

ETHIRAJ COLLEGE FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF MICROBIOLOGY
M.Sc. APPLIED MICROBIOLOGY
SYLLABUS TO BE EFFECTIVE FROM 2018-2019

ETHIRAJ COLLEGE FOR WOMEN
PG DEPARTMENT OF APPLIED MICROBIOLOGY
Revised Syllabus of June 2018

The Post Graduate Department of Microbiology is revising syllabus with effect from the academic year 2018-2019. PG Degree has two academic years. Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

PREAMBLE

PG Department of Microbiology submits changes and additions suggested in the curricula that are given in the ensuing pages.

- Modification of Course content in all the Core and Elective courses in accordance with emerging trends in the field of Microbiology.
- Addition of new Course and merging of courses as per the need.
- Shifting of courses between semesters to accommodate syllabus coverage

REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of M.Sc., Applied Microbiology course shall be required to have passed the B.Sc., Degree examinations in Microbiology /Zoology /Botany/Biotechnology under the University of Madras or as equivalent thereto by the Syndicate of the University of Madras.

2. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study for a period of not less than two academic years, passed the examination of all Four Semesters prescribed.

3. COURSE OF STUDY:

The Main subjects of study for Post graduate Degree shall consist of the following:

PART-I	: Core Theory and Core Practical
PART-II	: Major and Non Major Electives
PART- III	: Soft Skill
PART- IV	: Internship

4. PASSING MINIMUM:

A candidate shall be declared to have passed in each paper / practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 50% of the marks prescribed for the end semester examination.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Part I, II

Successful candidates passing the examination and securing the marks (i) 60 percent and above and (ii) 50 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. Candidates who pass all the examinations (Part I, II) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

COURSE PROFILE

	Course Code	Course Title	Hrs/ Wk	Credits	CA Marks	End Sem Marks	Total
SEMESTER I							
CORE I	16SP18/1C/GMY	General Microbiology	4	4	40	60	100
CORE II	16SP18/1C/MPY	Microbial Physiology	5	4	40	60	100
CORE III	16SP18/1C/BLY	Bacteriology	5	4	40	60	100
CORE ELECTIVE I	16SP18/1E1/MYP	Mycology and Parasitology	4	3	40	60	100
SOFT SKILL	PG18/1S/PEW	Personality Enrichment for Women	2	2	-	50	50
CORE PRACTICAL I	16SP18/2C/PR1	General Microbiology and Microbial Physiology	5	-	-	-	-
CORE PRACTICAL II	16SP18/2C/PR2	Medical Microbiology	5	-	-	-	-
SEMESTER II							
CORE IV	16SP18/2C/FDY	Food and Dairy Microbiology	4	4	40	60	100
CORE V	16SP18/2C/VLY	Virology	4	4	40	60	100
CORE VI	16SP18/2C/ARM	Analytical Tools and Research Methodology	4	4	40	60	100
CORE ELECTIVE II	16SP18/2E2/BST	Biostatistics	3	3	40	60	100
NON MAJOR ELECTIVE I	16SP18/2E/VMC	Vermicomposting and Mushroom Cultivation	4	3	40	60	100
SOFT SKILL	PG18/2S/LCE PG18/2S/FRE	*Languages- English or French	2	2	-	50	50

CORE PRACTICAL I	16SP18/2C/PR1	General Microbiology and Microbial Physiology	4	4	40	60	100
CORE PRACTICAL II	16SP18/2C/PR2	Medical Microbiology	5	4	40	60	100

Total Credits of I and II Semester = 45

*Communication Skills in English/French for Beginners

	Course Code	Course Title	Hrs/ Wk	Credits	CA Marks	End Sem Marks	Total
SEMESTER III							
CORE VI	16SP18/3C/ILY	Immunology	4	4	40	60	100
CORE VII	16SP18/3C/EMY	Environmental Microbiology	4	4	40	60	100
CORE Elective III	16SP18/3E3/INP	Industrial and Pharmaceutical Microbiology	4	3	40	60	100
NON MAJOR ELECTIVE II	16SP18/3E/GLP	Gardening and Landscaping	4	3	40	60	100
SOFT SKILL	16SP18/3S/CSC	Computing Skills for competitive examinations	2	2	-	50	50
CORE PRACTICAL III	16SP18/4C/PR3	Immunology and Molecular Biology	4	-	-	-	-
CORE PRACTICAL IV	16SP18/4C/PR4	Environmental Microbiology	4	-	-	-	-
CORE PRACTICAL V	16SP18/4C/PR5	Food and Industrial Microbiology	4	-	-	-	-
INTERNSHIP		**		2			
SEMESTER IV							
CORE VIII	16SP18/4C/MBY	Molecular Biology and Recombinant DNA Technology	4	4	40	60	100
CORE IX	16SP18/4C/PRO	Project	5	4	40	60	100
CORE ELECTIVE IV	16SP18/4E4/MIG	Microbial Genetics	4	3	40	60	100
CORE ELECTIVE V	16SP18/4E5/BIF	Bioinformatics	3	3	40	60	100
SOFT SKILL	16SP18/4S/EEP	Essentials of Entrepreneurship	2	2	-	50	50
CORE PRACTICAL III	16SP18/4C/PR3	Immunology and Molecular Biology	4	4	40	60	100
CORE PRACTICAL IV	16SP18/4C/PR4	Environmental Microbiology	4	4	40	60	100
CORE PRACTICAL V	16SP18/4C/PR5	Food and Industrial Microbiology	4	4	40	60	100

**Internship will be carried out during summer vacation of the II semester

Total credits of III and IV semester=46

Total credits=91

**TEMPLATE FOR EVALUATION PATTERN
CONTINUOUS ASSESSMENT –THEORY (CORE AND ELECTIVE)**

Semter	Course Code	Course Title	Continuous Assessment				
			Test I	Test II	Quiz/ Assignment/ Seminar/ Field Visit	Participatory Learning	Total
			10	10	10	10	40
I	16SP18/1C/GMY	General Microbiology	10	10	10	10	40
	16SP18/1C/MPY	Microbial Physiology	10	10	10	10	40
	16SP18/1C/BLY	Bacteriology	10	10	10	10	40
	16SP18/1E1/MYP	Mycology and Parasitology	10	10	10	10	40
II	16SP18/2C/FDY	Food and Dairy Microbiology	10	10	10	10	40
	16SP18/2C/VLY	Virology	10	10	10	10	40
	16SP18/2C/ARM	Analytical Tools and Research Methodology	10	10	10	10	40
	16SP18/2E2/BST	Biostatistics	10	10	10	10	40
III	16SP18/3C/ILY	Immunology	10	10	10	10	40
	16SP18/3C/EMY	Environmental Microbiology	10	10	10	10	40
	16SP18/3E3/INP	Industrial and Pharmaceutical Microbiology	10	10	10	10	40
	16SP18/3E/GLP	Gardening and Landscaping	10	10	10	10	40
IV	16SP18/4C/MBY	Molecular Biology and Recombinant DNA Technology	10	10	10	10	40
	16SP18/4E4/MIG	Microbial Genetics	10	10	10	10	40
	16SP18/4E5/BIF	Bioinformatics	10	10	10	10	40

RUBRICS FOR CONTINUOUS ASSESSMENT EVALUATION

- Assignment** - Appearance /Content/Originality/Presentation/Schematic Representation and Diagram/Bibliography
- Seminar** - Organization /Subject Knowledge/Visual Aids/Confidence Level/ Presentation
- Participatory Learning** - Answering Questions/Clearing Doubts/ Participation in Discussion/Attendance/Communication and Language
- Field Trip** - Participation/Preparation/Report/Attitude/Leadership

ASSESSMENT OF PRACTICAL COURSES

TYPE OF VALUATION	VALUATION PATTERN	MARKS
CONTINUOUS ASSESSMENT	I Model Test (50 marks converted to 10 Marks)	10
	II Model Test (50 marks converted to 10 Marks)	10
	Maintenance of Observation Book	10
	Participatory Learning	10
END SEMESTER EXAMINATION	End Semester Examination	60
	Total	100

ASSESSMENT OF PROJECT

VALUATION PATTERN	MARKS	TYPE OF ASSESSMENT
Choice of subject and Review of Literature	10	Continuous assessment
Organization and Interpretation	10	
Project Internal Presentation	20	
Dissertation(Internal and External)	40	End Semester Examination
Viva- Voce (Internal and External)	20	
Total	100	

STRUCTURE OF SOFT SKILL PAPERS

SEMESTER	CODE	COURSE TITLE
I	PG18/1S/PEW	Personality Enrichment For Women
II	PG18/2S/LCE PG18/2S/FRE	Languages- English or French
III	16SP18/3S/CSC	Computing Skills for Competitive Examinations
IV	16SP18/4S/EEP	Essentials of Entrepreneurship

**SEMESTER I
GENERAL MICROBIOLOGY**

TEACHING HOURS: 60
COURSECODE: 16SP18/1C/GMY

CREDITS: 4
L T P: 4 1 0

OBJECTIVES:

To enable students to

- Learn about Cultivation and Characterization of Microbes
- Classification and Identification of Microorganisms

COURSE CONTENT

UNIT I

10 Hours

History of Microbiology – Evolution of Microbiology with its recent developments. Outline Classification of Microorganisms-Bacteria, Fungi, Protozoa and Algae. Haeckel's Three Kingdom concept, Whittaker's Five Kingdom concept, Eight Kingdom concept and Three domain Concept. Principles of Classification – Phenetic and Phylogenetic Classification. Numerical Taxonomy-Similarity Matrix, Dendrograms.

UNIT II

10 Hours

Microscopy – Principle, Working and Application – Simple, Compound, Bright field, Dark field, Phase contrast, Fluorescence Microscopy and Confocal Microscopy, Transmission and Scanning Electron microscopy and Specimen preparation.

