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H.S.C. (VOCATIONAL)

MEDICAL LABORATORY TECHNICIAN

STD : XI (PAPER-2)

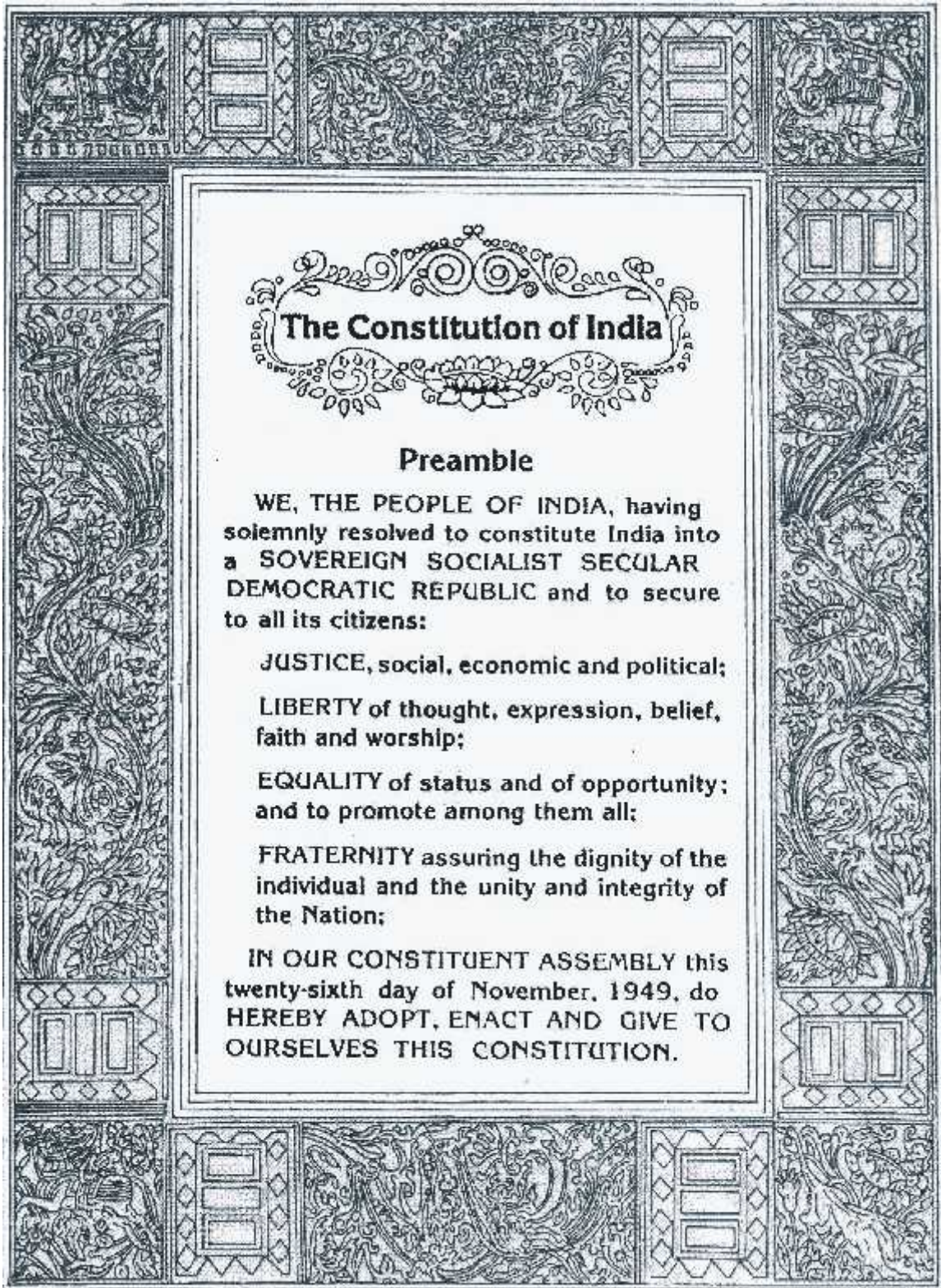
LABORATORY MANAGEMENT AND ETHICS PRACTICALS



[Price : Rs. 85]

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NATIONAL ANTHEM

Jana-gana-mana-adhināyaka jaya hē
Bhārata-bhāgya-vidhātā
Punjāba-Sindhu-Gujarāta-Marāthā
Drāvida-Utkala-Banga
Vindhya-Himāchala-Yamunā-Gangā
Uchchala-jaladhi-taranga
Tava subha nāmē jāgē, tava subha āsisa māgē,
Gāhē tava jaya-gāthā,
Jana-gana-mangala-dāyaka jaya hē
Bhārata-bhāgya-vidhātā,
Jaya hē, Jaya hē, Jaya hē,
Jaya jaya jaya jaya hē.



PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone lies my happiness.

PREFACE

The national policy of education (1986) envisages that the introduction of systematic, well planned and rigorously implemented programme of vocational education is crucial in the proposed educational reorganization. In accordance with the policy of Government of India, State Government of Maharashtra introduces +2 Vocationlization of Education in 1988-89. During last 25 years no substantial efforts has been taken to revamp the curriculum.

Ministry of Human Resource Development, Govt. of India developed the National Skill Qualification Framework (NSQF) to introduce vocational courses according to series of levels of knowledge & skills. Qualifications are made up of vocational standards for specific areas of learning units or units of competency. Units of competency are the specification of the knowledge and skill to the standard of performance expected in the workplace. The unit of competency or National Occupation Standards comprising generic and technical competencies an employee should possess is laid down by the Sector Skill Council of the respective economic or social sector.

The challenges before us were to make smooth transition of curriculum from knowledge based to skill based and rapid technological changes in all sectors of economy. Hence, the few obsolete courses were either merge with core courses or deleted. Hence, in first phase 30 courses were converted into 20 courses. In second phase 20 more courses can be added sector wise as per National Occupational Standards.

I acknowledge the hard team work done by District Vocational Education and Training Officer, who were the coordinators for curriculum designing, theory and practical books writing, along with the vocational teachers of various vocational field and experts from the industry. Shri. S. M. Haste, Joint Director and Shri. A. G. Gavit, Dy. Director has taken the sincere efforts from Directorate to produce the best text material with limited resources and time.

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Week No.	1 st & 2 nd
Practical No.	1
Title/ Aim	To draw an ideal clinical laboratory -site or location selection
Objectives	To prepare student for selecting site for setting up basic health laboratory.
Requirements	1. The knowledge of the area 2. Map of the area.
Environment	MLT Laboratory
Procedures	1. Inform students about basic guidelines for site selection. 2. Ask them to do survey of the respective area. 3. Use the specimen proforma for survey. 4. Make suitable changes if required in the proforma.
Observations <u>Proforma for site selection</u>	
1. Name of student : _____	
2. Name of the place : _____	
3. Mention the category— Taluka / Town / City	
4. Population of place : _____	
5. Disease profile of the place : _____	
6. Number of other established laboratories in the area	
7. <u>Location of the site</u> —	
• Main market area	<input type="checkbox"/>
• Near bus depot	<input type="checkbox"/>
• Near railway station	<input type="checkbox"/>
• Near main road	<input type="checkbox"/>
• Away from residential area	<input type="checkbox"/>
• Other (Transport & Travelling facilities)	<input type="checkbox"/>
8. <u>Number of hospitals/dispensaries around</u> ▣	
• Less than 2	<input type="checkbox"/>
• Between 2 to 6	<input type="checkbox"/>
• More than 6	<input type="checkbox"/>

