



अटल बिहारी वाजपेयी चिकित्सा विश्वविद्यालय, उ० प्र० लखनऊ
Atal Bihari Vajpayee Medical University, U.P., Lucknow.

COURSE CURRICULUM


BACHELORS IN MEDICAL LABORATORY SCIENCE (BMLS)

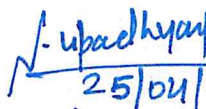
[w.e.f. Academic Session 2021-22]


Erstwhile BMLT (Bachelors of Medical Lab Technology)




Website: <https://abvmuup.edu.in/>


25/04/2022
(Dr. Bhagyat Singh)


25/04/2022
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25/4/2022
(Prof. Navneet Kumar)



BACHELORS IN MEDICAL LABORATORY SCIENCE (BMLS)

Objectives/aim of the course:

1. Proficiently perform a full range of clinical laboratory tests.
2. Develop and evaluate test systems and interpretive algorithms.
3. Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information.
4. Collection and receiving of specimens (infectious samples i.e. blood, urine, stool, sputum, pus, semen, tissues and body fluids) for various biochemical, pathological, microbiological, haematological and blood bank investigations, etc.
5. Maintenance of supplies of laboratory reagents / diagnostic kits.
6. Maintenance of quality control for reliability of laboratory reports.
7. With increasing automation and the use of computer technology, the work of Technologists has become less hands-on and more analytical.
8. The complexity of tests performed, the level of judgment needed, and the amount of responsibility workers assume depend largely on the amount of education and experience they possess.

Programme Specific Outcomes:

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

1. Perform routine clinical laboratory testing.
2. Make specimen-oriented decisions on predetermined criteria including working knowledge of critical values.
3. Communicate with other members of healthcare team, customers and patients in an effective manner.
4. Process information and ensure quality control as appropriate to routine laboratory procedures.
5. Train students in routine laboratory procedure.
6. Upgrade knowledge and skills in a changing healthcare scenario.
7. Should know the logical interpretation of clinical lab investigations.
8. Should be able to extrapolate data acquired
9. Should be able to working on automated machine

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1. Scope:

This ordinance shall apply to the program leading to Bachelors in Medical Laboratory Science (BMLS).

2. Admission Criteria:

2.1 Admission to **BMLS** will be made as per the rules prescribed by the Academic Council of University, from time to time.

2.2 The admission in paramedical Bachelors in Medical Laboratory Science (BMLS) degree course will be given by the selection committee of the University through written test/personal interview and merit of the qualifying examination i.e. 10+2.

The decision of the selection committee shall be final.

2.3 Qualifying Examination:

A Candidate seeking admission to the Bachelors in Medical Laboratory Science (BMLS) program should have passed 10+2 examination or its equivalent conducted by Boards/Councils established by State Government/Central Government with Physics, Chemistry, Biology or vocational course in MLS/MLT and English as subjects.

2.4 Marks:

- The candidate must have passed in 10+2 Intermediate examination with minimum 50% marks and must secure 50% marks in PCB.
- In respect of candidates belonging to Scheduled Castes, Scheduled Tribes & OBC, the marks obtained in Physics, Chemistry and Biology together in qualifying examination is not less than 45% instead of 50% as above or as per Govt.

2.5 Age:

A candidate seeking admission in Bachelors in Medical Laboratory Science (BMLS) course should have completed 17 years of age, as on 31st December of the year of admission.

3. Duration of the Course:

The duration of the Course of Bachelors in Medical Laboratory Science (BMLS) shall be 4 years (3.5 years academic and 6 months Compulsory rotatory internship).

3.1 The maximum period for completion of program successfully should not exceed Eight Years.

4. Medium of Instruction:

English shall be the medium of instruction for all the subjects of study and for the examinations of the Bachelors in Medical Laboratory Science (BMLS) Course.

5. Attendance:

5.1 A candidate is required to obtain minimum 75% attendance in Theory, Tutorials and Seminars and 80% in Practicals of each subject individually so as to be eligible to appear in the University Examination.

5.2 Further relaxation of attendance to a student can be given by the Head of Institution/Principal on genuine/Compassionate grounds with prior permission under special circumstances.

5.3 No student will be allowed to appear in the university examination if he/she does not satisfy the overall average attendance requirements of clause 5.1 and 5.2.



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5.4 Student who has been detained due to short attendance shall be required to repeat the course of the said semester with the next batch of students or will have the option to attend the classes conducted by the college and appear in the examination thereafter whenever/earliest/supplementary examination/within six months conducted by the university.

5.5 The names of the students who are not eligible to appear in the university examinations are to be intimated to the controller of examination & Students before the commencement of exam.

5.6 The Principal of the college will ensure that attendance is posted on the Notice Board of all the departments at suitable Interval.

