

**MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI**

UG COURSES – AFFILIATED COLLEGES

B.Sc. Biotechnology

(Choice Based Credit System)

(with effect from the academic year 2016-2017 onwards)

(44th SCAA meeting held on 30.05.2016)

Sem.	Pt. I/II/ III/ IV/V	Sub No.	Subject status	Subject Title	Hrs./ week	Cre- dits	Marks				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	17	Language	Tamil/Other Language	6	3	25	75	100	30	40
	II	18	Language	English	6	3	25	75	100	30	40
	III	19	Core - 5	MICROBIOLOGY	4	4	25	75	100	30	40
		20	Major Practical- III	MICROBIOLOGY (Practical Exam at the end of the fourth semester)	2	-	50	50	100	20	40
		21	Allied -III	BIOPHYSICS	4	4	25	75	100	30	40
		22	Allied Practical-III	BIOPHYSICS (Practical Exam at the end of the fourth semester)	2	-	50	50	100	20	40
IV	23	Skilled Based subject-I	A). CLINICAL BIOCHEMISTRY (OR) B). INDUSTRIAL BIOTECHNOLOGY	4	4	25	75	100	30	40	
IV	24	Non-Major Elective-I	A). NUTRITIONAL BIOTECHNOLOGY (OR) B). VECTOR BORNE DISEASE	2	2	25	75	100	30	40	
Subtotal					30	20					

Sem.	Pt. I/II/III/IV/V	Sub. No.	Subject status	Subject Title	Hrs. / week	Credits	Marks					
							Maximum			Passing minimum		
							Int.	Ext.	Tot.	Ext.	Tot.	
IV	I	25	Language	Tamil/Other Language	6	3	25	75	100	30	40	
	II	26	Language	English	6	3	25	75	100	30	40	
	III	27	Core - 6		IMMUNOLOGY	4	4	25	75	100	30	40
		28	Major Practical-IV		IMMUNOLOGY	2	2	50	50	100	20	40
		29	Allied -IV		BIOSTATISTICS	4	4	25	75	100	30	40
		30	Allied Practical-IV		BIOSTATISTICS	2	2	50	50	100	20	40
	IV	31	Skill Based Subject -II	A).FLORICULTURE (OR) B).VERMI AND MUSHROOM CULTURE	4	4	25	75	100	30	40	
	IV	32	Non-Major Elective-II	A).GENETIC DISEASES (OR) B).CANCER BIOLOGY	2	2	25	75	100	30	40	
V		Extension Activity	NCC,NSS, YRC, YWF		1							
Subtotal					30	25						

MICROBIOLOGY

Unit I

General Microbiology- History and Scope of Microbiology- Major contributors in microbiology. Principle, operation and maintenance of microbiology - Future of microbiology – Role of microbes in biotechnology.

Unit II

Microorganism – Classifications and Ultrastructure – Bacteria, Algae, Protozoa, Fungi, Viruses – Ultra structure and characteristics of microorganisms. Staining techniques.

Unit III

Culture media – Types – Ingredients – Preparation and Sterilization – Isolation of pure cultures – Culture of microorganisms – Measurement of growth – Calculation of generation time – Preservation of microorganisms.

Unit IV

Gram positive and gram negative organisms - Morphology, cultural characteristics, pathogenicity - Laboratory diagnosis – Treatments. Gram positive – *Staphylococcus*, *Streptococcus*, *Bacillus*, *Clostridium*, Gram - Negative – *Neisseria*, *E.coli*, *Klebsiella*.

Unit V

Microbial interaction – Plants – Rhizosphere – Mycorrhiza – Plant pathogens – Nodules – Bacterial and viral diseases. Antibiotics and antifungal agents – Mode of action. Probiotics and applications.

References

1. General Microbiology, Stanier, R.Y., Inram, J.L.K., Wheelis, M.L. and Painter, P.R., The Macmillan Press Ltd.
2. Biology of Microorganisms, Brock, Madigan, M.T., Martinko, J.M. and Parker J. Prentice- Hall.
3. Microbiology, Pelczar, M.J.Jr., Chan, E.C.S. and Kreig N.R., Tata McGraw Hill.
4. Microbial Genetics, Maloy, S.R., Cronan, J.E.Jr. and Freifelder, D. Jones, Bartlett Publishers.
5. Chemical Microbiology, An introduction to Microbial Physiology – A.H. Rose, Butterworth, London.
6. Microbiology – A laboratory Manual, Cappucino, J.G and Sherman, N, Addison Wesley.

