DHANALAKSHMI SRINIVASAN COLLEGE OF ARTS & SCIENCE FOR WOMEN (AUTONOMOUS)

(Affiliated to Bharathidasan University, Trichirappalli)

(Nationally Re-accredited with 'A' Grade by NAAC)

Perambalur- 621 212

B.Sc., MICROBIOLOGY COURSE UNDER CBCS

Sem	Part	Course	Course Title	Sub.Code	periods/ Week	Credit	Exam Hrs	Internal	Externnal	Total
I	I	Language course I	Cheyull (IkkalaIlakiyam), Sirukathai, Ilakiyavaralaru ,Hindi,French,Arabic,Sanskrit	18U1LT1/ 18U1LH1/18U1LF1/ 18U1LA1/18U1LS1	6	3	3	25	75	100
	II	English Language course I	English for Communication-I	18U1EL1	6	3	3	25	75	100
	III	Core Course-I (CC)	Fundamentals of Microbiology	18UMB1C1	6	6	3	25	75	100
		Core Course-II (CC)	Practicals –I Fundamentals of Microbiology	18UMB1C2P	4	3	3	40	60	100
		Allied Course-I	Biochemistry–I	18UMB1A1	3	3	3	25	75	100
		Allied Course-II	Lab in Biochemistry-I	18UMB1A2P	3	**	**	**	**	**
	IV	Environmental Studies	Environmental Studies	18U1EVS	2	2	3	25	75	100
					30	**20**				**600**
II	I	Language course II	Cheyull (IddikalaIlakiyam), Puthinumum, Hindi,French,Arabic,Sanskrit	18U2LT2/18U2LH2/ 18U2LF2/ 18U2LA2/18U2LS2	6	3	3	25	75	100
	II	English Language course II	English for Communication-II	18U2EL2	6	3	3	25	75	100
	III	Core Course-III(CC)	Microbial Physiology	18UMB2C3	6	6	3	25	75	100
		Core Course-IV(CC)	Practicals II- Microbial physiology	18UMB2C4P	4	3	3	40	60	100
		Allied Course-III	Biochemistry-II	18UMB2A3	3	3	3	25	75	100
		Allied Course-II	Lab in Biochemistry-I &II	18UMB1A2P	3	4	3	40	60	100
	IV	Value Education	Value Education	18U2VED	2	2	3	25	75	100

					30	**24**				**700**
III	I	Language course III	Cheyyul (Kappiyangal), Vurainadai, AluvalmuraiMadalgal, IlakkiyavaralaruHindi,French,Arabic,Sanskrit	18U3LT3/18U3LH3/ 18U3LF3/ 18U3LA3/18U3LS3	6	3	3	25	75	100
	II	English Language Course III	English Through Literature	18U3EL3	6	3	3	25	75	100
	III	Core Course – V	Immunology and Immunotechnology	18UMB3C5	6	5	3	25	75	100
		Core Course – VI	Practical-III Immunology and Immunotechnology	18UMB3C6	4	3	3	40	60	100
		Allied Course-IV	Biostatistics-I	18UMB3A4	3	2	3	25	75	100
		Allied Course-V	Lab in Biostatistics-I	18UMB3A5P	3	**	**	**	**	**
	IV	Non-major Elective-I	A) Vermi Culture	18UMB3N1A	2	2	3	25	75	100
			B) Mushroom Technology	18UMB3N1B						
			C) Biofertilizer Technology	18UMB3N1C						
			TOTAL		**30**	**18**				**600**
IV	I	Language course -IV	Cheyyul (Sangailakkiyam), Needhiilakkiyam, Nadagam, Illakiyavaralaru, PodhukatturaiHindi,French,Arabic,Sanskrit	18U4LT4/18U4LH4/ 18U4LF4/ 18U4LA4/18U4LS4	6	3	3	25	75	100
	II	English Language Course – IV	English For Competitive Examinations	18U4EL4	6	3	3	25	75	100
	III	Core Course – VII	Clinical Microbiology	18UMB4C7	6	6	3	25	75	100
		Core course – VIII	Practical-IV Clinical Microbiology	18UMB4C8P	4	3	3	40	60	100
		Allied Course-VI	Biostatistics-II	18UMB4A6	3	3	3	25	75	100
		Allied Course-V	Lab in Biostatistics I & II	18UMB3A5P	3	2	3	40	60	100
	IV	Non-major Elective-II	A) Elemental Concept of Microbiology	18UMB4N2A	2	2	3	25	75	100
			B) Social and Preventive Medicine	18UMB4N2B						
			C) Microbial Nutrition	18UMB4N2C						
			TOTAL		**30**	**22**				**700**
V	III	Core Course – IX	Agricultural and Environmental Microbiology	18UMB5C9	6	6	3	25	75	100
		Core Course – X	Industrial Microbiology	18UMB5C10	6	6	3	25	75	100

		Core Course – XI	Food and Dairy Microbiology	18UMB5C11	5	5	3	25	75	100
		Core Course – XII	Practicals Pertaining CCIX, CCX & CCXI	18UMB5C12P	3	3	3	40	60	100
		Major Based Elective-I	A) Clinical Research	18UMB5M1A	4	4	3	25	75	100
			B) Marine microbiology	18UMB5M1B						
			C) Virology	18UMB5M1C						
	IV	Skill Based Elective-I	A) Pharmacognosy	18UMB5S1A	2	2	3	25	75	100
			B) Clinical lab Technology	18UMB5S1B						
			C) Diagnostic Microbiology	18UMB5S1C						
		Skill Based Elective-II	A) Cell Biology	18UMB5S2A	2	2	3	25	75	100
			B) Endocrinology	18UMB5S2B						
			C) Bioinstrumentation	18UMB5S2C						
		Soft Skill Development	Soft Skill Development	18U5SS	2	1	3	25	75	100
			TOTAL		**30**	**29**				**800**
VI	III	Core course – XIII	Microbial Genetics	18UMB6C13	6	6	3	25	75	100
		Core course – XIV	Molecular Biology	18UMB6C14	6	6	3	25	75	100
		Core Course- XV	Practicals Pertaining CCXIII & CCXIV	18UMB6C15P	6	5	3	40	60	100
		Major Based Elective-II	A) Forensic Biology	18UMB6M2A	6	4	3	25	75	100
			B) Mycology	18UMB6M2B						
			C) Recombinant DNA Technology	18UMB6M2C						
		Major Based Elective-III	A)Genetic Engineering	18UMB6M3A	5	4	3	25	75	100
			B) Microbial Technology	18UMB6M3B						
			C) Microbial Taxonomy and Bioinformatics	18UMB6M3C						
	IV	General Studies	Genderl Studies	18U6GS	1	1	3	25	75	100
	V	Extension activity	NCC, NSS, Rotaract, YRC			1				
			TOTAL		**30**	**27**	**18**	**150**	**450**	**600**
				Grand Total	**180**	**140**				**4000**

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CORE COURSE : I

FUNDAMENTALS OF MICROBIOLOGY

Semester : I **Max Marks : 75**

Course Code : 18UMB1C1 **Credit : 6***

Total Period : 75 **ExamHrs : 3**

Objective

To understand the basic microbiological concept and techniques.

UNIT I Introduction to Microbiology (15 Period)

Definition, history and scope of Microbiology. Contributions of Antonyvonleeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, iwanowsky, Beijerinck, Winogradskyand Alexanderfleming. The universal phylogenetic tree: outline classification of living organisms: Heckle, Whittaker and Carl woese systems.

UNIT II Microscopy (10 Period)

Principles of Microscopy- bright field, dark field, phase Contrast, Fluorescent, and Electron Microscopy (SEM and TEM).

UNIT III Prokaryotic Cell Structure and Function (15 Period)

Differentiation of overview of prokaryotic cell structure : size, shape, arrangement, diagram of prokaryotic cell organization – Cell wall structure, cell membrane, cytoplasmic matrix, components external to the cell wall and bacterial endospores.

UNIT IV Eucaryotic Cell Structure and Function (15 Period)

Overview of eukaryotic cell structure: General structure and type of cells, external cell coverings and cell membrane, cytoplasmic matrix organelles of motility – Structure and movement of flagella and cilia. Comparison of prokaryotic and eukaryotic cells.

UNIT V Microbiological Techniques (20 Period)

Sterilization and disinfection techniques - Principles and methods of sterilization, physical and chemical methods. Isolation of pure culture techniques - Enrichment culturing, dilution -plating, streak - plate, spread - plate and micromanipulator. Stains and dyes. Staining methods.

Preservation of microbes cultures- subculturing, overlying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

REFERENCES

1. Noel, R. Krieg, Michael, J., Pelzar, Jr. and Chan, E.C.S. 1993. Microbiology. 5th Edition. *Tata McCraw Hill*, New Delhi.
2. Dubey, R.C. and Maheswari, D.K. 2012. A text of Microbiology. Revised Edition. *S. Chand and Company Ltd.*, New Delhi.
3. Prescott, Harly, Klein'S. 2008. Microbiology, 7th International edition. *McGraw Hill.*
4. Michael, T. Madigan, John, M. Martinko, Paul V. Dunlap, David, P. Clark. 2009. Brock Biology of Microorganisms. 12th Edition. *Pearsion.*
5. Atlas, R.A. Principals of Microbiology. 2nd Edition, 1997. *WM.C.Brown Publishers,*Lowa.
6. Tortora, G. J., Funke, B.R. and Case, C.L. 2005. Microbiology an Introduction. 8th Edition. *LPE- Pearson Education,Inc*.

CORE COURSE : II

PRACTICAL – I: FUNDAMENTALS OF MICROBIOLOGY

Semester : I	**Max Marks : 60**
Course Code : 18UMB1C2P	**Credit : 3***
Total Period : 45	**ExamHrs : 3**

Objective

To impart hands on training on fundamentals of microbiology.

1. Lab safety and precautions measures **(4 Period)**
2. **Sterilization Techniques**: cleaning of glasswares, autoclaving and fumigation **(6 Period)**
3. **Media Preparation**: Liquid media, solid media and slant prepration **(6 Period)**
4. **Pure Culture Technique**: Streak plate, pour plate, spread plate, decimal dilution. **(9 Period)**
5. **Motility Demonstration**: Hanging drop preparation, wet mount. **(5 Period)**
6. **Staining Techniques**: Simple staining, Gram staining, Capsule staining, lactophenol cotton blue staining **(9 Period)**
7. **Morphology of Microorganisms**: Morphological variations in algae. Morphology of fungi, yeast, slide culture techniques. **(6 Period)**

REFERENCE

1. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 1986. General Microbiology. *Mac Millan Education Ltd*. London.
2. Kanai, L. Mukherjee. 2010. Medical Laboratory Technology. *Tata McGraw Hill*.
3. Aneja, K.R. 2003. Experiments in Microbiology, Plant pathology and Biochemistry. 4th Edition. *New age International publishers*, India.

