YENEPOYA

(DEEMED TO BE UNIVERSITY)
Recognized under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade

YENEPOYA (DEEMED TO BE UNIVERSITY)

Deralakatte, Mangaluru -575018

REGULATIONS AND CURRICULUM GOVERNING

POSTGRADUATE PROGRAM

MASTER OF SCIENCE MEDICAL LABORATORY TECHNOLOGY

(CURRICULUM - EFFECTIVE FROM 2020-21)

ATTESTED

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Ref: No. Y/REG/ACA/ACM-39/2020 09.09.2020

NOTIFICATION

Sub: Revised syllabus of M.Sc. in Medical Laboratory Technology

Ref: 1. Minutes of the 30th Academic council meeting held on 20.10.2017, vide agenda-15
2. Minutes of 39th Academic council meeting held on 27.08.2020, vide agenda-15

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The Academic Council at its 30th meeting held on 20.10.2017 had granted permission for the start of M.Sc. in Medical Laboratory Technology from the academic year 2018-2019.
In order to bring this program under Choice Based Credit System, necessary revisions have been incorporated in the curriculum and regulations which have been approved in the 39th meeting of the Academic council meeting held on 27.08.2020 and subsequently the Board of Management at its 50th meeting held on 28.08.2020.

The curriculum and regulations for the M.Sc. in Medical Laboratory Technology shall be effective from the academic year 2020-21 admission onwards under the Faculty of Allied and Healthcare Professions.

REGISTRAR

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Copy to:

1. PA to Vice-Chancellor
2. Controller of Examinations
3. Dean, Allied and Healthcare Professions
4. Program coordinators
5. File copy

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YENEPOYA (Deemed to be) University

Regulations & curriculum for

M.Sc. Medical Laboratory Technology

Choice Based Credit System.

1. Preamble

Health care sector has become one of the largest employment generation sectors in India and abroad. Rapidly changing and expanding horizon of the health care sector demands formal training programs in all its Allied areas. Postgraduate Program in Allied Health sciences speciality often encompasses a wide range of disciplines. One such highly demanded speciality is Medical Laboratory Technology

The Master of Science in Medical Laboratory Science (MS in Medical Laboratory Science) program prepares students to become a vital part of the health care team. This career allows students to perform tests to analyze bodily fluids, which aid in the diagnosis and treatment of disease. The medical laboratory science curriculum is built around a core of basic and advanced theoretical knowledge combined with clinical practice in hematology, clinical chemistry, immunology, molecular diagnostics, immunohematology and clinical microbiology.

2. Programme Objectives:

PO 1: Proficiently supervise and perform full range of Hematological and Immuno-haematological laboratory tests.

PO 2: Develop and evaluate test systems and interpretive algorithms.

PO 3: Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information

PO 4: To teach under graduate students and develop/guide research projects

PO 5: Faculty development in Medical Laboratory Science (MLS)

Expectation from the future Postgraduate in providing patient care, teaching and research

At the end of the course the student should be able to:

PO 6: Supervise/Perform routine Hematological and Immuno-haematologicallaboratory testing.

PO 7: Make specimen oriented decision on predetermined criteria including working knowledge of critical values.

PO 8: Communicate with other members of healthcare team, customers and patients in an effective manner.

PO 9: Process information and ensure quality control as appropriate to routine laboratory.

PO 10: Train students in routine/special laboratory procedure.

PO 11: Upgrade knowledge and skills in a changing healthcare scenario.

PO 12: Should know the logical interpretation of clinical lab investigations.

PO 13: Should be capable to extrapolate data acquired

PO 14: Should be capable of supervise / guide the staff working on automated machine

PO 15: Should be capable of teaching, proposing/executing research project

3. Durations of the Programme:

The duration of the programme shall extend over 4 semesters (2 academic years) of 15 weeks or more each with a minimum of 90 actual working days of instructions in each semester and 2 – 3 weeks of examinations. The successful completion will lead to Masters Degree in Medical Laboratory Technology.

4. Semester:

An academic year shall consist of two semesters;

Odd Semester 1^{st}& 3^{rd}	July/August to December/January
Even semester 2^{nd}& 4^{th}	January/February to June/July

5. Medium of Instructions:

The medium of instruction and examination shall be English.

6. Eligibility for admission:

Candidates who have passed B.Sc. Medical Laboratory Technology (MLT) from institutions where the mode of study is a full time program, with minimum 4 years duration from this university or any other university in India or abroad as equivalent with not less than 50% of marks in aggregate and have completed 1 year of compulsory rotating internship in Colleges recognized by Yenepoya (Deemed to be University) -Karnataka are eligible.

Candidates completing B.Sc. Program through correspondence course are not eligible.

7. **Semester System and Choice Based Credit System:**

The semester system accelerates the teaching-learning process. The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a cafeteria 'type approach in which the students can take courses of their choice, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

8. Definition of Key words:

a. **Academic Year:**

Two consecutive (one odd + one even) semesters constitute one academic year.

b. **Choice Based Credit System**:

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

c. **Course:**

Usually referred to, as 'papers" is a component of a programme. The courses shall define learning objectives and learning outcomes. A course shall comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

d. **Credits:**

Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, normally in each of the courses, credits will be assigned on the basis of the number of lectures/tutorial laboratory work and other forms of learning required, to complete the course contents in a 16-20 week schedule: One credit =1 hour of lecture per week/ two hours of Laboratory or practical/three hours of clinical rotation, field work/posting. All courses need not carry the same credits.

e. **Programs:**

An educational program leading to award of a degree, diploma or certificate.

f. **Grade Point**:

It is a numerical weight allotted to each letter grade on a 10-point scale.

g. **Credit Point**:

It is the product of grade point and number of credits for a course.

h. **Cumulative Grade Point Average (CGPA**)

It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

i. **Letter Grade:**

It is an index of the performance of students in a said course. Grades are denoted by letters: A+, A, B+, B, C, P, and F.

j. **Semester Grade Point Average (SGPA):**

It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

k. **Transcript or Grade Card or Certificate:**

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester.

l. **Semester System and Choice Based Credit System:**

The semester system accelerates the teaching-learning process. The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a cafeteria ‘type approach in which the students can take courses of their choice, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

9. Types of Courses

a. **Core course**:

A course that should compulsorily be studied by a candidate as a core requirement is termed as a core course. This is the core requirement to complete the M.Sc. Medical Laboratory technology programme.

b. **Open Elective**:

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline or subject or domain or nurtures the candidates proficiency skill.

i. A candidate shall have the freedom to choose OE courses during the academic duration of the particular PG programme offered by Yenepoya (deemed to be) University through the PG departments or SWAYAM/MOOC external online platforms or a mix of courses offered by Yenepoya (deemed to be) University and SWAYAM/MOOC as appropriate.

ii. A candidate opting for SWAYAM/MOOC courses shall have the freedom to choose the courses of once own choice and complete such courses before appearing fourth Semester End Examination.

iii. A candidate shall compulsorily submit the pass certificate of each course successfully completed to the controller of examination of Yenepoya (deemed to be) University through the proper channel before appearing the fourth semester end examination.

iv. A candidate opting OE courses offered by the Yenepoya (deemed to be) University through the PG departments need to take up these courses generally during second and third semesters of the programme.

v. A candidate shall not take the courses offered by the department in which she/he is enrolled

vi. Registration for the OE courses offered by the Yenepoya (deemed to be) University shall be at least one week prior to the commencement of the course with the CBCS coordinator. The CBCS unit shall notify the list of courses after being approved by the respective BOS. For SWAYAM/MOOC courses shall be as per the enrollment notification by the respective implementation authorities.

Yenepoya (deemed to be) University shall adapt the regulations of UGC governing SWAYAM/MOOC courses as amended from time to time.

10. Assigning Credit Hours per Course

While there is flexibility for the departments in allocation of credits to various courses offered, the general formula shall be:

a. Every Core course shall be restricted to a maximum of 4 credits.
b. Projects shall be restricted to a maximum of 25 credits.
c. Every Open Elective course offered by the Yenepoya (Deemed to be) University shall be restricted to a maximum of 3 credits.
d. A candidate shall compulsorily complete a minimum of Two Open Electives (Total Six Credits) during the PG programme.
e. These courses shall be selected either from the SWAYAM/MOOC courses notified by the UGC time to time or from the list of courses offered by the respective PG departments following CBCS pattern of the Yenepoya (Deemed to be) University.
f. Weight age of the credits with respect to SWAYAM/MOOC courses shall be 2 or 3 or 4 credits per course as per the course regulations of the implementing authorities. Accordingly, a candidate shall be permitted to take Two (2) or Three (3) courses with a combination of 3+3, 4+2 and 2+2+2 credits respectively to a total of 6 credits.
g. A candidate who is desirous to add more credits shall be permitted to do so during the academic duration through SWAYAM/MOOC online platform. Extra credits earned by a candidate shall be included in the marks card on submission of course completion certificate. However, it shall not be considered for awarding the Grade in the PG programme.
h. The credits assigned to the course are indicated as L: T: P format. For example, for a 4-credit course format could be: 4:0:0 or 1:2:1 or 3:1:0 or 0:0:4 etc.

11. Assigning Total Credits for a Programme

The UGC, in its notification No.F.1-1/2015 (Sec.) dated 10/4/15 has provided a set of "Model curricula and syllabi for CBCS programmes. In conformation with this notification, at YENEPOYA (Deemed to be University), for PG programs with a study period of 4 semesters, the total credits assigned are minimum **90 credits** to a maximum of **110 credits**.

12. CBCS Programmes Coding System

The coding system shall be in the consonance with the system followed by the office of the controller of examination. Presently the following coding pattern is followed.

a. First two letters describe the faculty name followed by level of programme (UG – 01; PG – 02) and two letters represent the programme.

b. Course code shall have prefix denoting semester number followed by an alphabet of respective type of courses such as C = Core, E = Elective, OE = Open Elective, P = Practical followed by numbers denoting number of courses taught –

1st SEM: 1C1, 1C2, 1E1, 1E2, 1E2, 1P1, 1P2 etc.

2nd SEM: 2C1, 2C2, 2E1, 2E2, 2OE1, 2OE2, 2P1, 2P2 etc.

3rd SEM: 3C1, 3C2, 3E1, 3E2, 3OE1, 3OE2, 3P1, 3P2etc.

4th SEM: 4C1, 4C2, 4E1, 4E2, 4P1, 4P2 etc.

13. Attendance:

a. Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates with less than 80% of attendance shall be required to repeat that Course by attendingthe semester.

b. There shall be no provision for condo nation of shortage of attendance.

c. For SWAYAM/MOOC/NPTELit shall be as per the regulations governing the courses of implementingauthority.

d. The HOD/Course Coordinator through the Dean of Faculties shall announce the names of the candidates who will not be eligible to take the Semester End- Examinations (SEE) in the various courses and send a copy of the same to the Controller of Examinations (COE) Office. Registrations of such candidates for those courses shall be treated ascancelled.

14. Scheme of examination

a. Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by semester end university examination (SEE) for each course.

b. The components of CIA (Continuous Internal Assessment) may include session tests, Seminar/Journal Club/Review/Assignment /Micro projects/Social involvement and other activities as determined by the board of studies in the respective departments.

c. The marks for CIA shall be 40% and SEE shall be60%.

d. Candidate should have secured 40% in IA to be eligible for SEE.
e. Minimum marks required to be pass per course shall be 50% in aggregate (in IA and SEE put together).
f. There shall be examinations at the end of each semester ordinarily during December/January for odd semesters and during June/July for even semesters
g. The SEE duration shall be three hours.
h. A candidate has to pass minimum of two Core courses of each semester to be eligible to be promoted to next semester. A candidate who has more than three pending Core courses will not be allowed to take the Final Semester exam.