UNIT III

12 Hours

Prokaryotic cell structure – Cell Wall, Membrane, Capsule, Flagella, Inclusion Bodies and Spores. Outlines of Eukaryotic cell structure, function and differences between prokaryotic and eukaryotic cell. Staining –Classification of stains with examples. Simple staining, Gram staining, Acid-fast staining, Metachromatic granule staining, Nuclear staining, Capsule staining, Flagella staining and Spore staining.

UNIT IV

14 Hours

Cultivation of Bacteria- Aerobic and Anaerobic methods. Types of culture media and its applications. Decimal dilution. Pure Culture Techniques – Pour plate, Spread plate, Streaking and Stabbing. Preservation of microbial cultures. Antibiotics–Classification and mechanism of action. Antibacterial sensitivity testing methods and quality control. Mechanisms of Drug resistance and antibiotic policy, CLSI guidelines, EUCAST.

UNIT V

14 Hours

Sterilization - Physical and Chemical Methods- High temperature – Moist heat and dry heat, Radiation and Filtration. Disinfection methods - Phenol and Phenolic compounds, Alcohols, Halogens, Heavy metals, Dyes, Detergents, Quaternary Ammonium compounds, Aldehydes and Gaseous agents. Quality control of Sterilization methods.

COURSE OUTCOME:

The students will be able to understand the structure and function of microorganisms, their cultivation methods, sterilization and therapeutics.

RECOMMENDED TEXT BOOKS:

1. Michael.J. Pelczar., E.C.S. Chan and Noel. R. Krieg. (2007) Microbiology. 7th edn. Mc Graw – Hill, New York.
2. Prescott. L.M., Harley. J.P., Klein. D.A. (2013). Microbiology 9th edn. Wm. C. Brown publishers, Dubugue.
3. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th A La Carte Pearson.

REFERENCE BOOKS:

1. Davis. B.D., Delbecco. R., Eisen. H.N and Ginsburg. H.S. (1990). Microbiology. 5th edn. Harper and Row, New York.
2. Roger. Y. Stanier., John. L. Ingraham., Mark. L. Wheeles and Page.R. Painter. (1987) General Microbiology. 5th edn. Englewood cliffs, New Jersey, U.S.A.
3. Madigan, M.T., Martinko, J.M. and Parker, J. (1999). Brock's Biology of Micro organisms. 9th Edn. Prentice Hall, New Jersey.
4. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th edn. McGraw Hill Inc. New York.
5. Boyd, R.F. (1998). General Microbiology. Times Mirror, Mosby College Publishing, St Louis.

WEB RESOURCES

1. <http://www.microbiologyonline.org/>
2. <http://microbes.org/>
3. <http://www.microbes.info/resources/generalmicrobiology/>
4. <http://www.simhg.org/microbiology/>
5. www.brookscole.com/microbio/

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

**SEMESTER I
MICROBIAL PHYSIOLOGY**

TEACHING HOURS: 75
COURSE CODE: 16SP18/1C/MPY

CREDITS: 4
L T P: 4 1 0

OBJECTIVE:

To enable students to

- Learn about bacterial nutrition and their utilization.
- Learn metabolic pathways

COURSE CONTENT

UNIT I

15 Hours

Nutrition – Nutritional requirements and types in bacteria – Phototrophs, Chemotrophs, Autotrophs and Heterotrophs. Nutrient transport mechanisms- Passive diffusion, Facilitated diffusion, Active transport, Group translocation and Specific transport system.

UNIT II

10 Hours

Microbial growth – Growth curve and Measurement of Growth – Cell Number and Cell Mass and metabolic activity. Batch, Continuous, Synchronous and Asynchronous cultures, Factors affecting growth.

UNIT III

20 Hours

Enzymes – properties, functions and regulation. Basic concepts of metabolism, Oxidation – reduction reactions, Energy generation by anaerobic metabolism – Glycolysis, Pentose Phosphate pathway, ED pathway, Fermentation. Energy generation by Aerobic metabolism - TCA cycle, Glyoxylate pathway and Electron Transport chain, Mechanism of ATP synthesis – Chemiosmosis, Pasteur effect. Metabolism of lipids- β oxidation.

UNIT IV

15 Hours

Anaerobic Respiration - Nitrogen, Sulphur, Iron and Hydrogen Oxidation. Methanogenesis. Biosynthesis – Gluconeogenesis, Peptidoglycan synthesis, Amino acids, Purines, Pyrimidines Fattyacids, Triglycerides, Phospholipids and Sterols.

UNIT V

15 Hours

Photosynthesis – process, antenna of light-harvesting pigments, Photochemical reaction centers, Photosynthetic Electron Transport Chain-Cyclic and Non-cyclic. Oxygenic and Anoxygenic Photosynthesis. Calvin-Benson cycle. Bioluminescence - Process and application.

COURSE OUTCOME:

The students will be able to understand and predict the intermediate metabolism of any bacteria.

RECOMMENDED TEXT BOOKS:

1. Stanier R.Y., Ingraham, J.L. Wheelis, M.L and Painter, P.R. (2010). General Microbiology. 5th edn. Macmillan education Ltd. London.
2. Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubuque.
3. Moat, A.G. and Foster, J.W. (2003). Microbial Physiology. 4th Edn. John Wiley and Sons, New York.

REFERENCE BOOKS:

1. Salle. A.J. (1992). Fundamental Principles of Bacteriology. 7th edn. McGraw Hill Inc. New York.
2. Madigan, M.T., Martinko, J.M., & Parker ,J. (2000). Brock Biology of Microorganisms. 9th edn. Prentice Hall International, Inc, London.
3. Ingraham, J.L., & Ingraham, C.A. (2000). Introduction to Microbiology. 2nd edn. Brook / Cole. Singapore.
4. Gottschalk, G. (1986). Bacterial Metabolism. 2nd Edn. Springer-Verlag, New York.
5. Rose, A.H. (1976). An Introduction to Microbial Physiology. 3rd Edn. Plenum, New York.

WEB RESOURCES

1. <http://www.microbiologyonline.org/>
2. <http://www.accessexcellence.org/rc/microbiology>
3. www.oxfordreference.com
4. www.ncbi.nlm.nih.gov/
5. <https://en.m.wikipedia.org>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

**SEMESTER I
BACTERIOLOGY**

TEACHING HOURS: 75
COURSE CODE: 16SP18/1C/BLY

CREDITS: 4
LT P: 3 1 0

OBJECTIVES:

This paper focuses on

- Understanding the mechanisms of bacterial infections
- Knowledge to prevent and manage the infections

COURSE CONTENT

UNIT I

10 Hours

General Bacteriology - Normal Microbial Flora of Human Body and its importance, Host parasite interactions, Gnotobiosis. Classification of bacteria (Bergey's) and virulence factors in pathogenesis. Principles of epidemiology. Collection, transport and processing of specimens in bacteriology.

UNIT II

18 Hours

Gram Positive Bacteria - *Staphylococcus aureus* and Coagulase Negative *Staphylococci* implicated in Hospital acquired infections, *Streptococcus pyogenes*, *Streptococcus viridans* *Streptococcus agalactiae*, *Streptococcus fecalis*, *Streptococcus pneumoniae*, *Corynebacterium diphtheriae*, *Mycobacterium tuberculosis*, *Mycobacterium leprae*, MAIS complex and *Clostridium tetani*, *Clostridium botulinum*, *Clostridium perfringens* and *Clostridium difficile*.

UNIT III

16 Hours

Gram Negative Bacteria - *Escherichia coli*, *Klebsiella*, *Proteus*, *Salmonella*, *Shigella*, *Vibrio cholerae*, *Pseudomonas*, *Haemophilus influenzae*, *Bordetella*, *Neisseria*.

UNIT IV

16 Hours

Spiral Forms and Non-cultivable Bacteria - *Helicobacter pylori*, *Spirochaetes* – *Treponema pallidum*, *Leptospira*, *Borrelia*. *Mycoplasma*. *Rickettsiae* and *Chlamydia*. Anaerobic bacterial infections.

UNIT V

15 Hours

Zoonotic Bacterial Infections its prevention and control. Nosocomial infections- source, etiology, diagnosis and infection control committee. Biomedical Waste management. Antimicrobial agents in bacterial infections and Specific natural resistance.

COURSE OUTCOME:

Students understand the host parasitic interactions, bacterial infections and the diagnostic techniques in their detection.

They learn the antimicrobial therapies followed to overcome the illness caused by bacterial infections.

RECOMMENDED TEXTBOOKS

1. David Greenwood, Richard C.B,Slack John Forest. Peutherer (1992). Medical Microbiology. 14thedn, ELBS, Churchill Livingston.
2. Jawetz, E., Melnic, J.L. and Adelberg, E.A.(1997). Review of Medical Microbiology

- 9th edn. Lange Medical Publications, U.S.A.
3. Ananthanarayanan, R, & Panicker,C.K.J. (2013). Textbook of Microbiology. 9th edition. Orient Longman.

REFERENCES

1. Collee J.C. Duguid J.P. Foraser, A.C, Marimon B.P, (1996). Mackie & McCartney Practical Medical Microbiology. 14thedn, Churchill Livingston.
2. Monica Cheesbrough. (2002). District Laboratory Practice in Tropical countries. Cambridge University Press.
3. Kenneth J. Ryan and C. George Ray. (2004). Sherris Medical Microbiology. 4th edition.
4. Topley and Wilson's. (1998). Principles of Bacteriology.9th edn. Edward Arnold, London.
5. Salle. A.J. (1992). Fundamental Principles of Bacteriology. 7th edn. McGraw Hill Inc. New York.
6. Patrick R. Murray, Ken S. Rosenthal and Michael A. (2013). Medical Microbiology. Pfaller. 7th edn. Elsevier, Mosby Saunders.