CORE COURSE : III

MICROBIAL PHYSIOLOGY

Semester : II	**Max Marks : 75**
Course Code : 18UMB2C3	**Credit : 6***
Total Period : 75	**ExamHrs : 3**

Objective

To understand the growth and physiological processes of microbes

UNIT I Microbial Nutrition **(15 Period)**

Elemental nutrient requirements of microbes, nutritional groups of bacteria.The autotrophy - photoautotrophy and bacterial photo synthesis.Chemoautotrophy and autotrophic metabolism.Concept of heterotrophy - Photoheterotrophy and chemoheatrotrophy.Hetrotrophic metabolism in bacteria

UNIT IIMicrobiological Media **(18 Period)** Autotrophy media, defined synthetic mineral media, heterotrophic media. The concept of protorophs and auxotrophs, prototrophic (Minimal) media (defined media), complex media (Undefined media), basal medium, enriched media, enrichment media, selective media, biochemical media, differential media, maintenance media, transport media. Media for cultivation of fungi and microalgae.

UNIT III Metabolic Pathway **(12 Period)**

Energy production by catabolism of glycolysis (EMP, HMP and ED) pathways, TCA cycle and its integration. Biological membrane structure and functions electron transport, oxidative phosphorylation and their mechanism**.**

UNIT IVMicrobial Growth **(20 Period)**

Concept of the growth and factors affecting microbial growth.Cell cycle in microbes and generation time. Growth phases of bacteria - lag phase, exponential (Logarthamic) phase, stationary (ideo) Phase, decline and survival of microbial cells. Importance of each growth phase. Synchronous cultures - methods of synchronous culturing, continuous culturing methods, factors affecting growth. Methods of growth measurements.

UNIT V Nature and Properties of Spores (10 Period)

Bacterial endospore structure, phenomenon of sporulation, biochemistry and genetics of sporulation. Induction of sporulation phenomenan. Germination of spores respiration (aerobic and anaerobic) and fermentation.

REFERENCES

1. Review of Medical Microbiology by Jawitz, Melnick and Adelberg; bacterial and Mycotic infections of man. Ed. Dubos and HirstLipnicott; Principles of Microbiology and Immunology by Davis
2. Dulbecco, Eison, Ginsberg and wood; Text Book of Microbiology by Anathanarayanan
3. Microbiology by Pelczar M.J., Ried, RD and Chan, ECS,
4. Microbial Physiology by Moat, brocks biology of Microorganisms by Madigan, MT et al
5. Biochemistry of bacterial growth by Mandelstum, McQuillon and dawes, Bacterial metabolism by Dwellely
6. Photosynthesis by Dewlin and Barker, Laboratory Experiments in Microbiology by Gopalreddy et al.,
7. Microbes in Action by Seoley HW and Van-Demark, PJ

CORE COURSE : IV

PRACTICAL – II MICROBIAL PHYSIOLOGY

Semester : II	**Max Marks : 60**
Course Code : 18UMB2C4P	**Credit : 3***
Total Period : 45	**ExamHrs : 3**

Objective

To understand and analyses the growth of Microbes.

1. **Cultural Characteristics of Microorganisms**: Growth curve and generation time. **(10 Period)**
2. **Physiological Characteristics**: IMVIC test **(6 Period)**
3. TSI test **(3 Period)**
4. Oxidase and catalase production test. **(4 Period)**
5. Effect of high salt concentration **(6 Period)**
6. Endospore staining **(5 Period)**
7. Acid fast Staining **(6 Period)**
8. Casein and starch hydrolysis **(5 Period)**

REFERENCE

1. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R.1986. General Microbiology. *Mac Millan Education Ltd.* London
2. Aneja, K.R. 2003. Experiments in Microbiology, Plant pathology and Biochemistry. 4th Edition. New age International publishers, India.
3. Cappuccino and James. 1996. Microbiology a laboratory manual. 4th Edition. *Addison Wesley Publishing Company Inc.* England, California.
4. Holt. J.S., Kreig, N.R., Sneath, P.H.A and Williams, S.T. 1994. Bergey's Manual of Systematic Bacteriology. 9th Edition, *Williams and Wilkins*, Baltimore.

FIRST ALLIEDCOURSE :I

FOOD MICROBIOLOGY

Semester	**: I**	**Max Marks**	**: 75**
Course Code	**: 18UND1A1**	**Credit**	**: 3***
Total Period	**: 60**	**ExamHrs**	**: 3**

Objective

To enable the students to gain knowledge about the role of microorganism in health and disease.

UNIT I Introduction to Microbiology (20 Period)

Light microscopy, morphology of microorganisms bacteria, fungi, algae, yeast and virus - bacteriophage. Growth and multiplication - growth curve, definition of batch and continuous culture.Factor influencing the growth - Intrinsic factors, nutrient content, pH, redox potential, antimicrobial barrier and water activity. Extrinsic factors - Relative humidity, temperature and gaseous atmosphere. Antibiotic resistance.

UNIT II Infectious Diseases (10 Period)

Causes and symptoms of the followingfood borne diseases - *Salmonellosis, Botulism*, Cholera and Typhoid. Water borne disease - Gastero enteritis, Diarrhea: Campylobacter and Gardialamblia. Air borne disease - Tuberculosis and Pneumonia.Parasitic infections -Amoebiasis and Malaria.

UNIT III Microbiology of Perishable Food (10 Period)

Outline of contamination - Spoilage and intoxication. Preservation of vegetables and fruits, milk and milk products and canned food, meat and meat Products, egg and poultry.

UNIT IV Microbiology of Non - Perishable Food (10 Period)

Outlines of contamination – spoilage and preservation of cereal and cereal, Pulses and Pulses product, sugar and sugar products.

UNIT V Beneficial Effect of Microorganism (10 Period)

Fermented food - curd, cheese, sauerkraut, meat, soy based foods, alcoholic beverages, vinegar and organic acids.

REFERENCES

1. Adams, M. R. and Moss, M.O. 2005. Food Microbiology, *New age International (P) Ltd.* New Delhi.
2. Vijaya Ramesh, K. 2007. Food Microbiology. *MJP Publishers*, Chennai.
3. James G. Cappuccino and Natalie Sherman. 2008. Microbiology –A Laboratory manual, *Pearson education publishers*, USA.
4. James M. Jay. 2005. Modern Food Microbiology, 4th Edition, *CBS Publishers and Distributors*, New Delhi.
5. Adams Tamine. 2005. Probiotic Dairy Products, *Blackwell Publishing*, USA.

FIRST ALLIEDCOURSE:II

FOOD MICROBIOLOGY PRACTICALS

Semester : I	**Max Marks : 60**
Course Code : 18UND1A2P	**Credit : 3***
Total Period : 45	**ExamHrs : 3**

Objective

To gain knowledge on food spoilage and quality control aspects

1. Isolation of pathogens from spoiled food **(6 Period)**
2. Identification of fungi from spoiled bread by LPCB **(3 Period)**
3. A differential stain: Gram's staining method using spoiled vegetable **(6 Period)**
4. Methylene blue reduction test **(6 Period)**
5. Water quality by MPN technique **(9 Period)**
6. Preparation of wine using yeast **(9 Period)**
7. Preparationofpaneer and cheese **(6 Period)**

REFERENCES

1. Adams, M.R. and Moss M.O. 1995. Food Microbiology. *The Royal Society of Chemistry*. Cambridge.
2. Banwart, G.J. 1989. Basic Food Microbiology. *Chapman & Hall*, New York.
3. Basic Practical MicrobiologyPublished by the Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG, UK
4. Frazier, W.C, Westhoff, D.C. 1988. Food Microbiology, *TATA McGraw Hill*.

CORE COURSE : V

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Semester : III	**Max Marks : 75**
Course Code : 18UMB3C5	**Credit : 5***
Total Periods : 75	**ExamHrs : 3**

Objective:

This course aims to develop the skills in immunology and immunotechnology, and to introduce immunological foundations

UNIT I -Concepts of Immunology (15 Periods)

Introduction to immune system- History and developments.Immunity- innate and acquired immunity, Structure, Composition and types of cells and organs involved in immune system.Humoral and cell mediated immune responses. Immunization – Modern methods of vaccine production.

UNIT II Antigens and antibodies (15 Periods)

Antigen, Haptans and Adjuants- types and properties.Immunoglobulins: Structure, Types, Properties and their functions. Complement system. Nature of Antigen-Antibody interactions.Affinity, avidity and titre values.

UNIT III Allergens

Introduction to allergy. Types of allergens-Hypersensitivity-type I: asthma, type II: Blood transfusion reaction. Type III:Arthus reaction and type IV: tuberculin reaction.

UNIT IV Immunotechnology (15 Periods)

Preparation and Purification of antigens. Extraction of antigens from pathogens, Parasites and other biological materials, fractionation and Purification: Preparation of synthetic antigens, recombinant antigens and whole organism vaccines. Hybridoma technology.

UNIT V Immunotechniques (15 Periods)

Immunotechniques and its applications - precipitation, agglutination, complement fixation and radiology in immunotechniques. Enzyme-linked immune sorbent assay (ELISA), Western blotting, immune fluorescence (FAT).

REFERENCES

1. Ivan M.Roit(1994) essential immunology- Blackwell scientific publications, oxford kuby J (2001).
2. Abbas A.K. Lichtman, A.M. And Pober, J.S. (1997) Cellular and molecular immunology 3rd edition Philadelphia: W.B.Saunders.
3. Richard A Golds, Thomas J.K (2000). Immunology. W.H.Freeman& compares.
4. Chakravarthy, Ashim K. (2000). Immunology &immunotechnology. Oxford university press,
5. Julius cruse, Robert Lewis (2000). Atlas of immunology. Crc Press.
6. Ivan Roitt. Jonathan Brostoff and David Male.(2002). Immunology 6th edition.
7. Leffel, Donnenberg, A: and Rose, W (1997). Hand book of human immunology Boca Raton Fla: C.R.C
8. William E.Paul (2012). Fundamentals of immunology 7th edition.
9. Kenneth Murphy (2011). Janeway'simmunobiology (immunobiology: the immune system).
10. Immunobiology: the immune system in health and disease. 3rd edition by Travers.

CORE COURSE : VI

PRACTICAL-III: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Semester	**: III**	**Max Marks**	**: 60**
Course Code	**: 18UMB3C6P**	**Credit**	**: 3***
Total Periods	**: 75**	**ExamHrs**	**: 3**

Objectives:

To understand the concepts of immunology and principles of immunotechniques.

1. Blood grouping and Rh typing **(7 Periods)**
2. ASO Test **(7 Periods)**
3. Tube agglutination- WIDAL test **(8 Periods)**
4. Differential staining and neurtrophil count **(7 Periods)**
5. Total leukocyte count of the given blood sample. **(7 Periods)**
6. Separation of serum from the blood sample **(8 Periods)**
7. Immunodiffusion - Ouchterlony method. **(9 Periods)**
8. To perform immune electrophoresis. **(10 Periods)**
9. HCG detection by Dot ELISA **(12 Periods)**

REFERENCES

1. Essentials of immunology by Riott I.M. 1998. ELBS, Blackwell scientific publishers, London.
2. Immunology 2nd edition by Kuby J.1994.W.H. Freeman and Co.new York.
   Manual of clinical laboratory and immunology 6th edition. 2002 by Noel R.Rose, chief editor: Robert G. Hamilton and Barbara Detrick (Eds.), ASM Publications.
3. Pocket guide to clinical microbiology 2nd edition. 1998 by Patrick R.Murray, ASM Publications.

NON MAJOR ELECTIVE : I

VERMI CULTURE

Semester : III	**Max Marks : 75**
Course Code : 18UMB3N1A	**Credit : 2***
Total Periods : 24	**ExamHrs : 3**

Objectives:

To learn about the processes and methods involved in vermi culture and to learn the applications of vermi culture.