6. Organization of the Program:

6.1 Each academic year shall consist of two semesters.

6.2 There shall be minimum 15/16 Weeks devoted for academic activities & Clinical activities, excluding 3 Weeks for examination and their preparations.

6.3 The academic & Clinical activities shall be carried for minimum 40 hrs per week.

6.4 The course delivery in each academic year shall be carried out in accordance with minimum hours assigned to each theory and practical subject.

6.5 Six months of internship should be mandatory in a Government recognized Hospital/Institution as partial fulfillment for the award of Bachelors in Medical Laboratory Science (BMLS) Degree to candidates, as per government norms.

6.6 Rotatory Internship shall be of around 24 / 26 weeks and shall mean 8 hours integrated clinical duty per day.

7. Curriculum:

7.1 The 4 year curriculum has been divided into 6 semesters and shall include lectures, tutorials, practical, seminars, projects and case studies as defined in the scheme of instructions and examinations and executive instructions issued by the University from time to time.

7.2 The curriculum will also include such other curricular, co-curricular and extracurricular activities as may be prescribed by the University from time to time.

7.3 Degree will be awarded only after the completion of the Bachelors in Medical Laboratory Science (BMLS) course including the mandatory Six Months Internship.

8. Credit System:

8.1 **Credit System-** Each BMLS program will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

1 Lecture period (L) / week	= 1Credit 1Tutorial
period (T) / week	= 1 Credit 1Practical
period 2hrs. (P) /week	= 1 Credit

In addition to theory and Laboratory courses there may be other courses such as seminar, clinical training, projects etc., which will be assigned credits as per their contributions in the programme without regards to contact periods.



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8.2 Minimum Credit Requirements:

The minimum credit required for award of a **BMLS degree** is **175**. This is normally divided into Theory courses, tutorials, laboratory courses, seminars and projects in duration of six semesters. The credits are distributed semester wise as shown in the structure and syllabus manual of each program.

Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester wise schedule of courses given in the syllabus manual of respective programmes.





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9. Curriculum Outline:

First Semester (0-6 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS-101	Basic computer & information science	3	1	-	30	70	100	4
BMLS-102	English Communication and soft skills	3	1	-	30	70	100	4
BMLS-103	Introduction to Quality & Patient Safety	3	1	-	30	70	100	4
BMLS-104	Medical Law & Ethics	3	1	-	30	70	100	4
BMLS-105	Basic Preventive Medicine and Community Health Care	3	1	-	30	70	100	4
BMLS-106	Environment Science	3	1	-	30	70	100	4
Total		18	6	24	180	420	600	24
Total Hours in Semester		550						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Second Semester (6-12 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -201	General Clinical Microbiology	3	1	-	30	70	100	4
BMLS -202	Basic Haematology & Clinical Pathology	3	1	-	30	70	100	4
BMLS -203	Basic Clinical Biochemistry	3	1	-	30	70	100	4
BMLS -204	Human Anatomy and Physiology	3	1	-	30	70	100	4
BMLS -205	General Clinical Microbiology – (P)	-	-	4	30	70	100	2
BMLS -206	Basic Haematology & Clinical Pathology – (P)	-	-	4	30	70	100	2
BMLS -207	Basic Clinical Biochemistry – (P)	-	-	4	30	70	100	2
BMLS -208	Human Anatomy and Physiology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P – Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Third Semester (12-18 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -301	Systematic Bacteriology	3	1	-	30	70	100	4
BMLS -302	Basics of Haematological diseases	3	1	-	30	70	100	4
BMLS -303	Biochemical metabolism	3	1	-	30	70	100	4
BMLS -304	Fundamentals of Histology	3	1	-	30	70	100	4
BMLS -305	Systematic Bacteriology– (P)	-	-	4	30	70	100	2
BMLS -306	Basics of Hematological diseases – (P)	-	-	4	30	70	100	2
BMLS -307	Biochemical metabolism – (P)	-	-	4	30	70	100	2
BMLS -308	Fundamentals of Histology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1.Abbreviations L - Lecture, T - Tutorials and P – Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Fourth Semester (18-24 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -401	Applied Bacteriology	3	1	-	30	70	100	4
BMLS -402	Applied Haematology – I	3	1	-	30	70	100	4
BMLS -403	Analytical Clinical Biochemistry	3	1	-	30	70	100	4
BMLS -404	Applied Histopathology – I	3	1	-	30	70	100	4
BMLS -405	Applied Bacteriology– (P)	-	-	4	30	70	100	2
BMLS -406	Applied Haematology - I – (P)	-	-	4	30	70	100	2
BMLS -407	Analytical Clinical Biochemistry – (P)	-	-	4	30	70	100	2
BMLS-408	Applied Histopathology - I – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1. Abbreviations:

