VIVEKANANDHA
COLLEGE OF ARTS AND SCIENCES FOR WOMEN

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

(Affiliated to Periyar University, Approved by AICTE,

Re-Accredited with 'A' Grade by NAAC)

Recognized under section 2(f) &12(B) of UGC ACT 1956,

An ISO 9001:2008 (Certificate institution)

AUTONOMOUS

DEPARTMENT OF MICROBIOLOGY

M.Sc APPLIED MICROBIOLOGY

SYLLABUS & REGULATIONS

FOR CANDIDATES ADMITTED FROM

2018 - 2019 ONWARDS

UNDER AUTONOMOUS & CBCS PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS

Angammal Educational Trust

M.Sc., APPLIED MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

1. SCOPE OF MICROBIOLOGY

The Mission of the Department of Microbiology is to impart education and carry out research in various areas of Microbiology. There is an excellent combination of courses in both traditional microbiology and modern molecular biology**.** The facilities in the department are totally committed to provide highest quality of education for the rural students at Post-graduate and Research levels.

The world around us is full of organisms that are too small to be seen with the naked eye. These microbes live in a wide range of habitats from hot springs to the human body and the depths of the ocean. They affect each and every aspect of life on earth. Microbes have always affected our health, food and environment and they will play an important role in the big issues that we may face in the future: climate change, renewable energy resources; healthier lifestyles and controlling diseases.

Because microbes have such an effect on our lives, they are a major source of interest and employment to thousands of people. Microbiologists study microbes: where they occur, their survival strategies, how they can affect us and how we can exploit them. Before microbiologists can solve the problems caused by microbes, or exploit their amazing powers, they have to find out about the detailed workings of microbial cells. This basic knowledge of cell genetics, structure and function can then be used in applied microbiology as well as in other areas of biology.

Microbiology imparts knowledge about the importance of micro-organisms as experimental tools in basic research, biochemical and genetic studies. There is an increasing demand for trained microbiologists in pollution control organizations, food processing, pharmaceutical and fermentation industries, industrial effluent treatment plants and in various national and international research institutes.

2. SALIENT FEATURES

- Course is specially designed for a higher level career placement.
- Special guest lecturers from industrialists will be arranged.
- Enables students to gain a professional degree
- Special industry orientations and training are parts of the degree course.
- Project work is included in the syllabus to enhance conceptual and deductive skills.

3. OBJECTIVES OF THE COURSE

The specific objectives of the programme are:

- To equip the Postgraduate students with a sound knowledge of the fundamental principles involved in the study of microbiology.
- To produce graduates that would make impact in the diverse fields of human endeavor considering the ubiquitous nature of microorganism and the wide–ranging applications of the knowledge of microbiology.
- To provide focus for a career in various fields of Applied Science including Medicine, Pharmacy, Mining, Biotechnology, Industrial Production, Environmental Management, Agriculture and even the Computer industry.

4. CONDITIONS FOR ADMISSION

4.1 ELIGIBILITY CONDITIONS FOR ADMISSION

Candidate who has passed the B.Sc., degree in any Life Sciences [Microbiology / Applied Microbiology/ Industrial Microbiology/ Botany/ Plant Sciences and Plant Biotechnology/ Zoology/ Animal Science/ Applied Animal Science and Animal Biotechnology/ Biochemistry/ Bioinformatics/ Biology/ Life Sciences/ Home Science/ Food Science and Nutrition/ BHMS/ BSMS/ BAMS/ BUMS/ Chemistry with Botany or Zoology as Allied Subjects of this University or any other University accepted by the Syndicate as equivalent there to shall be eligible for admission to M.Sc., Degree Course in Applied Microbiology.

5. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the prescribed course of study in a college affiliated to the University for a period of not less than two academic years, passed the examination of all the four semesters prescribed, earning 90 credits and fulfilled such conditions as have been prescribed therefore.

6. DURATION OF THE COURSE

The duration of the course is for two academic years consisting of four semesters.

7. EXAMINATIONS

There shall be four semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

8. SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

Theory External marks = **75**

Part A = 25 Marks (5 x 5)

Part B = 50 Marks (5 x 10)

Internal marks = **25**

Total Marks = 100

Time = 3 Hrs.

<u>The following procedure will be followed for Internal Marks</u>

Theory - Internal Marks

Theory best average of two tests 10 Marks

Attendance	5 Marks
Seminar	5 Marks
Assignment	5 Marks
Total	**25 Marks**

Practical - Internal Marks

Practical best average of two tests	30 Marks
Attendance	5 Marks
Observation Note	5 Marks
Total	**40 Marks**

Project- Internal Marks

Presentations [Two reviews 25+25]	50 Marks
Project Report	100 Marks
Viva - Voce	50 Marks
Total	**200 Marks**

Break-up Details for Attendance

Below 75%	**No Marks**
76 to 80%	**1 Marks**
81 to 85%	**2 Marks**
86 to 90%	**3 Marks**
91 to 95%	**4 Marks**
96 to 100%	**5 Marks**

9. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS

(i) Candidates shall register their names for the first semester examination after the admission in the PG courses.

(ii) Candidates shall be permitted to proceed from the first semester up to the final semester irrespective of their failure in any of the semester examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time. Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the college from time to time.

10. PASSING MINIMUM

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.

c) In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.

d) Grading shall be based on overall marks obtained (Internal + External).

SCHEME OF CURRICULUM – M.Sc. in APPLIED MICROBIOLOGY
(For the candidates admitted during the academic year 2017-2018 onwards)

Sem	Subject code	Course	Subject title	Hrs/ week	Credit	Int. marks	Ext. marks	Tot. marks
I	18P1AMB01	Core-I	General Microbiology	5	5	25	75	100
	18P1AMB02	Core-II	Microbial Physiology & Biochemistry	5	5	25	75	100
	18P1AMB03	Core-III	Immunology	5	5	25	75	100
	18P1AMBP01	Core-IV Practical	Practical - I –General Microbiology	5	3	40	60	100
	18P1AMBP02	Core-V Practical	Practical - II - Microbial Physiology , Biochemistry &Immunology	5	3	40	60	100
		Elective-I	Should be selected from the list	4	4	25	75	100
			Library	1				
			Total	**30**	**25**	**180**	**420**	**600**
II	18P2AMB04	Core-VI	Medical Bacteriology & Mycology	5	5	25	75	100
	18P2AMB05	Core-VII	Microbial Genetics & Molecular Biology	5	5	25	75	100
	18P2AMB06	Core-VIII	Food and Industrial Microbiology	5	5	25	75	100
	18P2AMBP03	Core-IX Practical	Practical-III- Medical Bacteriology & Mycology	5	3	40	60	100
	18P2AMBP04	Core - X Practical	Practical-IV- Microbial Genetics, Molecular Biology, Food and Industrial Microbiology	5	3	40	60	100
		Elective-II	Should be selected from the list	4	4	25	75	100
			Library	1				
			Total	**30**	**25**	**180**	**420**	**600**

	18P3AMB07	Core-XI	Agricultural & Environmental Microbiology	5	5	25	75	100
	18P3AMB08	Core-XII	Medical Virology & Parasitology	5	5	25	75	100
	18P3AMB09	Core-XIII	Genetic Engineering & Gene Technology	5	5	25	75	100
III	18P3AMBP05	Core-XIV Practical	Practical -V- Agricultural & Environmental Microbiology	5	3	40	60	100
	18P3AMBP06	Core-XV Practical	Practical-VI- Medical Virology, Parasitology, Genetic Engineering & Gene Technology	5	3	40	60	100
		Elective-III	Should be selected from the list	4	4	25	75	100
			Human rights/Library	1	1	25	75	100
	18P3AMBIP01		Internship Programme			40	60	100
			Total	**30**	**26**	**245**	**555**	**700**
	18P4AMB010	Core-XVI	Research Methodology & Biostatistics	5	5	25	75	100
		Elective-IV	Should be selected from the list	4	4	25	75	100
IV	18P4AMBPR01	Core-XVII	Project work	10	5	50	150	200
	18P4BTED01	EDC	Plant and Animal cell culture techniques	2	2	25	75	100
		-	Extension Programme	2	1			
			Library & Project review	7				
			Total	**30**	**17**	**125**	**375**	**500**
Overall Total				**120**	**93**	**625**	**1710**	**2400**

Electives:

Semester I – 1. Advanced techniques in Microbiology (18P1AMBE01)
2. Quality control for Food & Pharmaceutical Microbiology (18P1AMBE02)

Semester II - 1. Diagnostic Microbiology (18P2AMBE03)
2. Poultry Microbiology (18P2AMBE04)

Semester III - 1. Genomics & Proteomics (18P3AMBE05)
2. Microbial Fuel cell Technology & Nanotechnology (18P3AMBE06)

Semester IV - 1. Bioethics, Biosafety and IPR (18P4AMBE07)

2. Entrepreneurship in Microbiology (17P4AMBE08)

11. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the first class. All other successful candidates shall be declared to have passed in second class. Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in first class with distinction, provided they pass all the examinations (theory papers, practical, project and viva-voce) prescribed for the course in the first appearance.

12. GRADING SYSTEM

The term grading system indicates a 7- point scale of evaluation of the performances of students in terms of marks obtained in the Internal and External examination, grade points and letter grade.

SEVEN POINT SCALE (As per UGC notification, 1998)

GRADE	GRADE POINT	PERCENTAGE EQUIVALENT
'O'= Outstanding	**5.50 – 6.00**	**75 – 100**
'A'= Very Good	**4.50 – 5.49**	**65 – 74**
'B' = Good	**3.50 – 4.49**	**55 – 64**
'C'= Average	**3.00 – 3.49**	**50 – 54**
'D'= Below Average	**1.50 – 2.99**	**35 – 49**
'E'= Poor	**0.50 – 1.49**	**25 – 34**
'F'= Fail	**0.00 – 0.49**	**00 – 24**

13. RANKING

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction. Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the first appearance will not be eligible for ranking.

14. PATTERN OF QUESTION PAPER

PART A (200 words): Answer All the Questions (Internal choice) **5 x 5 = 25 Marks**

PART B (500 words): Answer All the Questions (Internal choice) **5 x 10 = 50 Marks**

15. PROCEDURE IN THE EVENT OF FAILURE

If a candidate fails in particular subjects, she may reappear for the examination in the concerned subject in subsequent semester and shall pass the examination**.**

16. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2017-18 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2017-18 and thereafter.

17. TRANSITORY PROVISION

Candidates who were admitted to the PG course of Microbiology before 2017 – 2018 shall be permitted to appear for the examinations under those regulations for a period of two years i.e., upto and inclusive of the examination of Apr/May 2019. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

EXTRA DISCIPLINARY COURSE

1. Microbial Nanotechnology

2. **Entrepreneurship in Microbiology**

3. Medical laboratory technology

SEMESTER I

SEMESTER – I	**CORE – I**
17P1AMB01	**Total Number of Hours: 75**
Credits – 5	**5 Hours/ Week**

GENERAL MICROBIOLOGY

Objectives

To enable the learners to

- study the early development of Microbiology
- be familiar with the bacterial taxonomy
- acquire knowledge on algae and fungi
- learn the microbial culture techniques
- practice the microscopic and staining techniques

10%

UNIT I Basics in Microbiology **No. of Hours: 15**

History, Microscopy & staining: Microbiology – Definition – History and scope of Microbiology. Contribution of Scientists: Leeuwenhoek – Robert Koch – Louis Pasteur – Edward Jenner. Microscopy: Principle and applications of bright field, dark field, phase contrast and fluorescent microscope. Staining techniques: Simple, Differential staining – Gram staining, acid fast, Special Staining – capsular, endospore, metachromatic and flagellar.

UNIT- II Sterilization, Cultivation & Preservation **No. of Hours: 15**

Nutritional types of bacteria: phototrophs, autotrophs, chemotrophs, lithotrophs. Nutritional requirements of bacteria. Growth curve – batch, continuous and synchronous culture – factors influencing growth. Aerobic and anaerobic culture techniques. Media preparation. Pure culture techniques. Preservation of microbial culture. Sterilization and disinfection.

UNIT III Introduction to Bacteria & Viruses **No. of Hours: 15**

Bacteria: General characteristics & classification – Bergeys manual of systemic Bacteriology. Classification – traditional approaches – Major characteristics used in bacterial taxonomy – Modern approaches – Numerical taxonomy. Reproduction of bacteria. Economic importance of bacteria. Virus: General properties of virus – Virus classification. General characteristics of TMV, HIV and prions – Lytic and lysogenic cycle.

UNIT IV Introduction to Fungi & Algae **No. of Hours: 15**

Fungi: General characteristics & classification. General account on vegetative, asexual and sexual reproduction in Fungi and Yeasts. **Algae:** General characteristics & classification. Reproduction in algae. **Symbiotic relationship of fungi:** Lichens – Mycorrhiza. Economic importance of algae and fungi.