9. <u>Surrounding area</u>	<input type="checkbox"/>
• High class/ Middle class/ Slum	
10. <u>Available carpet area in square feet:</u> _____	
Approximate costing— <u>Ownership premises</u> ▣	
• 2 to 5 lacks	<input type="checkbox"/>
• 5 to 10 lacks	<input type="checkbox"/>
• More than 10 lacks	<input type="checkbox"/>
<u>Rental premises</u>	
• Rs.5000to 10000 per month	<input type="checkbox"/>
• Rs10000 to 20000 per month	<input type="checkbox"/>
• More than Rs 20000	<input type="checkbox"/>
11. <u>Location in the building</u>	
• Front side	<input type="checkbox"/>
• Back side	<input type="checkbox"/>
• Ground floor	<input type="checkbox"/>
• Other	<input type="checkbox"/>
12. Water supply & electricity—	
• Satisfactory / Inadequate (load shedding etc)	<input type="checkbox"/>
13. Waste management facility —	
• Available /Not available	<input type="checkbox"/>
14. Supporting staff—	
• Can be available /difficult to manage	<input type="checkbox"/>
15. <u>Licensing authority</u>	
• FDA	<input type="checkbox"/>
• Local authority	<input type="checkbox"/>
• Others	<input type="checkbox"/>

Skills to be achieved	Students will develop approach towards site selection for setting the lab.
Skills evaluating criteria	<ol style="list-style-type: none"> 1. Filling the survey form – 5 marks. 2. Writing the report – 5 marks.
FAQs	<ol style="list-style-type: none"> 1. What do you mean by planning? 2. What is the importance of location of the laboratory?
Assignments	Do the survey three different locations for site selection.
References/Link with Theory Topic	Chapter 5 Handbook of laboratory Management and Ethics

Week No.	3 rd
Practical No.	2
Title/ Aim	To plan an ideal clinical laboratory- Laboratory design
Objectives	1. Students shall get orientation about designing laboratory. 2. They shall understand laboratory environment to work safely with interest & specific needs of its users.
Environment	MLT laboratory
Procedures	1. Collect information about design, space, furniture, waste management facility etc from the various laboratories. 2. Visit the laboratories in surrounding areas. 3. Prepare plan for your own laboratory. 4. Use proforma to prepare visit report.

Observations Proforma For Visit Report

1. Name of student-
2. Name of the laboratory with address—
3. Area of laboratory—

• 300 to 400 sq ft.

• 400 to 600 sq ft.

• More than 600 sq f

4. Laboratory design —

• Separate cubicles

• Single large work area

5. Working & Moving space

• Adequate

• Crowded

6. Furniture

• Wooden (Water proof ply)

• Steel & glass

• Other

7. No. of various items		
• Number of chairs	<input type="checkbox"/>	
• Number of tables	<input type="checkbox"/>	
• Storage cabinets	<input type="checkbox"/>	
• Working platform area (app.)	<input type="checkbox"/>	
• Number of sinks	<input type="checkbox"/>	
8. Electricity —		
• Adequate (with Inverter/Generator)	<input type="checkbox"/>	
• Intermittent (Load shedding area)	<input type="checkbox"/>	
9. Disaster management—		
• Are there any chances of water logging during rainy season ?		Yes / No
• Does the building have proper drainage system ?		Yes / No
• Is the premises earthquake proof?		Yes / No
• Are the Fire safety norms followed ?		Yes / No
• Waste management — Facility available		Yes / No.
10. Is there enough ventilation in the laboratory ?		
• Windows / Vents	<input type="checkbox"/>	
• Exhaust fans	<input type="checkbox"/>	
• Air conditioners	<input type="checkbox"/>	
• Ceiling fans	<input type="checkbox"/>	
11. All the equipments major / minor		Yes / No.
• Some equipments are missing		Yes / No.
12. All types of glassware / Chemicals		Yes / No.
• Some are missing		Yes / No.

Result	Visit report based on observations and information gathered during the visit is prepared.
Skills to be achieved	<ul style="list-style-type: none"> • Students will learn more about laboratory design & planning. • They will learn to communicate with confidence.
Skills evaluating criteria.	<ol style="list-style-type: none"> 1. Knowledge about general principles of laboratory planning—4 marks. 2. Proper communication - 2 marks. 3. Diagram of laboratory – 4 marks
FAQs	<ol style="list-style-type: none"> 1. What are the general principles of laboratory planning? 2. What do you mean by safety at work? 3. What is the advantage of continuous electricity & adequate water supply in the laboratory?
Assignments	Draw a suitable diagram of an ideal laboratory.
References/ Link with Theory Topic.	Chapter 5 Handbook of Laboratory management and Ethics

Week No.	3 rd
Practical No	3
Title/ aim	To study Principle, & Maintenance of equipments
Objective	Student should know how to take care of different lab equipments.
Principle	For proper functioning of various equipments it is necessary to take care of them.
Requirements	<ol style="list-style-type: none"> 1. Microscope 2. Centrifuge 3. Oven 4. Incubator 5. Autoclave 6. Microtome
Environment	MLT laboratory
Procedure—	
<ol style="list-style-type: none"> 1. Study working and use of individual instrument. 2. Study how to take care of them. 	
<u>Care of microscope</u>	
<ul style="list-style-type: none"> • Do not touch the lenses. • Wipe the lenses with soft cloth or lens paper. • Use very little xylene to remove oil from oil immersion objective. • Keep the stage clean and dry. • Use machine oil to lubricate controlling mechanical parts. • Cover the microscope when not in use. • Consult the proper scientific instrument repairer if the microscope is damaged optically or mechanically • Microscope should never be kept in direct sun light. • Dust from the lenses can be removed by blowing air into them with a rubber bulb or using fine brush. • The condenser & mirror can be cleaned in the same way. 	
<u>Care of centrifuge</u>	
<ul style="list-style-type: none"> • Balance the tubes properly before starting centrifugation. • Oiling of moving parts. • It should be kept on sturdy / firm platform. • Put lid during operation. • Always clean the centrifuge with soft cloth. • Take care about the maintenance of centrifuge. • The chamber should be kept clean. • Never open the lid of centrifuge chamber until the rotator has come to a complete stop. 	

- Observe for usual normal vibration noise during operation the centrifuge may vibrate excessively if the tubes inside are not balanced properly. This should be checked immediately.
- Place a cover on the centrifuge when not in use.

Care of incubator

- Do not forget to put off the main switch when the heating period is over.
- Keep the incubator clean.
- As it is electrical instrument maintain it properly with the help of electrician.

Care of microtome—

- Keep the microtome closed when not in use.
- Keep moving parts well lubricated with lubricant oil (sewing machine oil).
- Clean the dust on metal surface with brush.
- Metal surfaces are wiped frequently with the help of coconut oil. This is to avoid rusting.
- Remove the paraffin wax with brush. If it is still attached remove it with xylene.

Care of hot air oven.

- Place the dry article in the oven.
- Close the door firmly.
- Wrap the clean and dry article in craft paper before putting in oven.
- Do not forget to put off the main switch when the heating period is over.

Care of autoclave.

- Water level should be properly adjusted. It should be up to basket support.
- Never heat too quickly to bring up the pressure and never leave the autoclave unattended while the pressure is rising.
- Never leave the autoclave to cool for too long without keeping the out flow valve open.

Care of photometric equipment

- Pipetting, weighing and diluting should be correct.
- The time of color development must be the same for all solution.
- The temperature should be constant.
- The solution should be constant.
- The cuvette should be clear without fingerprints.
- Time should be allowed for the instrument to warm up.
- Fluctuation in voltage should not occur.
- 0 and 100% transmittance should be checked frequently.
- The instrument should be protected from dust, heat, humidity and light.

