therapy, targets of antiviral intervention.

***Practical:*** Study of different types of compounds which can act as antiviral and identification of their target sites.

***Books recommended:***

1. Hi, Field; Antiviral Agents; the development and assessment of antiviral chemotherapy, Vol 002, CRC Press 1998.
2. J. B. Hudson, Antiviral compounds from Plants, CRC Press, 1990.
3. G. I. Glasso and C. A. B Boucher; Practical guidelines in Antiviral therapy; Elsvier Science, Ltd, 2002.

# Semester VIII Course

**MB 481 Industrial Microbiology – II** **Cr. Hr 2 +1**

Antibiotic: Penicillin, microbial biomass, biological control, microbial biotechnology, brewing, antibiotic production, recombinant protein production, vaccine production end waste treatment industries. scientific perspective, large-scale microbial fermentation, the principles and problems, bioreactors, case studies: industrial alcohol production form sugar cane; Citric acid production. Quorn(r) myco-protein, a spectrum of approach for microbial strain development, empirical strain development, mutagenesis and screening, semi-empirical strain development, selection, the use of auxotroph and analogue resistant mutants in strain development, continuous culture technologies for strain improvement, metabolic control Analysis; principles and means of rational strain development, case study tryptophan biosynthesis in Neurospora crassa.

***Practical:*** Industrial waste water treatment by various techniques, determination of physical conditions for microbes for better quality of industrial products development, comparative study of prototroph and auxotrophs used in industry for better yield.

***Books recommended:***

1. R. H. Baltz; Industrial Microorganisms; basic and applied Molecular genetics, American Society for Microbiology, Washington, DC, 1993.
2. G. Fix and l. fix; an analysis of Brewing Techniques, Brewers P, 1997.

**MB 482 Advanced Topics in Microbiology**  **Cr. Hr 2+1**

**OR**

**MB 482 Plant Biotechnology**  **Cr. Hr 2+1**

Introduction, the tissue culture revaluation, initiation and maintenance of callus, organogensis: Root and shoot development somatic embryogenesis, micropropagation: culture of shoot apex-plantlet formation, isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization, germplasm conservation, plant transformation techniques, recombinant products and expression, genetically engineered plants.

***Practical:*** Tissue culture techniques, callus organ and protoplast culture. Ti-plasmid transformation.

***Books recommended:***

1. S. H. Chawla; introduction to plant Biotechnology, Science Publishers, 2000.
2. M. J. Chrispeels; Plant biotechnology, Genetics and agriculture, J & B. P, 2002.

**MB 481** Seminar/ Regulatory issues like biosafety and protection **Cr. Hr 2**

**MB 473 Research**  **Cr. Hr 8**