UNIT I Vermiculture (6 Periods)

Definition, scope and importance; Local and exotic species for culture; Environmental requirements; Culture methods – wormery – breeding techniques; indoor and outdoor cultures – monoculture and polyculture.

UNIT IIEarthworms (5 Periods)

Taxonomic position and diversity; types – morphological and ecological grouping – Epigenic, Anecic andEndogneic species; Ecological role and economic importance of earthworms

UNIT III Applications of Vermiculture (5 Periods)

Vermicomposting – use of vermicastings in organic farming, Earthworms for management of municipal organic solid wastes.Nutrient value of worm cast/vermicompost – Effect of Vermicompost on plants.

UNIT IV Marketing the Products of Vermiculture (4 Periods)

Quality control, market research, marketing techniques – creating the demand by awareness and demonstration, advertisements, packaging and transport.

UNIT V Future Perspectives (4 Periods)

Predator/ pathogen control in wormeries; Potentials and constraints for vermiculture in India.

REFERENCES

1. Edwards CA, Hendrix P and Arancon N (2014) Biology and Ecology of Earthworms, Springer Publishers. 2. Karaca A (2011) Soil Biology: Biology of Earthworms. Springer Publishers.
2. Edwards CA, Arancon NQ and Sherman RL (2011) Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management, CRC Press, USA.
3. Ranganathan LS (2006) Vermibiotechnology– From Soil Health to Human Health. Agrobios, India.
4. Ismail SA (2005) The Earthworm Book. Edition, Other India Press, Apusa, Goa, India.
5. Ismail SA (1997) Vermicology: The Biology of Earthworms. Orient Longman, India.

NON –MAJOR ELECTIVE : I

MUSHROOM TECHNOLOGY

Semester : III	**Max Marks : 75**
Course Code : 18UMB3N1B	**Credit : 2***
Total Periods : 24	**ExamHrs : 3**

Objectives:

To provide knowledge on application of mushroom and to promote the students to become an entrepreneur.

UNIT I Scope and development of mushroom (4 Periods)

Classification of Edible Mushrooms- Medicinal Value of Mushrooms- Edible mushroom cultivation – Types of edible mushroom available in India – *Calacybeindica, VolvariellaVolvacea, Pleurotussp ., Agaricusbisporus*

UNIT II Food value and composition of mushroom (5 Periods)

Protein, Vitamins, Minerals, Carbohydrates, Fibre, Fatpure Culture- Preparation of media (PDA and Oatmeal agar media) Sterilization – Preparation of test tube Slants to store Mother Culture – Culturing of Pleuretus mycelium on Petriplates – Preparation of mother Spawn in Saline Bottle and Polypropylene Bags and their Multiplication .

UNIT III Cultivation Technology (5 Periods)

Infra structure, Substrates (locally available) polythene bag, vessels, Inoculation hood –low cost stove – sieves – Cultural rack mushroom unit (Thatched house) – Mushroom bed preparation – Paddy straw, sugarcane trash, maize straw, banana leaves- post harvest technique- packing- transport- storage- short term storage- long term storage Cultivation of button mushroom.

UNIT IV Pests and diseases of Edible Mushrooms (5 Periods)

Fungal diseases- dry bubble, wet bubble, cob web disease, green moulds, competitor moulds- bacterial diseases- bacterial blotch- viral diseases insect- sciarid flies, phorid flies, cecid files- mushroom mites- beetles nematodes .

UNIT V Economics of mushroom cultivation (5 Periods)

Fixed assets, recurring expenditure, Labour, Economics of Cultivation throughout the year and seasonal growing formulation of Project report for getting finance from funding agencies). Precautions in mushroom cultivation. Mushroom recipes western and Indian recipes, Pickles, Powders, Jams

REFERENCES

1. Arvindkumar. Vermitechnology ,Aph publishing corporation,2005.
2. Marimuthu. Oyster Mushrooms, Dept. of Plant pathology, TNAU, Coimbatore, 1991.
3. Mary violet Christy .A .Vermitechnology, Mjp publishers, 2008.
4. Nita Bahl. Hand book of Mushrooms, II edition, Vol. I & II, 1988.
5. Paul Stamets, J.S. and Chilton, J.S. Mushroom Cultivator: A practical guide to growing mushrooms at home, Agarikon Press, 2004.
6. Swaminathan M. Food and Nutrition, Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore, 1990.
7. Tewari and PankajKapoor S.C. Mushroo m cultivation, Mittal Publications, Delhi, 1988.

NON MAJOR ELECTIVE : I

BIOFERTILIZER TECHNOLOGY

Semester : III **Max Marks : 75**

Course Code : 18UMB3N1C **Credit : 2***

Total Periods : 24 **Exam Hrs : 3**

Objectives:

To demonstrate the effectiveness of biofertilizer cultural practices in the farmers fields for enhanced crop productivity through bioreclamation of waste/ marginal land ,To produce eco friendly agricultural inputs so as to nullify the ill effects of chemical fertilizers.

UNIT IIntroduction to Soil Environment (5 Periods)

Soil Environment-soil structure, soil profile, Physico-chemical conditions, Rhizoshere Microorganisms composition, Bio-geo chemical cycles –Carbon cycle, Nitrogen cycle and sulphur cycles.

UNIT II Microbial Interactions (5 Periods)

Microbial interaction mutalism ,amensalism , and commensalisms- plant microbial interactions– N2 fixation,symbiotic and free living- genetics of N2 fixation- Phosphate solubilization- Rhizosphere effect- Mycorrhizal association; ecto and endomycorrhizae.

UNIT IIIBiofertilizers (5 Periods)

Biofertilizers – Introduction, biofertilizers using nitrogen fixing microbes- phosphate solubilization - Rhizobium, Azatobacter, Azospirillum, Azolla; Anabaena Symbiosis, blue green algae and Vermi composting Cultivation, mass production and inoculation of Rhizobium, Azotobacter, Azospirillum, Azolla and cyanobacteria, Carrier-based inoculants, methods of Application .

UNIT IVPlant Diseases (5 Periods)

Major plant disease symptoms caused by fungi, bacteria and viruses. Plant diseases –Principles, symptoms and control measures of the following diseases: Fungal –Tikka, Fusarium wilts, Bacterial –Blight of rice, citrus canker, Xanthomonas (black rot). Viral and mycoplasmal –Bud necrosis of groundnut, citrus mosaic, tomato leaf Curl.

UNIT VBiopesticides (4 Periods)

Biopesticides –*Bacillus thuringiensis, B. sphaericus, B. popilliae, Psuedomonassyringae.*Biocontrol-Microbial control of plant pathogens- *Tricho dermatitis* Useful genes from microorganisms for agriculture (Herbicide resistant, Bt, viral). Biological Control – Use of Baculovirus, NPV virus, protozoa & fungi in biological control.

REFERENCES

1.Dirk J, Elas V, Trevors JT, Wellington, EMH (1997) Modern Soil Microbiology, Marcel Dekker INC, New York.

2.Agricultural Microbiology by G.Rangaswamy and Bagyaraj, Prentice Hall India.

3.Bio-fertilizers in Agriculture and Forestry, 1995, by N.S. SubbaRao.

4.Microbes For Sustainable Agriculture by K.V.B.R. Tilak, K.K. Pal, RinkuDey

5.Soil Microbiology and Plant Growth, 1995, by N.S. SubbaRao.

6.Plant Growth and Health Promoting Bacteria by Dinesh K. Maheshwari

7.Plant-microbe interactions, Volume 1 by Gary Stacey and Noel T. Keen

8.Biological control of crop diseases Volume 89 of Books in soils, plants, and the environment by S. S. Gnanamanickam

9.Plant-microbe interactions and biological control Volume 63 of Books in soils, plants, and the environment by Greg J. Boland, L. David Kuykend

CORE COURSE : VII

CLINICAL MICROBIOLOGY

Semester : IV	**Max Marks : 75**
Course Code : 18UMB4C7	**Credit : 6***
Total Periods : 75	**ExamHrs : 3**

Objective:

This course aims to develop the skills in clinical virology like viral infections and diseases.

UNIT I Mechanism of Pathogenicity (15 Periods)

Normal flora- opportunistic pathogen.Host microbe interatction- invasion, colonization, virlunce factors, pathogenicity.Physical barriers.

UNIT II Principles of epidemiology: (15 Periods)

Current epidemics (AIDS,Nosocomical, Acute respiratory Syndrome,) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.

UNIT III Bacterial Diseases (15 Periods)

Enteric diseases- cholera, dysentery, respiratory diseases- wooping cough, diphtheria, tuberculosis, zoonotic diseases- brucellosis, salmonellosis ,tetanus, sexually transmitted diseases- gonorrhoea, syphilis.

UNIT IV Viral Diseases (15 Periods)

Some common viral diseases - Adeno virus, Pox, Herpes,Picorna,Rhabdovirus,viral Hepatitis viruses,SARS,Influenza, Rabies, Rota and AIDS, pappilloma, Epstein Barr virus. SV40

UNIT V Fungal infection (15 Periods)

Superficial mycoses, cutaneous mycoses, subcutaneous mycoses, systemic mycoses, oppurtunistic mycoses, mycotoxicosis.

REFERENCES

1. Chakraborty P (2003). A Text book of Microbiology. 2nd edition published by New Central book agency (p) Ltd., Kolkata.
2. Ananthnarayanan R &JayaramPanikerCK(2000). Text book of microbiology 6th edition orient longman limited Chennai
3. Clnical virology manual by steven,S. Adnika, R.L.., Young, S.A.
4. Principles of virology. 2000 by Edward Arnold.
5. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24thedition. McGraw Hill Publication.
6. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4thedition. Elsevier.
7. Joklik WK, Willett HP and Amos DB (1995). Zinsser Microbiology. 19thedition. Appleton-Centuary-Crofts publication.
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CORE COURSE : VIII

PRACTICAL PERTAINING CLINICAL MICROBIOLOGY

Semester : IV **Max Marks : 60**

Course Code : 18UMB4C8P **Credit : 3***

Total Periods : 75 **ExamHrs : 3**

Objectives:

To impart hands on training on clinical Microbiology

1.Isolation of pathogen from Urine	**(11 Periods)**
2.Isolation of pathogen from Pus/Wound	**(11 Periods)**
3.Cogulase test for Staphylococci	**(10 Periods)**
4. Detection of Hbs antigen by dot ELISA	**(12 Periods)**
5.Quantification of HIV ag by ELISA	**(12 Periods)**
6. KOH mount for Fungal dermatitis	**(9 Periods)**
7.Germ tube test	**(10 Periods)**

REFERENCES

1. James Cappuccino. Microbiology: A Laboratory Manual (10th Edition).

2. Tiwari, G. S. Hoondal, Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers. 2005.

3. William Claus. G.W. 1989.Understanding Microbes –A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York.

4. Wilson. K and Goulding.K.H. 1986.A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London.

5. Tauro P., Kapoor, K.K. Yadav,K.S.An introduction to Microbiology first Edition, New Age International Publishers.

6. Kannan. N. Laboratory Manual in General Microbiology. Panima Publishing Corporation. New Delhi. 2ndEdition.

NON MAJOR ELECTIVE: II

ELEMENTAL CONCEPTS OF MICROBIOLOGY

Semester : IV **Max Marks : 75**

Course Code : 18UMB4N2A **Credit : 2***

Total Periods : 24 **ExamHrs : 3**

Objective:

To learn and to understand about the elemental concepts of microbiology.