Observations—**1. Use of common laboratory equipments –**

- Microscope : To see the object which is invisible by naked eye
- Colorimeter : To measure the OD of color solution.
- Autoclave : For sterilization.
- Hot air oven : For dry sterilization
- Incubator : For incubation.
- Cell counter : Used in hematology for counting cell.
- Auto analyzer : Used in biochemistry for performing different test.
- Centrifuge : For separating plasma and serum & solid ingredients from liquid solution.
- Balance : To weigh the chemical substance.
- Refrigerator : For storage of reagent at low temperature.
- Microtome : For cutting histological tissue section.

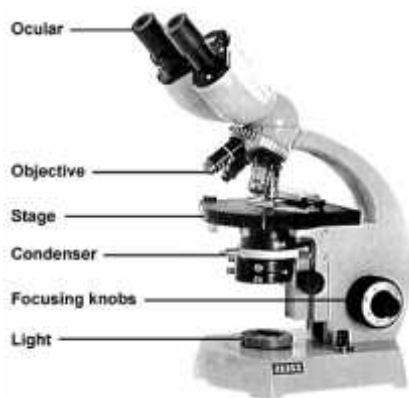


Fig. 3.1 Microscope



Fig. 3.2 Centrifuge



Fig. 3.3 Incubator



Fig. 3.4 Hot air oven



Fig. 3.5 Autoclave










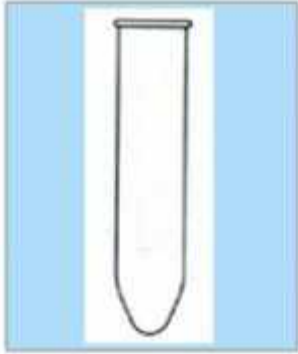
Fig. 3.6 Microtome



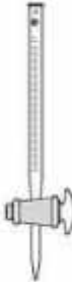

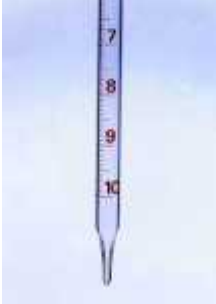
Clinical significance	Proper maintenance of various laboratory equipments provides long term service.
Skills to be achieved	Students will handle various instruments properly.
Skills evaluating criteria.	Proper operation of any two instruments— 10 marks.
FAQs	How to take care of microtome/ Microscope/ Autoclave/ Hot air oven?
Assignment/Activity	Clean the various parts of microscope, microtome, etc.
Reference/ Link with theory topic.	Chapter 6 - Equipment, glassware, reagents & chemicals of a lab and its care and use.

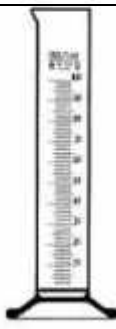


Week No.	4 th
Practical No.	4
Title/ Aim	Learning identification and use of common laboratory glassware.
Objectives to	After completing this practical students shall be able to identify & use common laboratory glassware.
Requirements	Common laboratory glassware.
Environment	MLT Laboratory.
Procedures	<ol style="list-style-type: none"> 1. Pick up each and every common glassware in the laboratory. 2. Observe identifying characters. 3. Classify them as volumetric and non volumetric glassware.

Observations-Non Volumetric Glassware

Sr. No.	Name	Identification & Use	Diagram
1	Test Tube	To carry out various laboratory tests e.g. Urine chemical tests	
2	Beaker	To hold & prepare solution.	
3	Conical Flask (Erlenmeyer's flask)	To hold, prepare & store solution. It is available in different sizes.	

Sr. No.	Name	Identification & Use	Diagram
4	Funnel	To separate solids from liquid.	
5	Pasteur pipette	To Transfer specimen reagent etc.	
6	Petri dishes	To prepare culture media.	
7	Slide	Slides are used for preparation of smear & microscopic examination.	
8	Centrifuge tube	Same to that of test tube but it has tapered bottom, used for centrifugation.	

Sr. No.	Name	Identification & Use	Diagram
9	Cuvette	Special kind of test tube which hold the solution for taking reading in colorimeter.	
10	Watch glass	Shallow concave disc available in different sizes, Watche glasses are used for holding stain, reagent or for evaporation.	
Volumetric glassware			
1	Burette	Long tube with graduations & stopper, Used for titration.	
2	Volumetric pipette with bulb	To deliver fixed quantity of solution e.g. 2ml, 5ml etc.	
3	Graduated pipette	To measure required quantity of solution.	

Sr. No.	Name	Identification & Use	Diagram
4	Measuring cylinder	To measure liquids to prepare solution.	
5	Volumetric flask	It is of some specific capacity for measuring solution. e.g. 50 ml, 100 ml etc.	
6	Micropipette	<p>Micropipettes are preset to deliver specific volume of reagent.</p> <p>Micropipettes accurately and precisely deliver small volume of liquid. (in microlitres)</p> <p>Disposable tips allow same pipette to be used for different samples</p>	
Clinical significance		Proper identification of different glassware helps to carry out tests correctly.	
Skills to be achieved		Students will learn to identify common laboratory glassware and their uses.	
Skills evaluating criteria		<ol style="list-style-type: none"> 1. Identification of any four glassware—4 marks 2. Use of any four glassware— 4 marks 3. Types of glassware— 2 marks 	

FAQs	<ol style="list-style-type: none">1. How will you take care of glassware?2. How will you differentiate various types of pipettes?
Assignments	Draw neat diagram of glassware mentioning use of each one below the diagram.
References/Link with Theory Topic	Equipments, glassware, reagents and chemicals of laboratory, its care and use –Hand book of Laboratory Management and Ethics

Week No.	5 th
Practical No.	5
Title/Aim	To clean dirty and new glassware.
Objective	Student must know standard cleaning procedure.
Principle	Clean glassware is important requirement of a clinical lab. The glassware should be clean physically, chemically and in certain cases bacteriologically. If glassware is not clean, it will give wrong results.
Requirements	<ol style="list-style-type: none"> 1. Detergent solution 2. Phenol 3. Distilled water 4. Chromic acid solution for special cleaning procedure
Environment	MLT lab
Procedure-	<p>1. Cleaning of new glassware-</p> <p>A. Cleaning of soda lime glassware:</p> <ul style="list-style-type: none"> • Soak new glassware for several hours in 1% HCl as new glassware contain free alkali on surface which could affect test results. • Soak glassware in tap water or detergent immediately after use • Wash with distilled water. • Dry at room temperature. <p>B. Cleaning of Borosilicate Glassware:</p> <ul style="list-style-type: none"> • Newly purchased Borosil glassware is soaked in 1% detergent for 1hr. • Wash it with running tap water till all traces of detergent are removed. • Wash with distilled water & dry at room temperature. <p>2. General cleaning of used glassware:</p> <ul style="list-style-type: none"> • If the glassware is infected soak them in 5% phenol for few hours. • After used rinse all glassware in running tap water. • Place in 2% detergent solution. Dissolve the detergent completely before putting the glassware. Soak for 1hr. • Scrub with good quality brush. Make sure that brush reaches all parts of glassware from inside & outside. • Wash the glassware under running tap water. All traces of detergent must be removed during rinsing process. • Finally rinse with distilled water • Dry glassware completely at room temperature or in an oven.