WEBSITES

1. <https://www.cdc.gov/>
2. <http://www.who.int/ihr/lyon/surveillance/methods/en/>
3. www.ncbi.nlm.nih.gov/pmc/articles/
4. www.sciencedirect.com/
5. <https://www.pharmaguideline.com/>
6. <http://www.textbookofbacteriology.net/>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER I
MYCOLOGY AND PARASITOLOGY
(For Our Department Students)

TEACHING HOURS: 60
COURSE CODE: 16SP18/1E1/MYP

CREDITS: 3
L T P: 3 1 0

OBJECTIVES:

To enable students to

- Understand the basic structure, classification and medical importance of fungi and parasites.
- Study the diagnostic approaches and advanced techniques in Mycology and Parasitology.

COURSE CONTENT

UNIT I **10 Hours**

Introduction to Mycology and Parasitology – Classification of Medically important Fungi. (Chander J, 2009) and Parasites (Chatterjee, 2009). Morphology, and Reproduction, Culture media and Preservation of fungal Cultures. Types of parasites and hosts, Cultivation of parasites.

UNIT II **10 Hours**

Clinical features, Pathogenesis, lab diagnosis, treatment of Superficial fungi- *Malassezia furfur*, *Piedraria hortae* and *Trichosporon beigeli*. Clinical types of dermatophytoses and pathogenesis. Fungi causing Mycetoma. Systemic fungi- *Histoplasma capsulatum*, *Blastomyces dermatitids*, *Coccidioides immitis*, *Paracoccidioides brasiliensis*.

UNIT III **10 Hours**

Clinical features, Pathogenesis, lab diagnosis and treatment of Fungi implicated in Opportunistic infections- *Candida albicans*, *Cryptococcus neoformans*, *Pneumocystis carinii*. *Pencillium*, *Aspergillus*, *Rhizopus* and *Mucor*. Dematiaceous fungi.

UNIT IV **20 Hours**

Protozoology – Sarcodines - *Entamoeba histolytica*, *Acanthamoeba*. Intestinal Flagellates- *Giardia*, *Haemoflagellates- Leishmania donovani*, *Trypanosoma cruzi* and *brucei*, Apicomplexa -*Plasmodium*, *Toxoplasma*, *Cryptosporidium*. Helminthology- *Taenia*, *Echinococcus*, *Enterobius*, *Trichuris*. *Schistosoma*, *Ascaris* and *Ancylostoma* Tissue nematodes-*Wuchereria* and *Brugia Malayi*.

UNIT V **10 Hours**

Mycotoxins. Laboratory diagnosis of Fungal and Parasitic infections. Clinical specimens, Collection and Transport, Recovery by Cultural, Immunological and Molecular methods. Antifungal and antiparasitic agents and testing methods .

COURSE OUTCOME:

The students acquire in depth knowledge on the fungal and parasitic infections, symptoms and their diagnostics.

RECOMMENDED TEXT BOOKS

- 1.Fisher, F. and Cook, N.B. (1998). Fundamentals of Diagnostic Mycology. W.B. Saunders Company, Pennsylvania.
- 2.Chander, J. (2009). A Text book of Medical Mycology. 3rd edn. Mehta publishers.
- 3.Chatterjee (2009). Medical Parasitology. CBS Publishers, New Delhi.

REFERENCE BOOKS

1. Parija S. C. (1996). Text Book of Medical Parasitology. Orient Longman.
2. Levanthal, R. and Cheadle, R.S. (2012). Medical Parasitology. 6th edn. S.A.Davies Co., Philadelphia.
3. Walter Beck, J. and Davies, J.E. (1976). Medical Parasitology. 2nd edn. C.V.Mosby Company, St. Louis.
4. Alexopolus, C.J. and Mims, C.W. (1995). Introductory Mycology. 4th edn .John Wiley and Sons, New York.
5. P.L.Choidini ,A.H.Moody, D.W.Manser.(2001). Atlas of Medical Helminthology and Parasitology. Churchill living stone.

WEB RESOURCES

1. www.mycologypathfinder.weebly.com
2. www.dmoz.org/desc/science/biology/mycology
3. <http://nt.ars-grin.gov/sbmlweb/fungi/index.cfm/>
4. www.parasitology.com/
5. www.parasite-diagnosis.ch/

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II
FOOD AND DAIRY MICROBIOLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/2C/FDY

CREDITS: 4
LTP: 3 1 0

OBJECTIVES:

This paper focuses on

- Microbiology of food and techniques in food processing.
- Application of microorganisms for food production.

COURSE CONTENT

UNIT I

10 Hours

Introduction to Food Microbiology - Factors (Extrinsic and Intrinsic) affecting Microbial Growth in food. Microorganisms in Food - Bacteria and Fungi. Determination of Microorganisms in food. Principles of Preservation - Asepsis, High Temperature, Low Temperature, Drying and Food Additives.

UNIT II

15 Hours

Spoilage of Food: vegetables, Fruits, sugar products, Fish and other sea foods, Meat and meat products. Spoilage of canned food. Microorganisms in Foods and methods for detection: Fresh meat, Processed meat, poultry, Fish and sea foods- Culture, Microscopic, and Sampling Method for detecting microbes. Food packaging materials, properties and benefits. Biosensors in food.

UNIT III

10 Hours

Food Borne Infections and Food Poisoning - *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella*, *Shigella*, *Staphylococcus*, *Vibrio*, Nematodes, Protozoa, Algae, Fungi and Viruses. Food borne outbreaks in India.

UNIT IV

10 Hours

Microbiology of Milk-Microbes in Milk, Milk borne Infections. Fermentation of Milk-Souring, Lactic Acid Fermentation, Colour and flavours, Gassy fermentation and proteolysis. Quality Control Tests – Phosphatase, Resazurin and Reductase Tests. Microbiology of Fermented Milk products - Production of Cheese, Yogurt, Buttermilk, Kumis, Kefir, Acidophilus milk and Probiotics.

UNIT V

15 Hours

Good Hygiene Practices, Sanitation in manufacture and retail trade; Food control agencies and their regulations, Hazard analysis and critical control points (HACCP); GMP, Plant sanitation-employees' health standard, waste treatment, disposal, quality control. Bureau of Indian standards. Food laws and standards in India (FSS). Recent trends and development in food technologies in India.

COURSE OUTCOME:

The course enables the students to understand the nature and cause of food spoilage, food borne diseases and the regulatory measures in adopting food safety.

RECOMMENDED TEXT BOOKS

1. Frazier, W.C., & Westhoff, D.C. (1987). Food Microbiology. 4thedn. Tata McGraw Hill. Publishing Company Ltd. New York.
2. Jay M.Jay.(1998). Modern Food Microbiology. CBS Publishers and Distributors, New York.
3. Richard K. Robinson. (2002).Dairy Microbiology Handbook: The Microbiology of Milk and Milk Products. 3rd Edition.

REFERENCES

1. Adams M.R, and Moss M.D. (2006). Food Microbiology. New Age International Pvt Ltd., Publishers.
2. Banwarst. G.J._(1979).Basic Food Microbiology. CBS Publishers and distributors.
3. Robinson R. K. (2002). Dairy Microbiology. Elseiver Applied Science, London.
4. Hobbs, B.C. and Roberts, D. (1993). Food Poisoning and Food Hygiene. Edward Arnold. London
5. Vijaya R K. (2007). Food Microbiology. MJP Publishers. Chennai.

WEBSITES

1. http://www.fda.gov/food/food_safety.html
2. www.microbiology_procedure.com
3. <https://www.uoguelph.ca/foodscience/book-page/dairy-microbiology>
4. www.wiley.com
5. www.journals.elsevier.com/food-microbiology

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II VIROLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/2C/VLY

CREDITS: 4
L T P: 3 1 0

OBJECTIVES:

To enable students to

- Understand the basics of Virology
- To impart the knowledge regarding the diagnostics, clinical aspects and related implications of human viral disease and emerging viral infections.

COURSE CONTENT

UNIT I

10 Hours

Brief outline of Virology - General properties of viruses- Morphology and Replication Strategies. Cultivation of Viruses – Inoculation in Animals, Embryonated Eggs, Tissue Culture -Estimation of virus yield-Plaque assay and TCID₅₀, methods for purification of Viruses. Virioids, Prions, Satellite RNAs and virusoids. Classification of Viruses- animal Plant Viruses .

UNIT II

15 Hours

Viral diseases of Humans – Morphology, Classification, Pathogenesis, Diagnosis, Prevention and Treatment of Herpes (Herpes Simplex virus, Varicella – Zoster virus, Cytomegalo virus and Epstein Barr virus) Hepatitis, Pox – (Vaccinia and Variola, Molluscum contagiosum) Rhabdo, Orthomyxo, Paramyxo (Respiratory syncytial virus, Mumps virus, Measles virus) Enterovirus – Coxsackie virus and Polio virus, HIV

UNIT III

15 Hours

Arthropod borne Viral Diseases - Toga and Flavi encephalitis, Mosquito borne encephalitis, Tick borne encephalitis, Venezuelan equine encephalitis, Bunya virus encephalitis, West Nile Yellow fever, Sand fly fever, Dengue, Chikungunya, Hanta, Marburg and Ebola. Study of Plant Virus –Tobacco Mosaic Virus and CMV. Viruses of Algae, Fungi and Cyanobacteria. Viral diseases of Crop plants-Paddy, Cotton, Tomato and Sugarcane.

UNIT IV

10 Hours

Viral Oncogenesis – Oncogenic Viruses, Pathogenesis of Cancers, Diagnosis and Prevention. Emerging viral infections. Bacterial Viruses – Structural Organization, Life Cycle, Transcription, Replication- Lytic and Lysogenic Cycles - ϕ X174, M13, MU, T4, Lambda. Phage Typing and its application in Bacterial Genetics.

UNIT V

10 Hours

Interferons, Viral Vaccines – Conventional Vaccines- Killed and Attenuated, Modern Vaccines-recombinant, subunit, DNA, Peptide Vaccines Other Vaccines and Anti-viral Drugs. Diagnosis of viral infections. Modern approaches of virus control-Antisense RNA, siRNA and miRNA.

COURSE OUTCOME:

The students will be gaining knowledge on viral morphology, cultivation, pathogenesis and diagnosis and therapeutic measures for the viral diseases.

