B.Sc., Microbiology and Clinical Lab Technology

Semester – I						
Course code:	**Allied I A**	**L**	**T**	**P**	**C**	**H/W**
23BMCA1	**Body Fluid Analysis**		T		3	3

Objectives	➢ Acquire knowledge of body fluids and their functions. ➢ Know about the Infection transmission process & its prevention ➢ Make aware of standard norms, principles, classification, sources & hazards associated with biomedical waste management.
Unit –I	**Body fluids:** Definition, **Types of body fluids**- blood and lymph, functions of body fluids. **Physical properties of body fluids:** Body fluid compartments, Solutes in body fluid, Clinical abnormalities of fluid volume regulation.
Unit-II	**Amniotic fluid**: Formation and function of amniotic fluid, Chemical composition, Collection, Testing – Alpha fetoprotein, Acetyl cholinesterase, Neural tube defects, Chromosomal abnormalities, Haemolytic disease of newborn, Gestation age, Fetal maturation.
Unit III	**Cerebrospinal fluid:-** Formation, Specimen collection, Causes of CSF pressure changes, Gross examination, Chemical analysis, Microbiologic examination, Immunologic tests, Cytological examination and clinical correlation and other fluid such as Serous fluid, Synovial fluid.
Unit IV	**Components of the blood** (Plasma and Cellular elements) and their functions, Mechanism of coagulation of blood, Coagulation system, Haemogram, Calculations of Anaemia using MCH, MCV & MCHC, Special Haematological tests: Osmotic fragility – Heinz body preparation, Blood parasites – Lupus Erythematosus (LE)
Unit V	**Laboratory that perform Low complexity tests**: Principle, reporting – techniques, Laboratory that perform moderate complexity Tests: Principle, reporting – techniques, Laboratory that perform high complexity tests: Principle, reporting techniques

Reference and Textbooks

Kanai Mukherjee, (2000). Medical Laboratory Technology, volume – I, II, III, TataMcGraw Hill.

Praful.B. Godkar, et al., (1996). Textbook of Medical Laboratory Technology, 2nd edition, Bhalani Publication House

Sambrook J and Russell DW, (2001). Molecular cloning – A laboratory manual, 3rd edition, Vol. I – III, Cold Spring Laboratory Press, New York.

Outcomes	After completion of the course, students are expected to be able to: ➢ Know the routes of infectious agents' transmission and how to control the diseases. ➢ Acquire knowledge on sterilization and disinfection. ➢ Manage the biomedical waste.

Semester - I						
Course code:	**Practical I A**	**L**	**T**	**P**	**C**	**H/W**
23BMCAP1	**Lab in Body Fluid Analysis**			P	2	2

Objectives

- Determine the levels of body fluids and know their functions.
- Know about the Infection transmission process & its prevention
- Make aware of standard norms, principles, classification, sources & hazards associated with biomedical waste management.

1. Standardization of distilled or deionized water.
2. Microscopic examination of total leukocyte count.
3. Determination of serum alkaline phosphatase by PNP method.
4. Determination of urine creatinine
5. Perform serological diagnosis of microbial diseases
6. Anti-streptolysin O (ASO) quantitative test
7. Perform C- reactive protein test (CRP)
8. Determination of blood hemoglobin by cyanomethemoglobin method
9. Reference ranges and normal values of RBC, Haemoglobin, WBC, Differentialwhite cell count.
10. Hemorrhagic disorders related to platelet and capillary defects.

Reference and Textbooks

Grimaldi and Scopacasa (2000) 'Evaluation of the Abbott CELL-DYN 4000 Hematology Analyzer', American Journal of Clinical Pathology.

Kanai Mukherjee, (2000). Medical Laboratory Technology, volume – I, II, III,Tata McGraw Hill.

Praful.B. Godkar, et al., (1996). Textbook of Medical Laboratory Technology, 2nd edition, Bhalani Publication House

Outcomes

After completion of the course, students are expected to be able to:

- Determine the leukocyte count, urea creatinine and blood hemoglobin.
- Identification of antigens by serological tests.
- Acquire basic knowledge on the reference and normal values of RBC and WBC.