Internal assessment format (distribution of marks)

Internal Assessment Components	**Maximum Marks**
Average of two IA tests	10
Journal Club /Seminar	10
Assignments	10
Case studies	10
Log Book/Record	10
Presentation Skill	10
Total Marks	**60**

Question Paper Pattern

SUBJECTS HAVING MAXIMUM MARKS = 90				**Duration**
Type of question	**Number of questions**	**Marks for each question**	**Total**	
LONG ESSAY TYPE	03	10	30	180 minutes
SHORT ESSAY TYPE	12	05	60	
SHORT ANSWERS	-	-	-	
		Total	**90**	

Practical examination

SI.NO	Components	Marks
1	Spotters	20
2	Case Scenario/Stations	20
3	Viva Voice	20
Total Marks		60

PARTICULARS OF PRACTICAL, VIVA-VOCE & DISSERTATION

- Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a specialist.
- Viva- Voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence &oral communication skills.
- Special emphasis shall be given to dissertation work during the M.Sc. MLT4th Semester examination.
- The marks of Viva-Voce examination shall be included in the clinical examination to calculate the percentage and declaration of results.
- OSCE/OSPE- shall have minimum of 5 stations.

15. Evaluation of Answer Scripts

a. Evaluation of answer scripts

i. Each theory examination shall be evaluated by one internal and one external examiner. There shall be a third evaluation if the difference is more than 15%.

ii. Practical examination shall be jointly conducted and evaluated by one internal examiner and one external examiner.

b. **Evaluation of Dissertation**

i. Dissertation shall be evaluated by 2 examiners, 1 external & 1 Internal from the panel of examiners approved by the board of studies and by the University.

ii. The criteria for the evaluation shall be as prescribed by the board of studies.

16. Classification of Successful candidates:

The results of successful candidates at the end of each semester shall be declared in terms of Grade Point Average (GPA) and Alpha-Sign Grade. The results at the end of the sixth semester shall be classified on the basis of the Cumulative Grade Point Average (CGPA) obtained in all the six semesters and the corresponding overall alpha sign grade.

a. Letter Grades and Grade Points:

Letter Grade	Grade Point	Range of Marks
O+ (Outstanding)	10	90 – 100
O (Excellent)	9	80 – 89.99
A+ (Very Good)	8	70 – 79.99
A (Good)	7	60 – 69.99
B+ (Average)	6	55 – 59.99
P (Pass)	5	50 – 54.99
F (Fail)	<5	< 50

b. Cumulative Grade Point Average (CGPA):

The results at the end of the fourth semester shall be classified on the basis of CGPA obtained in the four semesters and the corresponding overall letter grade. The letter grade as described below shall be adopted.

Letter Grade	CGPA Range
O+ (Outstanding)	9.0 – 10.0
O (Excellent)	8.0 – 8.99
A+ (Very Good)	7.0 – 7.99
A (Good)	6.0 – 6.99
B+ (Average)	5.5 – 5.99
P (Pass)	5.0 – 5.49
F (Fail)	< 5.0

17. Minimum for a pass:

a. A candidate shall be declared to have passed the UG program if he/she secures at least CGPA of 4.0 (Course Alpha-Sign Grade P) in the aggregate of both internal assessment and semester end examination marks.

b. The candidates who pass all the semester examinations in the first attempts in Three years are eligible for ranks provided they secure at least a CGPA of 8.0 (at least Alpha-Sign Grade A).

c. The results of the candidates who have passed the sixth semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed Lower semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.
d. A candidate who passes the semester examinations in parts is eligible for only CGPA and Alpha-Sign Grade but not for ranking.
e. There shall be no minimum in respect of internal assessment and viva-voce marks.
f. A candidate who fails in any of the project work/project report/dissertation shall reappear for the same and pass the examination subsequently within the nearest semester and examination schedule.

18. Carry over provision:

Carry over shall be allowed to the candidates for all the semesters.

19. Re-Entry after Break of the study:

a. Candidates admitted to a program abstaining for more than 3 months must seek readmission into the appropriate semester.
b. The candidate shall follow the syllabus in vogue (currently approved/is being followed) for the program.
c. All re-admissions of candidates are subject to the approval of the Vice Chancellor

20. Maximum period for completion of the Programme

A candidate shall complete the four semesters (two years) program within five years from the date of admission.

Distribution of Credits and Marks for M.Sc. Medical Lab Technology

Semester 1

Type of course	Course Title		Credits Distribution (L, T, P per Week)				Distributions of marks		Total Marks
			L	T	P	Total credits	IA	SEE	
Core	Hematology 1	Theory	2	1	-	3	60	90	200
		Practical	-	-	8	4	20	30	
Core	Blood Banking 1	Theory	2	1	-	3	60	90	200
		Practical	-	-	8	4	20	30	
Core	Clinical Pathology	Theory	2	1	-	3	60	90	200
		Practical	-	-	8	4	20	30	
Subsidiary - 1	Biostatistics and Advanced Research Methods		2			2	10	40	50
	Total					23			650

SEMESTER II

Type of course	Course Title		Credits Distribution (L, T, P per Week)				Distribution of marks		Total Marks
			L	T	P	Total credits	IA	SEE	
Core	Hematology 1I	Theory	2	2	-	4	60	90	250
		Practical	-	-	24	12	40	60	
Core	Biochemistry, Immunology, Microbiology, Histopathology and Cytology		2	2		4	60	90	150
	Open elective subjects		3			3	40	60	100
	Total					23			500

Semester III

Type of course	Course Title		Credits Distribution (L, T, P per Week)				Distribution of marks		Total Marks
			L	T	P	Total credits	IA	SEE	
Core	Blood banking II	Theory	2	2	-	4	60	90	250
		Practical	-	-	22	11	40	60	
Core	Cytogenetic, HIV/AIDS, Immunopathology, Automation in Hematology		2	2		4	60	90	150
Core	Health Care Management		2			2	10	40	50
	Open elective		3			3	40	60	100
	Total					21			550

Semester IV

Type of course	Course Title		Credits Distribution (L, T, P per Week)				Distribution of marks			Total Marks
			L	T	P	Total credits				
Core	Hematology III	Theory	2	2		4	60	90		250
		Practical	-	-	12	6	40	60		
Core	Blood Banking 1II	Theory	2	2	-	4	60	90		250
		Practical	-	-	12	6	40	60		
	Total					20				500

List of Open Electives

1. MHA - Hospital Information System
2. MSW - Human Relations and Communication
3. MPH - Project Management
4. MPT - Women's Health & Pregnancy
5. MSc Bioscience - Scientific Communication
6. MSc Biostatistics - Basic Data Analysis Techniques
7. M Library & Information Science - Scholarly Communication

SEMESTER I

Course Title: **HAEMATOLOGY 1**

Teaching Hours Lecture 30 hours. Tutorial 15 hours, Practical 120 hours

Learning objectives:

1. Describe Hematopoesis and various cellular elements of bone marrow.
2. Describe the physiology of coagulation and discuss haemostatic disorders.