MICROBIOLOGY

1. Preparation of liquid and solid media for growth of microorganism
2. Plating techniques - Spread, Streak and Pour plate
3. Storage of microorganism: slant and stab culture
4. Isolation of microorganism from soil
5. Growth : Growth curve – Measurement of growth by turbidometry method
6. Microscopic examination of bacteria and yeast
7. Counting of microorganisms using Hemocytometer
8. Assay of antibiotics and demonstration of antibiotic resistance
9. Biochemical characterization of selected microbes : IMViC, Oxidase, Catalase and Starch hydrolysis
10. One step growth curve of *Coliphage*

BIOPHYSICS

Unit I

Definition, scope and methods of biophysics, Physical quantities and their units, physics of atoms and molecules – atomic structure – atomic orbital, wave functions – electronic structure of atoms, spin of particles – relationship between atomic structure and chemical properties. Formation of molecules from atoms: bond different types – properties and strength – molecular orbital – molecular chirality in biological systems

Unit II

Bioenergetics, Laws of thermodynamics – Entropy – enthalpy – free energy of a system – chemical potential – oxidation reduction potential, Carnot cycle, living body as a thermodynamic system. Photosynthesis – Primary biophysical events.

Unit III

Diffusion – Fick's law of diffusion, Viscosity: Theory of viscosity, capillary viscometers, rotational viscometers, other viscometer systems, Rheology – biological properties of plasma, viscosity of blood, Newtonian and non-Newtonian fluids. Osmosis: Osmotic pressure, osmometry, biological significance

Unit IV

Bioacoustics – sound and its characteristics, physical organization of ear, mechanism of hearing. Bioelectric potentials - membrane potential, resting potential, action potential, conduction of nerve impulses, recording of nerve impulses. Heart – echocardiography, Brain – EEG, CT-Scan, X-ray.

Unit V

Electromagnetic radiation, Radioactive substances: radioisotopes – α particles, β particles, γ particles, radioactivity – units of radioactivity, radioactive decay, half life, effect of radiations on biological systems, harmful effect of radiations, beneficial effects of radiations, measurement of radioactivity – Geiger-Muller Counter, Liquid Scintillation Counter, γ ray detector, Autoradiography.

References:

1. Physical Biochemistry, applications to Biochemistry and Molecular biology – D. Freifelder
2. General Biophysics, Vol I and II – H.V. Volkones
3. Molecular Biophysics – B. Pullman and M. Voino
4. Aspects of Biophysics, Hughe S.W, John Willy and Sons
5. Introduction of Biophysics by Pranab Kumar Banargy, S. Chand and Co.

BIOPHYSICS

1. Determination of the thermodynamic parameters; ΔH , ΔG , ΔS and CP of protein lysozyme
2. Agarose gel electrophoresis
3. SDS – PAGE
4. Estimation of DNA by DPA method
5. Estimation of RNA by orcinol method
6. ECG, EEG, CT scan, X-ray – demonstration
7. Estimation of protein by Barfoed's method
8. Determination of pH of a solution
9. Determination of the viscosity of different solutions using Ostwald Viscometer

CLINICAL BIOCHEMISTRY

Unit I

Basic concepts of Clinical Biochemistry: Definition and scope of clinical Biochemistry in diagnostics, collection and preservation of biological fluids (blood, serum, plasma, urine and CSF), normal values of important constituents of blood, CSF, urine, etc. Biochemical principles of water and electrolyte imbalance, acid base homeostasis, preliminary concept of cardiovascular, liver and kidney disorders including laboratory test for respective markers.

Unit II

Diseases related to carbohydrate metabolism: Regulation of blood sugar, Glycosuria –types of glycosuria. Oral glucose tolerance test in normal and diabetic condition, Diabetes mellitus and diabetes insipidus – hypoglycemia, hyperglycemia, ketonuria, ketosis.

Unit III

Inborn errors of metabolism: Introduction – clinical importance, phenyl ketonuria, cystinuria, alkaptonuria, Fanconi's syndrome, galactosemia, albinism, tyrosinemia and haemophilia.