RECOMMENDED TEXT BOOKS:

1. Jawetz, E., Melnic, J.L. and Adelberg, E.A. (2000). Review of Medical Microbiology. 19th edn. Lange Medical Publications, U.S.A.
2. Timbury, M.C. (1986). Medical Virology. 9th edn. Churchill Livingstone, London.
3. Topley and Wilson. (1995). Principles of Bacteriology, Virology and Immunity. 9th edn. Edward Arnold, London.

REFERENCE BOOKS:

1. Dimmock N. J. and Primrose S. B. (1994). Introduction to Modern Virology. 6th edn. Blackwell Scientific Publishers.
2. Enquist., Krug., Recaniello and Skalka. (2000). Principles of Virology, Molecular Biology, Pathogenesis and control.
3. Morag C. and Timbury M.C. (1994). Medical Virology. 4th edn. Blackwell Scientific Publishers.
4. Conrat H.F., Kimball P.C. and Levy J.A. (1994). Virology. 3rd edn. Prentice Hall, Englewood Cliff, New Jersey.
5. Luria, S.E., Darnel, J.E., Jr., Baltimore, D. and Campbell, A. (1978). General Virology. 3rd Edn. John Wiley & Sons, New York

WEB RESOURCES

1. <http://www.virology-education.com/>
2. <http://www.clinicalvirology.org/>
3. <http://www.virology.net/>
4. <http://www.microbiologybook.org/mhunt/intro-vir.htm>
5. <http://www.vaccineinformation.org/>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II
ANALYTICAL TOOLS AND RESEARCH METHODOLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/2C/ARM

CREDITS: 4
LTP: 3 1 0

OBJECTIVES:

To enable students to learn

- Analytical Techniques in research
- Art of thesis writing

UNIT I

12 Hours

Principles of analytical instrumentation –Techniques and applications of Colorimetry and Spectrophotometry- Beer lamberts Law, Turbidimetry, UV-Vis Spectroscopy, Fourier Transform Infrared Spectroscopy, Fluorescence spectroscopy, NMR spectroscopy, Mass Spectroscopy, Circular Dichroism and Optical Rotatory Dispersion (ORD).

UNIT II

12 Hours

Centrifugation- Basic Principles, Instrumentation, types of Centrifuges and Methods of Centrifugation. Chromatography- Principles and types- Column, Thin layer, Paper, Adsorption, Gas liquid, Ion Exchange, Affinity, HPLC working and applications

UNIT III

12 Hours

Electrophoretic techniques- Native, SDS and 2D. Gel documentation system. PCR principle and applications. Detection and measurement of radioactivity –liquid and solid scintillation counters, Biosensors - Definition, Components of Biosensors, Types –Electrochemical, Enzyme, Environmental Biosensors and Application of Biosensors. Microbial identification systems (API).

UNIT IV

12 Hours

Objectives of Research- Problem identification and formulation, Approaches, design-exploratory descriptive and experimental, steps and Criteria of good research. Writing the research Report-Title, Authors, Address, Abstract, Keywords, Introduction, Review of literature, Materials and Methods, Results, Discussions, Summary, Acknowledgement and Bibliography, Research report- Tables, Figures and Formatting.

UNIT V

12 Hours

Importance of Scientific communication- Types and modes of scientific communications. Journals in Microbiology, Impact factor of Journals, When and Where to publish . Ethical issues related to publishing, Data fudging, Plagiarism and self plagiarism, software to detect plagiarism. Intellectual property rights- Types, patents, copy rights, trade marks, design rights, geographical indications – importance of IPR – patentable and non patentables – patenting life – legal protection of inventions – world intellectual property rights organization (WIPO). Comparison of IPR in India and foreign countries.

COURSE OUTCOME:

Students learn various analytical techniques for their research design, methodology and acquire the skill necessary to write a research thesis.

RECOMMENDED TEXT BOOKS

1. Wilson Keith and Walker John (2005) 6th Ed. Cambridge University Press, New York.
2. Rodney F. Boyer (2000) Modern Experimental Biochemistry 3rd edition ., Benjamin Cummings.
3. N. Gurumani. (2006). Research Methodology. MJP Publisher.

REFERENCE BOOKS

1. Anderson, J.B., Durston, H. and Poole, M. (1970). Thesis and Assignment Writing. Wiley Eastern Private Limited, New Delhi.
2. Webster, J.G. (2004). Bioinstrumentation. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
3. Pattabhi, V. and Gautham, N. (2002) Biophysics. Kluwer Academic Publishers, New York and Narosa Publishing House, Delhi
4. Day, R. 1998. How to write and publish a scientific paper, 5th edition. Orynx Press.
5. Nölting, B. (2006) Methods in modern biophysics. Second Edition. Springer, Germany.

WEB RESOURCES

1. <http://www.processresearchmethods.org/>
2. <http://www.scalelive.com/research-designs.html>.
3. www.ruf.rice.edu/~bioslabs/methods/.../spectrophotometer.htm
4. www.wou.edu/las/physci/ch462/Gel%20Electrophoresis.pdf
5. media.rsc.org/.../MCT5%20Chromatography.pdf

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II BIostatISTICS

TEACHING HOURS: 45
COURSE CODE: 16SP18/2E2/BST

CREDITS: 3
LTP: 2 1 0

OBJECTIVES:

To enable students to learn

- Data processing.
- Importance of Biostatistics in Research

COURSE CONTENT

UNIT I

10 Hours

Introduction to Bio-statistics, basic concepts, Biostatistics in Research. Data Collection and Analysis Types of data. Sampling – Designs and Types. Representation of data- Tabulation, Frequency distribution, Diagrams and Graphs.

UNIT II

10 Hours

Measures of Central tendency – Mean – Geometric and Harmonic, Median and Mode and percentiles, Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of variation. Standard error, skewness and kurtosis.

UNIT III

8 Hours

Probability: Random experiment, Events, Sample space, Mutually exclusive events, Independent and dependent events, Statement of addition and multiplication theorems of probability, Random variables (Discrete and continuous), Probability Distributions-Binomial, Poisson and Normal distributions and a few simple problems

UNIT IV

7 Hours

Correlation - Types, Methods, Coefficient of correlation. Regression - Equations, Regression lines. Testing of hypothesis -Null Hypothesis, Alternate hypothesis, Type I and Type II errors. Tests of Significance- Chi-square test, student t test, Z score.

UNIT V

10 Hours

Analysis of variance- ANOVA-one-way classification, Two-way classification, CRD, RBD, LSD, Duncan's multiple range test (DMR). Statistical package- Features of statistical software, SPSS for various applications in Biostatistical programme

COURSE OUTCOME:

Students acquire knowledge on basics of biostatistics, sampling and data analysis and interpretation, which helps them in research.

RECOMMENDED TEXT BOOKS

1. Veerbala Rastogi (2011). Fundamental of Biostatistics. Ane books Pvt.Ltd.
2. Gupta S.P.(2017). Statistical methods. Sultan Chand & Sons Publisher, New Delhi.
3. Snedecar G.W. and Cochram W.G. (1967). Statistical Methods. Oxford Press.

REFERENCE BOOKS

1. Campbell, R.C.(1969). Statistics for Biologists. Cambridge University Press.
2. Daniel, W.W. (1995). Biostatistics: A foundation for analysis in health sciences. 6th Edn. John Wiley & Sons, New York.
3. Zar, J.H. (2006). Biostatistical analysis. 4th Edn. Pearson education Inc. New Jersey
4. Norman T.J.Bailey. Statistical methods in biology, 3rd Ed.Cambridge University Press
5. Bernard Rosner Fundamentals of Biostatistics,5th Ed. Duxbury Thomson Learning USA

WEB RESOURCES

1. <http://davidmlane.com/hyperstat/>
2. <http://www.biostatistics.com/>
3. <http://www.biostat.ucla.edu/>
4. <http://www.onlinestatbook.com/rvls.html>
5. <http://www.biostat.harvard.edu/links/>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II
VERMICOMPOSTING AND MUSHROOM CULTIVATION
(For other department students)

TEACHING HOURS: 60
COURSE CODE: 16SP15/2E/VMC

CREDITS: 3
L T P: 3 1 0

OBJECTIVES:

To enable students to learn Cultivation of mushrooms and vermicomposting techniques

COURSE OUTLINE

UNIT I

10 Hours

Vermicomposting-Definition and scope of vermicomposting. Classification and characters of Earthworm species, requirements for vermicomposting- bedding materials, organic wastes and their sources.

UNIT II

10 Hours

Methods of vermicomposting- small scale (pit method) and large scale (windrow method)- methods of harvesting of earthworms. Application of Vermicompost in agriculture- Benefits to soil and plants.

UNIT III

10 Hours

Definition and General Characteristics – edible and poisonous mushrooms, Symptoms of mushroom poisoning, Nutritional aspects of edible mushrooms – fats, carbohydrates, proteins, vitamins and minerals – Medicinal value of Mushrooms.

UNIT IV

20 Hours

Mushroom cultivation- Culturing of mushrooms – Single spore method and Tissue culture method . Spawn preparation – Mother spawn and Planting spawn. Design of a mushroom farm (Composting yard and bulk pasteurization chamber).Steps in cultivation of button mushroom (*Agaricus bisporus*) - Composting methods (Long and Short) – Formulations of compost- Spawning – Definition and types. Production of crop – Shelf, Tray and Bag system. Casing operation. Harvesting of Mushrooms.

UNIT V

10 Hours

Management of mushroom pests (insects and nematodes). Diseases of mushroom – Bacterial (Bacterial blotch), Fungal (dry bubble and wet bubble) and Viral. Post harvest techniques (Long term and short term).

COURSE OUTCOME:

Students gain theoretical practical knowledge on mushroom cultivation
They learn to prepare organic fertilizer useful in agriculture.