UNIT V Introduction to Extremophiles **No. of Hours: 15**

Extremophiles: Definition and types. General characteristics of Arachea. Adaptations and applications of Thermophiles, Hyperthermophiles, Halophiles, Acidophiles, Alkalophiles, Mesophiles, Psychrophiles, Barophiles, Sulfur reducing organisms and methanogens.

Learning outcomes:

1. The students could understand the origin of Microbiology field, Microscopy & Staining Techniques.
2. The art of cultivating the Microorganisms, storing methods and removal of pathogenic organisms were taught
3. The students could learn in detail about the Bacteria & Viruses.
4. The students could learn in detail about the Fungi & Algae.
5. The Adaptations & applications of the extremophiles were studied.

Text Books:

1. Dubey, R.C. and Maheshwari, D.K., "A Text Book of Microbiology", Revised Edition, S.Chand & Company Ltd., New Delhi, 2010.
2. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology", Revised Edition, Tata Mc Graw Hill Publishers, New York, 2014.

Reference Books

1. Prescott, L.M., Harvey, J.P. and Klein, D.A., "Microbiology", Ninth Edition, Wm. C. Brown Publications, Iowa. 2015.
2. Black, J.G., "Microbiology: Principles and Explorations", Eighth Edition, John Wiley and Sons, Inc, New Jersey, 2012.
3. Sullia, S.B. and Santharam, S., "General Microbiology", Oxford IBH Pub. Co., 2011.
4. Willey, J.M., Sherwood, L.M. and Woolverton, C.J., "Prescott's Microbiology", Eighth Edition, McGraw Hill, New York, 2015.
5. Tortora, J.G., Funke, R.B. and Case, C.L., "Microbiology: An Introduction", Twelfth Edition, Pearson Education. Inc., San Francisco, 2016

Web Sources:

1. http://www.sheffcol.ac.uk/links/Science/Biology/Microbiology
2. http://www.microbiologyonline.org.uk/links.html
3. http://www.bact.wisc.edi/Microtextbook/index.php
4. http://www.bmb.leeds.ac.uk/mbiology/ug/ugteach/elect/elect.htm
5. http://www.microbeworld.org/

17P1AMB01

(For the candidates admitted from 2017- 18 onwards)

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

GENERAL MICROBIOLOGY

MAX MARKS:75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks.

1. a) Explain the history of microbiology in brief OR
b) Write a detailed account on principles and procedures of bright field microscopy

2. a)Write a short note on batch culture continuous culture and synchronous culture OR
b) Explain about the factors affecting the growth

3. a) Write a short note on characteristics of bacteria OR
b)Briefly explain molecular based classification

4. a) Write a short note on fungal classification
b)Explain n detail about BGA

5. a) Write a short note on general characteristics of arachea
b) Explain in detailed about adaptations and applications of Psychrophiles

PART B – (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks.

6. a) Explain the Differential staining techniques in detail OR
b) Write a detailed account on principles and procedures of fluorescent & phase contrast microscope

7. a) Write an essay about preservation f cultures OR
b).Explain in detail about chemical agents and sterilization

8. a) Explain in detail about general properties of viruses OR
b) Give a detailed account on Bergeys manual of systemic bacteriology

9. a) Write a short note on algal classification
b) Write an essay on economic importance of fungi and algae

10. a) Write a short note on Halophiles & its enzymes
b) Explain in detailed about adaptations and applications of Thermophiles & hyperthermophiles

SEMESTER – I	**CORE – II**
17P1AMB02	**Total Number of Hours: 75**
Credits – 5	**5 Hours/ Week**

MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

OBJECTIVES:

- To gain the knowledge on bioenergetics.
- To impart knowledge on carbohydrate anabolism and metabolism
- To impart the knowledge on respiratory metabolism.
- To know the knowledge on nitrogen cycle.
- To get the knowledge on enzyme

Unit – 1 **No of Hours:15**

Basic aspects of bioenergetics – entropy – enthalpy – electron carriers – artificial electron donors – inhibitors – uncouplers – energy bond – phosphorylation. Account on photosynthetic and accessory pigments – chlorophyll – bactriochlorophyll – rhodopsin – cartenoids – phycobiliproteins. Basics concepts of acids, base, pH and buffers.

Unit – 2 **No of Hours:15**

Carbohydrates – anabolism – autotrophy – oxygenic and anoxygenic photosynthesis – autotrophic generation of ATP; Fixation of CO_2 – Calvin cycle – C3-C4 pathway. Chemolithotrophy – sulphur – iron – hydrogen – nitrogen oxidations – luminescence.

Unit – 3 **No of Hours:15**

Respiratory metabolism – Electron Transport Chain - Embden Mayer Hoff pathway – Entner Doudroff pathway – glyoxlate pathway – Kerb's cycle and substrate level phophorylation – reverse TCA cycle – gluconeogenesis – Pasteur effect; Fermentation of carbhohydrates – homo and heterolactic fermentations.

Unit – 4 **No of Hours:15**

Assimilation of nitrogen – dinitrogen – nitrate nitrogen – ammonia – synthesis of major amino acids – polyamines; synthesis of polysaccharides – peptidoglycan – biopolymers as cell components – cell division – endospore – structure – properties – germination. Microbial development, sporulation and morphogenesis, hyphae verses yeast forms and their significance.

Unit – 5 **No of Hours:15**

Enzymes as biocatalysts, enzyme classification, specificity, active site, activity unit, isoenzymes. Enzyme kinetics: Michaelis – Menton equation for simple enzymes, determination of kinetic parameters, multistep reactions and rate limiting steps, enzyme inhibition, allosterism, kinetic

analysis of allosteric enzymes, principles of allosteric regulation. Vitamins and their role as coenzymes.

Learning outcomes:

1. The students could learn the basic about buffers, pH, pigmens and bonds between macromolecules.
2. The students can recognize the importance and types of photosynthesis and ATP formation.
3. They could understand the different kinds of metabolic pathways.
4. They can able to identify the assimilation patterns of Nitrogen.
5. It will provide a good idea of using enzymes as biocatalysits.

Textbooks:

1. Caldwell, D. R. 1995. Microbial Physiology and Metabolism. Brown Publishers.
2. Moat, A. G and Foster, J. W. 1999. Microbial Physiology. Wiley.

References:

1. Stainer, R. Y., Ingharam, J. L., WHeelis, M. L., Painter, P. R. 1986. General Microbiology. Macmillan Education Ltd.
2. Brun, Y. V. and Shimkets, L. J. 2000. Prokaryotic Development. ASM Press.
3. Freeman, W. H. 2001. Stryer Biochemistry. 5th Edition.
4. Lehniger. 2000. Principles of Biochemistry. Nelson and Cox (Worth) Publishers.

Websources:

1. https://www.omicsonline.org/enzymes-biocatalyst-scholarly-open-access-journals.php
2. http://www.cuchd.in/elibrary/resource_library/University%20Institutes%20of%20Sciences/Fundamentals%20of%20Biochemistry/Chap-20.pdf
3. http://www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-02.pdf
4. https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch12_carbohydrates/lecture_notes_ch12_carbohydrates_current.pdf

(For the candidates admitted from 2017- 18 onwards)

17P1AMB02

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

MICROBIAL PHYSIOLOGY & BIOCHEMISTRY

MAX MARKS: 75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks.

1. a) Explain entropy and enthalpy OR
b) Write about electron carriers in detail?

2. a) Write about anoxygenic photosynthesis with example? OR
b) Write a short note on luminiscence?

3. a) Write a short note on Embden Mayer Hoff pathway. OR
b) Write about glyoxlate pathway?

4. a) Write about the synthesis of polysaccharides? OR
b) Write short note on Endospore formation.

5. a) Write about the classification of enzymes?
b) Give s short notes on enzyme inhibition?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks.

6. a)Write a short note on accessory pigments OR
b) Give detailed account buffers and its use on molecular biology practical's.

7. a) Write about CO_2 fixation through calvin cycle OR
b).Explain the autotrophic ATP synthesis with a neat diagram.

8. a) Briefly explain the Electron Transport Chain OR
b) Write a short notes on Kerb's cycle with a neat flow chart

9. a) Briefly explain the steps involved in the Assimilation of nitrogen?
b) Explain about sporulation process in fungi?

10. a) Briefly explain the Vitamins and their role as coenzymes?
b) Explain in detailed about Enzyme kinetics?

SEMESTER –I	**CORE-III**
17P1AMB03	**Total Number of Hours:75**
Credits - 5	**5 Hours/ Week**

IMMUNOLOGY

Objectives:

- To understand cells and organs of the immune system and host parasite relationship.
- To gain knowledge about antigens, major histocompatibility complex and immunoglobulin's.
- To become familiar with *in vitro* and *in vivo* antigen-antibody reactions.
- To gain knowledge about & tumor and transplantation immunology.
- To understand hypersensitivity, autoimmune diseases and immunotheraphy.

UNIT I - Immune system and Immunity **No. of Hours: 15**

Historical background and scope of immunology- Blood cell formation, Apoptosis-Structure, composition and functions of cells and organs involved in immune system. Host parasite relationship. Immune responses – Innate, Acquired, Humoral and Cell Mediated Immunity. Immunohaematology – blood groups, transfusion and Rh incompatibilities.

UNIT II – Antigens and Antibody **No. of Hours: 15**

Antigens – types and properties, Haptens, Adjuvant and Super antigens. Immunoglobulin – classes and functions – Theories of antibody production. Major Histocompatibility Complex – structure and function of Class I, Class II and Class III molecules – antigen processing and presentation, T and B cell receptors – activation of T and B lymphocytes. Complement – pathways and biological consequences of activation.

UNIT III - Antigen – antibody reactions **No. of Hours: 1**5

Antigen and Antibody reaction – salient features. *In vitro* methods – agglutination, precipitation, complement fixation, immunofluorescence, RIA, ELISA, Immunoelectron microscope and Flow cytometry. *In vivo* methods: Skin tests and immune complex tissue demonstrations.

UNIT IV –Tumor and transplantation immunology **No. of Hours: 15**

Tumor immunology – tumour specific antigen – immunodiagnosis of tumors. Transplantation immunology – GVH reactions – Mechanism of graft rejection. Immune tolerance and immune suppression. Lymphokines and cytokines.

UNIT V – Hypersensitivity, Autoimmune diseases & Immunotheraphy. No. of Hours: 15

Hypersensitivity – Type I. Anaphylaxis; Type II. Antibody dependent cell cytotoxicity; Type III. Immune complex mediated reactions; type IV. Cell mediated hypersensitivity. Organ specific and systemic autoimmune diseases. Vaccines – types – DNA vaccines. Monoclonal antibodies – production and its applications.

Learning outcomes:

1. The students will gain the knowledge about basics of immune responses and immunohematology.
2. The students could learn about antigens, MHC and complement pathways.
3. The antigen and antibody reaction were studied in detail.
4. The students could learn about tumour and transplantation immunology.
5.Various types of hypersensitivity and autoimmune diseases and immunotherpahy could be studied.

Text Books

1. Kindt TJ, Osborne BA and Goldsby RA (1993). **Kuby Immunology.** 6th Edition. W.H. Freeman and Company, New York.
2. Annadurai B (2008).**A Textbook of Immunology and Immunotechnology**.1st Edition. S Chand &Co. Ltd., New Delhi.

Reference Books

1. Paul WE (2012). **Fundamental Immunology**. 7th Edition. Lippincott Williams & Wilkins, Philadelphia.
2. Janeway CA, Travers P, Walport M and Shlomchik MJ (2001**). Immunobiology.** 5th Edition. Garland Science, New York.
3. Ananthanarayanan Rand Panicker CK (2005). **Text Book of Microbiology.** 8th Edition.Oriental Longman Publications, Hyderabad.
4. Rao CV (2012) **Immunology**. 2nd Edition, Narosa Publishing House Pvt.Ltd.

Websources:

1. http://www-immuno.path.cam.ac.uk/-immuno/part1.html
2. http://www.Iclark.edu/-reiness/immuno/lectures.html
3. http://www.hhmi.org/biointeractive/immunology/lectures.html
4. http://www.immuneweb.xxmc.edu.cn/immunology/immunology.html

(For the candidates admitted from 2017- 18 onwards)

17P1AMB03

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

IMMUNOLOGY

MAX MARKS:75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks.

1. a) Explain the Structure composition and functions of immune cells OR
b) Write a detailed account Host parasite relationship

2. a) Briefly explain about Antigens and its properties OR
b) Explain about the complement system

3. a) Write a short note on Ag- Ab reactions OR
b) Explain in detail about ELISA

4. a) Write a short note on MHC and its classes
b) Explain n detail about antigen processing & presentation

5. a) Write a short note on Antibody dependent cell cytotoxicity
b) Explain in detailed about Immune complex mediated hypersensitivity

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks.