Course Content:

Unit **1:** Hematopoesis.

1. Origin, development, function and fate of blood cells

Unit **2: Erythropoiesis**

1. General concepts, morphology of red cells in health and diseases, biosynthesis of hemoglobin (Hb), nutritional factors in erythropoiesis, destruction of red cells
2. Structure of red cell membrane and metabolic pathways
3. Hemoglobin Structure and its function

Unit 3**: Granulopoiesis**

1. General concept
2. Different kinds of granulocytes , their morphology and functions
3. Disorders of WBC: leucocytosis, leucopenia, leukaemoid reaction, leukoerythroblastic picture

Unit 4**: Lymphatic system**

1. General concept
2. Lymphopoiesis and differentiation

Unit 5**: Hemostasis & coagulation**

1. The physiology of primary haemostasis
2. Platelets and megakaryocytes
3. Blood coagulation factors

Practicals

Practical objective:

1. Describe and demonstrate the steps of blood collection.
2. Discuss the various vacutainers and its use.
3. Demonstrate peripheral blood smearing and staining.
4. Perform basic tests – DC, Reticulocyte count, AEC, PCV, and ESR.
5. Demonstrate preparation of stains, reagents and diluting fluids for the above tests.

Course Content

1. Blood collection, Anticoagulants used in hematology
2. Red cell indices
3. E.S.R., PCV, Platelet count, Absolute eosinophil count
4. Reticulocyte count
5. Stains used in hematology
6. Preparation of blood film
7. Preparation of Leishman's stain, Giemsa stain and MGG stain
8. Peripheral smear staining by Leishman's stain, Interpretation of peripheral smear, Differential count.
9. Preparation of stains, reagents, diluting fluid

Books for References:

1Henry JB, AuBuchonJP.Clinical diagnosisandmanagementby laboratory methods.Archivesof Pathology and Laboratory Medicine. 1997; 121(9):1016.

2. McDonald GA, Dodds TC, Cruickshank B. Atlas of haematology. Churchill Livingstone; New York: distributed in US by Longman; 1978.

3. Firkin F, Chester man C, Rush B, Pennington D. De Gruchy's Clinical haematology in medical Practice. John Wiley & Sons; 2008 Jan 19.

4. Godkar PB, Godkar DP. Textbookofmedicallaboratorytechnology. Bhalani; 2003.

5. Nayak R, Rai S, Gupta A. Essentials in hematology and clinical pathology. JP Medical Ltd; 2011 Nov 25.

6. Mukherjee KL. Medica laboratory technology. McGraw-Hill Education; 2017 Oct 15.

7. Mohan H. Harsh Mohan Text Book Of Pathology, 6th.

8. Mitchell L, JB B. Dacie and Lewis Practical Haematology.

9. Kawthalkar SM. Essentials of haematology. JP Medical Ltd; 2012 Dec 30.

Course Title: **Blood Banking 1**

Teaching Hours Lecture 30 hours, Tutorial 15 hours, 150 -Practical hours

Learning objectives:

1. Describe basis blood bank procedure, blood collection, donor selection, storage and processing of blood, including recent advances.
2. Enumerate the transfusion reactions and describe the Immunopathology of same

Course content

Unit **1:** Donor selection, Blood collection, handling of blood, storage and processing, site complication

Unit **2:** Current trends in blood preservation and its advantages

Unit 3**:** Introduction to blood transfusion, principles of blood group serology

Unit 4**:** Fundamentals of immunology for blood bankers

1. Cells of immune system, cytokines, immunoglobulin structure, complement, laboratory examination of reaction between antigen and antibodies, factors influencing antigen antibody reaction

Unit 5**:** Record maintenance

Practicals

Practical Objective:

1. Demonstrate phlebotomy, donor selection, post donation care.
2. Discuss precautions and storage of blood and record keeping in blood bank.

Course content

1. Blood Collection [Phlebotomy]
2. Donor Selection
3. Post donation care
4. Preservation and storage of blood
5. Record keeping: To be observed

Books recommended:

1.Brecher MEAABB technical manual. Bethesda, MD: American Association of Blood Banks. 2005.

2. Emmanuel JC. The Clinical Use of Blood: Handbook. WorldHealthOrganizatio; 2001.

3. Makroo RN. Compendium of transfusion medicine. New Delhi: Alps Printers. 1999:91-2.

4. Klein HG, Anstee DJ. Mollison's blood transfusion I n clinical medicine. John Wiley & Sons; 2014 Feb 3.

5. Boorman KE, Dodd BE, Lincoln PJ. Blood group serology: theory, techniques, practical applications. Churchill Livingstone; 1977.

6.Harmening DM. Modern blood banking & transfusion practices. FA Davis; 2018 Nov 30.

Course title**: CLINICAL PATHOLOGY**

Teaching Hours Lecture 30 hours. Tutorial 15 hours, Practical 120 Hours

Learning objectives:

1. Describe appropriate methods of sample collection, transportation, preservation, and processing of following- urine, stool, sputum, gastric juice, CSF and body fluids.
2. Discuss renal function tests.

Course content

Unit 1: Collection, transport, preservation and processing of various clinical specimens

Unit 2: Urine examination & renal function test

1. Physical, chemical and microscopic. Urine analysis by Strip method.
2. Test for hemosiderin pigment
3. Renal function tests.