UNIT I History (5 Periods)

History and scope of Microbiology - Louis Pasteur - Robert Koch .Microscope and its types. Classification of microorganisms.

UNIT II Structure and Staining (5 Periods)

Structure and organization of Prokaryotes and Eukaryotes- Cell wall, Cell membrane, Mitochondria, Mesosomes, Vacoules, Nucleic acid, Golgibody, Flagella, pili. Staining- endospore staining , importance of Staining

UNIT III Media Preparation (4 Periods)

Media preparation and culture techniques, Nutrition - Different phases of growth - Growth curve .Structure and function of DNA and RNA, sterilization and preservation.

UNIT IV Eco Microbiology (6 Periods)

Biological interaction- Microbes-Microbes, Microbes- Plant, Microbes- Animal interaction.Decomposition, Biogeo chemical cycles.Bioleaching, Biodetrioration- microbial deterioration of metals, textile, paper.

.

UNIT V Industrial Microbiology (4 Periods)

Industrially important microbial strains(*Penicillium, Lactobacillus*). Fermentation- Continuous fermentation. Microbial production of industrial products- Citric acid, Penicillin, Riboflavin(vitamin B-12)

REFERENCES

1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill.
2. PelczarTR M J Chan ECS and Kreig N R (2006). Microbiology. Fifth edition, Tata McGraw-Hill INC. New York
3. KubyImmunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition, W H Freeman and company. New York.
4. Jawetz, Melnick, &Adelberg's. Medical Microbiology.26thEdition.McGraw Hill.
5 Patel AH (2005). Industrial Microbiology. Published by Mac Millan India Ltd., Chennai.
6 SubbaRaoNS (2004).Soil Microbiology.Fourthedition,Oxford ,IBH PublishinCo.Pvt.Ltd., New Delhi.
7. Atlas RM and Bartha R. (2000). *Microbial Ecology: Fundamentals &Applications*. 4th edition. Benjamin/Cummings Science Publishing, USA
8. Casida LE. (1991). *Industrial Microbiology*.1st edition. Wiley Eastern Limited

NON MAJOR ELECTIVE :II

SOCIAL AND PREVENTIVE MEDICINE

Semester : IV **Max Marks : 75**

Course Code : 18UMB4N2B **Credit : 2***

Total Periods : 24 **Exam Hrs : 3**

Objective:

To study about the concept of health, Identify threats to the environment and infection caused by microbes

UNIT I Concept in public health (5 Periods)

Definition of health; appreciation of health as a relative concept; determinants of health.Public health events - Sanitary awakening, germ theory of disease, rise of Public health in various countries. Indices used in measurement of health. National Health Policy

UNIT II Epidemiology concept (5 Periods)

Epidemiology - definition, concept and role in health and disease. Modes of transmission and measures for prevention and control of communicable and non-communicable disease.Principal sources of epidemiological data- frequency, mortality, morbidity.Common sampling techniques.

UNIT III Important epidemiological outbreaks (5 Periods)

Infective hepatitis, ARI, T.B. Malaria, Filariasis, STDs & AIDS, Diarrhoeal diseases, Kala Azar, Mental Health, Non communicable diseases, Blindness, Hypertension, Leprosy, Accidents, JE, VPDs, Plague, Chickenpox etc.

UNIT IVEmerging Diseases (5 Periods)

Epidemiology , Pathogenesis and Treatment of Clostridium*difficile* and *Pseudomembranous colitis,* Ebola and Nipha virus .

UNIT VInfectious Disease Treatment (4 Periods)

The main classes of antibiotics and antiviral agents.: Target, mechanism and resistance.

REFERENCES

1.Oxford Text book of Public Health: Detels R, McEwen J, Beaglehold R

2.Control of Communicable Diseases in Man: Benenson AS

3.Manson's Tropical Diseses:Cook G, Zumla A

4.Hunter's Diseases of Occupations: Baxter PJ, Admas PH

5.Hunters Tropical Medicine and emerging infectious diseases: Strickland GT

6.A Dictionary of Public Health. J Kishore

7.Clinical Epidemiology-the Essentials : Fletcher

8.Epidemiology and Management for Health Care for all: Sathe PV, Sathe AP

9.Training modules of various national & international institutes and national health programmes

10.MaxyRoseman John M.Last, Maxcy-Roseman Public Helath and Preventive Medicine, Appleton-Centrury-Crofts, Newyork

11.Hobson W, The Theory and Practice of Public Health, Oxford Med. Publication

12.Barker D J P, Practical Epidemiology, Churchill Livingstone

13.Park J E & K Park, Text Book of P & S.M., M/s BanarsidasmBhanot, Jabalpur

NON MAJOR ELECTIVE : II

MICROBIAL NUTRITION

Semester : IV **Max Marks : 75**

Course Code : 18UMB4N2C **Credit : 2***

Total Periods : 24 **ExamHrs : 3**

Objective:

This study compares the microbial nutritional content, and its physical and chemical factor requirement for growth .

UNIT I Nutritional Types (5 Periods)

Nutritional types : Requirement of Nutrients for microbes and classification of microorganisms based on carbon, energy and electron sources viz. Photoautotrophs; Photoorganotrophs; Chemo-lithotrophs (ammonia, nitrate sulphur, hydrogen, iron oxidizing bacteria); Chemo-organotrophs. Primary and secondary active transport; Passive and facilitated diffusion.

UNIT II Preservation Components (5 Periods)

Media type and Preservation Components; Criteria and role of macro and micro-nutrients. Natural, Synthetic, Complex, Selective media & Differential Media; Methods for culturing aerobic and anaerobic bacteria; Colony and broth culture characteristics; Maintenance and preservation of Microorganisms.

UNIT III Microbial Growth (5 Periods)

Microbial Growt: Growth in Microbes(growth phases, generation time, growth curve). Measurement of cell mass and cell number; Factors affecting microbial growth; Continuous and batch cultures ; details of synchronous and Diauxic growth curve. Physical factors influencing growth: Temperature; PH ; Atmospheric Pressure; Salt Concentration.

UNIT IV Chemical Factors (4 Periods)

Chemical factors: heavy metal (copper), surfactants. Control of Microorganisms: patterns of microbial death, control of microorganism growth by antiseptics.

UNIT V Microbial Photosynthesis (5 Periods)

Microbial Photosynthesis: Concept of photosynthesis and associated pigments in microbes; photosynthetic apparatus in pro and eukaryotes; anoxygenic and oxygenic photosynthesis ; light and dark reaction; photorespiration and its significance .

REFERENCES

1.Moat A.G. and Foster S.W.Microbial Physiology (4th Ed.)(2004).John Wiley and Sons, New York.

2.GeraldKarp.Cell Biology (3rd Ed.)(2003).McGraw Hill Book Company, New York.

3.Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. General Microbiology. (5th Ed.)(1987).McMillan Press.UK.

4.Dubey RC and Maheswari DK. A Text book of Microbiology.(2005).S.Chand&Company Ltd., New Delhi.

5.Nelson D. L. & Cox M. M. Lehninger's Principles of Biochemistry, 4th edition. (2005).W. H. Freeman & Co. NY.

6.Pelczar Jr, M J, Chan E C S., Krieg N R, Microbiology, (5th Ed.),(2001).McGraw HillBook Company, NY.

CORE COURSE : IX

AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5C9	**Credit : 6***
Total Periods : 75	**ExamHrs : 3**

Objective:

To Provide the fundamental knowledge about the various scopes of soil and agricultural microbiology, their concepts and its commercial aspects.

UNIT I Soil Microbiology (15 Peroids)

Physical chemical charecteristics and micro flora of various soil types- Microbial interaction mutalism,amensalism and commensalisms role of microorganisms in biological cycles - nitrogen , phosphorus , sulphur and carbon cycles.

UNIT II Biofertilizers (15 Peroids)

Biological Nitrogen fixation- nitrogenase enzyme- Nif genes. Phosphate solubilization – Rhizosphere effect –mycorrhizal association; ecto and endomycorrhizae . Soil health - crop residues, humus,mineralization, Composting - vermicomposting,green manure. Effect of crop residues on plant growth

UNIT III Biological agents (15 Peroids)

Biological control of soil-borne microbial pathogens and nematodes - microbial pesticides.interaction of synthetic pesticides with soil microorganisms .Entomopathogenic fungi. Recent trends in pest management; strategies, mass production, formulation and applications technology, constraints.

UNIT IV Environmental Protection Act (15 Periods)

Environmental Laws, national movements, sustainable development, environmental policies, environmental economics, environmental ethics – holistic approach of environmental protection and conservation, IUCN – role in environmental protection.Concept with reference to UN –

declaration, aim and objectives of human right policies with reference to India, recent north-south debate on the priorities of implementation, Environmental Protection Agency (EPA).

UNIT V Bioremediation (15 Peroids)

Bioremediation of Oil spills, Wastewater treatment, chemical degradation, heavy Metals. Microbial decomposition; Cellulose, Hemicellulose, Lignin, Pectin and Chitin .

REFERENCES

1. Atlas R.M.andBartha .R.1992,Microbial Ecology. Fundamental and application .3 rd edition Bengamin and Cummings
2. Alexander A M 1987.I ntroduction to soil microbiology,5 th edition John Wiley and sons
3. Mitchell R 1974 ,Introduction to environmental Microbiology , mrentice –Hall Inc ., Englewood Cliffs.
4. Rengasamy, G and D J Bagyaraj , Agricultural Microbiology ,Asia Publishing house New Delhi.
5. Randasamy G&Bagyaraj D.J. Agricultural Microbiology 2/e, Prentice –hall Publications 1993
6. Atlas , R.& Richard ,B. Microbial ecology 2/e Benjamin – Cummings publications 1987.
7. Prescott L.M,Harley J . P &K lein D. A ., Microbiology , 6 /e , McGraw Hill Publishers,2006., Madigan M.T.M Martinko J.M.& Brock P.J. Biology of Microorganisms 8/e

CORE COURSE : X

INDUSTRIAL MICROBIOLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5C10	**Credit : 6***
Total Periods : 75	**ExamHrs : 3**

Objectives:

To train the students on bioprocess techniques so as to develop their employability skill for industry.

UNIT I Industrially important microorganisms (15 Periods)

Isolation of cultures – screening of new products from microorganisms- inoculum development – scale up of microbes , Primary and Secondary Screening – strain improvement – screening and selection auxotrophic mutant and revertant. Starter culture

UNIT II Bioreactors (15 Periods)

Bioreactions – bioreactors in bioprocessing of cells – enzyme bioreactors. Basis concepts in medium design – design procedure growth limiting nutrient in designed medium. Bio instrumentation and computer control of fermentation processes.

UNIT III Upstream processing (15 Periods)

Types of fermentation- closed and open, aerobic and anaerobic, homolactic and heterolactic, fermentation media components- carbon source, nitrogen source, minerals and vitamins, growth factors, precursors, inducers, elicitors, inhibitors,anti-foaming agents, oxygen and water availability, media sterilization techniques

Downstream Processing

Bioproducts recover – conventional recovery methods .cell disruption , foam separation , centrifugation , cell distruption – liquid – liquid extraction , counter – current distruption – chromatography.