6. a) Explain about Humoral Mediated Immunity OR
b) Write a detailed note on blood grouping and Rh incompatibilities

7. a)Write an essay about immunoglobulins OR
b). Explain in detail about monoclonal antibodies.

8. a) Explain in detail about immunoelectron microscopeOR
b) Give a detailed account on Skin test

9. a) Write a short note on Tumour specific antigens
b) Explain in detail about T cell and B cell receptors.

10. a) Write a short note on Transplantation methods
b) Explain in detailed about Graft rejection

SEMESTER –I	**CORE PRACTICAL IV**
17P1AMBP01	**Total Number of Hours: 60**
Credits - 3	**5 Hours/ Week**

PRACTICAL – I- GENERAL MICROBIOLOGY

OBJECTIVES

To enable the students to

- learn the fundamental techniques in microbiology
- gain experience with staining methods
- be familiar with the methods of growing fungi and actinomyetes
- understand the micrometry
- learn the basics of preservation of microbes

1. Basic Laboratory Techniques for Isolation and Cultural characterization of Microorganisms.

- Isolation of Pure cultures using Spread Plate, Pour Plate or Streak Plate techniques
- Preparation of culture media- Basal, differential, enriched, enrichment, selective and transport media.
- Cultural characteristics of Microorganisms.

2. Microscopy

- Microscopic Examination of Living cell Preparations. (Motility Determination).
- Microscopic Measurement of Microorganisms. (Micrometry).

3. Bacterial Staining techniques

- Preparation of Bacterial Smears.
- Simple Staining.
- Negative Staining.
- Differential staining - Gram Staining and Acid Fast Staining (Ziehl Neelsen Method).
- Special Staining - Spore Stain (Schaeffer-Fulton Method) and Capsule Stain.

4. Cultivation of Microorganisms

- Effect of Temperature, UV, pH and disinfectants
- Effect of Atmospheric Oxygen on growth.
- Anaerobic Cultivation of Microorganisms.
- Bacterial Growth Curve.
- Determination of generation time

20%

5. Biochemical tests for identification of bacteria.

- Carbohydrate Fermentation.
- Triple Sugar Iron Agar Test
- IMViC Test
- Hydrogen Sulfide Test
- Urease Test
- Nitrate Reduction Test
- Catalase Test
- Oxidase Test
- API system of Bacterial analysis

6. Physical and Chemical Agents for the control of Microbial Growth.

- Physical Agents: Moist Heat
- Chemical Agents: Antibiotic - sensitivity test – Kirby- Bauer and Stokes methods & MIC

REFERENCE BOOKS

1. Aneja, K.R., 2003, "**Experiments in Microbiology and Plant Pathology**", New Age Publications, New Delhi.
2. Arora, B and D.R. Arora, 2013, **Practical Microbiology,** CBS Publishers & distributors Pvt. Ltd, New Delhi.
3. Benson, J.H., 2001, "**Microbiological Applications: A Laboratory Manual in General Microbiology**", Eighth Edition, McGraw-Hill, New York.
4. Cappuccino, J.G. and N. Sherman, 2005, "**Microbiology - A Laboratory Manual**", Seventh Edition, Benjamin and Cummings Publications, San Francisco.
5. Dubey, R.C and D.K. Maheswari, 2005, "**Practical Microbiology**", S. Chand and Company, New Delhi.
6. Gunasekaran, P., 2005, "**Laboratory Manual in Microbiology**", New Age International (P) Ltd, New Delhi.
7. Kannan, N., 2003, "**Laboratory Manual in General Microbiology**", Fourth Edition, Palani Paramount Publications, Palani.
8. Rajan, S and R. Selvi Christy, 2015, "**Experiments in Microbiology**", Anjanaa Book House, Chennai.

SEMESTER – I	**CORE PRACTICAL – V**
17P1AMBP02	**Total Number of Hours: 60**
Credits – 3	**5 Hours/ Week**

PRACTICAL – II – MICROBIAL PHYSIOLOGY, BIOCHEMISTRY & IMMUNOLOGY

1. Preparation of physiological buffers.
2. The colorimetric estimation of inorganic phosphates.
3. Estimation of carbohydrates in a given solution by Anthrone method.
4. Estimation of sugars in biological samples.
5. Protein estimation by Lowry's method.
6. Protein estimation by Bradford methods.
7. Analysis of urine for urea, glucose, uric acid and chloride.
8. Separation and preservation of serum and plasma.
9. Identification of human ABO blood group.
10. Latex agglutination test – RA test, CRP test, ASO test.
11. WIDAL slide and tube agglutination test.
12. Flocculation test – RPR test.
13. Immunodiffusion: Radial Immunodiffusion &Ouchterlony double diffusion.
14. Immunoelectrophoresis : Counrter current & Rocket immunoelectrophoresis.
15. Preparation of cellular antigen from bacteria.
16. Raising antiserum to protein (BSA) antigen.(DEMO)
17. Electrophoretic separation of serum protein.

References:

1. Sambrook J and Russell DW (2001). **Molecular Cloning – A laboratory manual.** 3rd Edition.Cold Spring Laboratory Press, New York.
2. Surzycki S (2000). **Basic Techniques in Molecular Biology**. Springer-Verlag, New York.
3. Riott IM (1988). **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, London.
4. Kindt TJ, Goldsby RA, Osborne BA and Janis Kuby (2007). **Kuby Immunology.** WH Freeman and Company, New York.
5. Chapel H and Halbey M (1986). **Essentials of Clinical Immunology**. ELBS, London.
6. Weir DM, Steward J (1993). **Immunology.** 7th Edition. ELBS, London.

SEMESTER – I	**ELECTIVE - I**
17P1AMBE01	**Total Number of Hours:60**
Credits – 4	**4 Hours/ Week**

ADVANCED TECHNIQUES IN MICROBIOLOGY

OBJECTIVES:

To gain the knowledge on Electrophoresis techniques.
To get aware on Chromatographic methods
To impart the knowledge on Spectroscopy.
To know the analytical methods of Hybridization techniques.
To get the knowledge on Radioisotopic techniques

Unit – 1 **No of Hours: 12**

Electrophoresis: Bio molecules and electron migration. Types and uses of Electrophoresis, Buffers and supportive media. Principle procedure, detection, quantification and applications of Gel electrophoresis – Native, SDS-PAGE and DISC-PAGE, PFEG, Immune electrophoresis, Isoelectric focusing, 2D gel electrophoresis.

Unit – 2 **No of Hours: 12**

Chromatographic techniques: Basic principles and types. Principles, procedure and applications of Paper chromatography, Thin layer chromatography (TLC), Column chromatography (CC), Gas chromatography (GC and GCMS), MALDI, CELDI – TOF, High performance liquid chromatography (HPLC and HPTLC). Optimum performance laminar chromatography (OPLC).

Unit – 3 **No of Hours: 12**

Spectroscopy: Basic principles – Molecular vibration and its types. Principles, procedure, interpretation and applications of Absorption spectroscopy – FTIR and NMR. Emission spectroscopy – Energy-dispersive X-ray spectroscopy and plasma emission spectroscopy. Scattering spectroscopy- Raman Spectroscopy.

Unit – 4 **No of Hours: 12**

Molecular hybridization of nucleic acids: Nucleotide probes and its types and labelling. Principle, procedure and application of Blotting techniques – Southern, Northern, Western and Dot blotting.DNA microarrays- Steps involved in microarrays – types of DNA chips and its applications.

Unit – 5 **No of Hours: 12**

Radioisotopic techniques : Radioactive labelling, principle and application of tracer techniques, Half life of isotopes, detection and measurement of radioactivity – ionization chamber, proportional chamber, GM and Scintillation counters, autoradiography and its applications. Dosimetry. Biosensors : Definition and types. Principle, preparation methods and applications.

TEXTBOOKS:

1. Upadhyay & Nath- **Biophysical Chemistry**
2. Boyer, **Modern experimental Biology**
3. **Chromatography: Concepts and Contrasts**- 1988 by James Miller. John Wiley and Sons. Inc., New York.

References:

1. D.A. Skoog, **Instrumental methods of analysis**
2. **Instrumental Methods of Analysis**. 6th Edition by H.H. Willard, L.L. Merritt Jr. and others. 1986. CBS Publishers and Distributors.
3. **Spectroscopy**. Volume 1. Edited by B.B. Straughan and S. Walker.
4. Chapman and Hall. **Gel Electrophoresis of Proteins- A Practical Approach by Hanes**.
5. Cotterill, R. M. J. (2002). **Biophysics: An Introduction**. John Wiley & Sons, England.
6. Nölting, B. (2006). **Methods in modern biophysics**. Second Edition. Springer, Germany.

(For the candidates admitted from 2017- 18 onwards)

17P1AMBE01

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

ADVANCED TECHNIQUES IN MICROBIOLOGY

MAX MARKS: 75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks

1. a) Write a short note on Buffers and supportive media. OR
b) Write about Native Gel electrophoresis in detail.

2. a) Write about Thin layer chromatography? OR
b) Write a short note on Optimum performance laminar chromatography?

3. a) Write a short note on Principles, procedure, interpretation and applications of FTIR. OR
b) Write about Energy-dispersive X-ray spectroscopy?

4. a) Write about synthesis of Nucleotide probes and its types? OR
b) Explain about the Southern blotting in detail

5. a) Write about principle and application of tracer techniques?
b) Give s short notes on Dosimetry?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks

6. a) Explain processing methods of Pulse Field Gel Electrophoresis. OR
b) Give detailed account on Isoelectric focusing.

7. a) Write about the sample preparation, procedure and analysis methods of GC. OR
b).Explain the CELDI – TOF in detail

8. a) Briefly explain the plasma emission spectroscopy OR
b) Write short notes on Raman Spectroscopy

9. a) Briefly explain the DNA microarrays?
b) Explain about types of DNA chips and its applications?

10. a) Briefly explain the GM and Scintillation counters?
b) Explain in detailed about Biosensors?

SEMESTER –I **ELECTIVE-I**
17P1AMBE02 **Total Number of Hours:60**
Credits - 4 **4 Hours/ Week**

MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL

Unit 1 - Microbiological Laboratory and Safe Practices No. of Hours:12

Good laboratory practices - Good laboratory practices, Good microbiological practices. Quality policy, quality objectives of food processing company, Standard Operating Procedures, Work instructions, GHP & GMP checklist. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL – 1, BSL – 2, BSL – 3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

Unit 2 - Determining Microbes in Food / Pharmaceutical Samples No. of Hours:12

Culture and microscopic methods – Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods – Limulus lysate test for endotoxin, gel diffusion, Pyrogen testing, sterility testing for pharmaceutical products. Antiseptics, disinfectants and their standardization. Molecular methods – Nucleic acid probes, PCR based detection, biosensors.

Unit 3 - Pathogenic Microorganisms of Importance in Food & Water No. of Hours:12

Enrichment culture technique, Detection of specific microorganisms – on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar. Quality assessment of chemicals, media and stains used in microbiological testing. Types of water (DM/Purified water/water for injection) used in pharmaceutical industry. Environmental monitoring. Growth promotion test

Unit 4 - Microbial quality control in Milk No. of Hours:12

Micro flora of milk – Sources of milk contamination – Milk borne diseases – Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centers (COB, 10 min Resazurin assay) – Preservation and spoilage of milk and milk products – Food control agencies and its regulations.

Unit 5 - HACCP for Food Safety and National standards No. of Hours:12

Hazard analysis of critical control point (HACCP) – Principles, flow diagrams, limitations. Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water. PFA, FPO, MMPO, MPO, AGMARK, BIS, Legal Metrology, Environment and Pollution Control Board, Factory License.

TEXT BOOKS:

1. Rajesh Bhatia (2000). **Quality Assurance in Microbiology**. CBS publishers and Distributors Pvt. Ltd., New Delhi.
2. Adams M.R and Moss M.O (2008). **Food Microbiology**, 2nd Edition, Royal Society of Chemistry.
3. Frazier W.C and Westhoff D.C (2013). **Food Microbiology**, 5th edition, Tat McGraw Education, New Delhi

REFERENCE BOOKS:

1. Mandal S.K (2007). **Total Quality Management - Principles and Practice**. 1st Edition. Vikas Publishing House Pvt. Ltd.-Noida.
2. James M Jay, Martin J Loessner and David A Golden (2006). **Modern Food Microbiology**, 7th edition, Springer Science and Business Media, New York.
3. Richard K. Robinson (2005). **Dairy Microbiology Hand book: The Microbiology of Milk and Milk Products**, 3rd edition, John Wiley and Sons, New York.
4. Baird RM, Hodges NA and Denyer SP (2005). **Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices**, Taylor and Francis Inc.