Unit 3: Stool examination

1. Collection of specimen of faeces
2. Macroscopic (Naked eye) inspection
3. Concentration method, Flotation method.
4. Microscopic examination
5. Chemical examination
6. Strip method
7. Test for Occult blood - Benzidine Test

Unit 4: Sputum examination - collection of specimen

1. Physical examination
2. Microscopic - Gram's stain, ZiehlNeilsen stain for AFB
3. Chemical examination

Unit 5: Gastric analysis

1. Indications, contra indication, method of collection.
2. Fasting gastric juice - Macroscopic and microscopic examination.
3. Fractional test meal
4. Augmented Histamine test
5. Hollander's test

Unit 6: Cerebrospinal Fluid Analysis

1. Method of obtaining CSF, indications, contra indications.
2. Examination of CSF : Physical examination, biochemical examination, microscopic examination, cytological examination, bacteriological examination

Unit 7: Body Fluids

1. Microscopic examination of pleural, pericardial, synovial, ascetic and peritoneal fluid.

Unit 8: Pregnancy test

1. Method, Interpretation

Practicals

Practical Objective:

1. Demonstrate – Physical, chemical and microscopy examination of urine including dipstick test.
2. Demonstrate physical, chemical and microscopy examination of stool and perform stool occult blood tests.
3. Demonstrate physical, chemical examination and microscopy of sputum, gastric juice and semen.
4. Perform – physical, biochemical and microscopic examination of CSF and body fluids.
5. Discuss and interpret urine pregnancy test.

Course content

Urine examination

a. Physical, chemical and microscopic.
b. Urine examination by strip method, urine test for hemosiderin pigment. [Demonstration]

Stool examination

a. Macroscopic examination
b. Concentration method, flotation method.
c. Microscopic examination
d. Benzidine test- for occult blood

Sputum examination

a. Macroscopic, microscopic and AFB staining

Examination of cerebrospinal fluid [CSF] and body fluids.

Pregnancy test

Examination of semen

Books recommended:

1. Nayak R, Rai S, Gupta A. Essentials in hematology and clinical pathology. JP Medical Ltd; 2011 Nov 25.
2. Sanyal S. Clinical pathology a practical manual. Elsevier Health Sciences; 2019 May 10.
3. Mukherjee KL. Medical laboratory technology. McGraw-Hill Education; 2017 Oct 15.
4. Godkar PB, Godkar DP. Textbook of medical laboratory technology. Bhalani; 2003.
5. Ochei JO, Kolhatkar AA. Medical laboratory science: theory and practice. McGraw Hill Education; 2000.

Course Title: Biostatistics & Advanced Research Methods

Number of Hours: 30 Hours Total Credits: 2

Learning Objectives:

- To Understand the Statistical Terms.
- To Possess Knowledge and Skill in the use of Basic Statistical and Research Methodology.

Course Content:

Unit 1: Introduction

Introduction to biostatistics &research methodology, types of variables & scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion, incidence & prevalence

Unit 2: Sampling

Population & Sample, Sampling and non-sampling errors and methods of minimizingthese errors, Random and non random sampling, different sampling techniques – simple random, stratified, systematic, cluster& multistage.

Unit 3: Sampling distributions

Parameter andStatistic. Standard error. Basic probability distributions - Normal, Poisson, binomial distributions with their applications in biological sciences.

Unit 4: Tests of significance

Basics if testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance (parametric) & power of the tests, p value, Confidence interval. Tests of significance – T test (paired &UN paired), Chi square test & Test of proportion, One way analysis of variance. Repeated measures analysis of variance. Tests of significance (non parametric) – Mann – Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance, Friedman’s Analysis of variance

Unit 5: Correlation and regression

Linear correlation by Karl Pearson and rank order correlation due to Spearman, Testing the significance of correlation co efficient, simple linear regression – estimation & testing, residual plots, multiple linear regression.

Unit 6: Sample size determination

General concept. Sample size for estimating means and proportion, testing of difference in means and proportions of two groups.

Unit 7: Study designs

Descriptive epidemiological methods – case series analysis and prevalence studies. Analytical epidemiological methods – case control and cohort studies. Clinical trials / intervention studies, odds ratio and relative risk, stratified analysis

Unit 8: Multivariate analysis

Concept of multivariate analysis, introduction to logistic regression and survival analysis

Unit 9: Reliability and validity of diagnostic tests

Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), ROC curve.

Unit 10: Format of scientific documentations

Structure of research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta-analysis.

Reference Books:

1. Rao NSN : Applied statistics in health sciences, JP publishers
2. Mahajan B.K: Methods of biostatistics, Kothari book depot, A.D Marg, Bombay
3. Potti L.R : A text book of statistics, Yamuna publications, Sreekanteshwaram,
4. Trivandrum.
5. Lancaster H.O: Introduction to medical statistics, Johnwiley& sons, New York.
6. LeiusA.E: Biostatistics, Reinhold publishing Co, New York.
7. Cotton T: Statistics in medicine, Little Brown & Co, Boston.
8. Hill A.B : Principles of medical statistics, Oxford University press, New York

SEMESTER II

Course title**: HAEMATOLOGY II**

Teaching Hours Lecture 30 hours. Tutorial 30 hours, Practical 360 Hours

Learning objectives:

1. Discuss normal and abnormal red cells.
2. Define and classify anemia. Discuss concepts and approach to Nutritional anemia, aplastic anemia and hemolytic anemia.
3. Discuss normal and abnormal WBC counts.
4. Define, classify and describe clinical features and approach to Leukemia'sand myeloproliferative disorders.
5. Discuss classification, clinical features and approach to lymphomas.
6. Discuss approach to plasma cell dyscrasia.

Course content

Unit 1 - RBC Disorders

1. Anaemia
2. General concepts and classification
3. Structure of red cell and its membrane
4. Microcytic anaemia: general concept and laboratory approach
5. Aplastic anaemia: general concept and laboratory approach
6. Haemolytic anaemia

Unit 2 -WBC Disorders

1. Leukaemia’s: acute and chronic
2. Plasma cell disorders
3. Myeloproliferative disorders : general features ,classification and investigations
4. Lymph proliferativedisorders: general features, classification and investigations
5. Lymphomas: Hodgkin and Non-Hodgkin lymphoma

Practicals

Practical objective:

1. Demonstrate smearing and staining of bone marrow including special stains for bone marrow.
2. Discuss and perform special tests for hemolytic anemia and nutritional anemia.
3. Able to interpret smears of leukemia.