UNIT IV-Industrial Fermentation Products (15 Periods)

Biofuels – Ethanol , Hydrogen , Methane . Antibiotics –β – lactum antibiotics (synthetic penicillin) , Sterptomycin ,Cephalosporin. Biopolymers – xanthan ,polyhydroxyalkanotes . Thermostable enzymes – proteases .Biosurfectants : a comparative account

UNIT V-Food and Healthcare Products (15 Periods)

SCP – Various types and processes .carotenoides , Amonoacids – Lysine , Glutamic acid , Vitamins – Riboflavin , vitamins B12 ,Fatty acids (Palmetateoleate).

REFERENCES

1. Mukhopadhayay , S.N., 2001 Process – biotechnology fundamentals . viva books(P) Ltd. Arnold.
2. L. Demain and Nadine A.Soloman .1986.Manual of industrial and biotechnology. Americal society for Microbiology ,Wasgigton DC
3. Stanbury , P.F., A .Whitaker and S .J .Hall .1995. principles of fermentation technology-second edition – Elsevier Publications .
4. Bioprocess Technology ; Fundamentals and Applications . stockholm KTH

CORE COURSE : XI

FOOD AND DAIRY MICROBIOLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5C11	**Credit : 5***
Total Periods : 75	**ExamHrs : 3**

Objective:

This course aims to provide instruction in the general principles of food microbiology and to understand microbiology of processed food, significance of different foods microorganisms, their control and other related aspects of dairy and other foods products.

UNIT I Introduction (15 Periods)

Importance of food microbiology, types of microorganisms in food spoilage, factors affecting the growth of microorganisms in food microbiology – Food preservation – principles – methods of preservations-Physical and chemical methods food spoilage.

UNIT II Microbiology of food Products (15 Periods)

Contamination, spoilage and preservation of cereals and cereals products, sugar and sugar products, vegetables and fruits, meat and meat products – fish and other sea foods, egg and poultry . Role of microorganisms in beverages – tea and coffee fermentations.Single cell proteins- Spirulina& mushroom.

UNIT III Food borne Diseases (15 Periods)

Food intoxication and infection - bacterial and non –bacterial food borne diseases. Quality standards of food – Government regulatory practices and policies FDA, EPA,HACCP,BIS and FSSAI. Food sanitation in food manufacture and in retail trade.

UNIT IV Fermented foods and preservation (15 Periods)

Methods and organisms used in bread-, wine, beer, vinegar fermentations – production and application of bakers yeast – soy sauce fermentation by moulds-fermented meat –sausages. Fermented vegetables –sauerkraut.Enzymes from microorganisms – production and application of microbial enzymes in food industry and preservation of fermented food and products.

UNIT V Dairy Microbiology (15 Periods)

Micro flora of milk- sources of contamination –methods of minimizing contamination .milk borne infection – intoxication . Milk preservation methods-pasteurization – sterilization .Fermented dairy products – microbes involved in fermentation – starter lactic acid cultures – butter milk , cream , Youhurt , Kafir , Kumis ,Acidophilus milk and cheese production and its types.

REFERENCES

1. Frazier WC and Westhoff DC (1988) Food Microbiology, TATA McGraw Hill Publishing Company Ltd .New Delhi
2. The microbiology of milk .Elsevier Applied Science ,London.8 Edward Harth ,J.T.Steele .Applied Dairy Microbiology .1998.
3. Modern Food Microbiology 4thEdition ,Van Nostra and Rainhokdd Co.
4. Milk & Milk Products –fouth Edition –clarence henry eckles,TataMcGrawHill Publishing Company.
5. Fundamentals of dairy microbiology prajapati..Volume Food Microbiolgy .2nd Edition by Adams
6. Food Microbiology : Fundamentals and Frontiers by Dolle Biotechnology : food fermentation Microbiology ,Biochemistry and Technology 2 by Joshi

CORE COURSE : XII

PRACTICAL PERTAINING AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY, INDUSTRIAL MICROBIOLOGY, FOOD & DAIRY MICROBIOLOGY

Semester : V	**Max Marks : 60**
Course Code : 18UMB5C12P	**Credit : 3***
Total Periods : 75	**ExamHrs : 3**

Objective:

To learn the skills of Isolation of microorganisms present in the soil to study the techniques of soil estimation .

1. Isolation of PGPR Bacteria from Rhizosphere (6 Periods)
2. Detection indole acetic acid producing bacteria (5 Periods)
3. Isolation of Rhizobium from root nodules (5 Periods)
4. Isolation of phosphate solublising bacteria/fungi from soil (6 Periods)
5. Determination of Nitrogen fixation activity of microorganisms (6 Periods)
6. Identifcation of colonization of AM fungi (6 Periods)
7. Determination of BOD of sewage (5 Periods)
8. Determination of COD of sewage. (5 Periods)
9. Screening of cellulase/lipase producing bacteria (6 Periods)

10. Immobilization by alginate (5 Periods)
11. Wine production (7 Periods)
12. Estimation of alcohol (4 Periods)
13. Wet Mount preparation of spoiled food from vegetables ,fruits (3 Periods)
14. Milk quality by Methylene Blue Reduction Test (3 Periods)
15. Coagulation test for milk (3 Periods)

REFERENCES:

1. Medical lab technology – Ramnik and Sood ,Jaypee brothers (Medical pub .New Delhi) 6th Edition -2009 .
2. An introduction to Practical Biochemistry – David Plummer , 3rd Edition -2008 .
3. APHA (American Public Health Association) Handbook – 2018.
4. Soil ,Plant and Water Analysis – P.C.Jaiswal – 2nd Edition -2006 .
5. Biochemical methods – S. Sadasivam , A. Manikam -3rd Edition -2007 ISBN 8122421407 .
6. Practical Biochemistryb-J.Jayraman – 1st Edition -2011 .
7. Chemical and Biological Analysis of water – Dr. R. K. Trivedy and P. K. Goel – Environmental publication -1986 .

MAJOR BASED ELECTIVE: I

CLINICAL RESEARCH

Semester : V	**Max Marks : 75**
Course Code : 18UMB5M1A	**Credit : 4***
Total Periods : 75	**ExamHrs : 3**

Objective:

To understand the basic needs of clinical research and promote knowledge on clinical ethical guidelines and to provide Internship at Hospitals to gain knowledge .

UNIT I Introduction to clinical research (15 Periods)

Basic terminology used in clinical research: Types of clinical trials, single blinding, double blinding, open access, randomized trials and their examples, interventional study, ethics committee and its members, cross over design, etc. and Institution Ethics Committee / Independent Ethics Committee Data Management in clinical Research.

UNIT II Drug discovery (15 Periods)

Clinical trials New drug discovery process- Phase-I, II, III, IV trials.Pre clinical toxicology: General principles, Systemic toxicology, Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, animal toxicity requirements.

UNIT III Standardization of drugs (15 Periods)

Biological standardization, general principles, Scope and limitation of bio-assay, bioassay of some official drugs. Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED50 and LD50 determination, special toxicity test like teratogenecity and mutagenecity.

UNIT IV Regulatory guidelines (15 Periods)

Various regulatory requirements in clinical trials, Schedule Y, ICMR guidelines etc. Documents in clinical study Investigator Brochure (IB), Protocol & Amendment in Protocol , Case Report Form (CRF), Informed Consent Form (ICF) , Content of Clinical Trial Report Essential Documents in Clinical Trial Good Clinical Practice: ICH guidelines Indian GCP guidelines (CDCSO guidelines) ICMR Guidelines

UNIT V Clinical trials and its applications (15 Periods)

Study of various clinical trials (completed or ongoing) Clinical Trial Application in India Import & Export of Drug in India Investigational New Drug application (IND) Abbreviated New Drug Application (ANDA). New Drug Application (NDA).

REFERENCES

1. Basic and Clinical Pharmacology, Prentice hall, International, Katzung, B.G. Clinical Pharmacology, Scientific book agency, Laurence, DR and Bennet PN.

2. Rick NG. Drugs From Discovery To Approval. John Wiley & Sons, Inc 2004

3. Allen Cato, Lynda Sutton Clinical Drug Trials and Tribulations Second Edition, Revised and Expanded. Marcel Dekker, Inc. 2002

4. Deborah Rosenbaum, Michelle Dresser. Clinical Research Coordinator Handbook Second Edition Practical Clinical Trials Series GCP Tools and Techniques Interpharm/CRC New York Washington, D.C.© 2002

5. https://www.healthline.com/health/clinical-trial-phases
6. https://www.drugs.com/new-drug-applications.html

MAJOR BASED ELECTIVE: I

MARINE MICROBIOLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5M1B	**Credit : 4***
Total Periods : 75	**ExamHrs : 3**

Objective:

This subject aims to introduce the students to understand microbial diversity , significance , dynamics of marine environment and marine microbial products.

UNIT I Marine environment (15 Periods)

Sea-benthic and littoral zone , salt pan , mangroves , estuarine and lagoon microbes , microbial loop – marine microbial community – planktons , bacteria , fungi , protozoa. Influence of physical , chemical and biological factors on marine microbes

UNIT II Characteristics of Marine Environment (15 Periods)

Methods of studying marine microorganisms – sample collection –isolation and identification : cultural , morphological , physiological , biochemical and molecular characteristics – Preservation methods of marine microbes .Role of microorganisms in carbon , nitrogen phosphorus and sulphur cycles in the sea under different environments and mangroves.

UNIT III Extremophiles (15 Periods)

Survival at extreme environments – starvation – adaptive mechanisms in thermophilic ,alkalophilicosmophilic and barophilic , psychrophilic microorganisms - hyperthrmophiles halophiles and their importance.

UNIT IV Role of Microbes in Marine Environments (15 Periods)

Microorganisms responsible for bioluminescence in marine environment .Uses of bioluminescence . Microbial indicators of marine pollution and control ,biofouling , biocorrosin biofilms , biodegradation and bioremediation of marine pollutants . use of genetically engineered microorganisms in biodegradation.

UNIT V Marine products (15 Periods)

Marine natural products ,bioactive compounds from marine microorganisms , marine biosensor . Biosurfactants , biopolymers and novel enzymes from marine organisms.

REFERENCES

1. Karl ,D& Buckley ,M (2005) Marine Microbial Diversity.

2. Mitchell ,R (2008) Microbial Ecology of the Oceans Wiley

3. Colwell ,R&Belkin (2010) Ocean & health : Pathogens of the Marine Environment Springer

4.Miller ,C., Wheeler ,P.A (2012) Biological Oceanography Wiley – Blackwell .

5. Bhakuni DS and Rawat DS. Bioactive marine natural Products .AnamayaPublishers ,New Delhi 2005.

MAJOR BASED ELECTIVE: I

VIROLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5M1C	**Credit : 4***
Total Periods : 75	**ExamHrs : 3**

Objectives:

This course aims to develop knowledge in virology like viral and phage Structures, Infections and diseases.

.**UNIT I Introduction to virology (15 periods)**

Early development of virology General Structure, Properties and Classification-Baltimore, cultivation of Viruses- virus purification and assays.

UNIT II DNAPhages (15 periods)

Reproduction of DNA phages- DNA lytic phages- lytic cycle of T4 phage The one step growth, adsorption to the host cell and penetration- synthesis of Phage nucleic acids and protein assembly of phage particles- release of phage particles.