Unit IV

Organ function test: Lipid and lipoproteins: Classifications, composition, mode of action – Cholesterol. Factors affecting blood cholesterol level. Dyslipoproteinemia, IHD, atherosclerosis, risk factor and fatty liver. Liver function test: Metabolism of Bilirubin, jaundice – types, differential diagnosis. Liver function test – Icteric test, Vandenberg test, plasma protein changes, PT. Renal function test: Clearance test – Urea, Creatinine, Inulin, PAH test, concentration and dilution test. Gastric function test: Collection of gastric contents, examination of gastric residuum, FTM, stimulation test, tubeless gastric analysis.

Unit V

Clinical enzymology: Functional and non-functional plasma enzymes, Isoenzymes with examples, Enzyme patterns in acute pancreatitis, liver damage, bone disorder, myocardial infarction and muscle wasting.

References

1. Text book of Clinical Biochemistry – Carl A. Bordis and Edward R. Ashwood
2. Text book of Medical Biochemistry – Dr. M.N. Chatterjee and Rane Shinde
3. Clinical Chemistry in diagnosis and treatment – Philip D. Mayne
4. Clinical chemistry – William Hoffman
5. Clinical Biochemistry with clinical correlation – Devin, Wiley
6. Practical Clinical Biochemistry – Harold Varley, CBS, New Delhi

INDUSTRIAL BIOTECHNOLOGY

Unit I

Biotechnological importance of microorganisms – Techniques of microbial culture – Growth media – Growth media, sources of nutrition, procedures for microbial cultures.

Unit II

Microorganisms and their products – Isolation of microbial strains – Improvement of microbial strains– mutations, recombination, protoplast fusion and rDNA techniques.

Unit III

Bioreactors/Fermentor: Types, features, operation: sterilization (Batch and Continuous), Inoculation and sampling. Control of bioprocess parameters. Types of Microbial culture – batch, fed batch, semi – continuous, continuous, Growth kinetics of microorganisms- Measurement of microbial growth

Unit IV

Downstream processing: Solid – liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, and evaporation, liquid – liquid extraction, membrane filtration, precipitation, adsorption, product purification by chromatography.

Unit V

Industrial process of food and beverages, fermented food, vegetarian products, alcoholic beverages - vitamins (eg. Vitamin B12)– amino acid (eg. Glutamic acid) – organic acids (eg. citric acid) – organic solvents (eg. Ethanol) – antibiotics (eg. Penicillin) – single cell proteins – Mushrooms, Biotransformation – techniques, Biotransformation to produce commercial products. Production of yeast biomass

References

1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
2. Industrial Microbiology, Reed C., Prescott and Dann's, 1982. Macmillan publishers. Fundamentals of Biotechnology, Prave. P. Faust, V. Siting. W., Sukatsh, DA, 1987. ASM press.
3. Biotechnology, Satyanarayana, U., 2006. Books and Allied (P) Ltd.
4. An introduction to Genetic Engineering, Desmond, S.T., Nicholl, 1994. Cambridge press.
5. Principles of Gene Manipulation. 4th edition, Old R.W. and S.B. Primrose, 1994. Blackwell scientific publication London.
6. Fundamentals of Biotechnology, P.Prave, P.Faust, V. Siting, Word Sukatasch D., 1987. VCH verlasgetell Schafor MBH, Weinhkeim.

NUTRITIONAL BIOTECHNOLOGY

Unit I

Nutrition – History, definition, Recommended Dietary Allowances (RDA) and balanced diet-factors affecting RDA, principles of deriving RDA. Carbohydrates – classification, functions, digestion and absorption maintenance of blood sugar level, sources, recommended dietary allowances, Dietary fibre – sources, recommended dietary allowance.

Unit II

Dietary fibre, role of fibres, recommended dietary allowances and sources, Lipids – classification, chemical composition, functions, sources, digestion and absorption recommended dietary allowances, deficiency diseases

Unit III

Proteins, classification, functions, chemical composition, digestion and absorption, sources, recommended dietary allowances, deficiency diseases, factors affecting protein utilization.

Unit IV

Vitamins- structure and biochemical roles, deficiency disorders of vitamin A, D, E,K, B₁, B₂, B₆, Folic acid, Panthothenic acid, Niacin and Vitamin C.