Semester - II							
Course code: 23BMCA2	**Allied I B**	**L**	**T**	**P**	**C**	**H/W**
	Blood Banking Technology		T		3	3

Objectives	To impart knowledge on ➢ Basics of blood banking. . ➢ The impression of the transfusion therapy. ➢ The recent advances in the blood banking techniques.
Unit –I	**Blood donation:** Donor Motivation, Motivational Techniques, Social Marketing, Preparation of IEC Materials. **Donor recruitment & Retention**: Types of blood donors, Donor selection, medical interview and medical examination, screening for haemoglobin estimation, Managing rejected blood donors, technique for conversion of first time donor into regular voluntary donor, donor felicitation. Blood collection room equipment, their principles, and use, emergency medicines, Pre donation counselling, Bleeding of the donor, post donation care, post donation counseling. Screening of blood units for mandatory tests, Discarding infected units.
Unit-II	**Blood Banking- Blood Components:** Selection of blood bags for component preparation, preparation of red cell concentrate, Fresh Frozen plasma, platelet concentrate, cryoprecipitate, washed red cells, Frozen red cells. Plasma Fractionation: Principles, manufacturing of different plasma derivatives- Component Testing, Labeling - Transportation and storage of blood components.
Unit III	**Transfusion Therapy-** Management of Blood Bank Issue Counter, Criteria for acceptance of requisition form, inspection of blood component prior to issue - Blood administration, transfusion filters, post transfusion care, Therapeutic plasma exchange - Judicious use of blood; management of different types of anemia, management of bleeding patient, Neonatal transfusion, Transfusion practices in surgery, Transfusion therapy for oncology and trans plantation patents.
Unit IV	**Quality Control Documentation and Legal Aspects of Blood Banking:** Quality control of blood grouping reagents, QC of anti-human globulin reagent, bovine albumin, Normal saline- Quality control of blood bags -Quality control of different blood bank Components, sterility test on component - Organization of blood bank services, Blood Bank premises and infrastructure, Regional blood transfusion centre and blood storage centres.
Unit V	**Recent Advances In Blood Banking Techniques:** Automation in Blood Banking - Nucleic Acid Testing - Apheresis - Stem Cells.

Reference and Textbooks

Abbas A K and Lichtman. A H. Basic Immunology, Saunders Elsevier.

David Latchman, 1997.Basic molecular and cell biology.BMJ Publishing group.

Denise M Harmening. Modern Blood Banking and Transfusion practices by, (5th ed)

Mollison PL Dacie , J A and Lewis S M Blood transfusion in clinical medicine- Practical Hematology.

National guide book in blood donor motivation. NACO, Ministry of Health and Family Welfare, Govt. of India.

<table>
<tr><td colspan="2">Roitt, I. Essential Immunology. (8th ed), Blackwell scientific publications
Standards for blood banks and blood transfusion services, NACO, 2007. Ministry of Health and Family Welfare, Govt. of India, New Delhi.
Transfusion Medicine technical manual-DGHS, 2003. Ministry of Health and Family Welfare, Govt. of India (2nd ed)
Voluntary blood donation program NACO, 2007. Ministry of Health and Family Welfare, Govt. of India, New Delhi,</td></tr>
<tr><td>Outcomes</td><td>After completion of the course, students are expected to be able to:
Acquire depth knowledge of selecting suitable blood donor and analysis of the blood components.
Know how to maintain the blood collection bags and preparation of blood for transfusion.
Be able to access the recent advance in blood banking techniques.</td></tr>
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Semester - II						
Course code: 23BMCAP2	**Practical I B**	**L**	**T**	**P**	**C**	**H/W**
	Lab in Blood Banking Technology			P	2	2

Objectives	To impart knowledge on ➢ Basics of blood banking. . ➢ The impression of the transfusion therapy. ➢ The recent advances in the blood banking techniques.

1. Qualitative test for ABO grouping with antisera and tube method
2. Cross reactivity
3. Coomb's test- direct and indirect method
4. Confirmation of HIV 1 and 2 using ELISA
5. VDRL test for the confirmation of syphilis
6. Examination of Plasmodium in blood by leishman staining
7. Isolation of DNA from blood
8. Demonstration for the confirmation of Hepatitis B and C

Reference and Textbooks

David Latchman, 1997.Basic molecular and cell biology. BMJ Publishing group.

Mollison PL Dacie , J A and Lewis S M Blood transfusion in clinical medicine- Practical Hematology.

National guide book in blood donor motivation. NACO, Ministry of Health and Family Welfare, Govt. of India.

Standards for blood banks and blood transfusion services, NACO, 2007. Ministry of Health and Family Welfare, Govt. of India, New Delhi.

Transfusion Medicine technical manual-DGHS, 2003. Ministry of Health and Family Welfare, Govt. of India (2nd ed)

Voluntary blood donation program NACO, 2007. Ministry of Health and Family Welfare, Govt. of India, New Delhi,

Outcomes	After completion of the course, students are expected to be able to: ➢ Acquire depth knowledge of selecting suitable blood donor and analysis of the blood components. ➢ Know how to maintain the blood collection bags and preparation of blood for transfusion. ➢ Be able to access the recent advance in blood banking techniques.