UNITIII RNAPhages (15 periods)

Lysogeny- Temperate bacteriophages- lambda phage- induction of lysogens- Generation of defective phages and their uses.Reproduction of RNA phages.

UNITIV Viral multiplication and replication strategies (15 periods)

Interaction of viruses with cellular receptors, entry of viruses, replication, assembly, maturation, and release of virions.

UNIT V Prevention and control of viral diseases (15 periods)

Anti viral compounds, interferons, viral vaccines.Applications of virology; use of viral vectors in cloning and expression, gene therapy and phage display.

REFERENCES:

1.Dimmock NJ, and Primrose SB. (1994).
Introduction to Modern Virology.4thedition. Blackwell Science Ltd.

2.Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology.6thedition (First Indian reprint 2007), Blackwell Publishing Ltd.

3.Carter J and Saunders V(2007). Virology: Principles and Applications. John Wiley and Sons.

4.Flint SJ, Enquist, LW, Krug, RM, Racaniello, VR, Skalka, AM (2004).Principles of Virology, Molecular biology, Pathogenesis and Control. 2ndedition. ASM press Washington DC.

5.Levy JA, Conrat HF, Owens RA. (2000). Virology. 3rdedition. Prentice Hall publication, New Jersey.

6.Wagner EK, Hewlett MJ. (2004). Basic Virology\.2nd edition.Blackwell Publishing.

7.Mathews. (2004). Plant Virology. Hull R. Academic Press, New York.

8.Nayudu MV.(2008). Plant Viruses. Tata McGraw Hill, India.

SKILL BASED ELECTIVE: I

PHARMACOGNOSY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5S1A	**Credit : 2***
Total Periods : 24	**ExamHrs : 3**

Objective:

This is to provide knowledge and information about pharmaceutical raw materials from natural sources, traditional medicines and chemical analysis and phytochemical screening of medicinal plants, medicinal plant biotechnology and phytotherapy .

UNIT I Pharmacognosy **(4 Periods)**

Definition , History , Scope of Pharmacognosy including indigenous system of medicine and various systems of classification of drugs and natural origin .

UNIT II Sources of drugs **(4 Periods)**

Natural sources - Plants , Animals ,Marine , Mineral , Microorganisms and Synthetic sources of drugs.

UNIT III Classification of drugs **(5 Periods)**

Alphabetical , Morphological ,Taxonomical , Chemical and Pharmacological classification of drugs.

UNIT IV Formulation of drugs (6 Periods)

Methods of collection , process and storage of medicinal and aromatic plants ; purification of raw drugs; factors causing drug contamination, methods of storage of drugs.Formulations in Ayurveda , Siddha and Unani ; classical and modern means of drug administration – Pharmacognosy of crude drugs : based on market survey including adulterants and substitutes .

UNIT V Pharmacodynamics (5 periods)

Overview and Principles of Pharmacodynamics.Drug-Receptor interactions, Chemical interactions.Dose-Response relationships.

REFERENCES

1. NarayanaAiyer ,K.andKolammal .M. 1963 .*Pharmacognosy of Ayurvedic Drugs* (12 vol.). University of kerala , Thiruvananthapuram.
2. Trease ,G.E. and Evans, W.C 1983. *Pharmacognosy* (12th ed). BailliereTindall,London.
3. Vaidya ,B.1982 .Some Controversial Drugs in India Medicine .ChaukambikaOrientalia , Varanasi.
4. Wallis,T.E.1997.Text Book of Pharmacognosy(5th ed) CBS Publishers&Distributors,Delhi.
5. Anonymous 1999 .The Ayurvedic Pharmacopoeia of India .Vol I (1&2).Ministry of health and family Welfare ,Govt . India ,New Delhi .
6. Chauhan M.G .and Pillai ,A.P.G .2005 .Microscopic Profile of Powdered Drugs Used in india systems of medicine .Institute of Ayurvedic Medicinal Plant Sciences .Jamnagar
7. Hughes G. Friendly pharmacokinetics: a simple introduction. Nurse Prescribing 14(1):34-43, 2016.

8. Aymanns C, Keller F, Maus S, et al. Review of pharmacokinetics and pharmacodynamics and the aging kidney. Clin J Am SocNephrol 5(2):314-327, 2010. doi:10.2215/CJN.03960609.

SKILL BASED ELECTIVE: I

CLINICAL LAB TECHNOLOGY

Semester : V **Max Marks : 75**

Course Code : 18UMB5S1B **Credit : 2***

Total Periods : 24 **ExamHrs : 3**

Objective:

To Provide information used in clinical decision-making. Clinical laboratory services have a direct impact on many aspects of patient care including, but not limited to, length of stay, patient safety, resource utilization, and customer satisfaction.

UNIT I Introduction to Clinical Microbiology (5 Periods)

Managing Clinical Microbiology Laboratory. Methods of Collection, transport and processing of clinical specimens - Blood, Urine, Sputum, CSF, Pus & Faeces for microbiological examination. Separation of blood and serum.

UNIT II Examination of Urine (4 Periods)

Sample collection, Physical and Chemical tests, Principles and methods, Microscopic examination - crystals, casts, Sediments, Pregnancy test.

UNIT III Blood analysis (5 Periods)

Staining &differential WBC count - Peripheral blood analysis examination and morphological abnormalities - Reticulocyte count - absolute eosinophil count - E.S.R and P.C.V. Blood indices - Platelet count: BT, CT, CRT -Prothrombin time. A.P.P.T and FDP estimation.

UNIT IV Laboratory methods in Basic Mycology and virology (6 Periods)

Collection and transport of clinical specimens - Microscopy, examination of culture media and incubation, Serological test for fungi . Laboratory methods in basic Virology - Viral culture - Media and cells used - specimen processing- Isolation and identification of Viruses. Viral Serology.

UNIT V Laboratory methods for parasitic infection (4 Periods)

Diagnostic techniques for fecal, Gastro intestinal and genital specimen . Microscopic examination and its significance .Identification of intestinal protozoa, Blood protozoa, Intestinal and Blood helminthes.

REFERENCES

1. Bailey &Scott's (2014). Diagnostic Microbiology. 13th edition, The C.V. Mosby Company.

2. Abdul Khader (2003). Medical Laboratory Techniques. First edition, Frontline Publications, Hyderabad.

3. Mukherjee, L. (1997). Medical Laboratory Technology. Volume I& II. Tata McGrew-Hill Publishing Company Limited, New Delhi.

4. Sundararaj, T (2005). Microbiology Laboratory Perungudi, Chennai-96. Manual,

5. Godkar,P.B. (2003). Textbook of Medical Laboratory Technology, 2nd Edition, Bhalani Publication.

6. Seiverd, Charles, E. Hematology forMediical Technologies, 4th Edition, Lea &Febiger, US.

7. RaminkSood, (2006). A Textbook of Medical laboratory Technology, Jaypee Brothers Medical Publishers (p).LTD, New Delhi.

SKILL BASED ELECTIVE: I

DIAGNOSTIC MICROBIOLOGY

Semester : V **Max Marks : 75**

Course Code : 18UMB5S1C **Credit : 2***

Total Periods : 24 **Exam Hrs : 3**

Objective:

To provide up to date information of laboratory methods of the diseases of various etiologies which are of serious human health threat globally .

UNIT I Laboratory methods in Mycology (5 Periods)

Collection and transport of clinical specimens – Direct Microscopic examination, culture media and incubation, Serological tests for fungi – Antifungal susceptibility testing. Diagnosis of Dermatophytes- Microsporum – Trichophyton, Epidermophyton- Madura mycosis- Opportunistic fungal infections- Candida albicans, Aspergillus, Mucor.

UNIT II Laboratory methods in parasitology (5 Periods)

Laboratory diagnosis methods for parasitic infections – Diagnostic techniques for faecal, gastrointestinal and urino-genital specimen.Parasitic diseases- Entamoebahistolytica, Giardia, Taeniasolium, Ascaris, Enterobius, Trichuristrichura, Plasmodium vivax, Wuchereriabancrofti.

UNIT IIILaboratory methods in bacteriology (5 Periods)

Etiology and laboratory diagnosis of Urinary tract infection- Meningitis, Diarrhea, Respiratory tract infections.Pyogenic infections- Staphylococcus and Pseudomonas: Sexually Transmitted Diseases Bacteria), Nosocomial infections - definition, sources and detection; phage typing, Bacteriocin typing.

UNIT IV Laboratory methods in Virology (5 Periods)

Viral culture- Media and cells used – Specimen processing – isolation and identification of viruses. Detection of viral antigen (fluorescent antibody and solid phase immunoassays).Viral SerologySpecial consideration- Hepatitis and AIDS.

UNIT V Therapeutic agents (4 Periods)

Antibiotics and chemotherapeutic agents- Mechanism of actions – Drug resistance – Antimicrobial susceptibility testing- Disc diffusion- Kirby Bauer method.

REFERENCES

1. Diagnostic Microbiology, Bailey and Scott's., 1990. Eighth edition.The C.V. Mosby Company.

2. Medical laboratory techniques, Abdul Khader, 2003, First edition. Frontline Publications, Hyderabad.

3. Medical laboratory manual for tropical countries. Microbiology by Monica chees brough (ELBS). Tropical Health Technology, Butter worths, 1985.

4. Manual of Clinical Microbiology, Lenetle, E., Balows, H.A., Hausler, W.J and Shadomy J., 1985. Bethesda American Society of Microbiology.

SKILL BASED ELECTIVE : II

CELL BIOLOGY

Semester : V **Max Marks : 75**

Course Code : 18UMB5S2A **Credit : 2***

Total Periods : 24 **Exam Hrs : 3**

Objectives

To Understand the Structure and organelles functions of microbes.

UNIT I Introduction (5 Periods)

History of cell biology, cell as basic unit of life, cell theory, protoplasm theory and organismal theory, broad classification of cell types, Bacteria, Archaea (prokaryotic) and Eukaryotic cells and their similarities and differences

UNIT II Cell structure (5 Periods)

Structure and functions of cell wall: bacterial cell wall – plant cell wall and fungal cell wall, plasma membrane – exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport. Cytoskeleton structure – microtubules, microfilaments, intermediate filament.

UNIT III Cell organelles (5 Periods)

Mitochondria – organization of respiratory chain, chloroplasts – photophosphorylation, nucleus, nucleolus, nuclear membrane and organization of chromosomes, cell cycle and its check points, cell division (mitosis and meiosis).

UNIT IV Structure and functions of cell organelles (5 Periods)

Endoplasmic reticulum (rough endoplasmic reticulum and smooth endoplasmic reticulum), golgi apparatus, lysosomes, microbodies (peroxysomes and glyoxysomes), vacuoles, ribosomes, centriole and basal bodies.

UNIT V Cell communication (4 Periods)

Overview – types of cell signaling – signal molecules – signal amplification – receptor types – quorum sensing.

REFERENCES

1. Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.
2. Hardin J. and Bertoni G. (2017) Becker's World of the Cell, 9 thEdn (Global Edition). Pearson Education Ltd.

3. Cooper G.M. and Hausman R.E. (2016) The Cell – A Molecular Approach, 7th Edn. Sinauer Associates Inc.

4. Mason K.A., Losos J.B. and Singer S.R. (2017) Raven Johnson's Biology, 11th Edn. McGraw-Hill Education. 3. Karp G. (2010) Cell and Molecular Biology – Concepts and Experiments, 6 thEdn. John Wiley and Sons.