Unit V

Minerals- biochemical functions of Na, K, Ca, P, I, Fe and Se - Disorders related to hyper activity and deficiencies of these elements. Diseases related to nutritional deficiencies- Carbohydrates, Lipid, Proteins, Vitamins and Minerals.

References

1. Nutrition science – B.SriLakshmi,New age international (P) limited
2. Nutritional Biochemistry – M.S. Swaminathan
3. Nutritional Biochemistry, 2nd edition, Tom Brody, Academic Press
4. Nutrition – An integrated approach, 3rd edition, Ruth L. Pike and Myrtle L.Brown

VECTOR BORNE DISEASES

Unit I

Introduction to general entomology, insect morphology and classification insects and other arthropods of medical importance and their structures and functions. Methods for collecting these insects and arthropods, their preservation maintenance and transportation.

Unit II

Biology and ecology of mosquitoes, biology and life history of Aedes, Culex and Anopheles, their behaviour and ecology with special reference to dengue, chickengunya, Japanese encephalitis and west Nile. Biology and ecology of other blood sucking insects, ticks and mites, Biology, morphology and disease relationship of sand flies (sand fly fever and chandipura) .Biology and morphology of fleas, lice, culicodes. Biology, ecology, life history of ticks with special reference to Kyasanur forest disease. Biology and morphology of mites.

Unit III

Communicable & infective disease control – definitions related to communicable diseases, infection, contamination, decontamination, disinfection, transmission (direct and indirect)

Unit IV

Vector borne diseases- a brief account of insect vectors affecting the health of man and domestic animals. Epidemiology and control of vectors and vector borne diseases like dengue, plaque, malaria, filariasis, tuberculosis, MMR, chicken pox, pertussis, chickengunya and mite borne diseases, etc.

Unit V

Various control strategies and environmental management. Control in urban settings, control at aquatic stages, adult population, personal protection, insecticide resistance mechanism and control dynamics.

References

1. Gordon R.M., Lavoipierre M.M.J., (1962). Entomology for Students of Medicine. Blackwell Scientific Publishers.
2. Service M.W., (1966) Medical entomology for students. Chapman and Hall.
3. Kettle D.S., (1984) Medical and Veterinary Entomolgy. CAB International.
4. Bates M (1949) Natural History of Mosquitoes. The Macmillan Co.
5. Baker R.H and Wharton R. (1952) Introduction to Acarology. The Macmillan Co.

IMMUNOLOGY

Unit 1

Introduction – History & Scope - Developments – Immunity - Cells of immune system – B and T lymphocytes, cell surface markers – TCR – BCR. Lymphocyte traffic – Primary and Secondary lymphoid organs - Structure and functions.

Unit II

Immunity - Types – Innate and Acquired - Immune response - Humoral and Cell Mediated. Vaccines – types, production and uses, Antigens – Properties - Types – Immunogenicity, antigenicity - Epitopes - Haptens - Adjuvants.

Unit III

Immunoglobulins - Structure – Types - Properties and functions - Antigen antibody interactions - Precipitation – Agglutination - Cross reactivity – Cytolysis. Complement systems - Classical and alternative pathways. Major Histocompatibility Complex - structure and functions.

Unit IV

Antigen processing and presentation – Exogenous and endogenous pathways – Cytokines – Hypersensitivity reactions - Immediate and Delayed, Autoimmune diseases, Immuno deficiency diseases, Transplantation Immunology – specificity of graft, mechanism of graft rejection, Tumour Immunology, Immunoregulation.

Unit V

Immunological techniques – WIDAL, VDRL, Pregnancy and Rheumatoid factor tests, Principle and applications of RIA – ELISA. Immunodiffusion – Immunoelectrophoresis – Immunofluorescence - Monoclonal antibody – Production and applications.

References

1. Ivan, M. Roit, Jonathan and Brostoff and David Male (1998): Immunology – 5th Edition. (Churchil Livingstone Publishers).
2. Janis Kuby (1998): Immunology – 3rd and 4th Edition (W.H.Freeman).
3. Weir, D.N (1997): Immunology (8th Edition, Churchil Livingstone Publishers).
4. Nandini Shetti: Immunology Introductory Text Books.
5. Essential Immunology by Roit, I, Blackwell Science, Oxford.

