

B. Sc (CBCS) Microbiology – III Year
Semester-V – Paper-V (Discipline Specific Course)
BASICS OF IMMUNOLOGY

Theory syllabus

UNIT-I

1. History of Immunology: Contributions of Edward Jenner, Louis Pasteur, Emil Von Behring, Early theories of Immunity.
2. Types of Immunity: Innate and Acquired Immunity, Humoral and cell-mediated immunity, Active and passive immunity
3. Structure and function of the immune system Primary lymphoid organs: Thymus, bone marrow and bursa fabricius. Secondary lymphoid organs: spleen and lymph nodes

UNIT-II

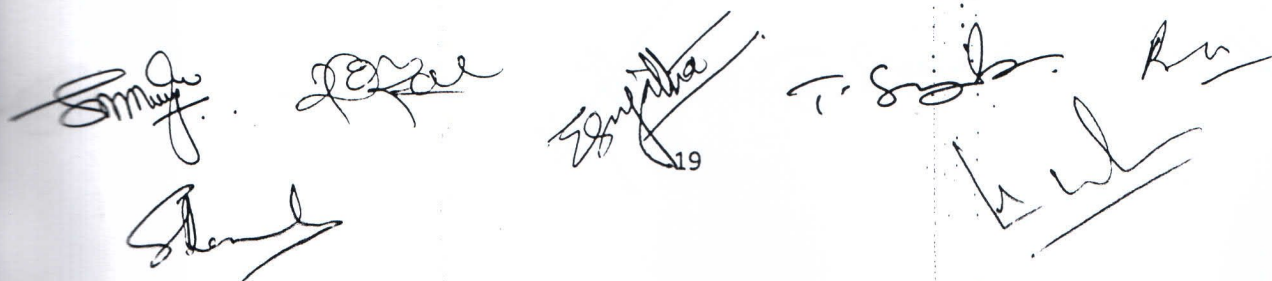
1. Cells of the immune system: B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils, eosinophils
2. Antigens – types of antigens, chemical nature of antigens, antigenic determinants, haptens, factors affecting antigenicity
3. Antibodies: Basic structure of immunoglobulins, types of immunoglobulin (IgG, IgM, IgA, IgE, IgD), Properties and functions of Immunoglobulins

UNIT-III

1. Types of antigen-antibody reactions - Agglutinations; Hemagglutinations, Bacterial agglutinations, Passive agglutinations Precipitations: Precipitation reactions in fluids, precipitation reactions in Gels Radial immunodiffusion, Double immunodiffusion (Ouchterlony method), Neutralization and Complement fixation
2. Antibody labeled immune reactions-ELISA (Enzyme linked immunosorbent assay) RIA (Radio immunoassay) and immunofluorescence
3. Components of complement and activation of complement pathways, Classical pathway, Alternative pathway, Properdin pathway

UNIT-IV

1. Monoclonal antibodies: Production of monoclonal antibodies and their applications
2. Hypersensitivity reactions - Immediate hypersensitivity: Systemic anaphylaxis, Localized anaphylaxis (Allergic rhinitis, asthma), Delayed hypersensitivity: Contact dermatitis
3. Auto immunity: Factors responsible for auto immunity, autoimmune disorders Systemic autoimmune disorders: Multiple sclerosis, Rheumatoid arthritis, Organ specific autoimmune disorders: Hashimoto's thyroiditis, Good's Pasture's syndrome



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Practical syllabus

1. Typing of human blood groups-slide agglutination
2. Estimation of hemoglobin content of human blood
3. Preparation of blood smear and different blood cell count
 - i) RBC count
 - ii) WBC count
4. Differential staining of WBC by Leishman's stain
5. Widal-slide agglutination test
6. RPR card test for syphilis
7. Tridot test
8. Tube flocculation test

References:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.
6. Richard C and Geffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

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B. Sc (CBCS) Microbiology – III Year
Semester-V – Paper-VI/A (Discipline Specific Elective)
RECOMBINANT DNA TECHNOLOGY

Theory syllabus

UNIT - I

1. Introduction to Genetic Engineering: Milestones in genetic engineering and biotechnology.
2. Molecular Cloning- Tools and Strategies: Cloning Tools; Restriction modification systems: Types I, II and III.
3. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering.

UNIT - II

1. DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases.
2. Cloning Vectors: Definition and Properties. Plasmid vectors: pBR and pUC series. Bacteriophage lambda and M13 based vectors. Cosmids, BACs, YACs.
3. Use of linkers and adaptors.

UNIT - III

1. Methods in Molecular Cloning: Transformation of DNA: Chemical method, Electroporation.
2. Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated delivery, *Agrobacterium* - mediated delivery.
3. DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, SDS-PAGE and Western blotting.

UNIT - IV

1. DNA Amplification and DNA sequencing: PCR: Basics of PCR, RT-PCR, Real-Time PCR.
2. Construction and Screening of Genomic and cDNA libraries: Genomic and cDNA libraries: Preparation and uses, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping.
3. Applications of Recombinant DNA Technology: Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal.

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RECOMBINANT DNA TECHNOLOGY

Practical syllabus

1. Preparation of competent cells for transformation.
2. Demonstration of Bacterial Transformation and calculation of transformation efficiency.
3. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
4. Ligation of DNA fragments.
5. Cloning of DNA insert and Blue white screening of recombinants.
6. Demonstration of designing of primers for DNA amplification.
7. Demonstration of Amplification of DNA by PCR.
8. Demonstration of Southern blotting.