RECOMMENDED TEXT BOOKS

1. Changs, T.,and Hayanes, W.A. (1978). Biology and Cultivation of Mushrooms. Academic Press, NewYork.
2. Singh and Singh. (2005). Modern Mushroom cultivation. Agrobiose publishers.
3. Dubey and Maheshwari. (2007), A textbook of biotechnology,S.Chand and company

REFERENCE BOOKS

1. Kannaiyan. (1999). Cultivation of Edible Mushrooms. TNAU Publication.
2. Ismail, S.A. (1997). Vermicology-The Biology of Earthworm. Orient longman.
3. Zadrazil, F and Grabbe, K. (1983). Edible Mushroom, Biotechnology 3:145 -187.
4. Garcha,H.S (1984). A Manual of Mushroom growing. PAU Publication.
5. Singh .H. (1991). Mushroom-The art of Cultivation. Sterling Publishers.

WEB RESOURCES

- 1.http://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
- 2.<http://www.fao.org/>
- 3.<http://www.nhb.gov.in/>
- 4.www.mushroom-directory.com/
- 5.www.fungi.fun.org/mushword/oyster.m/

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER II
GENERAL MICROBIOLOGY AND MICROBIAL PHYSIOLOGY (PRACTICAL)

TEACHING HOURS: 60

CREDITS: 4

COURSE CODE: 16SP15/2C/PR1

L T P: 0 0 4

OBJECTIVE: To train the students in basics of General Microbiology

COURSE CONTENT

1. Cleaning of glasswares.
2. Sterilization – Physical agents- Moist heat, Dry heat, Filtration.
3. Sterilization- Chemical agents–
 - a) Phenol Coefficient method
 - b) Agar Plate Sensitivity method
4. Quality Control of Sterilization – Physical, Chemical – Indicator strips. Biological – spore strips.
5. Calibration of Micrometer and measurement of Microbial size.
6. Observation of Algae by Wet Mount.
7. Demonstration of motility of bacteria by Hanging Drop Method.
8. Staining methods – Gram staining, Acid fast staining, Negative staining, Metachromatic granule staining and Spore staining.
9. Preparation of Solid, Liquid and Semi-solid media.
10. Pure culture technique- Streak Plate, Pour Plate and Spread Plate techniques.
11. Demonstrations of Fungi by LPCB mount and Slide culture technique.
12. Anaerobic Culture of bacteria.
13. Measurement of bacterial growth- by direct count and turbidity method.
14. Effect of temperature on Microbial growth and determination of thermal death point.
15. Effect of heavy metals on bacteria- Oligodynamic action.
16. Effect of pH on microorganisms.
17. Effect of UV radiation on microorganisms.
18. Chemotherapeutic agents- Kirby-Bauer method and Synergistic effect of drug combination.

COURSE OUTCOME:

Students learn the basic techniques in Microbiology and handling of microorganisms.

QUESTION PAPER PATTERN

Time : 9 Hours (3 hours, 3 days)

Max. Marks: 60

Major- 25 marks

Minor-15 marks

Spotters- 5 x 2 =10 marks

Record – 5 marks

Viva- voce- 5 marks

SEMESTER II
MEDICAL MICROBIOLOGY (PRACTICAL)

TEACHING HOURS: 75
COURSECODE: 16SP15/2C/PR2

CREDITS: 4
L T P: 0 0 5

OBJECTIVES

1. To Learn the Concepts of Sample Collection and Diagnostics.
2. To have hands on training in the field of Bacteriology, Virology, Mycology and Parasitology.

COURSE CONTENT

BACTERIOLOGY

1. Collection and transport of clinical specimens.
2. Direct examinations – wet films for faeces, staining for Pus, Sputum, Throat / Ear/Nasal /Wound swabs.
3. Differential and Special Staining methods- AFB, Metachromatic, Capsular-positive, Flagella.
4. Cultivation and Isolation methods – Basal, Differential, Enriched, Selective and Special media for the Pathogenic Bacteria.
5. Isolation and identification biochemical identification test for the respective Bacteria- *Staphylococcus*, *Streptococci*, *E.coli*, *Klebsiella*, *Pseudomonas*, *Proteus*, *Salmonella*, *Shigella*.
6. Antibiotic Sensitivity Tests — Disc Diffusion - Stokes and Kirby Bauer methods.
7. MBC and MIC techniques – Agar and broth dilution methods.
8. Beta-Lactamase activity- Acidometric method, Iodometric method.

VIROLOGY

9. Isolation and characterization of Bacteriophage from natural resources.
10. Phage titration.
11. Inoculation of Virus into Chick Embryo – CAM and yolk Sac.
12. Observation of Viral inclusions and CPE stained smears.
13. Detection of viral infections by ELISA.

MYCOLOGY

14. KOH observation of Skin, Hair and Nail scrapings for fungi, Woods Lamp Examination.
15. Preparation of fungal media- SDA/ Corn Meal Agar- Cultural and Microscopic characteristics of *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Candida*, Dermatophytes, *Fusarium*, *Curvularia*.
16. Slide Culture and LPCB mount, Chlamydospore formation on CMA.
17. Detection of *Candida albicans*- Germ tube test. Sugar Assimilation and Fermentation.

PARASITOLOGY

18. Examination of Parasites in Clinical specimens – ova / cysts in faeces - Direct and Concentration methods –Formal Ether and Zinc sulphate methods, Saturated Salt Solution Method.
19. Blood smear examination of Malarial Parasites –Leishman’s stain.

COURSE OUTCOME:

Enable the students to acquire practical knowledge in clinical sample collection, identification and isolation of pathogenic microorganisms.

QUESTION PAPER PATTERN

Time: 9 Hours (3 hours, 3 days)

Max. Marks: 60

Major- 25 marks
Minor-15 marks
Spotters- 5 x 2 =10 marks
Record – 5 marks
Viva- voce- 5 marks

SEMESTER- III IMMUNOLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/3C/ILY

CREDITS: 4
LTP: 3 1 0

OBJECTIVES

This paper focuses on

- Basic Immunology, Human defense mechanisms against infections.
- Applications of Immunological Techniques.
- Knowledge in Immune Response, autoimmune diseases and Vaccines.

COURSE CONTENT:

UNIT I:

10hrs

Introduction - History, Scope of Immunology and Recent development. Cells of Immune system. Hematopoiesis. Lymphoid Organs. T cell receptors, B cell receptors and other specific receptors. Inflammation. Lymphocyte trafficking.

UNIT II:

15hrs

Antigens and Antibodies – Antigens - Factors Influencing Antigenicity, Epitopes, Haptens, Superantigen, Mitogen, Adjuvants. Sequestered antigens. Antibodies - Structure, Types and Functions. Theories of antibody production and class switching. Production of monoclonal and polyclonal antibodies. Antigen Antibody Interactions - Agglutination and Precipitation reactions. Principles and Applications of RIA, ELISA, ELISPOT, Immunofluorescence, Nephelometry, FACS analysis.

UNIT III:

15 Hours

Infection and Immunity. Introduction and Classification of immunity - Innate and Acquired. Factors involved in Immunity. Complement. Host Parasite Relationship. – Immune response against bacterial, viral, fungal and helminthic infections. Evasion of immune defense. MHC - Definition, Structure, Types, Function and MHC restriction. HLA typing and its application in organ transplantation.

UNIT IV:

10 Hours

Immunoprophylaxis. Active and Passive Immunization. Latest Immunization schedule. Vaccines – Introduction and types. Recent vaccines. Hypersensitivity– Introduction, types and treatment. Skin test. Immunosuppressive drugs.

UNIT V:

10 Hours

Autoimmune Diseases. Types - cell Mediated, organ specific immune inflammatory, Humoral Mediated. Treatment of Autoimmune diseases. Immunodeficiency disorders. Immunotolerance and anergy. Oncoimmunology - An overview. Immunotherapy

COURSE OUTCOME:

Students gain insight to the basic concepts of host immune response to various infections and acquire knowledge on transplantation and cancer immunology.

RECOMMENDED TEXT BOOKS:

1. Kuby, J.(2006). Immunology 2nd edn. H.W.Freeman and company. New York.
2. Janeway C, Travers P, Walport M, Sholmchik M.(2004). Immunobiology 6th edn Gerald Science
3. Roitt R.I.M(2001). Essential Immunology.10th edn. Blackwell Scientific Publishers.

REFERENCES:

1. Stites D.P.,Abba I.Terr, Parslow T.G.(1997). Medical Immunology. 9th edn, Prentice-Hall Inc.
2. Tizard, R.I.(2000) Immunology- An Introduction. 4thedn. Saunders College Publishing, Philadelphia.
3. Nairn, R., & Helbert, M.(2006). Immunology for Medical Students. 2nd edn. Mosby International limited.
4. Humphrey, J.H. and White, R.G. (1995). Immunology for Students of Medicine, 5th edn. ELBS, London.
5. Ananthanarayanan, R, & Panicker,C.K.J. (2013). Textbook of Microbiology. Orient Longman.

WEBSITES:

1. www.frontiersin.org
2. www.immunologylink.com
3. <http://www.cell.com/trends/immunology/>
4. <https://immunologynotes.com>
5. www.nlm.nih.gov

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER- III
ENVIRONMENTAL MICROBIOLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/3C/EMY

CREDITS: 4
LTP: 3 1 0

OBJECTIVE:

To enable students to

- Gain knowledge on Air, Water, Soil and Agricultural Microbiology
- Learn aspects of biofertilizer production.

COURSE CONTENT

UNIT I

10 Hours

Microbiology of Air- Droplet Nuclei, Aerosols, Air borne transmission of Microbes. Assessment of air quality settlement under gravity, filtration technique, centrifugation, Impingement in solid and liquid, air Sanitation and air borne diseases – Bacterial, fungal, viral and protozoan.

UNIT II

15 Hours

Microbiology of potable water – Municipal water treatment. Sewage treatment process – Primary treatment process-screening and straining, grit removal, sedimentation, flotation, Coagulation and Flocculation, Secondary treatment process – Aerobic and Anaerobic, and tertiary treatment- Disinfection. Disposal of sewage sludge. Water borne Diseases. Microbiological examination of water quality – Multiple tube test, Membrane filtration technique and BOD. Water Pollution.