Semester - III						
Course code: 23BMCA3	**Allied II A**	**L**	**T**	**P**	**C**	**H/W**
	Hospital infection Control Practices		T		3	3

Objectives	➢ Understand the healthcare-associated infections & infection control policies ➢ Know about the Infection transmission process & its prevention ➢ Make aware of standard norms, principles, classification, sources &hazards associated with biomedical waste management.
Unit –I	**Introduction of healthcare-associated infections & infection control program:** Introduction, Role & responsibilities of ICN, Role of hospital administration in hospital infection control, Infection Protection for Healthcare Workers, Education and training of healthcare workers, patients, and families.
Unit-II	**Infection transmission & its prevention:** Introduction & various routes of transmission of infection, Standard / Universal precautions and its components, The significance of taking standard/ Universal precautions, Isolation policies and procedures and Infection Control measures to Control Transmission.
Unit III	**Sterilization and disinfection:** Physical and chemical methods of sterilization and disinfection, Cleaning & Disinfection of medical equipment, Disinfection of Hepatitis B virus, Hepatitis C virus, HIV or TB contaminated devices.
Unit IV	**Personal protective equipment and standard precautions:** Introduction, Types & Method of use of personal protective equipment (PPE): Gloves, Gown, mask, apron Protective eyewear (goggles), Boots or shoe cover & Cap or hair cover. **Hand hygiene practices**: Introduction, types of hand washing, Steps of hand washing, The role of hand hygiene in control of hospital-acquired.
Unit V	**Biomedical waste management:** Introduction, Standard norms for Biomedical waste, Principles of Waste Management, WHO Classification of BMWM, Sources of Biomedical Waste, The problem associated with biomedical waste management, Hazards related to biomedical waste management, Treatment and disposal techniques of BMWM.

Reference and Textbooks

Hospital Acquired Infections- Prevention and Control by Purva Mathur. Publisher:Lippincott Williams &Wilkins.

National, CDC, WHO guidelines on Hospital Infection Control.

Journals:

- Journal of Hospital Infection.
- Journal of patient safety and infection control.
- American Journal of Infection Control.
- Waste Management Journal Elsevier.

Outcomes	After completion of the course, students are expected to be able to: ➢ Know the routes of infectious agents' transmission and how to control the diseases. ➢ Acquire knowledge on sterilization and disinfection. ➢ Manage the biomedical waste.

Semester – III						
Course code: 23BMCAP3	**Practical II A**	**L**	**T**	**P**	**C**	**H/W**
	Lab in Hospital Infection Control Measures			P	2	2

Objectives

- Know the basic techniques followed in the hospital for the prevention of infections & diseases
- Acquire knowledge in the identification of infectious agents and laboratory first aid measures
- Perform basic and serological tests for the disease diagnosis

1. Organization of infection control and surveillance of hospital acquired infections.
2. Precaution measures for nosocomial infections
3. Examination of Hand Hygiene
4. Laboratory first aid measures
5. Preparation of normal saline
6. Examination of decontamination of Hospital Environment
7. Prevention of Device Associated Infections
8. Preventive Strategies for Surgical Site Infections
9. Examination of morphology of blood cells
10. Determination of bleeding time
11. Determination of blood clotting time by capillary method and Lee- White method
12. Antibiotic sensitivity test by disc diffusion method
13. Various culture media used for mycotic organisms

Reference and Textbooks

1. Anudita Bhargava, Atul Jindal, etc. (2019). Hospital infection Control Measures, All India Sciences of Medical Institute, Raipur.
2. Hospital Infection Control Manual, (2017). Sigma Hospital, India.
3. Praful.B. Godkar, et al., (1996). Textbook of Medical Laboratory Technology, 2nd edition, Bhalani Publication House
4. Kanai Mukherjee, (2000). Medical Laboratory Technology, volume – I, II, III, Tata McGraw Hill

Outcomes

After completion of the course, students are expected to be able to:

- Do the first aid
- Know how to prevent the environment and patients in the hospital from infections by applying various techniques learned through this course.
- Acquire knowledge on basic tests followed in the hospital such as calculation of bleeding time and clotting time.