SKILL BASED ELECTIVE : II

ENDOCRINOLOGY

Semester : V	**Max Marks : 75**
Course Code : 18UMB5S2B	**Credit : 2***
Total Periods : 24	**ExamHrs : 3**

Objective:

To provide the knowledge and to understand the Endocrine glands and Hormones.

UNIT I Hormones (5 Periods)

Definition, Classification, Biosynthesis and circulation in blood.Mechanism of hormone action.Mechanism of steroid hormone receptors – Mechanism of action of steroid hormone.

UNIT II Pituitary gland (5 Periods)

Morphology, Thyrotropin releasing hormone (TRH), Gonadotropin releasing Hormone, Control of GH Secretion, Dopamine and control of prolactin secretion.Thyroid gland : Biosynthesis of

Thyroid hormone, Iodine Trapping, Incorporation of Iodine, Mechanism of thyroid hormone action, Control of thyroid function .

UNIT III Hormonal regulation of fuel metabolism (4 Periods)

Body fuels – Glucose, Glycogen, Protein and fat. Overall regulation of blood glucose concentration (Short- term regulation, Long – term regulation)

UNIT IV Hormonal control of pregnancy and lactation (5Periods)

Puperty, Menstrual cycle – Menopause.Types and functions of placenta. Human Chorionic gonadotropin (HCG), Human chorionic Somatomammotropin (HCS), Corticotropin releasing hormone (CRH), Growth and development of mammary glands, Milk Production.

UNIT V Reproductive Health (5 Periods)

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminologies used in family planning .

REFERENCES

1. Bently, P. J., Comparative Vertebrate Endocrinology, Cambridge University Press.

2. Chandra, S. Negi, Introduction Endocrinology, PHI Learning Pvt. Ltd., New Delhi.

3. Wiliam, R. H., Textbook of Endocrinology, W. B. Saunders.

4. Gorbman et al., Comparative Endocrinology, John Wiley & Sons.

5. Yadav, B. N., Mammalian Endocrinology, Vishal Publishing Co., Jalandhar.

6. Martin, C. R., Endocrine Physiology, Oxford University Press.

SKILL BASED ELECTIVE : II

BIOINSTRUMENTATION

Semester : V	**Max Marks : 75**
Course Code : 18UMB5S2C	**Credit : 2***
Total Periods : 24	**ExamHrs : 3**

Objective:

To understand the Principles, Mechanism and Application of the instruments.

UNIT I Biophysical methods (5 Periods)

Buffers, molars and normal solutions, pH meter, pH electrodes - calomel and glass electrodes. Incubator, water bath shaker, laminar air flow.

UNIT II Centrifugation (5 Periods)

Principle - types of centrifuges - low speed, high speed, ultra centrifuge, Differential centrifugation - density gradient centrifugation. Applications of centrifuge.

UNIT III Electrophoresis (5 Periods)

Electrophoresis - SDS - PAGE and agarose gel electrophoresis. Southern blotting - Northern blotting- Western blotting- DOT blotting.

UNIT IV Chromatography (4 Periods)

Principle - types of chromatograpgy.Paper, Thin layer, Column, Ion exchange, Gas chromatography and HPLC.

UNIT V Quantification methods (5Periods)

Colorimetry, Spectrometry - UV & visible spectrophotometer, Flame photometry, FACS. Biosensors.

REFERENCES

1. BajpaiPK (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand& Co. Ltd., New Delhi.

2. Palanivelu P (2004). Analytical Biochemistry and Separation techniques. Third edition, MKUCo- op, Press Ltd., Palkalai Nagar, Madurai.

3. Gurumani N (2006). Research Methodology for Biological Sciences. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.

4. Subramanian MA (2005). Biophysics - Principles and Techniques. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.

5. John G Webster (2004). Bioinstrumentation.Student edition.John Wiley and Sons, Ltd.

6. Ravishankar S (2001). A Text Book of Pharmaceutical Analysis.Third edition.Rx Publications, Tirunelveli.

7. Upadhyay&Upadhyay. Biophysical Chemistry, (2010).Himalaya Publishing house.

CORE COURSE : XIII

MICROBIAL GENETICS

Semester : VI **Max Marks : 75**

Course Code : 18UMB6C13 **Credit : 6***

Total Period : 75 **Exam Hrs : 3**

Objective:

In addition to the most essential fundamentals of the subject, the paper aims to impart the current updated knowledge on molecular genetics of prokaryotes. It also endeavors to provide the required details on eukaryotic molecular genetics.

UNIT I History of genetics **(15 Periods)**

Mendalin genetics, **Nucleic Acids: components and properties of nucleic acid.**DNA structure and types, RNA types and structure. Genetic code properties. Wobble hypothesis

UNIT II Genetic material **(15 periods)**

DNA as genetic material, Experiments of Griffith; Avery, McCleod ;McCarthy and Harshey Chase. RNA as genetic material, Experiments of Fraenkel and Singer

UNIT III Mutation (15 periods)

Mutation – cause of mutation. spontaneous and induced Mutagen & Mutagenesis. Base substitution, insertion and deletion. Point, silent and frame shift mutation chemical and physical mutants

Unit IV DNA Repair mechanism (15 periods)

mismatch repair,Nucleotide Excision Repair (NER),Direct Repair of Damaged DNA, photoreactivation, Sos repair.

Unit V Genetic exchange (15 periods)

Genetic exchange – Transduction (specialized & generalized), Transformation, Conjugation - Hfr mapping, genetic recombination.

REFERENCES

1. Molecular Biology of the Gene, 4th edition by Watson J.D, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner(1987) Benjamin/ Cummings.
2. The RNA World (2nd edition) Gestel and R, T.Cech and J.Atkins(edition) 1999 Cold Spring Harbor, NewYork.
3. Cell biology and molecular biology by EDP Robertis and EMF Robertis, Saundercollege.
4. Molecular cell biology 2nd edition by Darnell.J, H.Lodish and D.Baltimore(1990), Scientific American books, New York.
5. GENES-IX by Benjamin Lewin.
6. Recombinant DNA Technology by Watson.
7. Molecular genetics by D.N.Bharadwaj
8. Advanced genetics by G.S.Miglani
9. Molecular biology techniques by Naik.
10. Genetics – analysis of genes and genomes- V Edition- Daniel L- Hartl and W.Jones.

CORE COURSE : XIV

MOLECULAR BIOLOGY

Semester : VI **Max Marks : 75**

Course Code : 18UMB6C14 **Credit : 6***

Total Period : 75 **Exam Hrs : 3**

Objective:

To understand the organization , expression, replication and regulation of the gene in both prokaryotes and eukaryotes .

UNIT I Genome organization (15 periods)

Organization of bacterial genome; Structure of eucaryotic chromosomes; Role of nuclear matrix in chromosome organization and function; Matrix binding proteins; Heterochromatin and Euchromatin; DNA reassociation kinetics(Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions; DNA methylation & Imprinting

UNIT II DNA Replication (15 Periods)

DNA replication in prokaryotes: Replicons – models of DNA replication – origin and termination of replication – rolling circle replication – proof for semi conservative replication (Meselson and Stahl Experiment) – enzymes and proteins involved in DNA replication (nucleases, polymerases, ligases, helicases, gyrases, single strand binding protein, replisome and primosome) – mechanism of semi discontinuous replication.

UNIT II Prokaryotic Gene expression (15 periods)

Organization of gene: upstream and down stream region of gen. promoter, operator, regulan. One gene one enzyme concept. Transcription and translation .

UNIT III Eukaryotic gene expression (15 periods)

Structure and organization of eukarytic genome.Enhancers, transcription factors. Post transcriptional modification-RNA splicing. Post translational modification

UNIT IV Gene regulation in prokaryotes (15 periods)

operon concept- Inducible operon –lactose utilization system. repressible operon- trp operon

REFERENCES

1. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6th Edition, Benjamin Cummings Publishing Company Inc, 2007.
2. Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002.
3. Rastogi S.C, V.N. Sharma, AnuradhaTanden, Concepts in molecular biology, 1993

CORE COURSE: XV

PRACTICAL PERTAINING MICROBIAL GENETICS, MOLECULAR BIOLOGY

Semester : VI **Max Marks : 60**

Course Code : 18UMB6C15P **Credit : 5***

Total Periods : 75 **Exam Hrs : 3**

Objective:

Explain the relationship between genetics, inheritance, genes and genomes. Describe the structure of DNA and individual nucleotides.

1. scoring of auxotrophic mutant by UV **(7 Periods)**
2. competent cell preparation **(7 Periods)**
3. Gene transformation- blue white selection **(7 Periods)**
4. Plasmid DNA Isolation **(7 Periods)**

5. Chromosomal DNA isolation **(8 Periods)**
6. Gel electrophoresis **(8 Periods)**
7. Protoplast generation **(7 Periods)**
8. Demonstration of Southern blotting **(8 Periods)**
9. Demonstration of Western blotting **(8 Periods)**
10. Demonstration of Polymerase Chain Reaction **(8 Periods)**

REFERENCES

1. Ananthanarayanan R and Paniker CKJ.(2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University press publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA.(2007). *Jawetz, melnick and adelbergs medical microbiology*. 24th edition. McGraw Hill publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D.(2007). *Mims' Medical Microbiology*, 4th edition. Elsevier.

MAJOR BASED ELECTIVE: II

FORENSIC BIOLOGY

Semester : VI **Max Marks : 75**

Course Code : 18UMB6M2A **Credit : 4***

Total Periods : 75 **ExamHrs : 3**

Objective :

To make the students to understand the examination of different samples of humans for forensic study.

Unit I Blood (15 Periods)

Composition, functions and forensic significance.Tests for identification of blood – Presumptive and confirmatory tests. Species identification.Blood groups – Introduction and identification.Typing of dried blood stains.

Unit II Semen (15 Periods)

Composition, functions and forensic significance.Morphology and lifespan of spermatozoa.Tests for identification of semen – Presumptive and confirmatory tests.Azoospermic and oligospermic conditions.

Unit III Forensic Analysis (15 Periods)

Composition, functions and Forensic significance of saliva, sweat, urine, faecal stains, milk and vomit.Tests for their identifications.Significance and origin of hair evidence.Structure and morphology of human hair. Comparison of hair samples - human and animal hair.

Unit IV Entomology and it's significance in forensics (15 Periods)

Forensic palynology – introduction and significance.Forensic examination of wood, seeds, leaves and diatoms. Wildlife forensics – introduction, agencies involved. IUCN red list.

Unit V Forensic Microbiology (15 Periods)

Introduction to microbiology, types of microbes. Microbial growth and environmental factors affecting the growth.Different methods for isolation of microorganisms from forensic samples like vomit, stool, stomach wash and residual food.Introduction to bioterrorism, popular case studies of bioterrorism.

REFERENCES

1. Lehninger, Principles of Biochemistry, 7th Edition.
2. Alan Gunn, Essential Forensic Biology, 2nd Edition, Wiley (2009)
3. L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York (1988).
4. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry, APPLETON & Lange, Norwalk (1993).
5. R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993).
6. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
7. G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).