UNIT III

10 Hours

Utilization of Solid Waste as Food, Feed and Fuel- Composting, Vermicomposting, Biogas production, Single Cell Proteins, Biodegradation of Xenobiotics - Recalcitrant Halocarbons, Recalcitrant, TNTs, PCBs, Synthetic polymers, Leather and Paper, Saccharification and pyrolysis. Pollution control bodies and Environmental laws in India.

UNIT IV

10 Hours

Distribution of Microorganisms in Soil, Rhizosphere effect, Rhizosphere ratio, Rhizosphere, Spermosphere, Phyllosphere. Biofertilizer – Uses and Production of *Rhizobium sp.*, *Azotobacter sp.*, *Azospirillum sp.* *Cyanobacteria* and Phosphate solublisers. Distribution and significance of Extremophiles.

UNIT V

15 Hours

Plant microbial disease-Causative agents, disease cycle and control of Rust, Red-rot in sugarcane, Citrus Canker, Soft rot in carrot, Crown gall disease. Bunchy top, angular leaf spot of cotton and Damping off of tobacco. Biopesticides – Fungal – Bacterial, and Viral.

COURSE OUTCOME:

Students learn the various aspects of air, water and soil microorganisms and their control.

RECOMMENDED TEXT BOOKS

1. Atlas R. M and Bartha R. (1992). Microbial Ecology Fundamentals and Applications. 3rd edn Benjamin & Cummings Redwood City .CA
2. Agrios,G N (1978). Plant pathology 2nd edn Academic press, NewYork.
3. SubbaRao.N.S. Biofertilizers in Agriculture and Forestry, 3rd edn. Oxford and IBH Publishing co. Pvt Ltd.

REFERENCE BOOKS

1. Rheinheimer .G (1980). Aquatic Microbiology. 2nd edn. John Wiley And Son, London.
2. Mitchell.R.(1974). Introduction to Environmental Microbiology. Prentice- Hall Inc. Englewood Chiffs, New Jersey.
3. Rao, S.N.S., (1995) .Soil Microorganisms and Plant Growth. Oxford.
4. Daniel, C.J. (1996). Environmental Aspects of Microbiology, Bright Sun Publications.
5. Lynch, J.M. and Poole, N.J. (1979) Microbial Ecology: A. Conceptual Approach. Blackwell Scientific Publications, London.

WEB RESOURCES

1. www.oisat.org/pests/diseases.html
2. www.britannica.com/science/plantdisease
3. www.environmentshumail.blogspot.in/
4. www.agritech.tnau.ac.in
5. <https://serc.carleton.edu/microbelife/index.html>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER- III
INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

TEACHING HOURS: 60
COURSE CODE: 16SP18/3E3/INP

CREDITS: 3
LTP 3 1 0

OBJECTIVES

To enable students to gain knowledge

- On fermentation process.
- Industrial production of Microbial products.
- Principles of pharmaceutical Microbiology.

COURSE CONTENT

UNIT I

10 hours

Introduction- Scope of Industrial Microbiology and Fermentation technology. Study of Industrially important Microorganisms (GRAS) and their preservation. Criteria for selection and strategies for Strain Improvement, maintenance and containment of recombinant organisms.

UNIT II

10 hours

Fermentation process- batch and continuous culture kinetics; effect of environment, temperature, pH, nutrient concentration, monitoring microbial growth in culture; cell number, direct and indirect methods. Continuous culture, Aeration and agitation- concepts of Newtonian and Non-Newtonian fluids, plastic fluids, apparent viscosities; antifoam agents. Inoculum development – Yeast, Bacteria and Mycelium. Scale up process.

UNIT III

10 hours

Basic features, design, components of a typical fermentor, different types of fermentor. Instrumentation and control of fermentation. Fermentation media – formulation strategies- sources of carbon and nitrogen, vitamins and minerals; role of buffers, precursors, inducer and inhibitors. Industrial sterilization – sterilization of media, air and equipment - Batch and continuous sterilization.

UNIT IV

15 hours

Down-Stream Processing- Choice of recovery process, biomass separation from fermentation media- Precipitation, filtration, centrifugation, Cell disruption for intracellular products, solvent extraction and recovery, chromatography, membrane processes, drying, crystallization and whole broth processing. Industrial production of aminoacids, enzymes- amylase, Protease and pectinase, alcoholic beverages – Wine and Beer. Industrial effluent treatment.

UNIT V

15hours

Pharmaceutical Microbiology- Production of vitamins, antibiotics, steroids and Vaccines, interferons and interleukins and therapeutic enzymes. Sterility testing of pharmaceutical products and quality assurance- GMP, QC of raw materials and Microbiological assays.

Recent trends of biotechnological and microbiological patents. Government regulations for microbial products.

COURSE OUTCOME:

Students gain knowledge on fermentors, Industrial production and fermentation process.

RECOMMENDED TEXT BOOKS

1. Stanbury, P. F., Whitaker, A., and Hall, S.T. (1995). Principles of Fermentation Technology 2nd edn. Pergamon press.
2. Reed, G. (1982) Industrial Microbiology. Mac Millan Publishers Ltd., Wisconsin.
3. Patel A.H. Industrial Microbiology. Mac Millan India Pvt Ltd.
4. Hugo, W.B and Russell, A.D.(2003). Pharmaceutical Microbiology. Blackwell Science, Oxford, UK.

REFERENCE BOOKS

1. Prescott, H., and Dunn, Industrial Microbiology, 4th edn. CBS publishers.
2. Casida, J. E. (1968) Industrial Microbiology. Wily Eastern.
3. Demain, A.L. and Solomon, N.A. (1986) Manual of Industrial Microbiology and Biotechnology. American Society for Microbiology, Washington
4. Pepler, H.J. and Pearl Man, D. (1979). Fermentation Technology, Vol 1 & 2, Academic Press, London.
5. Baumberg, S., Hunter, I.S. and Rhodes, P.M. (ed). (1989) Microbial Products - New Approaches. Cambridge University Press, Cambridge, UK.

WEB RESOURCES:

1. <http://www.yourarticlelibrary.com/micro-biology/bioreactors-fermenters-function-designs-and-types/33628/>.
2. <http://www.slideshare.net/saileegurav/downstream-processing-30441992>
3. <http://www.srmuniv.ac.in/sites/default/files/files/PENCILLIN.pdf>
4. <http://microbiollogy.blogspot.com/2014/01/scope-of-biotechnology-industrial.html>.
5. https://en.wikipedia.org/wiki/Alcoholic_beverage.

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

**NON MAJOR ELECTIVE
SEMESTER III
GARDENING AND LANDSCAPING**

(For other Department Students)

TEACHING HOURS: 60
COURSE CODE: 16SP18/3E/GLP

CREDITS: 3
LTP: 3 1 0

OBJECTIVE

To enable students

- to gain knowledge on basic aspects of horticulture.
- to learn about ornamental and aesthetic gardening.

COURSE CONTENT

UNIT I

10 Hours

Fundamentals of ornamental horticulture – principles of gardening. Methods of plant propagation- seed, cutting, grafting and layering -advantages and disadvantages.

UNIT II

15 Hours

History of gardening in India-Styles of garden- components of garden Methods of planting of flowerbed, hedges, topiary, water garden, paved garden - maintenance.

UNIT III

15 Hours

Lawn making- types of grasses- methods of planting–maintenance. Nursery management. operations and maintenance of a nursery, media and containers, Nursery practices for roses.

UNIT IV

10 Hours

Important plant species in gardening. Definition, Classification, Planting and maintenance of annuals- trees, shrubs, climbers and creepers.

UNIT V

10 Hours

Basic concepts and art principles of landscaping- Indoor Landscaping –Requirements for Indoor gardening, Gardening in tubs and hanging baskets- Residential landscape design.

COURSE OUTCOME

Students learn the art of gardening and aesthetics of landscaping.

RECOMMENDED TEXT BOOKS

1. Sheela, V.L. (2011). Horticulture. MJP Publishers.
2. Randhawa and Amitabha (1998). Floriculture in India. Allied Publishers.
3. Alan. T (1985). Green house gardener. Marshall Cavendish Books.

REFERENCE BOOKS

1. William Flemer. (1972). Nature's guide to successful gardening and landscaping. Crowell publications.
2. Reilly, A. (1990). Home Landscaper. Home Planners.
3. Black and Decker. (1993). Landscape design and construction. Creative Pub Intl
4. Taylor, P. (2006). Garden. Oxford University Press.
5. Kumar, N. (1989). Introduction to Horticulture. Rajalakshmi Publications

WEB RESOURCES

1. www.garden.org/
2. www.iloveplants.com/
3. [www.extension.iastate.edu/store /](http://www.extension.iastate.edu/store/)
4. <http://edis.ifas.ufl.edu/>
5. www.oliviassolutions.com/

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

III SEMESTER
SOFT SKILL
COMPUTING SKILLS FOR COMPETITIVE EXAMINATIONS

TEACHING HOURS: 30

CREDITS: 2

COURSE CODE : 16SP18/3S/CSC

L T P: 1 1 0

OBJECTIVES:

This paper provides knowledge on

- Basic mathematics required for competitive exams.
- Logical reasoning and quantitative aptitude.

CONTENT

Unit I

10 Hours

Basic Mathematics – BODMAS. Arithmetic rules – Commutativity of addition and multiplication, Arithmetic and Geometric Progression. Factorization - HCF. LCM. Fractions – Proper, Improper, Mixed and Equivalent fractions. Area and perimeter. Basic Algebra.

Unit II

10 Hours

Calculation of Mean and Average. Ratio and proportion. Direct and inverse proportions. Exponents and power. Square roots and cube roots. Linear equations. Weights and Measures. Metric conversions. Percentage. Profit and Loss.