	<p>3. Special cleaning procedure :</p> <p>1. <u>Reagent - Dichromate solution</u></p> <p>Potassium dichromate 100gm Conc. Sulphuric Acid 100ml Water 1000ml</p> <p>Dissolve 100gm of potassium Dichromate in 1000ml of water in a heat resistant beaker. Add 100ml of conc.sulphuric acid little by little very carefully stirring constantly with plastic rod. Store the fluid in wide mouth porcelain jar with a lid.</p> <p><u>Procedure—</u></p> <ul style="list-style-type: none"> • Rinse all the glassware in tap water & then dip in the cleaning solution for an hour. • Wash under running tap water. • Rinse with distilled water or deionized water.
<p>Observations -</p>	<p>Cleaning method as in image</p> <div data-bbox="461 871 1209 1352" data-label="Image"> </div> <p style="text-align: center;">Fig. 5.1</p>
<p>Result</p>	<p>Glassware is cleaned.</p>
<p>Clinical significance</p>	<p>Properly cleaned glassware gives accurate result.</p>
<p>Skills to be achieved</p>	<p>Students will perfectly wash the glassware.</p>
<p>Skill evaluating criteria.</p>	<ol style="list-style-type: none"> 1. Proper use of detergent – 2 marks. 2. Precautions taken while preparing and using chromic acid solution – 4 marks. 3. Uses of washed glassware – 2 marks.
<p>FAQs</p>	<ol style="list-style-type: none"> 1. Describe general cleaning procedure. 2. Describe special cleaning procedure.
<p>Assignment/ Activity</p>	<ul style="list-style-type: none"> • Clean 50 different given glassware properly.
<p>Reference/ Link with theory topic</p>	<p>Chapter 6- Equipment, glassware, reagents & chemicals of a lab and its care and use from handbook of Laboratory Management and Ethics.</p>

Week No.	6 th	
Practical No.	6	
Title/Aim	To prepare laboratory report formats.	
Objective	Students shall know the standard format of various common laboratory tests.	
Principle	The different tests having diagnostic importance should be added in standard report format along with reference ranges.	
Requirements	1. Collected reports from different laboratories.	
Environment	MLT laboratory	
Procedure	<ol style="list-style-type: none"> 1. Visit few pathological laboratories. 2. Collect formats of various tests carried out in laboratories. 3. Study them and prepare a standard format. 	
Observations-	some of standard formats are as follows	
1		
Name of laboratory-		
Address -		
Lab. No. _____		
Date: _____		
Name of Patient:		
Age/Sex : _____		
Referred By : Dr. _____		
<u>COMPLETE HAEMOGRAM</u>		
Test requested	Result	Normal value
Haemoglobin	_____gm%	Male 13 to 17gm% Female 12 to 15gm%
Total RBC count	_____Millions / cu mm	Male 4.5- 6 millions/cumm Female 4.5-5.5 millions/cumm
<u>RBC indices</u>		
HCT (PCV)	_____%	Male 42 to 52% Female 36 to 48%
MCV	_____fL	82 to 92 fL
MCHC	_____%	32 to 36 %
MCH	_____Pg	27 to 32 Pg
Total WBC count	_____/cu mm	5000 to 10000 / cumm

Test requested	Result	Normal value
Differential leukocyte count		
Neutrophils %	40 to 70%
Lymphocytes %	20 to 40%
Eosinophils %	1 to 6%
Monocytes %	2 to 10%
Basophils %	0 to 1%
Platelet count Lakhs/cumm	1.5-4.5 lakhs/cumm
Peripheral smear		
RBC morphology		
WBC morphology		
Platelets on smear		
Checked by	Signature of pathologist	

2

NAME OF LABORATORY**ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex:****Referred By** _____**Urine Examination**

Test requested	Result	Normal value
Physical examination		
Volume		
Color		Straw
Appearance		Clear
Odor		Aromatic
Reaction		Acidic
Specific gravity		1.002- 1.030
Chemical examination		
Protein		Absent
Glucose		Absent
Ketone bodies		Absent
Bile salt		Absent
Bile pigment		Absent
Urobilinogen		Absent
Blood		Absent
Microscopic examination		
Epithelial cells		Few
Pus cells		2-3/HPF
RBC		Absent
Casts		Absent
Crystals		Few
Amorphous material		Absent
Bacteria		Absent
Other		Absent

Checked by**Signature of pathologist**

3

NAME OF LABORATORY**ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex:** _____**Referred By** _____**STOOL EXAMINATION**

Test requested	Result	Normal value
Physical examination		
Color		
Form and Consistency		
Blood		
Mucus		
Adult parasite		
Chemical examination		
Reaction		
Occult Blood		
Fat Analysis		
Others		
Microscopic Examination (saline and Iodine preparation)		
Protozoa—Vegetative and cystic form or both		
Ova		
RBC		
Pus cells		
Bacteria		
Vegetable fibres		
Starch granules		
Fats		
Others		

Checked by**Signature of pathologist**

4

NAME OF LABORATORY**ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex :****Referred By: Dr.** _____**CSF ANALYSIS****Physical Examination**

Color: _____

Appearance: _____

Fibrin clot: _____

Chemical examination

Test requested	Result	Normal value
Physical examination		
Protein		20-40mg%
Sugar		40-80mg%
Chlorides		113-127meq/L

Microscopic examination

Test requested	Result	Normal value
Total cell count		5-10cells/cumm
Differential count		
Lymphocytes		
Neutrophils		
Other cells		

Bacteriological examination

Gram staining: _____

AFB staining: _____

Culture and Sensitivity: _____

Checked by**Signature of pathologist**

5

NAME OF LABORATORY**ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex:****Referred By: Dr.** _____**SEMEN ANALYSIS**

Time of collection: _____

Date of last emission: _____

Test requested	Result	Normal value
Physical examination		
Volume		2 to 5 ml
Color		Grey White
Liquefaction time		Complete by 30 min.
Viscosity		Slightly viscous
Reaction		Alkaline
Chemical examination		
Fructose test		Positive
Microscopic examination		
Sperm count		60 to 150 million / ml
Sperm motility %		
Motility at 00 hours		
Motility at 01 hours		
Motility at 02 hours		
Sperm morphology		
Normal Forms		80-85%
Abnormal forms		10-15%

Checked By**Signature of pathologist**

6**NAME OF LABORATORY****ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex:****Referred By: Dr.** _____**LIVER FUNCTION TESTS**

Test requested	Result	Normal value
Total Bilirubin		Up to 1mg/dl
Direct bilirubin		Up to 0.25mg/dl
Indirect bilirubin		Up to 0.7mg/dl
SGOT		Up to 37U/L
SGPT		Up to 40U/L
Total Protein		6-8gm/dl
Albumin		3.7-5.3 gm/dl
Globulin		2.3-3.6 gm/dl
A/G ratio		1 to 2.3
Alkaline phosphatase		Adults-37-147 IU/L

Checked By**Signature of pathologist**

7

NAME OF LABORATORY**ADDRESS****Lab. No.** _____**Date:** _____**Name of Patient:****Age/Sex:****Referred By: Dr.** _____**WIDAL TEST****Slide agglutination method**

Salmonella Antigen	Agglutination	Titre
Salmonella typhi O		
Salmonella typhi H		
Salmonella paratyphi AH		
Salmonella paratyphi BH		

Note.—Agglutination titre greater than 1:80 is considered as diagnostic.**Checked by****Signature of Pathologist**

Result	Standard report formats prepared.
Skills to be achieved	Students will prepare standard format of reports.
Skill evaluating criteria	Preparing report format — 10marks (any two).
FAQS	1. Which basic points are to be covered while preparing test reports?
Assignment / Activity	Collect reports from different laboratories.
Reference /Links with theory topics-	Chapter 1-Human Health & Diseases From Handbook of Laboratory management and ethics

Week No.	7 th
Practical No.	7
Title/ aim	Learning different chemicals and reagents-To label and store chemicals.
Objective	Student shall understand the importance of proper labeling and storage of chemicals.
Principle	Chemicals are labeled and stored systematically in lab or in store room to avoid damage to the chemicals as well as for prevention of chemical hazards (accidents) in lab.
Requirements	1. Containers with chemicals 2. Label
Environment	MLT laboratory
Procedure	<p>Labelling of chemicals</p> <ol style="list-style-type: none"> 1. Container should be labeled before adding the material. No reagent should be placed in an unlabeled container. 2. Never put any material or solution in a container other than that. 3. Bottles of poisonous solutions should be labeled as 'POISON' in red ink. 4. Bottles of inflammable solutions should be labeled as 'FLAMMABLE' in red ink. 5. An unmarked container without any assurance of its content should be discarded entirely. 6. In case of simple solution, percentage normality and the name of material should be written on label of the container. 7. All solvent other than water should be noted. 8. If solution is mixture, all its components should be labeled, unless it has particular name by which it can be identified. 9. The date of preparation and expected date of expiry, beyond which it should not be used should also be noted.
Observations	