References:

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA.
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education.
6. Brown TA. (2007). Genomes-3. Garland Science Publishers.
7. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.

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B. Sc (CBCS) Microbiology – III Year
Semester-V – Paper-VI/B (Discipline Specific Elective)
INSTRUMENTATION AND BIOTECHNIQUES

Theory syllabus

UNIT – I

1. Microscopy: Brightfield and darkfield microscopy, Fluorescence Microscopy, Phase contrast Microscopy.
2. Electron Microscopy (Scanning and Transmission Electron Microscopy).
3. Biophysical Principles: Osmosis, osmotic pressure, Donan equilibrium, diffusion potential, diffusion coefficient, endocytosis & exocytosis, gradient of chemical potential as driving force in transport, membrane potential & ionophores.

UNIT - II

1. Chromatography: Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection.
2. Gel filtration chromatography, ion-exchange chromatography and affinity chromatography, GLC, HPLC.
3. Sedimentation and filtration.

UNIT - III

1. Electrophoresis: Principle and applications of native polyacrylamide gel electrophoresis.
2. SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis. Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.
3. Spectrophotometry: Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry.

UNIT - IV

1. Centrifugation: Principle, working and applications of centrifuge. Preparative and analytical centrifugation, fixed angle and swinging bucket rotors.
2. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.
3. Fundamental of Radioactivity: Radioactive & non radioactive isotopes, Laws of Radioactivity, Half life & Average life, types of radiation (α , β , γ radiations) application of radioactive isotopes in biology.

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Semester-V – Paper-VI/B (Discipline Specific Elective)
INSTRUMENTATION AND BIOTECHNIQUES

Practical syllabus

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Separation of mixtures by paper / thin layer chromatography.
3. To demonstrate column packing in any form of column chromatography.
4. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
5. Separation of components of a given mixture using a laboratory scale centrifuge.
6. Understanding density gradient centrifugation with the help of pictures.

References:

1. A.Upadhyay, K.Upadhyay and N. Nath 2006 Biophysical Chemistry, Principles and Techniques Himalaya Pub. House.
2. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
3. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
4. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein's Microbiology. 9thEd., McGraw Hill.
5. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
6. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.
7. Cooper G.M. and Hausman R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington D.C., Sinauer Associates, MA.
8. Nigam A and Ayyagari A. 2007. Lab Manual in Biochemistry, Immunology and Biotechnology. Tata McGraw Hill.

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B. Sc (CBCS) Microbiology – III Year
Semester-V – Paper-VI/C (Discipline Specific Elective)
BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS (IPR)

Theory syllabus

UNIT - I

1. Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types.
2. Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms.
3. Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges.

UNIT - II

1. Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture.
2. Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol.
3. AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions.

UNIT - III

1. Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge.
2. Geographical Indications- importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).
3. Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures.

UNIT - IV

1. Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.
2. Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties.
3. Indian Patent Act 1970 & recent amendments.

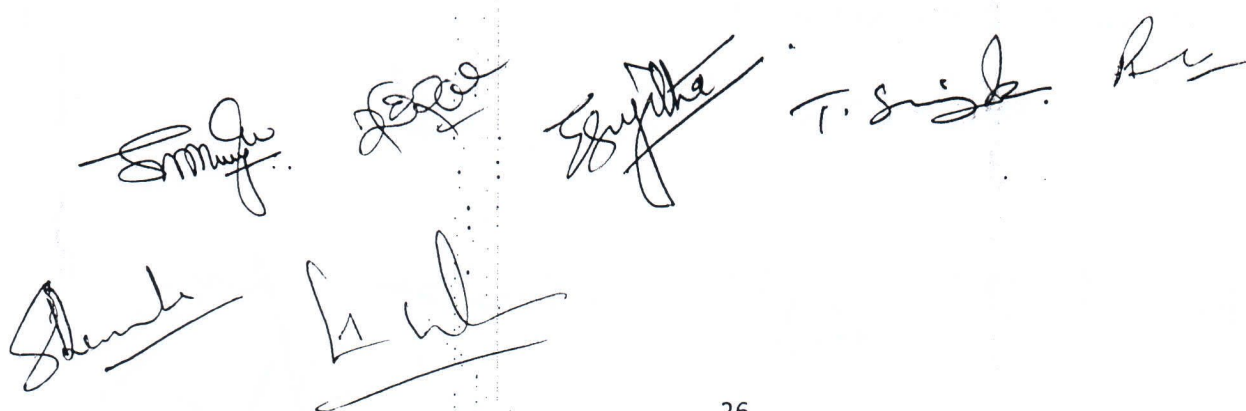
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BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS (IPR)

Practical syllabus

1. Study of components and design of a BSL-III laboratory.
2. Filing applications for approval from biosafety committee (IBSC).
3. Filing primary applications for patents.
4. Study of steps of a patenting process.
5. A case study.

References:

1. Bare Act, 2007. Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi
3. Mittal, D.P. (1999). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer India.
5. Goel D & Prashar S (2013). IPR, Biosafety and Bioethics. Pearson.
6. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.

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