Unit III

10 Hours

Problem solving in relation with logical reasoning, day and date, hour and seconds, time and direction, velocity and direction of Train. Missing numbers. Series of Alphabets. Alphabet and Number codes. Interpretation from Union and Intersect. Data handling - Pie charts and graphs.

COURSE OUTCOME

Students get enriched with the key concepts that help them to take up various competitive examinations.

RECOMMENDED TEXT BOOKS

1. Dr. Surender Singh. UGC NET Paper I. Tata McGraw Hill Education.
2. S. Chand .Quantitative aptitude for competitive examinations. S. Chand publications 7th edition.

REFERENCES BOOKS

1. Timothy Gowers .The Princeton companion to Mathematics. First edition. Princeton University Press.
2. Dr. R. S Agarwal. A Modern Approach to verbal and Non verbal Reasoning. S. Chand publications.

WEB RESOURCES

1. <http://www.csirhrdg.res.in/>.
2. <http://www.math.com/>.

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 50

Section A- Multiple choice questions

50X1 mark = 50 marks

SEMESTER- IV

MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY

TEACHING HOURS: 60 hrs

CREDITS: 4

COURSE CODE: 16SP18/4C/MBY

LTP: 3 1 0

OBJECTIVES

To enable students to understand

- The Structure and Functions of Macromolecules.
- Principles and applications of Gene cloning.

COURSE CONTENT

UNIT I

10 Hours

Proteins: structural classification of proteins, primary, secondary, tertiary, quaternary structures of proteins. Ramchandran plot. Lipid Composition of Microorganisms - common types of membrane lipids: Phospholipids, Cholesterol, Glycolipids, Archaeal Lipids, ganglioside, cerebroside, sphingomyelin, triacylglycerols, arachidonic acid, properties. Plasmids - Nomenclature, General properties of plasmids- replication, copy number, host range and Incompatibility. Structure and uses of natural plasmids. Plasmids encoding metal resistance and plasmids for degradation of recalcitrant compounds (PAH, PCB).

UNIT II

10 Hours

Gene cloning. Isolation of DNA - Bacteria, Phage, Plasmid, Plant and animal DNA. DNA modifying enzymes and their applications: DNA polymerases, Terminal deoxynucleotidyl transferase, kinases and phosphatases, topoisomerases methylases, reverse transcriptases and DNA ligases. Restriction endonucleases, Use of linkers and adaptors.. Cloning vectors – Plasmids pBR322, pUC vectors. Shuttle vectors. λ Phages, M13 phage. Cosmids, Phagemids. Artificial chromosomes -YAC and BAC, Baculovirus based vectors.

UNIT III

10 Hours

Transformation. Artificial techniques - Calcium chloride induction, electroporation, microinjection, biolistic method liposome and viral-mediated delivery, *Agrobacterium* - mediated delivery. Methods of selection of recombinants- *E.coli* and yeast genomic and cDNA libraries - construction and screening.

UNIT IV

15 Hours

Molecular techniques - colony and plaque hybridization probes. Gene probes - Reporter Genes. Southern, Northern and Western blot, Dot and Slot blotting. PCR- Hot start, nested, RT- PCR, Real time, Multiplex PCR. DNA finger printing, RFLP and RAPD

UNIT V

15 Hours

An overview of applications of Genetic Engineering – Production of recombinant protein in prokaryotes and eukaryotic cells. Agriculture- transgenic plants, Antisense technology, Medicine- gene therapy for inherited diseases, recombinant pharmaceuticals- Vaccines, growth hormones, Insulin, Blood products. DNA analysis in forensic science.

COURSE OUTCOME:

Students learn techniques and applications of molecular biology helpful for betterment of human life and applications of GMO in agriculture.

RECOMMENDED TEXT BOOKS

1. Brown T. A. (1995). Gene Cloning. Chapman and Hall.
2. Russell P.J, (2010). Genetics-a molecular approach 3rd edn, Benjamin Cummings.
3. Bernard R.Glick and Jack J. Pasternak (1998).Molecular Biotechnology. ASM Press, Washington, D.C.

REFERENCE BOOKS

1. Nelson, D.L and Cox, M.M. (2008). Lehninger Principles of Biochemistry, 5th edn. W.H. Freeman and Company.
2. Watson, J. D., Gilman, M., Witkowseski,J., (1992). Recombinant DNA, 2nd edn, Scientific Books.
3. Old R. W. and Primrose S. B. (1989). Principles of Gene Manipulation. 4th edn. Black well Scientific Publications, London.
4. Freifelder, D. (1995) Molecular Biology. Narosa Publishing House, New Delhi.
5. Glover, D.M. (1984) Gene Cloning: The Mechanism of DNA Manipulation. Chapman and Hall, London.

WEB RESOURCES

1. <http://www.cellbio.com/>.
2. <http://www.rpi.edu/dept/chem-eng/Biotech-Environ/Projects00/rdna/rdna.html>.
3. <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/R/RecombinantDNA.html>.
4. http://biology.kenyon.edu/courses/biol114/Chap08/Chapter_08a.html.
5. <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/R/RecombinantDNA.html>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

MICROBIAL GENETICS

TEACHING HOURS: 60

COURSE CODE: 16SP18/4E4/MIG

CREDITS: 3

L T P: 3 1 0

OBJECTIVES:

To promote interest among students about

- The structure and importance of Genetic material.
- Gene transfer mechanisms and their significance.

COURSE CONTENT

UNIT I

15 Hours

Organization of genetic material in prokaryotes and eukaryotes, Concept of gene, genome, genome size, C-value, and C-value paradox. Composition and Structure of DNA - super helicity of DNA, linking number, topological properties and role of topoisomerase. Structure of A-DNA, B-DNA and Z-DNA. Replication in Prokaryotes – Models of DNA replication – Replisome, unidirectional and bidirectional replication, Rolling circle replication. Enzymes involved in replication. Replication in Eukaryotes. Repair of DNA damage- mismatch repair, photo reactivation, excision repair, SOS, recombination repair.

UNIT II

10 Hours

Structural features of RNA (rRNA, tRNA, mRNA) and polycistronic and monocistronic RNA. Transcription, Post transcriptional modification, maturation and splicing of RNA transcripts and catalytic RNA. Genetic code and wobble hypothesis. Protein synthesis and Inhibitors of protein synthesis. Post translational modification. An overview of protein sorting and transport.

UNIT III

10 Hours

Mutation, mutants and mutagenesis -Spontaneous and induced mutation, different types of mutants, molecular basis of mutagenesis, site specific, random and Tn mutagenesis. Transition, transversion and tautomeric shifts. Point mutations and consequences-silent mutation, missense mutation, nonsense mutation. Mutagenic chemicals and radiations and their mechanisms of actions – EMS, MMS, acridines, NTG, Hydroxylamines -Mutagenic radiations -UV and gamma rays, Importance of mutation. Mutation toxicity testing

UNIT IV

10 Hours

Transcriptional regulation in prokaryotes (inducible and repressor system, positive and negative regulation) Operon concept-lac and trp operons. Viral and phage genetics-Genomic organization and genetic significance of M13, SV 40, HepB, H1-N1, Retroviruses. Lytic and lysogenic cycles of lambda phage. Fungal genetics-Yeast (*Saccharomyces cerevisiae*), *Neurospora* genomes as genetic model systems. Britton and Davidson's model of eukaryotic gene regulation.

UNIT V

15 Hours

Gene Transfer Mechanisms – Conjugation-Discovery, mechanism, Hfr and F' strains, Interrupted mating technique and time of entry mapping. Transduction-Generalized transduction, specialized transduction, LFT & HFT lysates, Mapping by recombination and co-transduction of markers, Transformation-Discovery, mechanism of natural competence. and Transposition-Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition and Mu transposon.

COURSE OUTCOME:

Enable the students to learn the basics of genome organization, functions, mutations and gene transfer mechanisms.

RECOMMENDED TEXT BOOKS

1. Friedfelder D. (1990). Microbial Genetics, 2nd edn, Navosa publishing house, India
2. Gardner E.J and Snusted D.P (1991). Principles of Genetics, 8th edition, John Wiley and sons Inc.
3. Peter Paoella, Introduction to Molecular biology, International edition, McGraw-Hill.

REFERENCE BOOKS

1. Hays W. (1985). The Genetics of Bacteria and Viruses.2nd edn. Blackwell Scientific Publishers, Oxford.
2. Synder L and Chapness W. (1997).Molecular genetics of bacteria.ASM Press Washington-D.C.
3. Russell P.J. (2010). Genetics in Molecular approach, 3rd edn Pearson New International Edn.
4. Strachan, T. and Read, A. P. (1996). Human Molecular Genetics, Bios Scientific Publishers, U.K.
5. Benjamin Lewin. (1997) .Genes VII. Oxford University Press, London, UK.

WEB RESOURCES

1. <http://www.scidsu.edu/smalog/microbialgenetics>
2. <http://science.jrank.org/pages/4303/microbialgenetics.htm>
3. <http://www.nature.com/>
4. <http://www.garlandscience.com/>
5. <http://www.highered.meducation.com/sites/>

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER- IV BIOINFORMATICS

TEACHING HOURS: 45
COURSE CODE: 16SP18/4E5/BIF

CREDITS: 3
L T P: 2 1 0

OBJECTIVE

To enable students to

- Learn basic concepts of Bioinformatics.
- Gain Knowledge about biological databases.

COURSE CONTENT

UNIT I

9 Hours

Basics of Internet- Internet Protocol (TCP/IP), Worldwide web (WWW), File transfer protocol (FTP), HTML, HTTP, Telnet and URL. Biological Data Base- Nucleic acid sequence databases- GenBank, EMBL, DDBJ, Protein sequence databases- SWISS-PROT, TrEMBL, PIR and Uniprot. structure database- PDB, Genome Databases at NCBI, EBI, TIGR, SANGER.

UNIT II

9 Hours

Computer tools for Sequence Analysis. Similarity vs homology. Similarity searching- Dot plot, Dynamic programming. Scoring matrices- PAM and BLOSUM. Pair wise alignments- BLAST and FASTA. Multiple alignment- CLUSTAL and T-coffee. Gene prediction methods and tools.

