6th Semester Syllabus for B.Sc. in Microbiology

Program Name	**B.Sc.in Microbiology**	Semester	**VI**
Course Title	**IMMUNOLOGY AND MEDICAL MICROBIOLOGY(Theory)**		
Course Code:	**21BSC6C13MBL**	No. of Credits	**4**
Contact hours	**60 Hours (4hours per week)**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Outcomes (Cos): After the successful completion of the course, the student will be able to:

CO1: To understand pathogenic bacterial infections, symptoms, diagnosis and treatment process treatment process.
CO2: To gain a preliminary understanding about various immune mechanisms.
CO3: To familiarize with Immunological techniques and serodiagnosis of infectious diseases.

CONTENT

UNIT-I: Immune system Edward Jenner, Louis Pasteur, Immunity; Natural (active and passive) and artificial (active and passive) with example, Innate and acquired, Humoral and cell mediated. Early theories to explain the formation and specificity of antibody; Selective, instructional and clonal selection. Cells and organs of immune system: Hematopoiesis, cytokines, properties and functions of B and T Lymphocytes, Natural killer (NK) cells, Granulocytes (Neutrophils, Eosinophils and Basophils), Monocytes and macrophages, Dendritic cells and Mast cells. Primary lymphoid organs; Bone marrow and Thymus. Secondary lymphoid organs; Spleen and Lymphnodes.	15 hrs
UNIT-II: Antigen and antibody Antigen: Immunogenicity and antigenicity, epitopes, haptens. Properties of antigen contribute to immunogenicity; Chemical nature (proteins, carbohydrates, lipids and nucleic acids), degree of foreignness, molecular weight, chemical composition and complexity, degradability. Adjuvants (alum, Freund's incomplete and complete) and their importance. Epitopes. Antibody: Basic structure of antibody, light and heavy chain, variable and constant region, hinge region. Structure and functions of different types of antibodies (IgM,IgG, IgA, IgE,and IgD). Antibody mediated effector functions; opsonization, complement activation and antibody dependent cell mediated cytotoxicity (ADCC). Antigenic determinants on immune globulins: Isotype, allotype and idiotype. Polyclonal Monoclonal antibody production. Complement system: Functions of complement components, Complement activation, type of complement activation pathways, membrane attack complex (MAC),complement fixation, Hypersensitive reactions: Classification, Type I ,Type II, Type III and Type IV, Antigen-antibody interactions: Definition of affinity and avidity. Agglutination, Immuno precipitation; Radial diffusion (Mancini) and double diffusion (Ouchterlony), Enzyme linked immune-sorbent assay(ELISA):Direct, indirect and sandwich ELISA. Radio immune assay(RIA).Immunofluorescence	15hrs
UNIT-III: Human microbiota and Medical Bacteriology Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions – Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS. Sample collection, transport and diagnosis. Medical Bacteriology: Details of Symptoms, mode of transmission, prophylaxis and control Respiratory diseases: *Streptococcus pyogenes, Haemophilus holera a, Mycobacterium tuberculosis* Gastrointestinal Diseases*: Escherichia coli, Salmonella typhi, Vibrio holera, Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani*.	15hrs

UNIT-IV Medical Virology, parasitology and Mycology Details of Symptoms, mode of transmission, prophylaxis and control Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Corona, Influenza, swine flu, Ebola, Chikungunya, Japanese Encephalitis Protozoan diseases: Malaria, Kala-azar, Entamoeba Fungal infections- Cutaneous mycoses: Tinea, pedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis Antimicrobial therapy: Antimicrobial agents: General characteristics and mode of action Antibacterial agents: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine . Antibiotic resistance, MDR, XDR, MRSA, NDM-1.	15hrs

References:

1. Bradley and Mecharty. Clinical Immunology. Oxford University Press, New York.
2. Abbas AK, Lichtman and Pobes. Cellular and Molecular Immunology. W.B. Saunders Co.,
3. Coleman. Fundamental Immunology. Brown Publishers. BubuoneZowa.
4. Catty. Maintenance of Laboratory Animals and Production of antibodies.
5. Janis Kubey. Immunology. Freeman & Co., New York.
6.Topley and Wilson. Principles of bacteriology, Virology and Immunity. Edward Arnold

Course Title	**IMMUNOLOGY AND MEDICAL MICROBIOLOGY (LAB)**	Practical Credits	**2**
Course Code	**21BSC6C14MBP**	Contact Hours	**4Hours/week**
		Duration of Exam	**3 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

Course outcome: After the successful completion of the course, the student will be ableCO1: To identify the pathogenic bacteria, fungi.
CO2: Able to detect the blood groups, WBC count.CO3:
Able to study Immuno diagnosis.

1. Identify pathogenic bacteria (any three of *E.coli, Salmonella, Pseudomonas, Staphylococcus Bacillus*) on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.
2. Study of composition and use of important differential media for identification of pathogenic bacteria:EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar,TCBS.
3. Study of bacterial flora of skin by swab method.
4. Acid-fast staining.
5. Dental caries susceptibility test.
6. Anti bacterial sensitivity by Kirby-Bauer method.
7. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chickenpox,HPV warts, Candidiasis, dermatomycoses, ringworms.
8. Study of various stages of malarial parasite in RBCs using permanent mounts.
9. Identification of human blood groups.
10. Perform Total WBC Count of the given blood sample.
11. Perform Differential WBC Count of the given blood sample.
12. Separate serum from the blood sample (demonstration).
13. Perform immune diffusion by Ouchterlony method.
14. Perform DOT ELISA.
15. Immuno electrophoresis(Demonstration)

Pedagogy: Experiential learning, Problem solving, Project

References:

1. Benjamin E,1. Mohamed A Daw. Medical microbiology, laboratory manual second edition 2009. ISBN: 978-9959-53-052-3.
2. R Panjarathinam. Practical Medical Microbiology, Published by Jaypee Brothers Medical PublishersCoice R and Sunshine G. Immunology – A Short course. 4th Ed. Willey-Liss
3. Rajashekarpandiam M. Immunology and Immunotechnology laboratory Manual- A book Published at January 2013.
4. Villani AC, Sarkizova S, Hacohen N (April 2018). "Systems Immunology: Learning the Rules of the Immune System". *Manual Review of Immunology*.
5. Rich, Robert R.; Chaplin, David D. (2019). "The Human Immune Response". *Clinical Immunology*. Principles and Practice (5th ed.). pp. 3–17.e1.

Program Name	**B.Sc. in Microbiology**		Semester	**VI**
Course Title	**MICROBIAL GENETIC ENGINEERING**			
Paper code	**21BSC6C15MBL**		No. of Credits	**4**
Contact hours	**60Hours(4Hoursperweek)**		Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**		Summative Assessment Marks	**60**

Course Outcomes(COs):After the successful completion of the course, the student will be able to:
CO1. Toknow the tools in Microbial genetic engineering and applications.
CO2.To understand the concept of cloning vectors and bacteriophages.
CO3.To know the cloning host in various micro organisms
CO4. Acquire knowledge on the concepts and terminology in genetic engineering.