Figure 5.1



Figure 5.2 Label

Result	Chemicals are properly labelled.
Clinical significance	<ul style="list-style-type: none"> • Proper labelling of chemicals helps to identify chemicals. • No use of chemicals after its expiry otherwise errors in result can occur.
Skills to be achieved	<ul style="list-style-type: none"> • Students will label the chemicals properly. • They store them according to the requirement.
Skill evaluating criteria	<ol style="list-style-type: none"> 1. Proper labelling – 4 marks. 2. Proper storage – 6 marks.
FAQs	1. What is significance of labelling chemicals?
Assignment/Activity	<ul style="list-style-type: none"> • Classify the chemicals according to its grade and store them properly.
Reference/ Link with theory topic	Chapter 6- Equipment, glassware, reagents & chemicals of a lab and its care and use from handbook of Laboratory Management and Ethics.

Week No.	8 th , 9 th , 10 th
Practical No.	8
Title/ Aim	Specimen handling-
	To prepare various containers for different samples.
Objectives	Student shall be able to prepare containers for collecting different samples.
Principle	Various containers are used for collecting and storing samples for different types of tests to be carried out.
Requirements	<p>Various containers are used for collecting specimen are-</p> <ol style="list-style-type: none"> 1. Glass bottle, 2. Plastic bottle, 3. Petri dish, 4. Screw cap bottle. 5. Disposable containers <p>Container should be wide mouth, clean, dry and detergent free.</p> <ol style="list-style-type: none"> 6. Sterile containers for microbiology
Environment	MLT Laboratory
Procedures	<ol style="list-style-type: none"> 1. As per the test select the container and label it properly with the name of patient or its identification number. 2. After collecting sample process it properly.

Observations

Containers for blood

- Usually bottles or tubes are used to collect blood specimen with or without anticoagulants depending on the test required.
- For clotted blood plain tubes are used.
- For hematological examination EDTA / Double oxalate / Citrate anticoagulant is used.
- For bacteriological examination sterile container is used.

Containers for urine:-

- For urine collection clean dry detergent free wide mouth bottle with cork or plastic cover is used. For routine examination container is of 300ml capacity and for 24 hour 4.5 liter capacity.
- Container should be sterile for microbiology.

Container for sputum:-

- A wide mouth bottle with a screw cap or plastic cover is used
- The bottle should be sterile for microbiology.
- Cardboard boxes are used for single use only.

Containers for stool:-

- An empty card board box.
- A plastic box.
- A waxed card board box.
- A glass jar with stopper.
- For bacteriology it should be collected in sterile container.
- For transportation of stool specimen **Cary Blair** transport medium is used which preserves many bacteria and vibrio cholera up to four week.
- A stool swab can be taken.

Container for throat swab

- For bacteriological examination a throat swab without any preservative is taken in a sterile tube plugged with sterile cotton.
- Immediately after collection of specimen the swab should be placed in the tube and examined within four hours.
- For detection of diphtheria bacilli coagulated serum is used which is stored in refrigerator.

Containers for CSF

- CSF is collected by lumbar puncture and should be taken in 3 to 4 sterile vials or tubes.
- For dispatching the same containers are used with tight plastic cover or screw cap which are sterilized.



Fig 6.1 Sterile container



Fig. 6.2 Sample container

Clinical significance	Proper selection of container is necessary to avoid confusion during testing and reporting.
Skills to be achieved	Students can collect specimen in proper container.
Skill evaluating criteria	1. Identification of containers and labelling – 10 marks. (2 mark for each container).
FAQs	1. Name the different containers used for collecting various samples for testing in laboratory.
Assignments	Collect and label 25 different samples.
References	Chapter 7- Specimen Handling.

Week No.	11 th
Practical No.	9
Title/Aim	To label the containers.
Objective	Student shall be able to label the containers.
Principle	Proper labelling of specimen containers is required to get accurate results.
Requirements	<ol style="list-style-type: none"> 1. Different specimen containers 2. Different types of labels 3. Marker
Environment	MLT laboratory
Procedures	<ol style="list-style-type: none"> 1. Read the requisition form carefully before collecting specimen. 2. Every specimen must be accompanied by request slip which should indicate date, patient's full name, age and sex, hospital identification number, name of referring doctor, diagnosis, kind of specimen to be obtained. 3. The request slip should be complete and clearly written. 4. Printed specimen labels are used in bigger laboratories, smaller laboratories use adhesive tapes. 5. It is most important that specimen should be labeled securely, so that label will not fall off, thus making specimen unidentifiable. 6. Use marker pen to write on label. 7. The request form must accompany the specimen and should never be separated.

Observations- Format of requisition slip

LABORATORY REQUISITION SLIP

- Hospital address: _____
- Date:
- OPD/IPD no.
- Patient's name: Sex / Age : _____
- Address:
- Name of referring doctor:
- Provisional diagnosis:
- Type of specimen:
- Time of collection:
- Specimen collected by:

Signature _____

PATHOLOGY SPEC		
NAME		
DATE	SEX	AGE
ROOM	NUMBER	
DOCTOR		
SPECIMEN		

Clinical significance	Registration, identification and labelling of specimens containers prevents occurrence of errors in result.
Skills to be achieved	<ul style="list-style-type: none"> Students can label the specimen containers properly. They understand the significance of proper labelling of containers.
Skill evaluating criteria	<ol style="list-style-type: none"> 1. Proper selection of label - 4 marks. 2. Proper entry of details on label – 6 marks.
FAQs	Give a format of requisition slip.
Assignments	Visit different laboratories to observe specimen collection and labelling.
References/Link with Theory Topic	Chapter 7- Specimen Handling.

Week No.	12 th & 13 th , 14 th	
Practical No.	10	
Title/ Aim	Bio-medical waste management	
	To study the disposal of Bio-medical waste using proper color coded bags in the laboratory.	
Objectives	Student shall understand the source, categories, management, disposal and hazards of biomedical waste.	
Principle	Biomedical waste is any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities related to the production or testing of biological, human anatomical, animal, microbiological, biotechnological waste materials. Such waste should be disposed in a proper manner.	
Environment	<ol style="list-style-type: none"> 1. MLT laboratory 2. Different types of hospitals and pathological laboratories. 	
Procedure	<ol style="list-style-type: none"> 1. Segregate the different types of waste generated in medical laboratory. 2. Select the proper color coded bag. 3. Dispose as per the prescribed norms. 	
Observations		
Color of Bag	Waste type	Treatment
Yellow	Human anatomical waste, Animal waste, Microbiology and Biotechnology waste, Blood contaminated solid waste.	Incineration / Deep burial.
Red	Microbiology and Biotechnology waste, Blood contaminated solid waste and disposable items.	Autoclaving/Microwaving/chemical treatment.
Blue	Waste sharps, Disposable items.	Autoclaving/Microwaving/chemical treatment destruction/Shredding.
Black	Discarded medicine, Incineration ash, Solid chemical waste.	Secured landfill.

Table No 10.1
Color code for Bio waste disposable bag

YELLOW BAGS	RED BAGS	BLUE BAGS	BLACK CARBOY
Infectious waste, bandages, gauze, cotton or any other objects in contact with body fluids, human body parts, placenta etc.	Plastic waste such as catheters, in injection syringes, tubings, iv bottles	All types of glass bottles and broken glass articles, outdated & discarded medicines	Needles without syringes, blades, sharps and all metal articles.