IMMUNOLOGY

1. Identification of human blood groups – A, B, AB, O and Rh factor.
2. Total leucocyte count on the given blood sample.
3. Total RBC count on the given blood sample.
4. Identify different cells of the blood sample.
5. Differential count of the given blood sample
6. Immunodiffusion by Ouchterlony method - Demonstration.
7. Immuno-electrophoresis with a given antigen – antibody system - Demonstration.
8. Rocket Immuno-electrophoresis – Demonstration.
9. Perform DOT ELISA.

BIOSTATISTICS

Unit I

Definition and scope of biostatistics and their limitations. Collection, classification, tabulation of statistical data, Frequency table – univariate and bivariate frequency table, diagrammatic and graphical representation of data.

Unit II

Measure of central tendency – mean, median, mode (individual, discrete and continuous series) and their merits and demerits

Unit III

Measure of dispersion – range, quartile deviation, mean deviation, standard deviation (individual, discrete and continuous series) and their merits and demerits. Coefficient of variation, standard error, Skewness – Karl Pearson's and Bowley's coefficient of Skewness, Kurtosis

Unit IV

Correlation Analysis – Scatter diagram – Karl Pearson's Correlation Coefficient, Spearman's Rank Correlation, Regression analysis – Regression lines – fitting of straight lines using method of Least Squares

Unit V

Test of significance – ANOVA (one way and two way), Student's t test and Chi square test. Concept of probability – Addition and multiplication theorem of probability, conditional probability.

References

1. Statistical Methods by S.P. Gupta – Sultan Chand & Sons
2. An introduction to Biostatistics by Sundar Rao and Richard J, PHI publications
3. Fundamentals of Biostatistics by Veer Bala Rastogi
4. Statistics by R.S. N. Pillai and Bhagavathi, S. Chand & Sons
5. Biostatistics by P.N. Arora and P.K. Malhan, HPH Publications
6. Biostatistics by Gurumani

BIOSTATISTICS

1. Diagrammatic representation of data – bar (simple, multiple), pie diagram using MS EXCEL
2. Computation of measures of central tendency using MS EXCEL
3. Computation of measures of dispersion using MS EXCEL
4. Computation of skewness and kurtosis using MS EXCEL
5. Computation of correlation using MS EXCEL
6. Computation of regression equation using MS EXCEL
7. Calculation ANOVA – one way and two way using MS EXCEL
8. Computation of Student's t test using MS EXCEL
9. Computation of Chi square test using MS EXCEL

**MSU/2016-17/UG-Colleges/Part-III (B.Sc. Biotechnology) / Semester-IV/ Ppr.no.31 (A)/
Skilled Based –II (A)**

FLORICULTURE

Unit I

Avenues and scope of floriculture, emerging trends in floriculture biotechnology, Floriculture in the era of WTO, National and International status of Floriculture Industry.

Unit II

Cultivation of floriculture crops: Anthurium, Bird of Paradise, Carnation, Chrysanthemum, Gladiolus, Gloriosa, Iris, jasmine, Lily, Marigold, Orchids, Rose, Tulip. Nutritional aspects of floriculture crops.

Unit III

Package of practices for management of pest and disease for floricultural crops, Role of Green house in improving the quality and productivity of floricultural plants. Eco-friendly cultivation of floricultural crops, Compatibility for Inter cropping of floricultural crops with other agricultural crops.

Unit IV

Research and development in Floriculture: Modern Floriculture Industries, Improvement of aesthetic values, Genetic Improvement programmes through biotechnological approaches, Production of F1 hybrids, rapid propagation methods. Role of tissue culture in Floriculture Industry.

Unit V

Floriculture Industries (National and International status). Harvesting, Packing, Marketing, Revenues, Avenues for employments in Floriculture Industries, Socio economical aspects of Floriculture Industry. Sustainability.

References

1. Floriculture Technology, Trades and Trends by Prakash J and Bhandary K.R. New Delhi, Oxford and IBH publication

VERMI AND MUSHROOM CULTURE

Unit I

Vermi composting - Definition, introduction and scope: Ecological classification: Humus feeders, Humus formers leaf, mold, top soil and sub soil types. Physical, chemical and biological changes brought by earthworm in soil-burrows- drilosphere - earthworm casts.