Semester - IV						
Course code: 23BMCA4	**Allied II B**	**L**	**T**	**P**	**C**	**H/W**
	Microbial Biotechnology		T		3	3

Objectives	➢ Provide the student with an understanding of the current views of microbial association in various environments. ➢ Evaluate the continuing roles played by microbes in the environment. ➢ Recognition of microorganisms as indicators of alteration of an ecosystem. ➢ Understand microbial processes aimed to solve environmental problems.
Unit –I	**Brief history of fermentation;** Fermentation- general concepts, Applications of fermentation; Range of fermentation process- Microbial biomass, enzymes, metabolites, recombinant products, transformation process; Component parts of a fermentation process.
Unit-II	**Microbial biotechnology:** Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology, Use of prokaryotic and eukaryotic microorganisms in biotechnological applications, Genetically engineered microbes for industrial applications: Bacteria and yeast
Unit III	**Organic feedstock:** ethanol; Acetone; Ethanol Organic acids: Production of Citric acid; Acetic acid; Lactic acid; Gluconic acid; Kojic acid; itaconic acid; Amino acids: Use of amino acids in industry; methods of production; Production of individual aminoacids (L-Glutamic acid; L Lysin;L-Tryptophan).
Unit IV	**Enzymes:** commercial applications; production of Amylases; Glucose Isomerase; L Asparaginase Proteases Renin; Penicillin acylases; Lactases; Pectinases; Lipases; Structure and biosynthesis Nucleosides Nucleotides and related compounds.
Unit V	**Vitamins**- Vitamin B12; Riboflavin; B carotene; Antibiotics: beta-Lactam antibiotics; amino acid and peptide antibiotics; Carbohydrate antibiotics; Tetracycline and antracyclines; Nucleoside antibiotics; Aromatic antibiotics; bioplastics (PHB; PHA); biotransformation of steroids.

Reference and Textbooks

Crueger Wand Crueger, A. Biotechnology. A Textbook of Industrial Microbiology, Sinauer Associates Publisher

Reed, G. *Industrial microbiology*, CBS publications

Demain L *Biology of Industrial microorganisms* ,Stanbury P.F.A

Vogel H C, Todaro C.L, Todaro C.C. *Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment*, Noyes Data Corporation/ Noyes Publications.

Scheper. T, *New Products and New Areas of Bioprocess Engineering* (Advances inBiochemical Engineering/Biotechnology, 68) Springer Verlag Publications

Outcomes	After completion of the course, students are expected to be able to: ➢ Understand on soil characteristics and biogeochemical cycling ➢ Be familiar with the microbial analysis of drinking water andAeromicrobiology ➢ Know the different aspects of waste management and sewage Treatment systems ➢ Acquire knowledge on bioremediation and microbial leaching

Semester - IV						
Course code: 23BMCAP4	**Practical II B**	**L**	**T**	**P**	**C**	**H/W**
	Lab in Microbial Biotechnology			P	2	2

Objectives

- Highlight the roles and characteristics of microorganisms in field of Biotechnology
- Impart knowledge on the basic concept of multiplication in microorganism
- Know the metabolic pathways and products can be used in biotechnology.

1. Isolation of industrially important microorganism from different sources using specificsubstrates.
2. Design and Preparation of Media for Bioprocesses.
3. Growth curve of bacteria/Yeasts in batch culture and calculation of maximum specific growthrate.
4. To study the various methods of biomass measurement.
5. Production of ethanol from sucrose by yeast.
6. Determination of yield coefficient and Monod's constant and metabolic quotient ofE.coli culture using glucose as a carbon source.
7. Design of fermenter.
8. Production of citric acid using sucrose and molasses.
9. Production of extracellular enzymes.
10. Ethanol production using immobilized yeast culture.

Reference and Textbooks

Atlas, R.M. and Bartha, R. 1992. *Microbial Ecology: Fundamentals and Applications*. (3rd ed) BenjaminCummings, Redwood City.CA.

Reed G, *Industrial microbiology*, CBS publications

Demain L *Biology of Industrial microorganisms* ,Stanbury P.F.A

Vogel H C, Todaro C.L, Todaro C.C. *Fermentation and Biochemical Engineering Handbook:Principles, Process Design, and Equipment*, Noyes Data Corporation/ Noyes Publications.

Scheper. T, *New Products and New Areas of Bioprocess Engineering* (Advances in Biochemical Engineering/Biotechnology, 68) Springer Verlag Publications.

Outcomes

After completion of the course, students are expected to be able to:

- Know the principles involved in preparation of Beverage and industrial Alcohols and the physical and chemical conditions influencing their production.
- Understand the importance of microbial enzymes, their applications, production process and relate biotransformation principles to biotransformation of steroids
- Conceptualize the principles and production process of different types of Vaccines.