Fig. 10.1

Clinical significance	<p>Biological waste carries a higher potential for infection and injury than any other type of waste.</p> <ul style="list-style-type: none"> • It may have serious public health consequences and significant impact on the environment.
Skills to be achieved	<ul style="list-style-type: none"> • Students get acquainted with different types of biomedical waste. • They identify the nature of waste and accordingly put it into the color coded bags required for its disposal.
Skills evaluating criteria	<ol style="list-style-type: none"> 1. Correct color coding – 5 marks. 2. Segregation of waste -5 marks.
FAQs	<ol style="list-style-type: none"> 1. What is biomedical waste? 2. How is it segregated? 3. Which different color code bags are used for disposal?
Assignments	<p>Visit different hospitals and observe method of disposal of Biomedical waste.</p>
References/Link with Theory Topic	<p>Chapter 8- Biomedical Waste Management</p>

Week No.	15 th & 16 th
Practical No.	11
Title/ Aim	To prepare & display Safety charts & symbols.
Objectives	Student must know safety symbols and safety measures.
Principle	To identify hazard in the work place and assess the risk to the staff, patients and others awareness about safety measures is important.
Environment	MLT laboratory
Procedures	1. Study various safety symbols. 2. Prepare charts of safety symbols.

Observations



Table 11.1

Symbol	Meaning	Symbol	Meaning
	E Explosive		O Oxidising
	F Highly flammable		T Toxic
	Xn Harmful		Xi Irritating
	C Corrosive		N Harmful for the environment

Table 11.2



Fig 11.1



Fig. 11.2



Fig. 11.3



Fig. 11.4

Result	Safety charts are prepared.
Clinical significance	Knowing safety symbols helps person to keep away from laboratory accidents.
Skills to be achieved	Students become aware of the various safety signs and symbols.
Skill evaluating criteria	Identification of new safety symbols – 10 marks (2marks each symbol).
FAQs	1. What is significance of knowing safety signs and symbols?
Assignments	Prepare charts of various safety signs & symbols.
References/Link with Theory Topic	Chapter 9-Laboratory safety A Handbook of Laboratory Management and Ethics

Week No.	17 th
Practical No.	12
Title/ Aim	To study to use fire extinguisher.
Objectives	Students must know how to use fire extinguisher in an emergency.
Principle	Fire extinguishers are an integral part of dealing with fires, and an understanding of how a fire extinguisher works will enable us to better use this equipment in case of an emergency.
Requirements	PPT presentation
Environment	MLT laboratory
Procedures	Remember the acronym PASS , which stands for P ull, A im, S queeze, and S weep.



Pull the pin. This will allow you to discharge the extinguisher.



Aim at the base of the fire. If you aim at the flames (which is frequently the temptation), the extinguishing agent will fly right through and do no good. You Want to hit the fuel.



Squeeze the top handle or lever. This depresses a button that releases the pressurized extinguishing agent in the extinguisher.



Sweep from side to side until the fire is completely out. Start using the extinguisher from a safe distance away, and then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.

Observations

Fig. 12.1

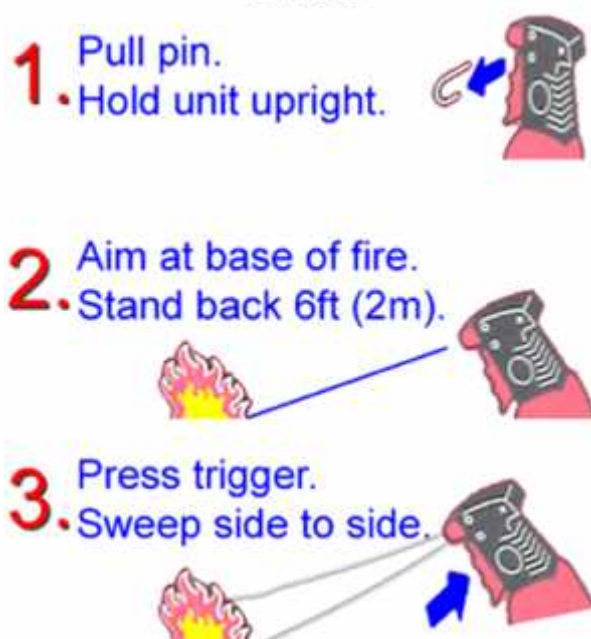



Fig. 12.2

Clinical significance	A first line of defense to cope with fires of limited size.
Skill evaluating criteria	Knowledge of correct technique of using of Fire Extinguisher -10 marks.
FAQs	Explain working of fire extinguisher.
Assignments	Learn the use of fire extinguisher.
References/Link with Theory Topic	Chapter 9-Laboratory safety A Handbook of Laboratory Management and Ethics.

Week No.	18 th & 19 th
Practical No.	13
Title/ Aim	To prepare first aid box.
Objectives	Students shall know contents of First Aid Box and how to use them in case of an accident.
Principle	First aid is immediate treatment given to the victim of accidents in the lab before proper medical attention.
Requirements	<ol style="list-style-type: none"> 1. The first aid box - A white cross on a green background made of metal or plastic to prevent it being damaged by pests and to protect the content from dust and dirt. 2. 5 % sodium carbonate solution. 3. 2% sodium bicarbonate solution in eye drop bottle. 4. 5 % Acetic acid solution. 5. Saturated boric acid solution in eye drop bottle. 6. Antibiotic ointment or any other antiseptic ointment. 7. 5 % soap water solution. 8. Tincture iodine. 9. Cotton wool, bandages and gauzes. 10. Adhesive dressing material. 11. Wash bottles. 12. Surgical spirit, etc. 13. Forceps, scissors, tourniquet etc. 14. Syringes and needles. 15. Emergency medicines.
Environment	MLT laboratory
Procedures	<ol style="list-style-type: none"> 1. Take First Aid box. 2. Arrange all above contents properly in it. 3. First aid box and eye wash bottle should be kept in the lab in a place that is known and accessible to all members of staff. 4. Inspect the first aid box content regularly for Expiry date & any damages.
Observations	 <p style="text-align: center;">Fig. 13.1</p>

Result	First Aid box is prepared.
Clinical significance	<ul style="list-style-type: none"> • Knowing contents of first aid box and their uses help the technician to give treatment in certain laboratory accidents before doctor arrives. • First aid helps to reduce pain and may save life in some accidental cases.
Skills to be achieved	Students will give first aid in common lab accidents.
Skill evaluating criteria	<ul style="list-style-type: none"> • Identification of contents of First aid box and its use – 8 marks (1 marks each). • Proper organization of First Aid Box- 2 marks
FAQs	<ol style="list-style-type: none"> 1. What is first aid ? 2. Name contents of first aid box.
Assignments	Arrange contents of first Aid Box.
References/Link with Theory Topic	Chapter 9- Laboratory safety

Week No.	20 th & 21 st	
Practical No	14	
Title/ aim	To demonstrate some important first aid procedures	
Objective	Students shall gain practical knowledge about first aid procedures.	
Requirements	PPT or YOU TUBE Video presentation.	
Environment	MLT laboratory.	
Procedure	Some common emergencies in laboratory and the first aid for such problems can be demonstrated in the laboratory with the help of PPT or YOU TUBE Video.	
Observations		
Sr. No.	Type of emergency	Simple first aid steps
1	Bleeding Cuts & wounds with sharp objects	<ul style="list-style-type: none"> • Wash your hands. • Stop bleeding with the help of guaze. piece,or bandage or cloth or with your hands. • Clean the wound with clear water or mild antiseptic lotion. • Apply antibiotic cream. • Cover the wound with bandage. • Go to hospital for deep injury where stiches are necessary. • Remind for tetanus vaccine if not taken.
2	Chemical burn (acid, alkali or any strong chemical)	<ul style="list-style-type: none"> • Remove the chemical causing burn thus protecting yourself. • Rinse burn area with plenty of cold water. • Apply burn ointment if necessary. • Apply some loose sterile bandage if required.
3	Electrical shock	<ul style="list-style-type: none"> • Put off the supply. • Seperate the affected person using non conducting object like plastic or wooden object. • Cover the burn area loosely with bandage or clean cloth. • In case of moderate to severe burns take the person to hospital immediately.
4	Accidental swallowing of reagent (mouth pipetting)	<ul style="list-style-type: none"> • Ask the person to rinse mouth with ample of cold water. • Visit the doctor for further advice.
5	Inhalation of toxic fumes	<ul style="list-style-type: none"> • Try to remove the source generating fumes. • Open the door & windows to increase ventilation. • Move to open space & do deep breathing.