Unit II

Optimal conditions for vermin culture-temperature, moisture, pH, soil type, organic matter, protection from sunlight, rain, predators-food preference. Basic components for vermi culture-culture practices- Home- School-Industries-Vermi wash.

Unit III

Composting- vermi composting-Required conditions-Methods-Advantages-Cost-Benefit analysis of vermi composting.

Unit IV

Introduction and Importance of mushrooms; History of mushrooms cultivation; present status of mushroom industry in India cultivable edible mushrooms; Biology of mushrooms: food value of edible mushrooms; uses of mushrooms; Poisonous mushrooms and Medicinal mushrooms.

Unit V

Mushrooms farm structure; design and layout; Spawn principles and techniques of spawn production; Principle and techniques of compost and composting; Cultivation techniques of white button mushroom, oyster mushroom ;Management of fungal bacterial and viral diseases in mushroom; Competitors, pests and nematodes in mushrooms; Post harvesting techniques and Economics of mushroom cultivation.

References

1. Sultan Ahmed Ismail, 2005, The Earthworm Book, second revised Edition, Mother India Press, Goa.
2. Edwards C.A. and Bohlen, P.J 1996, Ecology of earthworms – 3rd Edition, Chapman and Hall.
3. Jsmail, S.A., 1970, Vermicology, The Biology of earth worms, Orient Longman, London.
4. Lee, K.E., 1985. Earthworms – Their ecology and relationship with soil and land use, Academic Press, Sydney

GENETIC DISEASES

Unit I

The origin of medical genetics, classification of genetic diseases- definition and impact of genetic diseases, human chromosomes – structure and organization of DNA – Normal human karyotype, chromosomes abnormalities, disorder of autosomes and sex chromosome,.

Unit II

Metabolic disorders and inherited disease- Diabetes, Hypertension, Alzheimer disease, Duchene's muscular dystrophy, Urolithiasis, Huntington's cholera, Parkinson's disease, Schizophrenia, Hemophilia, Sickle cell anemia.

Unit III

Carcinogenesis and mutation, phenotype of cancerous cells, Tumor suppressor oncogene, cancer stem cell theory, Radiotherapy, chemotherapy and immune therapy

Unit IV

Diagnostic and therapeutic protocol: antiviral drugs, antifertility drugs, anticancerous agents, anti inflammatory drugs, diagnostic kit and probes, Vaccines

Unit V

Genetic counselling, prenatal diagnosis technique, treatment, methods of tracking diseased genes, diagnosis of genetic disorders.

References

1. Genetics – Strickberger, M.W, Printice Hall Edition 4, 1997.
2. Genes VII by Benjamin Lewin.
3. Cell and Molecular Biology – Robertis et al. Waverly publication, edition 8, 1995.
4. Molecular Biology of the Cell – Alberts, Garland Publication, edition 4 , 2002.
5. Principles of Genetics - E. J.Gardener, M.J. Simmons and D.P. Snustad, John Wiley and Sons publications.
6. The science of Genetics by Alen G. Atherly, Jack. R, Girton, Jhon. F, Mc Donald, Sounders college publishers.
7. Human Genetics, A. Gardener, R.T. Howell and T. Davies, published by Vinod Vasishta for Viva Books private Ltd.

CANCER BIOLOGY

Unit I

Fundamentals of Cancer biology- regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumour markers, molecular tools for early diagnosis of cancer.

Unit II

Principles of carcinogenesis – Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, X –ray radiation - mechanisms of radiation carcinogenesis.

Unit III

Principles of Molecular Cell Biology of Cancer – Signal targets and cancer, activation of kinases, Oncogenes, Identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation, telomerases.

Unit IV

Principles of cancer metastasis - Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

Unit V

New Molecules for Cancer Therapy – Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer, Gene therapy.

References

1. Maly B.W.J, “Virology a Practical Approach”, IRLI Press, Oxford, 1987.
2. Dunmock N.J and Primrose S.B., “Introduction to Molecular Virology”, Blacwell Scientific Publications, oxford, 1988.
3. “An Introduction To Cellular and Molecular Biology of Cancer”, Oxford Medocal Publications, 1991.