Content

Unit I:Introduction to Genetic engineering: Historical prospectives: Definition of genetic engineering, milestones in genetic engineering, prospects and problems of genetic engineering. **Tools in Microbial Genetic Engineering**: Restriction modification systems- Types, Mode of action, nomenclature, applications of restriction enzymes in genetic engineering. DNA modifying enzymes and their applications: DNA polymerases, methylases, Terminal deoxy nucleotidyl transferase, kinases and phosphatases and DNA ligases.	15Hrs.
Unit II: Cloning Vectors: Definition and Properties. Characteristics of cloning vectors. Plasmid vectors: pBR and pUC series. Bacteriophage lambda, cosmids, BACs, YACs. Use of linkers and adaptors. Expression vectors: Baculovirus based vectors, mammalian SV40-based expression vectors. Cloning host- Cloning in *Escherichia coli*, cloning in *Saccharomyces cerevisiae*, cloning in GRAS microorganism. Gene Library: Construction of cDNA library, genomic library. DNA transfer methods: Microinjection, Biolistic, Electroporation, Calcium phosphate and Liposome mediated DNA transfer. Identification and selection of recombinants: DNA hybridization, blue white selection, antibiotic selection, colony and plaque hybridization.	15Hrs.
Unit IV:DNA template and Host used for cloning: Amplification of DNA, PCR and its types. Designing primers. Rolling Circle Amplification Technology. Hosts for Recombinant DNA technology, Competency, prokaryotic hosts, unicellular eukaryotic hosts, multicellular eukaryotic hosts, Acellular hosts.	15Hrs.
Unit V: Genetic engineering techniques in industrial production of recombinant Products Industrial production of recombinant products: Products of human therapeutic interest insulin, hGH, anti sense molecules. Bt Cotton, Bt Brinjal. Gene therapy, recombinant vaccines. Biological, ethical and social issues of gene cloning and IPR. Gene Library: Construction and application of cDNA and genomic libraries. Application of recombinant microorganisms in basic research, industry, medicine, agriculture, environment.	15Hrs.

References:

1. Brown TA. Ed. Homes BD & Richwood D, 1998; Molecular Biology – LABFAX, Academic Press.
2. Gerard Karp, 1999; Cell and Molecular Biology, John Wiley & Sons Inc., New York.
3. Miller G et al, 1996; An introduction to Genetic analysis, Freeman & Co., New York.
4. Watson JD et al, 1992; Recombinant DNA, Scientific American Books.
5. Desmond ST & Nicoll, 1994; an introduction to Genetic Engineering, Cambridge Uni. Press.
6. Nichol DST, 1994, an introduction to Genetic Engineering, Cambridge Univ.Press.
7. Trapp BE &Freifelder D, 2007; Molecular Biology – Genes to proteins, Jones &Bartlet Publ. Inc.Learning.
8. David P Clark, 2005; Molecular Biology, Academic Press

Course Title	**MICROBIAL GENETIC ENGINEERING (LAB)**	Practical Credits	**2**
Course Code	**21BSC6C16MBP**	Contact Hours	**4 Hours/Week**
		Duration of Exam	**3 Hours**
Formative Assessment	**25Marks**	Summative Assessment	**25Marks**

PRACTICAL CONTENT

Course outcome: After the successful completion of the course, the student will be able
CO1: To know the isolation and cloning of DNA.
CO2: To understand the estimation of DNA by Various methods.

1. Preparation of buffers-TE, TAE and Lysis buffer.
2. Isolation of plasmid DNA from *Escherichia coli.*
3. Estimation of DNA by DPA method.
4. Demonstration of estimation of DNA by spectrophotometric method.
5. Resolution and visualization of DNA by Agarose gel electrophoresis.
6. Induction of mutations in bacteria by UV light.
7. Preparation of competent cells and demonstration of bacterial transformation.
8. Demonstration of bacterial transformation and calculation of transformation efficiency.
9. Digestion of DNA with restriction enzymes.
10. Demonstration of ligation of DNA fragments.
11. Preparation of master and replica plates.
12. Designing of primers for DNA amplification.
13. Demonstration of amplification of DNA by PCR.
14. Demonstration of Southern blotting.

Pedagogy: Experiential learning, Problem solving, Project

References:

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier AcademicPress, USA
2. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett
3. Learning Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology.Blackwell Publishing, Oxford, U.K.
5. Russell PJ. (2009). Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
6. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold SpringHarbor Laboratory Press
7. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold SpringHarbour Laboratory press.
8. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin CummingsWiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education.