MAJOR BASED ELECTIVE : II

MYCOLOGY

Semester : VI **Max Marks : 75**

Course Code : 18UMB6M2B **Credit : 4***

Total Periods : 75 **ExamHrs : 3**

Objective:

This paper deals to an explosion of knowledge relating to fungi with a traditional base.

UNIT I Historical perspectives (15 Periods)

History and significance of mycology in the scientific development.General characteristics of fungi - Structure and organization of fungi – The fungal body and cells, Colony, communication and signaling.Cell differentiation and reproduction.Reproduction in fungi - Vegetative, asexual and sexual reproduction in fungi with special reference to their significance.

UNIT II Taxonomy (15 Periods)

Criteria for classification.Traditional, Chemo and molecular taxonomy and their significance.Myxomycetes, Ascomycetes, Basidiomycetes and imperfect fungi. Ecology (Fungal Lifestyle)- the way they make their living, Distribution of yeasts and fungi

UNIT III Nutrition and metabolism in fungi (15 Periods)

Nutritional requirement of fungi, saprophytic, parasitic, obligatory and facultative.Culture media for fungi, Natural substrates of fungi.Biotrophic semi-biotrophic and necrotrophic mode of growth. Fungal-microbe interaction, fungal - plant interactions – symbiotic and antagonistic interactions.

UNIT IV Endophytic fungi (15 Periods)

Symbiotic and opportunistic associations, co evolution and loss of reproductive structures, Secondary metabolite production, toxins – importance, toxicity to herbivores and insects.Use of endophytic fungi as biocontrol agents against plant diseases, insect herbivores.Mycorrhizal associations – endo and ectomycorrhiza.

UNIT V-Significance of fungi in human and livestock health (15 Periods)

Symbiotic fungi, toxigenic fungi and mycotoxins, pathogenic fungi; Significance of yeasts and fungi in agricultural production – symbiotic fungi, fungi in improving plant productivity, toxigenic fungi and mycotoxins, plant pathogenic fungi, fungi in biocontrol; Significance of fungi in biotechnology and industrial production; Fungal metabolites and their economic significance – mycotoxins, medicinal uses of fungi (antibiotics), food additives, alcohol, vinegar, enzymes, biopesticides. Fungi as food – mushrooms, Mushroom poisoning.

REFERENCES

1. Ainsworth (2009), Introduction to the History of Mycology, Cambridge University Press

2. Mehrotra RS and KR Aneja. An Introduction to Mycology, New Age Publishers

3. P. D. Sharma (2005), Fungi and Allied Organisms. Alpha Science International Publishers

4. Bennett, J. W., and M. Klich. 2003. Mycotoxins. Clin.Microbiol.Rev. 16:497-516.

5. P. D. Sharma (2006), Plant Pathology. Alpha Science International Publishers.

6. Steven L. Stephenson (2010), The Kingdom Fungi: The Biology of Mushrooms,molds and lichens.

MAJOR BASED ELECTIVE : II
RECOMBINANT DNA TECHNOLOGY

Semester : VI **Max Marks : 75**

Course Code : 18UMB6M2C **Credit : 4***

Total Periods : 75 **ExamHrs : 3**

Objective:

To provide knowledge about the cloning techniques enzymes used in the r DNA technology and the techniques used for gene manipulation .

UNIT IGene manipulation (15 Periods)

Definition and Application, Restriction Enzymes, Discovery, Types and Mode of Action, Ligases and Methylases, Modifying enzymes- Alkaline Phosphatase, Phosphonucleo Kinase.

UNIT IIGene Cloning (15 Periods)

cloning strategies. Chemical Synthesis of DNA, Genomic Library and cDNA Library construction.Knockout mice.

UNIT IIIVectors (15 Periods)

Plasmid based Vectors- Natural (PSC101, RSF2124, PMB1), Artificial – pBR322 &pUC 18 Construction: Phage based Vectors- ג) Lamda phage Vectors and its Derivatives: Hybrid Vectors- Phagemid, Phasmid and Cosmid, BAC and YAC.

UNIT IV Gene Transfer Techniques (15 Periods)

Physical – Biolistic Method, Electroporation, Microinjection. Chemical- Calcium chloride and DEAE Methods, liposomes, Biological in vitro package method .Screening and Selection of recombinants - direct and indirect method.

UNIT V Molecular techniques (15 Periods)

PCR and its application. DNA Sequencing (Sanger's Method AND Next gen sequencing) Blotting (Southern, Western, Northern) Techniques, RFLP and Application, - RAPD and Application - Microarray.

REFERENCES

1. Old. RW and Primrose, 1995 Principles of Gene Manipulation, 5th edition. Blackwell Scientific Publication, Boston.

2. Winnecker, E.D, 1987- From gene to clones, Introduction to Gene Technology, VCH Publication, FRG.

3. T.A Brown 1995, 3rd edition, An introduction to Gene Cloning ,Champman and Hall .

4. Glick B.R and Pasternak J .J, 1994.Molecular Biotechnology. Principles and Application of recombinant DNA, ASM Press,Washington.

MAJOR BASED ELECTIVE: III

GENETIC ENGINEERING

Semester	**: VI**	**Max Marks**	**: 75**
Course Code	**: 18UMB6M3A**	**Credit**	**: 4***
Total Periods	**: 75**	**ExamHrs**	**: 3**

Objective:

To make the students to understand the applications of genetic engineering technique in different fields .

UNIT I Synthesis of commercial products (15 Periods)

Microbial synthesis of commercial products-Proteins-Pharmaceuticals – Interferons - Human growth hormone- Antibiotios -Biopolymers.

UNIT II Vaccines (15 Periods)

Vaccines-Subunit vaccines, Edible vaccine, Recombinant vaccine – Monoclonal antibody.Gene therapy.

UNIT III Transgenic plants (15 Periods)

Transgenic plants-Ti plasmid – insect, virus, herbicide resistant plants – microbial insecticides – bacteria, fungi and viruses.

UNIT IV Transgenic animals (15 Periods)

Transgenic animals-mice – retroviral method – DNA Microinjection method – embryonic stem cell method- Application-Transgenic - sheep – Transgenic fish .

UNIT V Applications of Genetic Engineering (15 Periods)

DNA finger printing and its Application.Human Genome Project and History and its Application.

REFERENCES

1. Brown T.A 1995 An Introduction to gene cloning.3rd edition. Chapman and hall
2. Bernard. R Glick and Jack JPasternak.1994 Molecular biotechnology, Panima Publishing Corporation.
3. U.Sathyanarayana., Biotechnology Books and Allied (P) Ltd.,(2005)First Edition.s

MAJOR BASED ELECTIVE : III

MICROBIAL TECHNOLOGY

Semester	**: VI**	**Max Marks**	**: 75**
Course Code	**: 18UMB6M3B**	**Credit**	**: 4***
Total Periods	**: 75**	**ExamHrs**	**: 3**

Objective:

To provide information on the fundamentals of the fermentation process, strain improvement and culture, and the use of different microorganism for the production of avariety of industrial products.

UNIT I Introduction to fermentation technology (15 Periods)

Chronology and components of fermentation processes - A general account on microbial biomass, enzymes, metabolites and recombinant products - Range of fermentation processes -Transformation processes. Isolation, preservation, optimization and improvement of industrially important microorganisms.

UNIT II Fermentor and Media (15 Periods)

Fermentor - basic functions- body construction-aerators, agitators (impellers and spargers) - asepsis-containment-valves and steam traps- types of fermentors. Substrates for media preparation-Medium formulation–Sterilization of medium.Steps and methods in recovery of products.

UNIT III Food dairy, beverages (15 Periods)

Single cell proteins (SCP) - SCP as food and feed –mass cultivation of Spirulina–Mycoprotein - Yogurt and cheese production.Alcoholic beverages–Beer and wine fermentation.

UNIT IV Pharmaceutical and related industries (15 Periods)

Antibiotics-sources and types- production of Penicillin and Streptomycin.Production of insulin and Hep B vaccine.Transformation of steroids.Vitamins-Production of vitamin B12.

UNIT V Enzymes, Amino acids, Organic acids and other products (15 Periods)

Microbial Enzymes-Production and application of amylase, protease, andlipase. Microbes used for amino acid production-production of L-glutamic acids- Organic acids: citric acid, acetic acid production-Bioplastics and Exopolymer production-Biofertilizers and biofuels.

REFERENCES

1.Crueger F and AnnelieseCrueger, 2000. Biotechnology: Industrial Microbiology Panima publishing Corporation, New Delhi.

2.Stanley, P. F.,Whittaker, A. and Hall, S.J., 1995. Principles of Fermentation technology First edn, Pergamon Press, UK.

3.Balasubramanian, D., Bryce, C. F. A., Dharmalingam, K., Green, J. and KunthalaJayaraman,1998.Concepts in Biotechnology, COSIST Publications, India.

4.Adams, M.R. and Moss, M.O., 1995. Food Microbiology
New Age International Publishers,New Delhi.
5.Casida, L. E. Jr. 1996. Industrial Microbiology.New Age International Publishers, NewDelhi.
6.Alexander N. Glazer and Hiroshi Nikaido, 1994. Microbial Biotechnology: Fundamentals of Applied microbiology. W.H. Freeman and Co., New York.
7.Satyanarayana U. 2010. Biotechnology, Books and Allied (P) Ltd. Kolkata.

MAJOR BASED ELECTIVE :III

MICROBIAL TAXONOMY AND BIOINFORMATICS

Semester : VI **Max Marks : 75**

Course Code : 18UMB6M3C **Credit : 4***

Total Periods : 75 **ExamHrs : 3**

Objectives

To Make the students to understand the Taxonomy of microbes based on various aspects like growth , nutritional and reproduction.

UNIT I Microbial Taxonomy (15 Periods)

Basics of microbial taxonomy- concept of species and taxa and strain.Classification systems-Numerical taxonomy or Adansonian classification, phenetic and phylogenetic Classification.

UNIT II Bacterial taxonomy (15 Periods)

Principles and modern approaches of bacterial taxonomy.Basic idea about Hackel and Whittaker's kingdom concept and domain concept of Carl Woose.Out line classification of bacteria and archaea as per 2nd edition of Bergy's Manual.

UNIT III Molecular characteristics (15 Periods)

Biodiversity and systematics Modern trends in taxonomy chemotaxonomy, molecular systematics, numerical taxonomy (only brief idea).Characters used in microbial taxonomy (morphological, physiological, ecological, genetics protein content, nucleic acid sequence and base composition)

UNIT IV–Bio informatics (15 Periods)

Analytical tools for sequences databanks: BLAST, FASTA, Pairwise alignment- Multiple alignment- ClustalW, PRAS. Evolutionary analysis: distances – clustering methods – rooted and unrooted tree representations – bootstrapping strategies

UNIT V DATABASES(15 Periods)

Biological databases, Importance of databases, Nucleic acid sequence databases, Protein databases and Structure database (SCOP, CATH, KEGG, OMIM)..

REFERENCES

1. Fundamentals of Bacteriology by A.J Salle

2. Principles of Microbiology by Ronald Atlas.

3. Microbial Physiology. 4th edition. John Wiley & Sons.

4. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India.
5. HusonDH ,et al . MEGAN analysis of metagenomicdata , genome -2007 .
6. Parkhill J., Birney E, and Kersey P. (2010) Genomic information infrastructure after the deluge . Genome Biol .