6 Fainting	<ul style="list-style-type: none"> • Take care that person is lying down comfortably. • Don't get crowded over the fainted person, let the fresh air come. • Do elevation of legs or give head low position • Loosen the clothes specially around the neck. • Maintain the airway, turn the head to one side • Offer some glucose or tea or coffee after gaining consciousness.
7 Burn due to flame or hot plate	<ul style="list-style-type: none"> • Rinse with cold water • Apply antibiotic cream • Loosely cover the area or keep uncovered if very small
8 Person in shock	CPR-Cardio-pulmonary resuscitation (see the video)



Fig. 14.1 In case of Cut

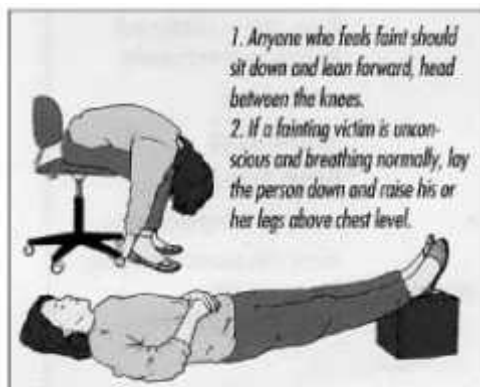


Fig. 14.2 Fainting



Fig. 14.3 Bandaging

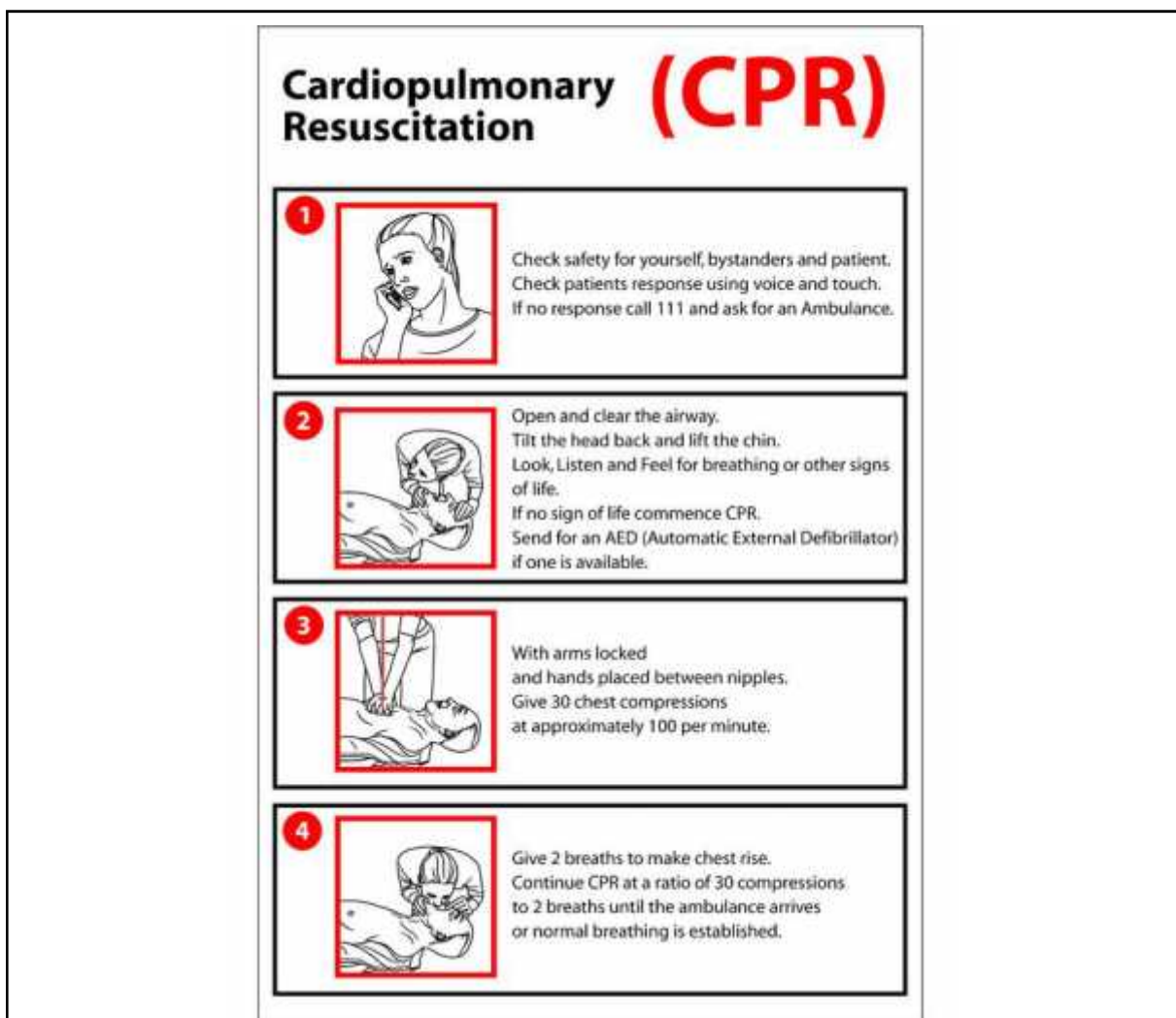


Fig. 14.4

Clinical significance	Knowing various first aid procedures help to reduce the pain and can save life of a victim.
Skills to be achieved	Student can observe actual first aid procedures in demonstrations thereby will gain knowledge about correct first aid procedures.
Skill evaluating criteria	Identification of common injuries and its first aid given (any 5) ——— 10marks (2each)
FAQs	<ol style="list-style-type: none"> 1. What do you mean by First aid? 2. How will you handle minor burn due to hot flame? 3. What is the common cause of fainting?
Assignment/Activity	Prepare first aid kit for your laboratory.
Reference/ Link with theory topic	Laboratory safety- Hand book of Laboratory Management and Ethics

Week No.	20 th & 21 st
Practical No.	15
Title/ Aim	Learning vacutainers
Objectives	Student shall learn use of vacutainers in collection of blood.
Principle	Vacutainer is blood collection tube made of either plastic or glass with a closure that is evacuated to create a vacuum inside the tube facilitating the draw of a prede-termined volume of blood.
Requirements	<ol style="list-style-type: none"> 1. Tourniquet 2. Hypodermic needle 3. Vacutainer with correct color code 4. Alcohol swab
Environment	MLT laboratory
Procedures	<ol style="list-style-type: none"> 1. The vein is first punctured with the hypodermic needle which is carried in a translucent plastic holder. 2. The needle is double ended, the second shorter needle being shrouded for safety by the holder. When a Vacutainer test tube is pushed down into the holder, its rubber cap is pierced by the second needle and the pressure difference between the blood volume and the vacuum in the tube forces blood through the needle and into the tube. 3. The filled tube is then removed and another can be inserted and filled the same way. 4. It is important to remove the tube before withdrawing the needle, as there may still be some suction left, causing pain upon withdrawal. 5. The test tubes are covered with a color-coded plastic cap. 6. They often include additives that mix with the blood when collected and the color of the tube's plastic cap indicates which additives that tube contains.