(For the candidates admitted from 2017- 18 onwards)

17P1AMBE02

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRY

MAX MARKS: 75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks

1. a) Write a short note on Good microbiological practices. OR
b) Write about the methods used in discarding biohazardous waste

2. a) Write in detail about Pyrogen testing? OR
b) Explain about the Limulus lysate test?

3. a) Write a short note on Environmental monitoring. OR
b) Write about the media and stains used in microbiological testing?

4. a) Write about source of milk contaminations? OR
b) Write short note on Assays used to analyse the milk

5. a) Write about HACCP?
b) Give s short notes on BIS standards for drinking water?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks

6. a) Explain briefly about the GHP & GMP checklist . OR
b) Give detailed account on Biosafety cabinets and its types.

7. a) Write about the analysis method of PCR based detection in food industry. OR
b).Explain the Standard plate count, MPN test and Direct microscopic count of water sample

8. a) Briefly explain the selective media used for the isolation of pathogens OR
b) Write a short notes on Types of water used in pharma industry

9. a) Briefly explain the milk borne diseases and MBRT assay?
b) Explain about Food control agencies and its regulations?

10. a) Briefly explain the BIS standards for common fooods?
b) Explain in detailed about getting the license from Environment and Pollution Control Board?

SEMESTER II

SEMESTER – II	**CORE – VI**
17P2AMB04	**Total Number of Hours: 75**
Credits – 5	**5 Hours/ Week**

MEDICAL BACTERIOLOGY AND MYCOLOGY

25%

Objective:

- To study the pathogenesis, laboratory diagnosis and antimicrobial sensitivity testing.
- To gain knowledge about the diseases caused by Gram positive and Gram negative cocci.
- To impart knowledge on the diseases caused by Gram positive bacilli and Gram negative bacilli.
- To understand the fungal classification, diagnosis, cultivation and antifungal agents.
- To study the superficial, cutaneous, sub cutaneous, systemic and opportunistic mycoses.

The course deals with importance of microorganisms in human health. Students will study the important diseases caused by bacterial and fungal pathogens with reference to etiology, pathogenesis, clinical features, laboratory diagnosis and prevention.

UNIT- I **No. of Hours: 15**

Introduction to Medical Bacteriology : Normal microbial flora of human body – Infection – Types, Source, Modes of Transmission, Mechanism of bacterial pathogenesis – Laboratory diagnosis of infectious diseases – Antibiotic Sensitivity Test, Antibacterial drugs and mechanism of action.

UNIT- II **No. of Hours: 15**

Gram positive bacterial pathogens : Brief account on pathogenesis, symptoms and laboratory diagnosis of *Staphylococcus aureus, Streptococcus pneumoniae, Neisseria gonorrhoeae, Corynebacterium diphtheria, Bacillus anthracis, Clostridium* sp and *Mycobacterium* sp.

UNIT- III **No. of Hours: 15**

Gram negative bacterial pathogens and Cellular parasite: Brief account on pathogenesis, symptoms and laboratory diagnosis of *Escherichia coli, Klebsiella pneumonia, Proteus* species, *Salmonella typhi, Shigella dysenteriae, Pseudomonas aeruginosa, Vibrio cholerae* and Spirochetales. Obligate intra cellular parasites – *Mycoplasma pneumonia, Chlamydia* and *Rickettsiae.*

UNIT- IV **No. of Hours: 15**

General Mycology : Classification of medically important fungi – Laboratory diagnosis of fungal diseases – Collection and examination of fungal specimens – Isolation and identification of fungi

– Staining of fungi – KOH, LCB, PAS, H&E, GMS – Cultivation of fungi - Antifungal drugs – Antifungal susceptibility test .

UNIT- V **No. of Hours: 15**

Fungal pathogen : Classification of Mycoses based on infection- Brief account on pathogenesis, symptoms and laboratory diagnosis of *Tinea nigra*, Piedra, Dermatophytoses, Mycetoma, Histoplasmosis, Cryptococcosis, Candidiasis and *Aspergillosis.* Mycotoxicoses.

Learning outcomes:

Students who complete this course will be able to:

1. Identify and examine the bacterial and fungal pathogens of clinical importance
2. Outline the scientific method as it is used for classification of bacteria and fungi
3. Students could learn the morphology, lifecycle, symptoms, diagnosis and treatment method for some important bacterial and fungal pathogens
4. They can aware about the antibacterial and antifungal agents and their mode of action.

Text Books:

1. Arti Kapil (2013). **Ananthanarayan & Jayaram Paniker's Text book of Microbiology**. 9th edition, Orient Longman Limited, Chennai.
2. Jagdish Chander (2012). **Text book of Medical Mycology**. 3rd edition. Mehta Publishers, New Delhi.

References:

1. Jawetz E and JL Melnic (2001). **Medical Microbiology**, 22nd edition, Tata McGraw-Hill, New Delhi.
2. David Greenwood CB and Richard (2002). **Medical Microbiology**. 22nd edition, Tata McGraw- Hill, New Delhi.
3. Monica Cheesbrough (2003). **District Laboratory Practice in Tropical Countries**. Part 1 and 2. Low-Price edition, Cambrige University Press.
4. Chakraborty P (2003). **A Text book of Microbiology.** 2nd edition, Published by New Central Book Agency (P) Ltd., Kolkata.

Websources:

1. http:// www.bact.wisc.edu/bact330
2. http:// www-micro.msb.le.ac.uk/224
3. http:// www.cellsalive.com/ecoli.htm
4. http:// www.bact.wise.edu/microtextbook/
5. http:// www. Pitt.edu/-super1/lecture/lec4771/
6. http:// www.textbook of bacteriology.net/

(For the candidates admitted from 2017- 18 onwards)

17P2AMB04

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

MEDICAL BACTERIOLOGY & MYCOLOGY

MAX MARKS:75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks.

1. a) Explain the sources of bacterial infection OR
b) Write detailed account different types of samples

2. a) Briefly explain about symptoms and lab diagnosis of *Staphylococcus aureus* OR
b) Explain about the symptoms and lab diagnosis of *Corynebacterium diphtheria*

3. a) Briefly explain about symptoms and lab diagnosis of *Shigella dysenteriae* OR
b) Explain about the symptoms and lab diagnosis of *Rickettsiae*

4. a)Write about the different morphology of fungi OR
b) Explain few fungal specimens in detail.

5. a) Briefly explain about the symptoms and lab diagnosis of *Tinea piedra*
b) Explain the Mycotoxicosis in detail

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks.

6. a) Explain about Normal flora OR
b) Write a detailed note on Antibiotic susceptibility testing

7. a) Explain about the symptoms and lab diagnosis of *Clostridium* OR
b). Explain about the symptoms and lab diagnosis of *Bacillus anthracis*

8. a) Explain about the symptoms and lab diagnosis of *Mycoplasma pneumonia* OR
b). Explain about the symptoms and lab diagnosis of *Salmonella typhi*

9. a)Explain the different types of fungal staining techniques in detail.
b) Give a detailed note on antifungal drugs

10. a) Write about Deramatophytosis in detail
b) Briefly explain about the candidiasis.

SEMESTER –II	**CORE-VII**
17P2AMB05	**Total Number of Hours: 75**
Credits - 5	**5 Hours/ Week**

MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Objectives:

- To gain the knowledge about the structure of Nucleic acid.
- To understand the basic mechanisms of replication, transcription, and translation
- To understand the genetic consequences and molecular mechanisms of several prokaryotic and eukaryotic gene regulation systems.
- To understand the structure and organization of the prokaryotic and eukaryotic chromosomes.

UNIT I - Genetic material DNA/RNA — No. of Hours:15

Evidences for DNA as the genetic material – Watson and Crick model – Types and forms of DNA – Law of DNA constancy and C value paradox – Physical and chemical properties of DNA. RNA as genetic material – Structure, types and functions of RNA. Prokaryotic Genome: *E. coli* chromosome – nucleosome. Eukaryotic genome organization: Structure of chromatin, chromosome, centromere, and telomere. Genome organization in Virus and Yeast.

UNIT II - DNA replication and Repair mechanisms — No. of Hours:15

DNA replication – Evidence for semi-conservative replication - DNA replication mechanism, enzymology of DNA replication – bidirectional and rolling circle replication – Prokaryotic & eukaryotic DNA polymerases, Types & function - Inhibitors of DNA replication – DNA recombination – Models - Role of Rec A in homologous recombination - DNA repair mechanism – photoreactivation, excision repair, SOS repair, mismatch repair, recombination repair and glycocylase system.

UNIT III – Transcription and Translation — No. of Hours:15

Transcription – Structure and function of RNA polymerase. Mechanism of transcription – steps involved. Post transcriptional modifications – RNA processing: Capping, polyadenylation, splicing – Genetic code – Salient features – Wobble hypothesis. Translation – direction of protein synthesis – Rribosomes and their organization – Initiation of translation: SD sequence, initiator tRNA – Elongation of translation, translocation and termination mechanisms. Post – translational modification. Inhibitors of transcription and translation. Gene regulation in bacteria – *lac*, *trp* and *ara* operons.

Unit IV – Mutagenesis **No. of Hours: 15**

Mutation –Types of mutation – Mutagens - Molecular basis of mutation – Spontaneous mutations; Luria and Delbruck experiment, Newcombe experiments. Induced mutation; DNA damages – Deamination of bases, alkylation, damage due to reactive oxygen, UV induced damage. Detection and isolation of mutants, mutant selection – Beadle & Tatum experiment: detection of nutrional mutants in *Neurospora*. Carcinogenicity testing.

Unit V – Plasmid and Gene transfer mechanisms **No. of Hours: 15**

Plasmid Biology – types and properties – compatibility, replication, control of copy number and plasmid segregation– episomes. Gene transfer in bacteria – Conjugation: Discovery, types - $F^+ \times F^-$, F', Hfr. Transformation – evidence and mechanism. Transduction – Lytic and lysogenic cycle of phage – Generalized and specialized transduction. Insertion sequences – mechanism of transposition, complex and compound transposons – T10, T5 and retroposon & composite.

Text Books

1. Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM. (1998). **Molecular Biology of the Gene.** The Benjamin/Cummings publishing company.
2. Freifelder D. (2012). **Molecular Biology**, 2nd edition, Narosa Publishing Home
3. R.S. Old and S.B. Primrose. (2001). **Principles of Gene Manipulation**, 6th Ed., Black well Scientific Publications, London.

Reference Books

1. Maloy SR, Cronan Jr.JE and Freifelder D. (1994). **Microbial Genetics**. Jones and Bartlett Publishers.
2. Frieldberg EC, Walker GC, and Siede W. (2006). **DNA repair and Mutagenesis**, 2nd edition, ASM press.
3. Gardner EJ, Simmons MJ and Snustad DP, (2006). **Principles of Genetics**, 8th edition, John Wiley and Sons.
4. Singer M and Berg P. (1991). **Genes and Genomes**. University Science Books.

Web sources:

1. www.en.wikipedia.org/wiki/Microbial_genetics
2. www.microbiologyprocedure.com/genetics/microbial-genetics/microbial-genetics.htm
3. www.bestwebbuys.com/Microbiology-N_10038066-books.html
4. www.en.wikipedia.org/wiki/Molecular_biology
5. www.web-books.com/MoBio/

(For the candidates admitted from 2017- 18 onwards)

17P2AMB05

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

MICROBIAL GENETICS & MOLECULAR BIOLOGY

MAX MARKS: 75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks.

1. a) Explain the Law of DNA constancy and C value paradox? OR
b) Write about structure, types and functions of RNA?

2. a) Write about the evidence for semi-conservative replication? OR
b) Write a note on photoreactivation and excision repair?

3. a) Write a short note on Structure and function of RNA polymerase? OR
b) Discuss about *lac* operon?

4. a) Write about types of mutation?
b) Write short note on UV induced damage.

5. a) Write about Transduction of phages.
b) Give s short notes on Conjugation mechanism?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks.

6. a) Explain about Evidences for DNA as the genetic material. OR
b) Give detailed account on Genome organization in Virus and Yeast.

7. a) Explain the bidirectional and rolling circle replication. OR
b). Explain in detail about types & function of Inhibitors in DNA replication.

8. a) Explain in detail about the mechanism of Translation? OR
b) Give a detailed account on inhibitors of transcription and translation.

9. a) Briefly explain the DNA damages in detail?
b) Explain about the carcinogeneicity testing?

10. a) Briefly explain the plasmis characters and types ?
b) Explain in detailed about Insertion sequences?