Course content

1. Microcytic hypo chromicanaemia: Investigations including serum Iron & TIBC
2. Macrocytic anaemia: Investigations including B12 & folate assay, Schilling test
3. Haemolytic anaemia: General laboratory investigations
4. Haemolyticanaemia: Special tests.
5. Osmotic fragility test, alkali denaturation test, sick ling test, Hb electrophoresis, investigations of G6PD deficiency, autoimmune haemolyticanaemia investigations, Coomb's test
6. Bone marrow: Preparation of bone marrow smears , trephine biopsy smears
7. Staining of B.M aspiration smears. Demonstration of iron stain
8. Leukaemia's: Interpretation of peripheral smear in leukaemias.
9. Cytochemical stains: Demonstration

Books recommended:

1. Nayak R, Rai S, Gupta A. Essentials in hematology and clinical pathology. JP Medical Ltd; 2011 Nov 25.
2. Sacks D. Clinical Diagnosis and Management by Laboratory Methods, John Bernard Henry, ed. Philadelphia: WB Saunders, 2001, 1512 pp., $99.00. ISBN 0-7216-8864-0. Clinical Chemistry. 2001 Dec 1;47(12):2188-9.
3. McDonald GA, Dodds TC, Cruickshank B. Atlas of haematology. Churchill Livingstone; New York: distributed in US by Longman,; 1978.
4. Firkin F, Chesterman C, Rush B, Pennigton D. De Gruchy's Clinical haematology in medical Practice. John Wiley & Sons; 2008 Jan 19.
5. Godkar PB, Godkar DP. Textbook of medical laboratory technology. Bhalani; 2003.
6. Mukherjee KL. Medical laboratory technology. McGraw-Hill Education; 2017 Oct 15.
7. Mohan H. Textbook of pathology. Jaypee Brothers Medical Publishers; 2018 Nov 30.
8. Mitchell L, JB B. Dacie and Lewis Practical Haematology.
9. Greer JP, Arber DA, Glader BE, List AF, Means RM, Rodgers GM. Wintrobe's clinical haematology. Lippincott Williams & Wilkins; 2018 Nov 19.

10. Hoff brand AV, Higgs DR, Keeling DM, Mehta AB. Postgraduate haematology. John Wiley & Sons; 2016 Jan 19.
11 Kawthalkar SM. Essentials of haematology. JP Medical Ltd; 2012 Dec 30.
12. Tejandrasingh .Text book of haematology (theory and practical); latest edition

Course title**: BIOCHEMISTRY, IMMUNOLOGY, MICROBIOLOGY, HISTOPATHOLOGY AND CYTOLOGY**

Teaching Hours Lecture 30 hours. Tutorial 30 hours.

Learning objectives:

- Discuss various histopathological techniques to prepare sections for microscopy
- Discuss special biochemical investigations;LFT and RFT
- Impact knowledge about sterilization and different tests required to diagnose transmission of transmissible diseases and also covers the basics aspects of immunity and autoimmune diseases

Unit 1 – BIOCHEMISTRY

1. Plasma protein
   - General concept
   - Separation and purification
2. Liver function tests/ Kidney(renal) function tests

Unit 2 - IMMUNOLOGY

1. HLA
2. Complement system
3. Immunoglobulin and protein electrophoresis
4. T and B cells
5. Collagen vascular profile
6. Autoimmune diseases

Unit 3 - MICROBIOLOGY

1. Sterility testing of blood
2. Transmissible disease like syphilis, viral hepatitis and malaria

Unit 4 - HISTOPATHOLOGY

1. General processing of various tissue and particular reference with bone marrow biopsy
2. Electron microscopy

Unit 5 - CYTOLOGY

1. Cytotechniques, cytological classification of various lymphomas and their appearance

Books recommended:

1. Selwyn S. Mackie and McCartney: Practical medical microbiology: Eds JG Collee, JP Duguid, AG Fraser & BP Marmion, ; Churchill Livingstone (1989).£ 32.00.
2. Ananthanarayan R. Ananthanarayan and Paniker's textbook of microbiology. Orient
3. Panikar& Satish Gupte Medical Microbiology; recent edition
4. Varley H. Practical clinical biochemistry. Practical clinical biochemistry.. 1954.
5. Chatwal GS. Anand, instrumental of chemical Analysis. Goel Publishers, New Delhi. 2003; 2:625.
6. Culling CF. Handbook of histopathological techniques (including museum technique).
7. Delves PJ, Martin SJ, Burton DR, Roitt IM. Roitt's essential immunology. John Wiley & Sons; 2017 Jan 17.
8. Koss LG, Melamed MR, editors. Koss' diagnostic cytology and its histopathologic bases. Lippincott Williams & Wilkins; 2006.
9. Owen JA, Punt J, Stranford SA. Kuby immunology. New York, NY, USA:: WH Freeman; 2013.
10. Parslow TG, Stites DP, Terr AI, Imboden JB. Medical immunology. McGraw-Hill; 2001.

SEMESTER III

Course title: **BLOOD BANKING II**

Teaching Hours Lecture 30 hours. Tutorial 30 hours, Practical 330 Hours

Learning objectives:

1. Discuss blood grouping, cross matching and coomb's tests under following -, procedure, principles and indications.
2. Describe indication and preparation of blood components.
3. Discuss types and indications of blood transfusion.
4. Discuss transfusion transmitted disease.
5. Discuss Rh incompatibility and hemolytic disease of newborn and exchange transfusion.

Course content

Unit 1- ABO, Rh, Bombay blood group system and other blood grouping systems

Unit 2- Coomb's test: Application - DCT, ICT Rh antibody titre

Compatibility testing: Major, minor, Coomb's cross match

Unit 3- Blood components: Indications, preparation of blood components

Unit 4- Autologous transfusion

Unit 5- Transfusion transmitted diseases

Unit 6- Haemolytic disease of the new born and exchange transfusion

Unit 7- Transfusion therapy

Unit 8- Transfusion in special situations-auto immune haemolyticanaemia

Unit 9- Transfusion reactions and investigation of transfusion reaction

Practicals

Practical objective:

1. Demonstrate – various methods and steps of forward grouping, reverse grouping, Rh typing, coomb's test, cross matching/ compatibility testing.
2. Perform tests for transfusion transmitted diseases.
3. Perform component preparation.