UNIT III

9 Hours

Detection of Conserved Protein Motifs. Protein structure prediction. Phylogenetic analysis- rooted vs unrooted tree. NJ and Maximum Parsimony, bootstrapping. Basics of drug designing- Lipinski's rule of five, ligand and target selection, drug designing tools.

UNIT IV

9 Hours

Whole genome analysis – Preparation of ordered Cosmid Libraries, Bacterial Artificial Chromosome Libraries, and Shot Gun Libraries. Conventional (Sanger's and Gilbert) automated sequencing and Modern DNA Sequencing Methods.

UNIT V

9 Hours

DNA and Protein micro array – Principles and applications. Analysis of single nucleotide polymorphism using DNA chips. Proteome analysis- two dimensional separation of total cellular proteins by mass spectroscopy. Applications of Bioinformatics- pharmaceutical industry, immunology, agriculture, forestry, cheminformatics in biology, geoinformatics.

COURSE OUTCOME:

Students learn data mining, analyse gene and protein structure and acquire basic knowledge on phylogenetic analysis and drug designing.

RECOMMENDED TEXT BOOKS

1. Attwood, T.K. and Parry-Smith, D.J. (1999). Introduction to Bioinformatics. Addison Wesley Longman Limited, England.
2. Sharma, Munjal, Shankar, (2008). A text book of Bioinformatics-, First South Indian Edition, Rastogi Publications.
3. Jin Xiong, (2011). Essential bioinformatics, First south Indian Edition, Cambridge University Press.

REFERENCE BOOKS

1. Paul G. Higgs and Teresa K. Attwood. (2005). Bioinformatics and Molecular Evolution. Blackwell publishing, First Indian Reprint.
2. Abhilash, (2010). Bioinformatics. M. B Publishers and distributors Pvt Ltd. First Edition
3. P.K.Gupta, (2008). Biotechnology and Genomics, Rastogi Publications.
4. Yi-Ping Phoebe Chen, (2007). Bioinformatics Technologies. Springer Publications.
5. Harshawardhan P.Bal, (2006). Bioinformatics Principles and Applications, Tata McGraw-Hill Publishing Company Limited.

WEB RESOURCES

1. <http://ncbi.nlm.nih.gov/pubmed>
2. <http://bioinformaticsweb.net/>
3. <http://www.ebi.ac.uk/>
4. www.bioinformatics.org/
5. <http://www.ii.uib.no/~inge/list.html>.

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 100

Section A- Answer all 10 questions (10 questions will be given covering all Five Units)
10 x 2 marks = 20 marks

Section B- Answer any 5 questions (8 questions will be given covering all Five Units)
5 x 8 marks = 40 marks

Section C- Answer any 2 questions (4 questions covering any Four units will be given)
2 x 20 marks = 40 marks

SEMESTER- IV

IMMUNOLOGY AND MOLECULAR BIOLOGY (PRACTICAL)

TEACHING HOURS: 60

CREDITS: 4

COURSE CODE: 16SP18/4C/PR3

LTP: 0 0 4

OBJECTIVE

To enable students to

- Have hands on training in Molecular techniques.
- Learn the aspects of rDNA technology.

COURSE CONTENT

1. Blood collection, Serum and Plasma separation.
2. RBC, WBC and Differential Cell Counts.
3. Separation of Lymphocytes from Peripheral Blood by Density Gradient Centrifugation.
4. Purification of Antibodies by Ammonium Sulfate Precipitation.
5. Bacterial agglutination.
6. Latex agglutination – RF, ASO, CRP.
7. WIDAL.
8. RPR.
9. Haemagglutination – TPHA, ABO blood grouping.
10. Precipitation – estimation of antigen concentration by SRID, Double Immunodiffusion-pattern and specificity and Immunoelectrophoresis. Staining of Precipitation lines.
11. Serum Electrophoresis.
12. Coomb's testing.
13. Estimation of DNA by diphenylamine method.
14. Determination of T_m value of DNA.
15. Isolation of Plasmid DNA.
16. Isolation of Chromosomal DNA.
17. Estimation of RNA
18. Restriction Digestion of DNA & Ligation of Digested DNA fragments.
19. Transformation.
20. Replica Plate Technique.
21. Separation of Proteins by Column Chromatography.
22. Separation of Proteins by SDS PAGE.
23. Western blot.
24. PCR.

COURSE OUTCOME

Students gain in depth knowledge about various immunological and molecular techniques that favours their placement in research and development departments and laboratories.

TEMPLATE OF THE QUESTION PAPER - 60marks (9 hours, 3 days)

Major	-	25 marks
Minor	-	15 marks
Spotters	-	10 marks
Record	-	5 marks
Viva-voce	-	5 marks

SEMESTER- IV
ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)

TEACHING HOURS: 60
COURSE CODE: 16SP18/4C/PR4

CREDITS: 4
LTP: 0 0 4

OBJECTIVE

To enable students to

- Hands on training in quality analysis of Water and Air Microbiology.
- Gain knowledge in isolation of bacterial bio-fertilizers.

COURSE CONTENT

1. Water analysis-Multiple Tube Test:
 - a. Presumptive test.
 - b. Confirmed test.
 - c. Completed test
2. Membrane filtration technique.
3. Estimation of BOD of the sewage sample.
4. Enumeration of bacteria and fungi from air – Settle plate technique.
5. Enumeration of bacteria and fungi from air – Air sampler.
6. Isolation of *Rhizobium Sp.* from nodules.
7. Isolation of *Azotobacter Sp.* from soil.
8. Isolation of *Azospirillum Sp* from soil
9. Isolation of *Frankia Sp* from soil.
10. Isolation of Phosphate solubilisers from soil.
11. Preparation of Biofertilizer and testing the efficiency of prepared biofertilizer
12. R:S ratio of soil.
13. Estimation of soil enzymes- urease and phosphatase.
14. Study of phylloplane microflora by leaf impression method.
15. Isolation of cellulose degrading bacteria.
16. Isolation of phenol degrading organisms from soil.
17. Isolation of pesticide degrading bacteria from soil.
18. Preparation of a vermicompost.

COURSE OUTCOME

Students learn various methods of environmental sampling, preparation of biofertilizers and biodegradation techniques.

TEMPLATE OF THE QUESTION PAPER - 60marks (9 hours, 3 days)

Major- 25 marks
Minor-15 marks
Spotters- 5 x 2 =10 marks
Record – 5 marks
Viva- voce- 5 marks

SEMESTER- IV
FOOD AND INDUSTRIAL MICROBIOLOGY (PRACTICAL)

TEACHING HOURS: 60
COURSE CODE: 16SP18/4C/PR5

CREDITS: 4
LTP: 0 0 4

OBJECTIVE

Hands on training in quality analysis of food

- Quality analysis of milk and dairy products
- Preparation of industrially important products.

COURSE CONTENT

1. Isolation of Bacterial and fungal pathogens from spoiled food.
2. Direct microscopic examination and standard plate count of milk.
3. Isolation of lactic acid bacteria from probiotic foods.
4. Methylene blue reductase test.
5. Phosphatase test
6. Resazurin test.
7. Sterility testing of injectables.
8. Isolation of antibiotic producer by crowded plate technique and bioassay of penicillin.
9. Wine production.
10. Production of Beer from cereals.
11. Preparation of Sauerkraut.
12. Cheese production.
13. Separation of amino acids by ion exchange chromatography.
14. Comparison of amylase activity of *Aspergillus* culture grown in liquid medium and on solid substrate.
15. Immobilization of enzyme in calcium alginate beads and qualitative and quantitative estimation of activity.
16. Visit to Food / Beverage Industry.

COURSE OUTCOME

Students gain practical knowledge on quality control methods of milk and dairy products, food sampling and enzyme analysis.

TEMPLATE OF THE QUESTION PAPER - 60marks (9 hours, 3 days)

Major- 25 marks

Minor-15 marks

Spotters- 5 x 2 =10 marks

Record – 5 marks

Viva- voce- 5 marks

**IV SEMESTER
SOFT SKILL**

ESSENTIALS OF ENTREPRENEURSHIP

TEACHING HOURS: 30

CREDITS: 2

COURSE CODE: 16SP18/4S/EEP

L T P: 1 1 0

OBJECTIVES:

To promote interest among students about

- The importance of presentation skills.
- Gain knowledge about Entrepreneurship.

COURSE CONTENT

UNIT I

10 Hours

Resume writing- Tips for making good impression-Interview dress, hair style, shoes and posture. Writing e-mail, Telephone interview.

UNIT II

10 Hours

Women Entrepreneurship-need and problems faced by women entrepreneurs- styles and types. Development programs- Financial assistance for Small scale units-Role of SSI sector.

UNIT III

10 Hours

Identification of Business opportunity. Ownership structures-Proprietorship, Partnership, company, Co-operative, Franchise.

COURSE OUTCOME

Students are equipped with the necessary inputs to start a small scale business

RECOMMENDED TEXT BOOKS

1. Hisrich, Robert D., Michael Peters and Dean Shepherded. Entrepreneurship, Tata Mc Graw Hill, ND
2. Barringer, Brace R., and R., Duane Ireland. Entrepreneurship, Pearson Prentice Hall, New Jersey (USA).

REFERENCE BOOKS

1. Lall, Madhurima, and Shikha Sahai. Entrepreneurship. Excel Book, New Delhi.
2. Charantimath and Poornima. Entrepreneurship Development and Small Business Enterprises. Pearson Education, New Delhi.

WEB RESOURCES

1. www.ediindia.org/Entrecore3dtl.asp
2. <http://www.niesbud.nic.in/>
3. www.udyogini.org/
4. www.ediindia.org/
5. www.micromentor.org/Business-Resources

QUESTION PAPER PATTERN

Time: 3 Hours

Max Marks: 50

Section A- Answer any 10 questions (out of 12 questions)

10X5 marks = 50 marks