SEMESTER –II	**CORE-VIII**
17P1AMB06	**Total Number of Hours:75**
Credits - 5	**5 Hours/ Week**

FOOD, INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

OBJECTIVES

To enable the students to

- understand the principles of food preservation and spoilage
- learn the food and milk borne diseases
- aware the Government regulatory practices and policies
- be familiar with the upstream and downstream processes
- know the various microbial products

UNIT - I Microbial importance of food — No. of Hours:15

Food as a substrate for microorganisms. Intrinsic & Extrinsic factors. Important microorganisms in food (Bacteria, Mold and yeasts). Contamination of foods. General Principles of food preservation – Asepsis – removal of microorganisms – use of temperature (low & high), drying, radiation and food additives. Food Spoilage – vegetables and fruits, eggs and canned foods.

UNIT - II Food borne disease & food safety — No. of Hours:15

Food borne diseases – Food poisoning– Bacterial, viral, Fungal and Mycotoxins. Quality assurance- Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI and FSSAI. Food safety, safety of dairy products, control and hazards.

Unit – III Bioprocess technology — No. of Hours:15

Introduction to bioprocess-historical developments - fermentor designing, Components & types. Industrially important strains – screening, strain improvement, Inoculum development. Upstream processing – media formulation & sterilization. Downstream processing – Recovery & purification of extracellular & intracellular products. Fermentation economics – Application of computer in fermentation technology.

Unit – IV Microbes in pharmaceuticals — No. of Hours:15

Microbial spoilage of pharmaceutical products and their sterilization – sterile injectibles – non injectibles – ophthalmic preparations and implants. Quality assurance and quality management in pharmaceuticals – ISO, WHO and US certification. Sterilization control and

sterility testing -heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization.

Unit–V Microbial products **No. of Hours:15**

Microbial production technology – Antibiotics –penicillin & streptomycin, organic acids – citric acid, vitamins – B12, enzymes – amylase, alcoholic beverages - beer and wine. Single cell protein – Sprulina. Fermented food – Bread. Oriented foods – Soy Sauce. Fermented drink – kombucha. Fermented vegetables– sauerkraut. Vaccines – synthetic peptide vaccines & multivalent subunit vaccines.

TEXT BOOKS

1. Frazier, W.C. and D.C. Westhoff, (2008), "**Food Microbiology**", Sixth Edition, Tata McGraw Hill Publications Co. Ltd., New Delhi.
2. Adams, M.R. and M.O. Moss, (2007), "**Food Microbiology**", New Age International (P) Ltd., New Delhi.
3. Patel, A.H., (2003), "**Industrial Microbiology**", Eighth Edition, McMillan Publishers, New Delhi.

REFERENCE BOOKS

1. Mukhopadhyay, S.N., (2010), "**Process Biotechnology fundamentals**", Third Edition, Viva Books, Chennai.
2. Modi, H.A., (2007), "**Dairy Microbiology**", First Edition, Sheetal printers, Jaipur.
3. Bamforth, C. W., (2005), "**Food, Fermentation and Microorganisms**", Blackwell Science Ltd., London.
4. **Pharmaceutical Microbiology** - Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications. 2.
5. **Analytical Microbiology** - Edt by Frederick Kavanagh Volume I & II. Academic Press New York. Fernandes, R., (2009), "**Microbiology Handbook - Dairy Products**", Leatherhead Food International Ltd, London.
6. Jain, N., Singh, V., and A. Sharma, (2011), "**Instant Notes in food Biotechnology**", CBS. Publishers and Distributors Pvt. Ltd. New Delhi.

Web sources:

1. http://www.microbes.info
2. http://www.fsis.usda.gov/
3. http://www.cdc.gov/
4. http://web.indstate.edu/thcme/mwking/
5. http://lifesciences.asu.edu/text/classesbk.html

(For the candidates admitted from 2017- 18 onwards)

17P2AMB06

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

FOOD, INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

MAX MARKS: 75 **TIME:3 HOURS**

PART A – (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks

1. a) Explain the Food as a substrate for microorganisms? OR
b) Write about general principles of food preservation?

2. a) Write about Mycotoxins? OR

b) Write a note on Food safety, control and hazards?

3. a) Write a short note on Fermenter? OR
b) Discuss about Application of computer in fermentation technology?

4. a) Write about sterility test?
b) Write short note on i) D value ii) z value iii) survival curve

5. a) Write about antibiotic production?
b) Give s short notes on Single cell protein?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks

6. a) Explain about important microorganisms in food. OR
b) Give detailed account on Food Spoilage.

7. a) Write an essay microbiological quality standards of food. OR
b).Explain in detail about Food borne diseases.

8. a) How to improve the strains and inoculums Explain? OR
b) Give a detailed account on Upstream and Downstream processing.

9. a) Briefly explain the Microbial spoilage of pharmaceutical products and their sterilization?
b) Essay on Quality assurance and quality management in pharmaceutical products?

10. a) Briefly explain the Fermented food and types ?
b) Explain in detailed about Vaccines and its types?

SEMESTER – II	**CORE PRACTICAL – IX**
17P2AMBP03	**Total Number of Hours: 60**
Credits – 3	**5 Hours/ Week**

PRACTICAL-III-MEDICAL BACTERIOLOGY AND MYCOLOGY

1. **Processing of clinical specimen, Isolation, Identification and Antibiogram of unknown Bacterial pathogens in specimens.**
   (a) *Staphylococcus* spp.,
   (b) *Streptococcus* spp.,
   (c) *Bacillus* spp.,
   (d) *Escherichia* spp.,
   (e) *Klebsiella* spp.,
   (f) *Proteus* spp.,
   (g) *Salmonella* spp.,
   (h) *Shigella* spp.,
   (i) *Pseudomonas* spp.,
   (j) *Vibrio* spp.,
2. **Isolation and Identification of Fungal Specimens**

- Direct Microscopy – KOH and Lacto phenol preparations.

3. **Isolation and Identification of Yeast – Germ tube, Gram Staining and Negative staining**
   (a) *Candida* spp.
   (b) *Cryptococcus* spp.
4. **Cultivation and identification of fungal pathogens from clinical specimens.**
   (a) Dermatophytes
   (b) *Aspergillus* spp.

REFERENCE BOOKS

1. Aneja, K.R., (2003), "**Experiments in Microbiology and Plant Pathology**", New Age Publications, New Delhi.
2. Arora, B and D.R. Arora, (2013), **Practical Microbiology** CBS Publishers & distributors Pvt. Ltd, New Delhi.
3. Benson, J.H., (2001), "**Microbiological Applications: A Laboratory Manual in General Microbiology**", Eighth Edition, McGraw-Hill, New York.
4. Cappuccino, J.G. and N. Sherman, (2005), "**Microbiology - A Laboratory Manual**", Seventh Edition, Benjamin and Cummings Publications, San Francisco.
5. Gunasekaran, P., (2005), "**Laboratory Manual in Microbiology**", New Age International (P) Ltd, New Delhi.

SEMESTER – II	**CORE PRACTICAL – X**
17P2AMBP04	**Total Number of Hours: 60**
Credits – 3	**5 Hours/ Week**

PRACTICAL – IV – MICROBIAL GENETICS AND MOLECULAR BIOLOGY

1. Isolation of chromosomal DNA from bacteria.
2. Isolation of plasmid DNA from *E. coli*.
3. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
4. Confirmation of nucleic acid by spectral study.
5. Quantitative estimation by diphenylamine test.
6. Effect of UV radiations to study the survival pattern of E. coli/yeast.
7. Repair mechanisms in *E. coli*/yeast (Dark and photoreactivation)
8. Extraction and Purification of RNA from S. cerevisiae.
9. Study the effect of chemical mutagens on bacterial cells.
10. Isolation of antibiotic resistant mutant by gradient plate technique.
11. Autotrophic Mutant isolation by replica plating.
12. Isolation of coli phage from sewage
13. Bacterial Transformation
14. Bacterial Conjugation
15. Transduction

FOOD AND INDUSTRIAL MICROBIOLOGY

1. Enumeration of microorganisms in food samples- vegetables and fruits.
2. Isolation of fungi from spoiled bread
3. Microbial examination of curd
4. Qualitative testing of milk by MBRT (Methylene Blue Reduction Test) & Resazurin test
5. Counting of bacteria in milk by breed count method
6. Wine production using grape juice
7. Estimation of ethanol in wine
8. Citric acid production and estimation
9. Spirulina cultivation & nutritional analysis
10. Immobilization of yeast cell using gel beads
11. Enzyme production : Amylase enzyme
12. Sterility control by LAL test
13. ONPG test

REFERENCE BOOKS

1. Benson, J.H., (2001), "Microbiological Applications: A Laboratory Manual in General Microbiology", Eighth Edition, McGraw-Hill, New York.
2. Cappuccino, J.G. and N. Sherman, (2005), "Microbiology - A Laboratory Manual", Seventh Edition, Benjamin and Cummings Publications, San Francisco.
3. Gunasekaran, P., (2005), "Laboratory Manual in Microbiology", New Age International (P) Ltd, New Delhi.
4. Kannan, N., (2003), "Laboratory Manual in General Microbiology", Fourth Edition, Palani Paramount Publications, Palani.

SEMESTER – II	**ELECTIVE – III**
17P2AMBE03	**Total Number of Hours: 60**
Credits – 4	**4 Hours/ Week**

DIAGNOSTIC MICROBIOLOGY

OBJECTIVES:

- To gain the knowledge on microbial sample collection.
- To get aware on microbial pathogencity.
- To impart the knowledge on clinical epidemiology.
- To know the analytical methods on clinical microbiology

UNIT 1 **No of Hours: 12**

Microbiological samples: Sample collection, transport, processing and testing methods of – Blood, Urine, Stool, Sputum, Skin scrapings, Body fluids – CSF, Pleural, peritoneal & pericardial fluid, Bronchoalveolar lavage fluid, hydatid cyst fluid, Joint fluid.

UNIT 2 **No of Hours: 12**

Microbial pathogenicity – pathogenicity and virulence. Quantitative measures of virulence – minimal lethal dose (MLD), LD50, ID50, TCID50. Virulence determinants – colonization, toxins, enzymes and invasiveness. Facultative / obligate intracellular pathogens.

UNIT 3 **No of Hours: 12**

Molecular microbial epidemiology: Biochemical and Immunological tools – biotyping, serotyping, phage typing, FAME, Curie Point PyMS, protein profiling, multilocus enzyme electrophoresis (MLEE); Molecular typing: RFLP (ribotyping, IS based), RAPD, 16S-23S IGS, ARDRA, rep (REP, ERIC, BOX)-PCR, PFGE, AFLP, MLST, MVLST, VNTR, SNP.

UNIT 4 **No of Hours: 12**

Clinical Bacteriology & Mycolgy: Laboratory diagnosis of pyogenic infection, Leprosy, Tuberculosis, URTI, LRTI, Enteric fever, Bacillary dysentery, Diarrhoeal diseases, Urinary tract infection and Meningitis. Candidiasis, Cryptococcal meningitis

UNIT 5 **No of Hours: 12**

Clinical Parasitology & virology: Laboratory diagnosis of Malaria, Protozoal dysentery, Kalazar, Hook worm infection, Ascariasis, Filariasis, Taeniasis, hepatitis, Viral diarrhea and HIV/AIDS,

TEXTBOOKS

1. Jawetz, Melnick, & Adelberg's (2004). **Medical Microbiology by Brooks GF**, Butel JS, Morse SA, Melnick JL, Jawetz E, Adelberg EA . 23rd edition. Lange Publication..

2. Cossart P, Boquet P, Normark S, Rappuoli R. (2005).**Cellular Microbiology.** 2nd edition. American Society for Microbiology Press.

3. Salyers AA and Whitt DD eds. **Bacterial Pathogenesis: A molecular approach.** (2002). American Society for Microbiology Press, Washington, DC USA.

REFERENCES:

1. Hacker J and Dorbindt U. (2006). **Pathogenomics: Genome analysis of pathogenic microbes**. ed. Wiley-VCH.

2. Persing DH, Tenover FC, Versalovic J, Tang Y, Unger ER, Relman DA, White TJ. (2004). **Molecular Microbiology: Diagnostic Principles and Practice**. American Society for Microbiology Press.

3. Nelson KE, Williams CM, Graham NMH. (2001). **Infectious Disease Epidemiology: Theory and Practice.** An Aspen Publication.

Web sites

1. http:// www.microbiologyonline.org.uk/sgmprac.htm
2. http:// www.cvm.uiuc.edu/vdl/AppenA_man.html
3. http:// www.microbes.info/resources/education_and learning
4. http://infohost.nmt.edu/-nmtlib/subj/boil.html
5. http:// www.hoflink.com/%7Ehouse/microbio.html
6. http:// www. Splammo.net/bact102/home102.html
7. http://www.pathmicro.med.sc.edu/book/bact-sta.htm

(For the candidates admitted from 2017- 18 onwards)

17P2AMBE03

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

DIAGNOSTIC MICROBIOLOGY

MAX MARKS: 75 **TIME:3 HOURS**

PART A - (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks

ANSWER ALL QUESTIONS

1. a) How to collect clinical sample and transport? Explain. OR
b) Write about processing and testing methods of Blood and Urine,?