Course content

1. Blood grouping : ABO grouping, forward grouping (slide &tube method)

Reverse grouping: Preparation of pooled A, B & O cells

2. Grading of reaction. Other methods of grouping.
3. AB0 antibody titration, cold antibody titration.
4. Rh grouping & Rh typing (slide & tube method)
5. Du Testing
6. Rh - antibody titration
7. Antiglobulin testing, direct and indirect
8. Preparation of Coomb's Control Cells.
9. Compatibility testing
10. Cross matching technique : Major, minor, saline, albumin, Coomb's
11. Emergency cross matching
12. Preparation and storage of blood components
13. Packed cells, fresh frozen plasma [FFP], platelet concentrate, cryoprecipitate
14. Component transfusion- selection of blood group
15. Cross-matching in special situations
16. Exchange transfusion - selection of blood group
17. Autoimmune haemolyticanaemia
18. Investigation of blood transfusion reaction
19. Testing for transfusion transmitted diseases
20. Elisa-HIV, HBsAg , HCV
21. VDRL test
22. Malaria

Books recommended:

1. Makroo RN. Compendium of transfusion medicine. New Delhi: Alps Printers. 1999:91-2.
2. Klein HG, Anstee DJ. Mollison's blood transfusion in clinical medicine. John Wiley & Sons; 2014 Feb 3.
3. Boorman KE, Dodd BE, Lincoln PJ. Blood group serology: theory, techniques, practical applications. Churchill Livingstone; 1977.
4. Harmening DM. Modern blood banking & transfusion practices. FA Davis; 2018 Nov 30

Course title**: CYTOGENETICS, IMMUNOPATHOLOGY, AUTOMATION IN HAEMATOLOGY**

Teaching Hours Lecture 30 hours. Tutorial 30 hours

Learning objectives:

- Describe the chromosomal abnormalities and different technique to find out chromosomal abnormalities
- Describe the various immune diseases their etiology ,causes ,diagnosis and prognosis
- Discuss various automated instruments in hematology

Course content

Unit 1 - CYTOGENETICS

1. Structure and molecular organization of chromosomes
2. Identification of human chromosomes
3. Karyotyping
4. Direct chromosome preparation of bone marrow cells
5. Culture techniques
6. Banding techniques
7. Sex chromatin/Barr bodies
8. Autoradiography of human chromosomes
9. Chromosome identification by image analysis and quantitative cytochemistry
10. Clinical manifestations of chromosome disorders

Unit 2 - IMMUNOPATHOLOGY

1. Mechanism of antibody-mediated inactivation: direct and indirect. E.g. Diabetes mellitus, thyroid diseases, pernicious anaemia, polyendocrinopathy, infertility, haemophilia, myasthenia gravis, anti-idiotypes and diseases.
2. Immune deficiency disorders
3. Immunohematologicdiseases: transfusion reactions, erythroblastosis fetails, warm-antibody diseases, cold antibody diseases, drug and haemolytic diseases, agranulocytosis, thrombocytopenic purpura, immune suppression cytotoxic antibodies in vitro.
4. Immune complex reactions: Arthus reaction, serum sickness, evaluation of circulating immune complexes.

5. Connective tissue diseases: Polyarteritis nodosa, SLE, dermatomyosis, rheumatic fever, rheumatoid arthritis, progressive systemic sclerosis.
6. Atopic anaphylactic reactions : reaginic antibody, anaphylaxis, atopic allergy - factors involved, asthma, hay fever, food allergy, insect allergy, atopic eczema, delayed hypersensitivity reactions, contact dermatitis, viral infections, graft-host relationship in pregnancy.
7. Auto allergic diseases: encephalomyelitis, multiple sclerosis, orchitis, thyroiditis, Sjogren's syndrome.
8. Granulomatous reactions: Infectious diseases like tuberculosis, leprosy.
9. Autoimmune diseases: organ specific and systemic.
10. Immunomodulators
11. Clinical transplantation: Kidney, bone marrow, heart and liver.
12. Tumour and tumour markers.
13. Immunohematology: Compatibility testing.

Unit 4 - AUTOMATION IN HEMATOLOGY

1. Various automations in haematology laboratory, their principles, advantages, interpretation and quality control.

Books recommended:

1. Mitchell L, JB B. Dacie and Lewis Practical Haematology.
2. Lewin B, Dover G. Gene’s v. New York: Oxford University Press; 1994 Feb.
3. Gardner EJ. Principles of genetics. London, UK, John Wiley & Sons, Inc.; 1972.
4. Petty EM. Instant Notes in Genetics, by PC Winter, GI Hickey, and HL Fletcher.
5. Delves PJ, Martin SJ, Burton DR, Roitt IM. Roitt's essential immunology. John Wiley & Sons; 2017 Jan 17.
6. Owen JA, Punt J, Stranford SA. Kuby immunology. New York, NY, USA: WH Freeman; 2013.
7. Parslow TG, Stites DP, Terr AI, Imboden JB. Medical immunology. McGraw-Hill; 2001.
8. Watson JD. Molecular biology of the gene. Molecular biology of the gene... 1970(2nd edn).
9. Twyman R. Advanced molecular biology: a concise reference. Garland Science; 2018 Dec 20.

Course Title: Health Care Management

Number of Hours: 30 Credits 2

Learning Objectives:

- Concepts of Hospitals – The student will gain knowledge about hospital administration &planning.
- Workflow in hospitals - Enumerate and identify various Clinical Services like OPD, IPD, ward Management, OT, Emergency, disaster Management and ICU.
- Organizational Structures - To learn to meet special challenges posed by human behavior in workplace of 21stcentury
- Quality management - To create awareness about the process of applying for and implementing various accreditation processes in healthcare facilities.

