

## BACHELOR WITH BIOTECHNOLOGY AS MAJOR

### 2<sup>nd</sup> SEMESTER

#### BTG 222J: MICROBIOLOGY AND IMMUNOLOGY

CREDITS: THEORY - 4, PRACTICAL – 2

MAXIMUM MARKS: 100, MINIMUM MARKS: 36

- **Objective:** Students will learn basics of microbiology like structure, bacterial genetics and general account of viruses. Students will learn about immune system – types of immune response, cells and different organs of the system. They would also learn responses generated by Lymphocytes, Antigen-Antibody interactions.
- **Expected Learning Outcomes:**
  - A student will be able to use microscopes, differentiate bacteria on basis of Gram staining and differentiate between different types of gene transfers in bacteria and classify viruses.
  - A student will be able to grow bacteria, measure their growth, determine the effect of different factors on growth and be able to control the growth of microbes.
  - Will be able to differentiate between different immune responses, cells involved and organs of immune system.
  - Able to classify antigen, adjuvants and haptens. Carry out different antigen-antibody interactions.

#### Unit –1      15 Hours

General structure of Bacterial cell (cell wall – Gram +ve and Gram –ve, flagella, bacterial chromosome, plasmid, cell inclusions).

Gene transfer in bacteria (Transformation, conjugation, transduction).

General structure of viruses (Capsid symmetry, enveloped and non-enveloped viruses) viral classification (RNA & DNA, positive & negative stranded viruses). Bacteriophages - lambda phage life cycle).

#### Unit –2      15 Hours

Nutritional requirements, Bacterial nutritional types (photolitho-autotrophy, chemolithio-autotrophy, photoorgano-heterotrophy and chemoorgano-heterotrophy). Growth curve - its phases, Growth kinetics. Factors affecting growth (solute and water activity, pH, temperature, oxygen concentration, pressure), Measurement of bacterial growth. Control of microbial growth (physical, chemical and antibiotics).

#### Unit – 3      15 Hours

Innate Immune system, (Anatomical and physiological barriers). Hematopoiesis, Cells of

myeloid and lymphoid system (Basophils, Neutrophils, Eosinophils, monocytes, T cells, B cells, NK cells, dendritic cells, mast cells). Phagocytosis and respiratory burst, Inflammation (clinical signs, initiators and mediators), Organs of immune system – primary (bone marrow, thymus) secondary (lymph node, spleen, MALT). Lymph and lymphatic system. Host-pathogen interaction, Toll like Receptors, Basic concept of cytokines. Complement system – pathways.

#### **Unit – 4      15 Hours**

Nature and properties of antigen, Structure and types of antibodies, Primary and secondary immune response. Antigen processing and presentation. Mechanism of humoral immune response, Significance of Co-Stimulation. Mechanism of cell mediated immune response. Monoclonal antibodies – uses. Basic concept of vaccines.

#### **PRACTICALS (2CREDITS: 30 hours)      Maximum Marks: 50, Minimum Marks: 18**

1. Preparation and sterilization of culture media for bacterial cultivation.
2. Culture Techniques: Streaking, Spreading etc.
3. Gram staining
4. Blood smear preparation and staining.
5. Introduction to different types of media, selective, differential media etc.,
6. Total and differential Leukocyte count, Total RBCcount and Blood grouping.
7. Field trip/subject tour (visit to food/dairy/industry/institute/lab/university)

#### **BOOKS RECOMMENDED**

1. General Microbiology: Stanier, R. Y., Ingraham, J. L., Wheelis, M. L. and Painter, P. R. – Macmillan Press Ltd., UK.
2. Microbiology: Prescott, L.M.,Harley, J.P.and Klein, D.A.-McGraw-Hill.
3. Microbiology: Pelczar,M.J., Chan, E. C.S. and Krieg, N.R.-McGraw-Hill.
4. Kuby Immunology: Goldsby, R. A., Kindt, T. J., Osborne, B. A. and Kuby, J. - W.H. Freeman and Company, New York.
5. The Immune System: Parham, P.-Garland Publishers.
6. Text Book of Immunology, Seemi Farhat Basir, PHI.

## **BACHELOR WITH BIOTECHNOLOGY AS MINOR**

### **2<sup>nd</sup> SEMESTER**

#### **BTG 222N: MICROBIOLOGY AND IMMUNOLOGY**

**CREDITS: THEORY - 4, PRACTICAL – 2**

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#### **Unit –1      15 Hours**

General structure of Bacterial cell (cell wall – Gram +ve and Gram –ve, flagella, bacterial chromosome, plasmid, cell inclusions).

Gene transfer in bacteria (Transformation, conjugation, transduction).

General structure of viruses (Capsid symmetry, enveloped and non-enveloped viruses) viral classification (RNA & DNA, positive & negative stranded viruses). Bacteriophages - lambda phage life cycle).

#### **Unit –2      15 Hours**

Nutritional requirements, Bacterial nutritional types (photolitho-autotrophy, chemolithio-autotrophy, photoorgano-heterotrophy and chemoorgano-heterotrophy). Growth curve - its phases, Growth kinetics. Factors affecting growth (solute and water activity, pH, temperature, oxygen concentration, pressure), Measurement of bacterial growth. Control of microbial growth (physical, chemical and antibiotics).

#### **Unit – 3      15 Hours**

Innate Immune system, (Anatomical and physiological barriers). Hematopoiesis, Cells of

myeloid and lymphoid system (Basophils, Neutrophils, Eosinophils, monocytes, T cells, B cells, NK cells, dendritic cells, mast cells). Phagocytosis and respiratory burst, Inflammation (clinical signs, initiators and mediators), Organs of immune system – primary (bone marrow, thymus) secondary (lymph node, spleen, MALT). Lymph and lymphatic system. Host-pathogen interaction, Toll like Receptors, Basic concept of cytokines. Complement system – pathways.

#### **Unit – 4      15 Hours**

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