2. a) Write about virulence factor of Pathogens? OR
b) Differentiate the Facultative / obligate intracellular pathogens?

3. a) Write a short note on i) biotyping, ii) serotyping, iii) phage typing. OR
b) Write about RFLP and RAPD?

4. a) Write about Enteric fever? OR
b) Write short note on i) Candidiasis ii) Cryptococcal meningitis

5. a) Write about Hook worm infection?
b) Give s short notes on hepatitis?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks

6. a) Explain processing methods of pleural, peritoneal & pericardial fluid. OR
b) Give detailed account on processing and testing methods of skin scrapings and body fluids.

7. a) Write about quantitative measures minimal lethal dose (MLD), LD50, ID50, TCID50. OR
b).Explain the virulence determinants of colonization, toxins, enzymes and invasiveness of pathogens.

8. a) Briefly explain the biochemical and immunological tools used in epidemiological studies OR
b) Write a short notes on i) protein profiling ii) FAME iii) ERIC iv) SNP

9. a) Briefly explain the laboratory diagnosis of pyogenic infection and URTI?
b) Explain about Diarrhoeal diseases, Urinary tract infection and Meningitis?

10. a) Briefly explain the Laboratory diagnosis of Malaria,Protozoal dysentery and Kalazar?
b) Explain in detailed about HIV/AIDS and its Laboratory diagnosis?

SEMESTER – II	**ELECTIVE – IV**
17P2AMBE04	**Total Number of Hours: 60**
Credits – 4	**4 Hours/ Week**

POULTRY MICROBIOLOGY

OBJECTIVES:

25%

- To gain the knowledge on poultry and its products
- To improve knowledge about the growth of chickens
- To impart the knowledge entrepreneurship in poultry field
- To know the disease profile of chickens.

UNIT - 1 **No of Hours: 12**

House and Cage – Types of poultry houses. Different types of rearing – advantages and disadvantages. Environmentally controlled housing. Brooding: Types of brooders; preparation of shed to receive chicks. Classification of poultry with respect to production characters, age and standards. Cage management – Different types; Advantages and disadvantages

UNIT – 2 **No of Hours: 12**

Nutrition Value of poultry production – Feeding management–Classification of nutrients – Factors influencing nutrient requirements – feed consumption, Nutrient requirements and feed formulations. Feeding systems–Feed restrictions – phase feeding – Additives and supplements. Nutritional and metabolic disorder – Rickets, Osteomalacia, Vitamin A deficiency, Vitamin E deficiency.

UNIT – 3 **No of Hours: 12**

Poultry judging. Egg structure – Physical and chemical composition. Bio-security and principles of disease prevention management. Health care for common poultry diseases – vaccination. General principles of poultry medication. Poultry waste management, pollution, disposal of hatchery waste and environmental issues.

UNIT – 4 **No of Hours: 12**

Viral disease – Newcastle disease – Ranikhet diseases – fowl pox – EDS -76 (egg drop syndrome) – Infectious bursal diseases (Gumboro diseases) – Infectious bronchitis – Infectious Laryngo Tranchitis – Inclusion body hepatitis – Avian encephalomyelitis – Reoviral arthritis – Marek's disease – Avian lymphoid leukosis.

UNIT – 5 **No of Hours: 12**

Bacterial, Fungal and Protozoan diseases – Salmonellosis – Avian coliform infection – Staphylococci – Avian Tuberculosis – Infectious coryza – Avian streptococcal infection –

Clostridia – Avian pasteruellosis. Parasitic and Fungal diseases – Protozoan diseases – Coccidiosis. Internal parasites – Ascardia galli, Tape worms. External parasites - Fowl ticks, Lice, Mites. Fungal diseases. Aspergillosis and aflatoxcosis.

Textbook

1. Mahajan Naresh, (2015). Poultry Nutrition and Management. 1st Edition. Anmol Publications Pvt. Ltd., New Delhi.
2. Wiseman. J, and Garnsworthy. P. C., (1999). Recent Development in Poultry Nutrition.
3. Titus Harry. W, and Fritz James. C, (1971). The Scientific Feeding of Chickens. 5th Edition.

References Books

1. F. Jordan, M. Pattison, D. Alexander and T. Faragher. (2001). **Poultry diseases**. W.B Saunders London.
2. B. W. Calrek (1997). **Diseases of poultry.** 10th Ed., Iowa state university. Ames, Iowa. USA.
3. Reena Kandwal, (2013). **Nutrient Requirements of Poultry**. 3rd Edition.
4. Bell D. Donald and Weaver D. William Jr., (2007). **Commercial Chicken Meat and Egg Production**. 5th Edition. Springer India Pvt. Ltd., Noida.
5. Reddy Ramasubba V., and Bhosale T. Dinesh, (2004). **Handbook of Poultry Nutrition**. 1st Edition. International Book Distribution Co., Lucknow, India.

(For the candidates admitted from 2017 – 2018 onwards)

17P2AMBE04

M.Sc., DEGREE EXAMINATIONS

-------- / ------- 2017.

First Semester

Applied Microbiology

POULTRY MICROBIOLOGY

MAX MARKS: 75 **TIME:3 HOURS**

PART A – (5x5=25)

Answer **ALL** the Questions

All questions carry equal marks

1. a) Explain about the types of poultry houses. OR
b) Write about Different types of rearing and its adavantages and disadvantages.

2. a) Write about the Classification of poultry nutrients? OR
b) Explain about the factors influencing poultry nutrient requirements?

3. a) Write a short note on egg structure and its physical and chemical composition. OR
b) Write about the general principles of poultry medication?

4. a) Write about Newcastle disease and Ranikhet diseases? OR
b) Write short note on Avian encephalomyelitis

5. a) Write about salmonellosis in poultry?
b) Explain about the avian streptococcal infection?

PART B - (5x10=50)

Answer **ALL** the Questions

All questions carry equal marks

6. a) Explain about the Brooding and its types. OR
b) Give detailed account on Classification of poultry.

7. a) Write about the feeding systems present in the poultry. OR
b).Explain the Nutrient and metabolic disorders seen in poultry

8. a) Briefly explain the vaccination of chickens OR
b) Explain in detail about Poultry waste management.

9. a) Briefly explain the Infectious bronchitis and Infectious Laryngo Tranchitis?
b) Explain about Reoviral arthritis and Marek's disease?

10. a) Briefly explain about the External parasites present in chickens ?
b) Explain in detailed about Fungal diseases of poultry?

SEMESTER III

SEMESTER – III **CORE – XI**
17P3AMB07 **Total Number of Hours: 75**
Credits – 5 **5 Hours/ Week**

AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

OBJECTIVES

To enable the students to

- study the soil microbial distribution, interaction and their significance
- learn the microbial diseases of crops and to understand theproduction of biofertilizer and biopesticides
- be familiar with airborne microbes
- be aware of potable and waste water treatment systemand disposal
- acquire knowledge on microbial action in the environment

UNIT - I

Soil formation. Physical and chemical characteristics of soil. Soil atmosphere-water, pH and temperature. Role of microorganisms in composting and humus formation. Microbial degradation of cellulose. Distribution of bacteria, actinomycetes, fungi, algae, protozoa and virus in soil. Microbial interaction-mutualism, amensalism, commensalisms, protocooperation, predation, parasitism and competition.

UNIT - II

Plant microbial interaction – spermosphere, phyllosphere and rhizosphere. N_2 fixation (symbiotic and free living), genetics of N_2 fixation and phosphate solubilisation. Brief account on actinorrhizae. Mycorrhizal association. Mechanism of pathogenesis, symptoms and control measures of the following plant diseases – red rot of sugar cane, late blight of potato, bunchy top of banana and little leaf of brinjal. Biofertilizers types and methods of application – *Rhizobium, Azotobacter, Azospirilum* and Cyanobacteria. Biopesticides: bacterial, fungal and viral. Microbial nematicides and microbial herbicides.

UNIT - III

Aerobiology: Composition of air – aerial environment – microbial propagules in air- Indoor and Outdoor flora of air. Seasonal and diurnal periodicities of airspora. Air sampling techniques: Settle plate method – Anderson sampler and impingers. Significance of air flora. Hazards of laboratory techniques.

UNIT - IV

Aquatic Microbiology: Detection of water borne pathogens: Indicators of faecal pollution – coliform test for water quality – sewers swab method – membrane filter techniques – multiple tube fermentation test. Sewage and effluent treatment: Physical, chemical and biological treatment process of sewage – disinfestation of sewage. Disposal of treated sewage: Irrigation, composting and land filling. DO, BOD and COD. Impact of eutrophication.

UNIT- V

Biofilm formation in water distribution system, biocorrosion of water distribution system, bioremediation of toxic chemicals, bioaugmentation of recalcitrant chemicals. Bioenergy: Bioethanol – biodiesel – biogas – microbial fuel cells. Bioplastics. Biofilters. Bioscrubbers. Microbial enhanced oil recovery – Biosurfactants. Bioleaching of metals: Copper, Uranium and Gold. Bioaccumulation of heavy metals by microbes. Biodeterioration of paint, textile and leather. Biosensor: Structure and function. Biochips. Genetically Modified Organism: *Pseudomonas putida* (super bug).

TEXT BOOKS

1. Rangaswami, G. and D.J. Bagyaraj, (2001). "**Agricultural Microbiology**", 2nd Edition, Prentice-Hall of Private Limited, New Delhi.
2. Subbarao, N.S., (2001). "**Recent Advances in Biological Nitrogen Fixation**", Oxford and IBH, New Delhi.
3. Subbarao, N.S., (1995). "**Soil Microorganisms and Plant Growth**", 4th Edition, Oxford and IBH, New Delhi.

REFERENCE BOOKS

1. Agrios, G.N., (2005). "**Plant Patho**logy", Elsevier Academic Press, Burlington.
2. Paul, A., (2014). "**Soil Microbiology**, Ecology and Biochemistry", Fourth Edition, Academic Press Inc., New York.
3. Lowenfels, J. and W. Lewis, (2010). "Teaming **with Microbes: The Organic Gardener's Guide to the Soil Food Web**", Timber Press, Portland.
4. Sylvia, D.M., Fuhrmann, J.J., Hartel, P.G. and D.A. Zuberer, (2005). "**Principles and applications of soil microbiology**", Second Edition, Pearson, London.
5. Barton, L.L. and Northup, D.E., (2011). "**Microbial Ecology**", John Wiley & Sons, Inc., New Jersey.
6. Lebaron, P., Matheron, R., Normand, P. and Sime-Ngando, T., (2015). "**Environmental Microbiology: Fundamentals and Applications**", Springer, New York.

7. Mitchell, R. and Gu, J.D., (2010). "**Environmental Microbiology**", 2nd Edition, John Wiley & Sons, Inc., New Jersey.
8. Pepper, I.L., Gerba, C.P. and Gentry, T.J, (2015). "**Environmental Microbiology**", 3rd Edition, Elsevier, New York.
9. Ronald, A.M. and Bhartha, R., (2000). **"Microbial Ecology"**, 4th Edition. Benjiman/Cummings Publications, California.

SEMESTER – III	**CORE – XII**
17P3AMB08	**Total Number of Hours: 75**
Credits – 5	**5 Hours/ Week**

MEDICAL VIROLOGY AND PARASITOLOGY

Objectives:

- To gain knowledge about general properties of viruses.
- To understand the diseases caused by arthropod borne and rodent borne viruses.
- To gain knowledge about the diseases caused by pox, adeno, herpes and hepatitis viruses.
- To understand protozoan diseases.
- To gain knowledge about diseases caused by helminthes.

The contents of this course will help the students to understand important diseases caused by viruses and parasites with reference to etiology, pathogenesis, laboratory diagnosis, control and treatment.

UNIT I

General Properties of viruses – Detection of viruses and antigens in clinical specimens – Serological diagnosis of virus infections. Cultivation of viruses – Vaccines and Interferons – Antiviral agents.

UNIT II

Arthropod borne and rodent borne viral diseases - Picorna viruses, Rabies, Orthomyxo and Paramyxo viruses.

5%

UNIT III

Pox, Adeno, Herpes, Varicella Zoster, CMV, Epstein – Barr Viruses, Hepatitis viruses, HIV Viruses, Oncogenic viruses – Viral vaccines- Preparation and their immunization schedule.

UNIT IV

Introduction to Medical Parasitology – Classification, Protozoa – *Entamoeba* sps – *Plasmodium* sps, *Leishmania* sps- *Trypanosoma* sps – *Giardia* sps – *Trichomonas* sps – *Balantidium* sps.