Course Content:

Unit I: Hospital Structure

- Introduction to Hospitals, Healthcare &Medical Care, Rationale of Hospital Administration
- History of Hospitals, Public Health Delivery system in India, Types of Hospitals, Voluntary Health Organizations

Unit II: **Management of Health care Organizations**

- Introduction to Management
- Evolution & Theories of Management
- Management Functions: Planning
- Organizing
- Controlling
- Decision Making
- Staffing
- Techniques in Management

Unit III: **Organizational Behavior**

- The Importance of Interpersonal Skills, Scope & Process of OB Structure &theories
- Motivation - Abraham Maslow's hierarchy of needs theory, Theory X & Y. Contemporary theories of motivation.
- Foundations of Group Behavior – Formal Vs Informal, Social Identity Theory

- Organizational Culture
- Communications in an Organization

Unit IV: Management and Health Economics

- Demand &Supply
- Nature of Costs
- Marginal cost and breakeven analysis
- Market structure: Business & Government, Role of Government

Unit V: **Accounting for Hospital Management**

- Budgeting & Budgetary control - Classification of budget, P & L, Balance Sheets
- Types of Accounts, Debit &Credit
- Financial Statement Analysis

Unit VI: **Concept of Hospital**

- Departmentation in Hospital
- Outpatient, Inpatient Services
- Intensive Care Unit, Emergency Services
- Laboratory, Radiology
- Organizing of support services, Utility Services
- Evaluation of Hospital services – Hospital Statistics
- Hospital Information Systems - Issues related to Healthcare Technology, Planning, Infrastructure

Unit VII: **Evolution of Quality management**

- Quality Management Tools &methods
- Quality certification & Accreditation – NABH,NABL

Text book/ Reference Books:

1. Principles of Management by LMPrasad
2. Organizational Behavior by StephenRobbins
3. Hospital Planning & Administration by B.M.Sakharkar
4. Hospital Administration by CMFrancis
5. Financial Management in Hospitals, Kulkarni, Satyashanker, Anil Gomes.

SEMESTER IV

Course title**: HAEMATOLOGY III**

Teaching Hours: Lecture30 hours. Tutorial 30 hours, Practical

180 Hours

Learning objectives:

1. Describe the coagulation disorders, platelet disorders.
2. Describe the Fibrinolysis, pathology and know the applied aspect of the same.
3. Describe DIC and investigation in DIC.
4. Discuss anticoagulants and their applied aspect.

Course content

Haemostatic Disorders

Unit 1 - Physiology of coagulation, Fibrinolysis

Unit 2 - Inherited and acquired coagulation disorders

Unit 3 - Platelet structure, function, metabolism and preservation

Unit 4 - Inherited platelet function disorders, Thrombocytopenia

Unit 5 - Monitoring of oral anticoagulants, Control of heparin - therapy

Unit 6- Disseminated Intravascular Coagulation (DIC)

Unit 7- Natural and acquired anticoagulants

Practicals

Practical objective:

1. Demonstrate PT, APTT, and BT, CT estimation by manual and automated method.
2. Discuss and demonstrate the principle and procedure involved in d-dimer estimation, mixing studies, coagulation factor assays and fibrinogen assay.

Course content

1. Hemorrhagic disorders
2. Collection and anticoagulants used - Demonstration
3. BT, CT: Demonstration
4. PT, INR, APTT, TT- Demonstration
5. Mixing experiments: Demonstration
6. Test for d-Dimers: Demonstration
7. Assay of coagulation factors: Demonstration
8. Factor VIII: C Inhibitor Study- Demonstration
9. Urea solubility test for factor XIII: Demonstration

10. Fibrinogen assay : Demonstration
11. Thrombotic work up: Demonstration
12. Investigation for antiphospholipid antibody: Demonstration

Recommended Books

1. Schmidt PJ. Blood bank standards and procedure manuals. In Quality Assurance in Blood Banking and Its Clinical Impact 1984 (pp. 43-53). Springer, Boston, MA.
2. Makroo RN. Compendium of transfusion medicine. New Delhi: Alps Printers. 1999:91-2.
3. Klein HG, Anstee DJ. Mollison's blood transfusion in clinical medicine. John Wiley & Sons; 2014 Feb 3.
4. Boorman KE, Dodd BE, Lincoln PJ. Blood group serology: theory, techniques, practical applications. Churchill Livingstone; 1977.
5. Harmening DM. Modern blood banking & transfusion practices. FA Davis; 2018 Nov 30.

Course title: **BLOOD BANKING III**

Teaching Hours Lecture 30 hours. Tutorial 30 hours, Practical 180 Hours

Learning objectives:

1. Discuss hemapherisis, GVHD.
2. Describe various aspects of tissue and stem cell/ cord blood banking.
3. Discuss medico-legal aspects of blood banking and stem cell banking.
4. Discus recent advances in blood bank technology.
5. Describe biomedical waste management in blood bank.

Course content

Unit 1 - Immunomodulation and graft versus host reactions

Unit 2 - Hemapherisis- definition, types of aphaeresis, machines and techniques.

Unit 3 - Tissue banking and cord blood banking

Unit 4 - Stem cell processing, storage and transplantation

Unit 5 - Medico legal aspects of blood transfusion

Unit 6 - Technical advances and future trends in blood banking

Unit 7 - Quality assurance in blood bank

Unit 8 - Organization & quality control in the laboratory

Unit 9 - Biomedical waste management, disposal of wastes and biologically Hazardous substance in the blood bank

Practicals

Practical objective:

1. Demonstrate techniques of aphaeresis including management of equipment.
2. Discuss the quality control in blood banking and hematology lab.
3. Demonstrate – hospital waste management.
4. Discuss record keeping in blood bank.

Course content

1. Quality control - methods
2. Reagents
3. Test methods
4. Products
5. Documents
6. Equipments
7. Aphaeresis procedures: Types of aphaeresis, machines and techniques.

8. Biomedical waste management: Demonstration
9. Record keeping
10. Documentation

Recommended Books

1. McPherson RA, Msc MD, Pincus MR. Henry's clinical diagnosis and management by laboratory methods E-book. Elsevier Health Sciences; 2021 Jul 16.
2. G.A. McDonald. Atlas of Haematology ;5th edition
3. Firkin F, Chesterman C, Rush B, Pennington D. De Gruchy's Clinical haematology in medical Practice. John Wiley & Sons; 2008 Jan 19.
4. Godkar PB, Godkar DP. Textbook of medical laboratory technology. Bhalani; 2003.
5. K.L.Mukherjee. Medical laboratoryTechnologyby;Volume-I
6. Mohan H. Textbook of pathology. Jaypee Brothers Medical Publishers; 2018 Nov 30.
7. Luttgens WF. PRACTICAL HAEMATOLOGY. California Medicine. 1964 Oct;101(4):320..
8. Greer JP, Arber DA, Glader BE, List AF, Means RM, Rodgers GM. Wintrobe's clinical hematology. Lippincott Williams & Wilkins; 2018 Nov 19.
9. Green AR. Postgraduate haematology. John Wiley & Sons; 2010 No