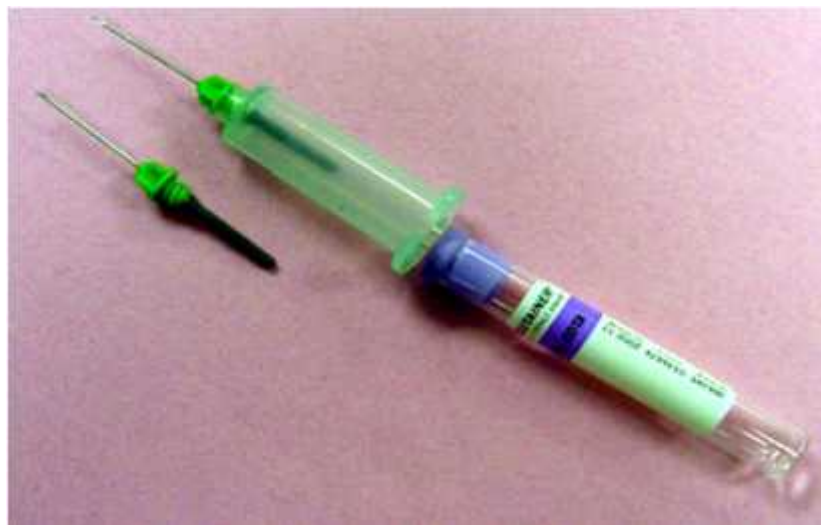
Observations.

Fig. 15.1

Sample bottles for blood - order of draw			
Order	Colour	Description / anticoagulant	Notes
1	White	Serum	Alpha fetoprotein
2	Brown	Serum gel	Immunology, virology, microbiology antibody tests
3	Orange	Lithium heparin	Most routine biochemistry, microbiological assays, immunology, B12, ferritin, folate. NB: Manganese use old special metal-free tube.
4	Green	Sodium citrate	All clotting and thrombotic screening
5	Yellow	Sodium fluoride	Glucose, lactate
6	Blue	EDTA for blood transfusion	Blood Transfusion only Handwritten details or BloodTrack generated labels only
7	Red	EDTA	1.2mls: All routine haematology, immunology, PTH, ACTH, FK506, cyclosporin for chemical pathology. 4.9mls: Virology molecular immunology, microbiology, PCR's, molecular genetics. 9.0mls: Molecular genetics.

Table 15.1

Clinical significance	<ul style="list-style-type: none"> • Each vacutainer tube is designed to draw exactly the right amount of blood. Correct blood to additive ratio is maintained. Hence chance of micro clot formation and hemolysis of blood are minimum. • The plasma separator tube is heparinized and contains an inert gel barrier. These tubes are mainly useful for quick separation of plasma and determination of electrolytes. • The vacutainer blood culture systems offer early detection of microbial growth by ensuring minimum risk of contamination. • It eliminates the preparation of anticoagulant containing bulbs and tubes. • There is no processing of containers.
Skills to be achieved	Students will collect blood using vacutainers perfectly.
Skill evaluating criteria	<ol style="list-style-type: none"> 1. Proper use of color code – 5 marks. 2. Correct method of collection – 5 marks.
FAQs	<ol style="list-style-type: none"> 1. What are vacutainers? 2. What precautions are taken while using vacutainers for blood collection?
Assignments	Collect blood of 10 different subjects using vacutainer.
References/Link	Chapter 2 Hand book of Hematology, Clinical pathology of Std XII.

Week No.	22 nd & 23 rd
Practical No.	16
Title/ Aim	Material management
	To prepare voucher of supplies.
Objectives	Student shall be able to prepare voucher of supplies.
Principle	Bill is documentary (written) evidence of transaction made by the supplier.
Environment	MLT laboratory
Procedures	1. Prepare a voucher for item to be purchased. 2. Voucher contains final amount of material.

Observations**Form of Invoice -**

Name of firm—

Date :

Address—

Challan No.

To, _____,

_____.

Sr. No.	Particular	Description	Expiry date	Quantity & size	Rate in Rs.	Amount in Rs.
1						

Prepared by

Authorised signatory

Signature of Receiver,

RECEIPT

Receipt is given by supplier. It is given after payment is made by purchaser. This payment may be in cash or by cheque. This receipt contains date and amount paid by purchaser. It is signed by person of the supplier, who receives the payment.

Format of receipt—

Name of the firm—

Date-

Received with thanks Rs. _____

From Mr/Mrs. _____

Against challan no. in cash/ by cheque.

Signature of receiver

Clinical significance	<ul style="list-style-type: none"> • Preparing voucher helps to maintain record of payment done for supplies. • It is a simple way of maintaining an inventory list.
Skills to be achieved	<ul style="list-style-type: none"> • Students can prepare voucher properly.
Skill evaluating criteria	<ol style="list-style-type: none"> 1. Proper record of payment done – 5 marks. 2. Arrangement of vouchers date wise – 5 marks.
FAQs	<ol style="list-style-type: none"> 1. Define voucher. 2. What is significance of voucher?
Assignments	To observe lab purchase register.
References/Link with Theory Topic	Chapter 11- Material management

Week No.	24 th & 25 th							
Practical No.	17							
Title/ Aim	Material management							
	To prepare stock card.							
Objectives	Student shall be able to prepare stock card.							
Principle	Stock card is also called as bin card. Bin means rack or shelves. The stock card gives information about stock position of material.							
Environment	MLT laboratory							
Procedures	Take stock room inventory and prepare stock card.							
Observations								
Proforma of Stock card								
Name of Item								
Address of supplier								
.....								
Cost (Unit price)								
Year—								
Sr. No.	Ordered		Received		Issued		In stock	
	Date	Qty	Date	Qty	Date	Qty	Date	Qty
1								
Clinical significance			<ul style="list-style-type: none"> • Stock card provide information about quantities received, issued and in stock at any time. • It can be used to calculate orders. • It is a useful tool for preventing shortages and over-stocking. 					
Skills to be achieved			<ul style="list-style-type: none"> • Students can take stock room inventory and prepare stock card. 					
Skill evaluating criteria			<ol style="list-style-type: none"> 1. Method of taking stock room inventory – 5 marks. 2. Placing orders – 5 marks. 					
FAQs			1. Give proforma of stock card.					
Assignments			Observe lab purchase register and stock register.					
References/Link with Theory Topic			Chapter 11- Material management					

Week No.	26 th				
Practical No.	18				
Title/ Aim	Material management				
	To maintain registers for records.				
Objectives	Student shall be able to maintain different laboratory records.				
Principle	Ledger book is register in which all the information of lab material which is purchased is entered systematically.				
Requirements	Ledger book				
Environment	MLT laboratory				
Procedures	<p>Prepare a ledger book containing information about</p> <ul style="list-style-type: none"> • Material received with its detail, • Stock of the material, • Order level of that material, • Name of the firm from which material is to be purchased. 				
Observations					
Information in Ledger book is stored a					
Sr. No.	Name of item	In stock	In use	Balance	Remark
Clinical significance	<ul style="list-style-type: none"> • Ledger book gives all the information about particular material so material management becomes easy. 				
Skills to be achieved	<ul style="list-style-type: none"> • Students can maintain Ledger book. 				
Skill evaluating criteria	1. Correct way of maintaining Ledger book – 10 marks (1 mark each for proper entry).				
FAQs	1. What is ledger book ?				
Assignments	Observe lab purchase register and stock register.				
References/Link with Theory Topic	Chapter 11- Material management				