UNIT V

Platyhelminthes – *Taenia – Fasciola – Paragonimus – Schistosoma. Nemathelminthes – Ascaris – Ankylostoma – Enterobius – Trichuris – Wuchereria –*. Laboratory techniques in Parasitology. Examination of faeces for ova and cysts – Concentration methods. Blood smear examination for Parasites. Cultivation of Protozoan Parasites.

Text Books

1. Saravanan P (2006). **Virology**. 1st Edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
2. Arti Kapil (2013). **Ananthanarayan and Paniker's Text Book of Microbiology**.9th Edition, Orient Blackswan Private Limited.
3. Chakraborty P (2015). **A Text Book of Microbiology**. New Central Book Agency (P) Ltd., Kolkata.
4. Subhash Chandra Parija (2004). **Text Book of Medical Parasitology**. 2nd Edition, All India Publishers and Distributors, New Delhi.

Reference Books

1. Dimmock NJ and Primrose SB (1994). **Introduction to Modern Virology**. 4th Edition, Blackwell scientific Publications, Oxford.
2. Jawetz, Melnick and Adelberg, (2010**). Medical Microbiology** (25th edition) McGraw Hill Publications.
3. Flint JS and Skalka AM, Enquist LW and Racaniello VR (2015). **Principles of Virology**. 4rd Edition, ASM Press, New York.
4. Chatterjee KD (2009). **Medical Parasitology**. 13th Edition, CBS Publishers and Distributors Pvt Ltd., New Delhi.

SEMESTER –III	**CORE-XIII**
17P3AMB09	**Total Number of Hours: 75**
Credits - 5	**5 Hours/ Week**

GENETIC ENGINEERING AND GENE TECHNOLOGY

Objectives

To enable the students to

i. acquire knowledge on DNA modifying enzymes
ii. understand the molecular biology of vectors
iii. be familiar with the cloning techniques
iv. understand the concept of transgenic technology
v. learn the applications of genetic engineering

20%

UNIT - I

Restriction enzyme: Types and properties. DNA modifying enzymes: Ligase, kinase, phosphatase, S_1 Nuclease, exonuclease and terminal transferase. Polymerase enzymes: *Taq*, *Pfu*, T4 DNA polymerase and reverse transcriptase.

UNIT - II

Vectors: Types and properties of vector. Plasmid vector: pBR^{322}, pUC19 and Ti plasmids. Phage vectors: λ and M13 vectors. Cosmid and phasmid vectors. Artificial chromosomes: YAC, BAC, PAC and HAC.

UNIT - III

Gene cloning: cloning strategies - Host selection, vector selection and target selection. Genomic libraries and cDNA libraries. Library screening: nucleic acid hybridization, immunological and screening by function. Gene transfer techniques: physical, chemical and biological transfer techniques.

UNIT - IV

Transgenics and its applications : Transgenic and gene knockout technologies: targeted gene replacement, gene augmentation and gene silencing. DNA sequencing: enzymatic, chemical and pyro sequencing. Mutagenesis: site directed, cassette and random mutagenesis. PCR - Types and applications. RAPD, RFLP and AFLP.

UNIT - V

Applications of Genetic engineering: Medicine (production of Hormone: insulin, somatostatin and somatotropin interferon and recombinant vaccines). Ethics and fate of genetically modified organisms (GMOs).

Reference Books

1. Brown, T.A., "Gene Cloning and DNA Analysis: An Introduction", Sixth Edition, Wiley-Blackwell Publishing Ltd., Oxford, 2010.
2. Cooper, G.M. and Hausman R.E., "The Cell: A Molecular Approach", Fifth Edition, Sinauer Associates Inc., New York, 2009.
3. Dale, J.W. and Park, S.F., "Molecular Genetics of Bacteria", Fourth Edition, John Wiley & Sons Ltd., Chichester, 2004.
4. Dale, J.W., Schantz von M. and Plant, M., "From Genes to Genomes : Concepts and Applications of DNA Technology", Third Edition, John Wiley & Sons Ltd., Chichester, 2012.
5. Dubey, R.C., "A Text Book of Biotechnology", S. Chand and Company, New Delhi, 2000.
6. Freifelder, D, "Molecular Biology", Narosa Publishing House, New Delhi, 1991.
7. Glick, B.R. and *Pasternak, J.J.,* "Molecular Biotechnology", A.S.M. Press, London, 2001.
8. Karp, G., "Cell and Molecular Biology: Concepts and Experiments", Sixth Edition, John Wiley & Sons Inc., New York, 2010.
9. Primrose, S.B. and Twyman, R.M., "Principles of Gene Manipulation and Genomics", Seventh Edition, Blackwell Science Publishing, Oxford, 2006.

SEMESTER –III	**CORE PRACTICAL-XIV**
17P3AMBP05	**Total Number of Hours: 60**
Credits - 3	**5 Hours/ Week**

CORE PRACTICAL – V
AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

1. Isolation of bacteria, fungi and actinobacteria from rhizosphere soil
2. Isolation of Rhizobium from root nodule
3. Isolation and culturing of Azotobacter
4. Isolation of cyanobacteria from paddy field
5. Isolation of phosphate solubilizing bacteria from soil
6. Mass production of Azolla, Mycorrhizae
7. Isolation of cellulose degrading bacteria from compost
8. BOD
9. COD
10. MPN technique
11. Membrane filter technique

10%

Reference Books

1. Aneja, K.R., "Experiments in Microbiology and Plant Pathology", New Age Publications, New Delhi, 2003.
2. Benson, J.H., "Microbiological Applications: A Laboratory Manual in General Microbiology", Eighth Edition, McGraw-Hill, New York, 2001.
3. Cappuccino, J.G. and Sherman, N., "Microbiology - A Laboratory Manual", Eleventh Edition, Benjamin and Cummings Publications, San Francisco, 2017.
4. Dubay, R.C. and Maheswari, D.K., "Practical Microbiology", New Age Publications, New Delhi, 2002.
5. Kannan, N., "Laboratory Manual in General Microbiology", Fourth Edition, Palani Paramount Publications, Palani, 2003.

SEMESTER –III	Core Practical -XV –Practical
17P3AMBP06	**Total Number of Hours: 75**
Credits - 3	**5 Hours/ Week**

CORE PRACTICAL - V- MEDICAL VIROLOGY, PARASITOLOGY, GENETIC ENGINEERING AND GENE TECHNOLOGY

Cultivation of viruses

(a) Egg inoculation methods (all routes)

(b) Animal tissue culture (demonstration)

Serological tests: Serodiagnosis of various viral diseases.

- ELISA – HBV and HIV.
- Complement fixation test.
- Haemagglutination and Haemagglutination Inhibition Test.

Genetic Engineering

1. Isolation of genomic DNA from bacterial cells and quantification by UV spectrophotometer
2. Isolation of plasmid DNA from bacterial cells and separation by agarose gel electrophoresis.
3. Melting point determination of bacterial DNA.
4. Single and Double Restriction enzyme digestion of plasmid DNA.
5. Determination of Molecular weight of proteins by SDS PAGE.
6. Bacterial transformation and blue white selection assay.
7. NCBI Blast search algorithm (Demonstration)
8. Western blotting (Demonstration)

Reference Manuals

1. Dubey RC and Maheshwari DK (2012). **Practical Microbiology.** 3rd Edition. S. Chand & Company Ltd., New Delhi.
2. Aneja KR (2010). **Experiments in Microbiology, Plant pathology and Biotechnology**. 4th Edition, New age International publishers, Chennai.

3. Chaitanya KV (2013). **Cell and Molecular Biology: A Lab Manual.** Prentice Hall India Learning Pvt Ltd.
4. Vennison SJ (2010). **Laboratory Manual for Genetic Engineering**. 1st Edition, Prentice Hall India Learning Pvt Ltd.
5. Palanivelu P (2009). **Analytical Biochemistry and Separation Techniques.** 4th Edition. Twenty First Century Publications.

SEMESTER –III	**CORE-XV**
17P3AMBE05	**Total Number of Hours: 75**
Credits - 4	**5 Hours/ Week**

GENOMICS AND PROTEOMICS

Objectives

To enable the students to

i. be familiar with the concepts of genomics
ii. learn the techniques of genome sequencing
iii. acquire knowledge on proteomic methods
iv. understand the principle of mass spectrometry
v. be familiar with the applications of genomics and proteomics

UNIT - I

Genomics: Basic concepts and scope of genomics. Structural features: Prokaryotic genome (*E.coli*) - eukaryotic genome (Yeast, *Drosophila*, *Arabidopsis thaliana* and human genome). Genome projects: *E.coli*, *A.thaliana* and *Homo sapiens*. Genome mapping: Physical mapping and cytological mapping.

UNIT – II

Genome sequencing: Hierarchical sequencing and whole genome shotgun Sequencing. Genome annotation. Expressional analysis: Parallel analysis of gene expression- cDNA microarray, Long oligonucleotide microarray, Short oligonucleotide microarray and SAGE.

UNIT - III

Proteomics- Basic concepts and scope of proteomics. Protein separation: Single dimensional and two dimensional gel electrophoresis - advantages of two dimensional gel electrophoresis. Detection of protein spots in gel: Organic dye staining, silver staining and fluorescent staining and image analysis. Protein arrays: Definition, applications, diagnostics and expression profiling.

UNIT - IV

Proteomic tools: Gel spot visualization and picking. Tryptic digestion of protein and peptide fingerprinting. Mass spectrometry: Ion source (MALDI) - analyzer (ToF) and detector.

UNIT – V

Application of genomics and Proteomics: Embryogenomics - cancer genomics – pharmacogenomics - metabolomics. Personalised medicine. Applications of proteome analysis: Protein-protein interaction (Two hybrid interaction screening) - Protein engineering - Protein chips and functional proteomics.

Reference Books

1. Brown, T.A., "Gene cloning and DNA analysis: An Introduction" Sixth Edition, Wiley-Blackwell Publishing Ltd., London, 2010.
2. Gibson, G. and Muse, S.V., "A primer of Genome Science", Second Edition, Sinauer Associates Inc., Massachusetts, 2004.

3. Hoffman, E.D. and Stroobant, V., "Mass Spectrometry-Principles and applications", Third Edition, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, 2007.
4. Liebler, D.C. and Yates, J.R., "Introduction to Proteomics-Tools for the New Biology", Humana Press, Totowa, 2002.
5. Mishra, N.C., "Introduction to Proteomics: Principles and Applications", First Edition, John Wiley & Sons, Inc. New Jersey, 2011.
6. Primrose, S.B. and Twyman, R.M., "Principle of Gene Manipulation and Genomics", Seventh Edition, Black Well Publishing Company, Oxford. 2012.
7. Rehm, H., "Protein Biochemistry and Proteomics", First Edition, Elsevier Academic Press., Burlington, 2006.
8. Starkey, M. and Elaswarapu, R., "Genomics: Essential Methods" John Wiley & Sons, Ltd. West Sussex. 2011.
9. Veenstra, T.D. and Yates, J.R., "Proteomics for biological Discovery", First Edition, A John Wiley & Sons, Inc. New Jersey, 2006.
10. Westermeier, R. and Naven, T., "Proteomics in Practice: A laboratory Manual of Proteome Analysis". Wiley-VCH, Darmstadt, 2002.

SEMESTER –III	**CORE-XV**
17P3AMBE06	**Total Number of Hours: 75**
Credits - 4	**5 Hours/ Week**

MICROBIAL FUEL CELL AND NANOTECHNOLOGY

OBJECTIVES

To enable the students to

i. know the microbial fuel cell technology and its types
ii. understand the mechanism of microbial fuel cell
iii. acquire the knowledge on nanotechnology
iv. learn the methods of nanoparticle synthesis
v. study the applications of nanotechnology

UNIT – I

Microbial fuel cell - definition and history. Types of MFC- mediator microbial fuel cell, free microbial fuel cell, microbial electrolysis cell, soil based microbial fuel cell-designing of microbial fuel cell-materials used for construction of MFC.

UNIT – II

Flow control in microbial fuel cell technology. Biochemical and electrochemical perspectives of the anode of a microbial fuel cell- Catabolic pathways involved in energy production from microbes and electron transfer mechanisms. Factors that affect performance of microbial fuel cells and potential remedies. Applications- power generation, biosensor and water treatment.

UNIT – III

Nanotechnology - history and scope of nanotechnology. Techniques used in nanotechnology: Bottom-up techniques - top down approaches. Methods of nanoparticle synthesis- Physical methods (ball milling and laser ablation) - chemical methods (sol-gel methods and microwave synthesis) – Biological methods (bacteria, fungi and plants).

UNIT – IV

Nanoparticle characterization- SEM, TEM, EDAX, XRD, FTIR and DLS. Antimicrobial activity of nanoparticles-mechanism of activity. Nanodrug delivery - liposomes, dentrimers, polymeric micelles, nanocapsules, nanotubes- advantages of nanodrug delivery.

UNIT – V

Nanotechnology in agriculture. Nanotechnology in food industry. Nanotechnology in textiles. Environmental risks of nanoparticles. Ethical considerations in the advance of nanotechnology. IPR in nanotechnology.

TEXT BOOKS

1. Karkare, M., 2008, "Nanotechnology: Fundamentals and applications", I.K. International Publishing House Pvt. Ltd., New Delhi.
2. Murthy, B.S., Shankar, P., Raj, B., Rath, B.B. and J. Murday, 2012, "Text book of Nanoscience and Nanotechnology", First Edition, University Press, Hyderabad.

REFERENCE BOOKS

1. Foster, L.E., 2006, "Nanotechnology-Science, innovation and opportunity", Pearson, Noida.
2. Menon, J., 2009, "Nanotechnology", First Edition, Essential Book, New Delhi.
3. Rathinasamy, A., Parameshwari, C. and V. Ponnuswami, 2012, "An introduction to nanotechnology", New India Publishing Agency, New Delhi.
4. Schulte, J., 2010, "Nanotechnology-Global strategies, industry trends and applications", Wiley India Pvt. Ltd., New Delhi.
5. Soni, S.K., 2007, "Microbes: A source of energy for 21st Century", New India Publishing Agency, New Delhi.
6. Tsan Wang, C., 2014, "Technology and application of Microbial cells", InTech Publishers, Croatia.

SEMESTER IV

SEMESTER –IV	**CORE-XVI**
17P3AMB010	**Total Number of Hours: 75**
Credits - 5	**5 Hours/ Week**

RESEARCH METHODOLOGY AND BIOSTATISTICS

Objective

This paper is aimed at providing exposure to the students on the basic skills for becoming

a researcher in microbiology.

UNIT - I

Introduction – importance - identification of research areas. Review of Literature- Research design and experimentation-Preparation of research report. Guidelines for preparing an article - ISSN, ISBN impact factor, citation index, h-index, I-index, Google scholar, Scopus. Computers in biological research-methods of data presentation, graphical representation by histogram, polygon, ogive curves and pie diagram.

UNIT - II

Microscopy – TEM, SEM, AFM, Electrophoresis, PCR, RAPD, RFLP. Immuno-assays: SRID, ELISA, RIA, Western Blotting, Immunofluroscens and their application. Histochemical studies.

UNIT- III

Analytical Techniques-Centrifugation, Column, Gas and High Pressure Liquid Chromatograpy, Spectrophotometry, Flurimetry, NMR, Atomic Adsorption and Mass Spectroscopy, X-ray diffraction, Radio isotope techniques, GM outer and Scintillation Counter.

UNIT- IV

Basic definitions and applications. Measures of central tendency: Mean, Median, Mode. Representative sample, sample size, sampling bias and sampling techniques. Data collection and presentation: Types of data, methods of collection of primary and secondary data, methods of data presentation.

UNIT - V

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Tests of significance: Small sample test (Chi-square t test, F test), large sample test (Z test) and standard error. Frequency distributions, Probability curve, Measures of central tendency,

Variability, z-scores, Correlation-regression, Student's t-test, Chi square test, F-test, ANOVA, one and two way classification. Statistical tools –MATLAB, SPSS, RSM.

References

1. Gurumnani, N., (2006). Research methodology for biological sciences (1st Edition). MJP Pubsihers. A unit of Tamilnadu Book House, Chennai.
2. Bajpai, S. (Ed.), (2006). Biological instrumentation and methodology. Chand & Company Ltd., New Delhi,
3. Jeffrey A. W. and L. S.Myra, (2002). Statistics for the Life Sciences (3rd Edition). PrenticeHall
4. Essentials of Immunology by Riott I .M. 1998. ELBS, Blackwell Scientific Publishers, London.
5. Glick, B.R. and J.J.Pasternack, (1998). Molecular Biotechnology (2nd Edition). ASM Press, Washington, DC.
6. Webster, J.G., (2004). Bioinstrumentation. Student Edition. John Wiley and Sons, Ltd.
7. Glantz , S.A., (2001). Primer of Biostatistics. McGraw-Hill. 12.Rosner, B., (1999). Fundamentals of Biostatistics. Duxbury Press.
8. Motulsky, H.,(1995) Intuitive Biostatistics. Oxford University Press.

Web References

http://www.math.yorku.ca/scs/statResource.html# General
http://www.jegsworks.com/Lessons/index.html

http://www.bettycjung.net/statsites.html
http://www.biostat.harvard.edu/links/
http://www.ped.mod.utah.edu/genpedscrr/Epibio.html\

SEMESTER –IV	**CORE-XV**
17P3AMBE07	**Total Number of Hours: 75**
Credits - 4	**5 Hours/ Week**

BIOETHICS, BIOSAFETY AND IPR

This course helps to adhere to the ethical practices appropriate to the discipline at all times and to adopt safe working practices relevant to the bioindustries & field of research :

Objectives:

1. Students will gain awareness about Intellectual Property Rights (IPRs) to take measure for the protecting their ideas
2. They will able to devise business strategies by taking account of IPRs
3. They will be able to assists in technology upgradation and enhancing competitiveness.
4. They will acquire adequate knowledge in the use of genetically modified organisms and its effect on human health
5. They will gain more insights into the regulatory affairs.

UNIT I:

Introduction to Bioethics. Social and ethical issues in Biotechnology. Definition of Biosafety. Biosafety for human health and environment. Social and ethical issues. Use of genetically modified organisms and their release in to the environment. Special procedures for r-DNA based products, Transgenic plants and Animals.

UNIT II:

Regulatory Affairs: Regulation, national and international guidelines of Biosafety, rDNA guidelines, Regulatory requirements for drugs and Biologics GLP and GMP.

UNIT III:

Intellectual Property Rights : Intellectual property rights and protection, patents and methods of application of patents, Trade Secrets copyrights, Trade Marks, legal implications, farmer's rights, plant breeder's rights. International and National conventions on biotechnology and related areas, WTO guidelines.

UNIT IV:

Safety, Responsibilities and Rights: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk – the three mile island and case studies. Collegiality and loyalty -

respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights.

UNIT V:

Global Issues : Multinational corporations - Environmental ethics - computer ethics - weapons development and bioterrorisms - engineers as managers consulting engineers - engineers as expert witnesses and advisors - moral leadership-sample code of Ethics.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCEBOOKS:

1. Sasson A, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993. 7. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001. 9. Singh K. "Intellectual Property Rights on Biotechnology", BCIL, New Delhi.

SEMESTER –IV	**CORE-XV**
17P3AMBE08	**Total Number of Hours: 75**
Credits - 4	**5 Hours/ Week**

ENTREPRENEURSHIP IN MICROBIOLOGY

OBJECTIVES

To enable the students to

i. understand the fundamental concepts of entrepreneurship
ii. comprehend the procedure in starting an entrepreneurial career
iii. keep abreast of the institutional support in the field of entrepreneurship
iv. know the role of microbes in environmental management
v. learn the applications of microbiology

UNIT - I

Entrepreneurship: evolution concepts of entrepreneur – entrepreneurship: Definitions-Meaning-characteristics- types of entrepreneurs- qualities- functions of an entrepreneur. Development – need – role of source, talent and spirit – Process of entrepreneurship to socio-economic gains. Starting a business: Forms of ownership - Product selection - licensing procedures.

UNIT - II

Project analysis: Idea generation – sources of idea generation – Trade fairs and Exhibitions-Project identification and selection – classification – project formulation – project appraisal - feasibility analysis- market, production, technical and social.

UNIT - III

Institutions and schemes of Government of India. Schemes and Programmes, Department of Science and Technology schemes, Nationalized banks- other financial institutions - support for entrepreneurs: APEDA, DIC, TIIC, SISI, NABARD and commercial banks. Entrepreneurial development programmes

UNIT - IV

Skills for entrepreneur – communication skills, problem solving skills; Business plan development; Market need – Market research, SWOT analysis, identifying competitors. Financial plan – Financial support for business, business insurance, Marketing – mix-product, distribution, price, promotion and market goal setting.

UNIT - V

Composting of domestic, agricultural and industrial wastes. Vermicomposting, Spirulina and mushroom cultivation (brief account only). Production of teaching kits (plasmid DNA isolation, electrophoresis) and diagnostic kits (Widal test kit and ABO blood grouping kit). Designing and execution of clinical laboratory, quality control lab and research laboratory.

TEXT BOOK

1. Study material prepared by the Department of Microbiology.

REFERENCE BOOKS

1. Bhatia, B.S. and G.S. Batra, 2003, "Entrepreneurship and small business management", Deep and Deep Publications, New Delhi.
2. Desai, V., 2001, "Dynamics of Entrepreneurial Development and Management", Fourth Edition, Himalaya Publishing House Mumbai.
3. Gordon, E. and K. Natarajan, 2009, "Enterpreneur Development", Third Edition, Himalaya Publishing House, Mumbai.
4. Gupta, C.B. and N.P. Srinivasan, 2003, "Entrepreneurial Development", Reprint, Sultan Chand and Sons, New Delhi.
5. Hisrich, D.R., 2008, "Entrepreneurship", Sixth Edition, Tata McGraw Hill Private Limited, New Delhi.
6. Mohanty, S.K., 2005, "Fundamentals of Entrepreneurship", Sixth Edition, Prentice Hall India Private Limited, New Delhi.
7. Nagendra, S., 2008, "Entrepreneurship and Management", Sanguine technical Publishers, New Delhi.
8. Naidu, V.V.R., 2008, "Management and Entrepreneurship", I.K. International Pvt. Ltd, New Delhi.
9. Saxena, S., 2015, "Applied Microbiology", Springer, New York.

SEMESTER –IV	**CORE-XV**
17P3AMBE08	**Total Number of Hours: 75**
Credits - 4	**5 Hours/ Week**

ENTREPRENEURSHIP IN MICROBIOLOGY

UNIT - I

Evolution of the concept of entrepreneur - Entrepreneurship: Definitions - concept of Entrepreneurship, development - need - role of resource, talent and spirit - process of Entrepreneurship to socio-economic gains.

UNIT - II

Institutions and schemes of Government of India - Ministry of Science and Technology, Nationalized banks - other financial institutions - SIDBI, NSIC, NABARD, IDBI, IFCI and ICICI.

UNIT – III

Skills for entrepreneurs - communication skills, problem solving skills, Business plan development. Market need - market research, SWOT analysis, identifying competitors. Financial plan - financial support for business, business insurance, Marketing - mix-product, distribution, price, promotion and market goal setting.

UNIT – IV

Project- idea generation - Sources of idea generation-Trade Fairs and Exhibitions Project identification-classification - project formulation - project appraisal. Composting of domestic, agricultural and industrial wastes, vermi - composting, SCP production - mushroom cultivation.

UNIT - V

Biofertilizers and Biopesticides. Microbial synthesis of nanoparticles and nano based product. Production of teaching kits (plasmid DNA isolation, serum electrophoresis) and diagnostic kits (Widal test kits, ABO blood grouping kits).

References

1. Marks, G.C. and T.T. Koslowski (Eds.),1973. Ectomycorrhizae, Academic Press. London. 53

3. Sandera, F.E., B. Mosse. and P.B. Tinke, 1975. Endomycorrhizae. Academic Press, London.

4. Thompson, L. M. and T. Fredrick, 1979. Soils and Soil Fertility. Tata Mc GrawHill Publishing Co., New Delhi.

5. Rao, N.S., 1980. Biofertilizers in Agriculture. Oxford and IBH Publishing Co. Pvt. Ltd., Bombay.

7. Harley, J.L. and S.E. Smith, 1983. Mycorrhizal Symbiosis. Academic Press, London.

8. Tirdale, S.L. Nelson, L. Werver and J.D. Becton, 1985. Soil fertility and fertilizers. Macmillan Publishing Co., New York.

10. Tilak, K.V.B.R., 1990. Bacterial Biofertilizers. IARI Publications, New Delhi.

12. Subba Rao, N.S., 1995. Biofertilizer in agriculture and forestry. Oxford and IBH, New york.

13. Totawat, K.L., L.L. Somani, R.A. Sharma and S.R. Maloo, 2004. Biofertilizer Technology. Agrotech Publishing Academy, Udaipur, Rajasthan. Web references

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2. www.orgs.tigweb.org/33065

3. www.womensjoblist.com/resumes/18143-Microbiologist.html

4. www.entretechforum.org/mm_May19_2009.htm

5. www.linkedin.com/pub/dir/george/hlass.