L - Lecture, T - Tutorials and P – Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Fifth Semester (24-30 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -501	Immunology & Bacterial serology	3	1	-	30	70	100	4
BMLS -502	Applied Haematology – II	3	1	-	30	70	100	4
BMLS -503	Applied Clinical Biochemistry – I	3	1	-	30	70	100	4
BMLS -504	Applied Histopathology - II	3	1	-	30	70	100	4
BMLS -505	Immunology & Bacterial serology – (Practical)	-	-	4	30	70	100	2
BMLS -506	Applied Haematology - II – (Practical)	-	-	4	30	70	100	2
BMLS -507	Applied Clinical Biochemistry – I- (Practical)	-	-	4	30	70	100	2
BMLS-508	Applied Histopathology-II – (Practical)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P – Practical
Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Sixth Semester (30-36 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -601	Medical Parasitology & Entomology	3	1	-	30	70	100	4
BMLS -602	Advanced Haematology	3	1	-	30	70	100	4
BMLS -603	Applied Clinical Biochemistry – II	3	1	-	30	70	100	4
BMLS -604	Cytopathology	3	1	-	30	70	100	4
BMLS -605	Medical Parasitology & Entomology - (P)	-	-	4	30	70	100	2
BMLS -606	Advanced Haematology - (P)	-	-	4	30	70	100	2
BMLS -607	Applied Clinical Biochemistry – II-- (P)	-	-	4	30	70	100	2
BMLS-608	Cytopathology - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P – Practical
Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Seventh Semester (36-42 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS-701	Medical Virology & Mycology	3	1	-	30	70	100	4
BMLS-702	Blood Banking & Genetics	3	1	-	30	70	100	4
BMLS-703	Immunopathology & Molecular Biology	3	1	-	30	70	100	4
BMLS-704	Research methodology and Biostatistics	3	1	-	30	70	100	4
BMLS-705	Principles of Laboratory Mangement	3	1	-	30	70	100	4
BMLS-706	Medical Mycology and Virology - (P)	-	-	4	30	70	100	2
BMLS-707	Blood Banking & Genetics- (P)	-	-	4	30	70	100	2
BMLS-708	Immunopathology & Molecular Biology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		15	7	12	240	560	800	26
Total Hours in Semester		550						

Notes:

1. Abbreviations: L - Lecture, T - Tutorials and P – Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)



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Eighth Semester (42-48 months)

(Six months Internship)

9.1 Internship:

There shall be six months of internship after the completion of Seventh Semester for candidates declared to have passed the examination in all the subjects.

No candidate shall be awarded degree certificate without successfully completing six months of internship. The internship shall be rotatory and cover clinical branches concerned with BMLS viz:-

S.No.	Lab	Days
1	Haematology & Clinical Pathology	30 Days
2	Biochemistry	30 Days
3	Microbiology & Serology	45 Days
4	Histopathology	30 Days
5	Blood Banking	30 Days
6	Cytology	15 Days

Other Details

Rotatory internship Compulsorily to be Completed From the Organization's Hospital (Only Under special circumstances/ on Compassionate ground the Internship may be permitted from the Hospital Outside the campus) or Medical College approved by the University. Every candidate after passing all the subjects of every semester will compulsorily undergo rotatory internship to the satisfaction of the college Authorities and University concerned for a period of six months so as to be eligible for the award of the degree of Bachelors in Medical Laboratory Science (BMLS) and registration.

The University shall issue a provisional degree of Bachelors in Medical Laboratory Science (BMLS) on passing the final examination and after the completion of internship on demand by the candidate.

The internee shall be entrusted with laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.

Internee will not issue any certified copy of investigation reports or other related documents under their signature.



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Assessment of Internship:

The Internee shall maintain the record of work, which is to be verified and certified by the senior medical officer/Technician under whom he /she works. Apart from scrutiny of record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during at the end of training. Based on the record of work and date of evaluation, The Director/Principal shall issue certificate for satisfactory completion of training following which the university shall award the degree of Bachelors in Medical Laboratory Science (BMLS).

Internship Log Book

Signed and completed Internship log book is compulsory to submit in the department/college to obtain internship completion and course completion letter/certificates.

1. Course/Subject codes:

BMLS Program: In the syllabus manual of BMLS, subject code is assigned for each course. The subject code consists of six to seven digits. First four digits (letters) indicate the program of BMLS, or next digit (letter) indicates course is either core/compulsory or elective or laboratory or seminar or Project or Clinical training. A fifth digit (number) indicates semester of a program and six and seven digit (number) indicates serial number of course. An eighth digit (number) is only applicable for elective course which indicates the serial number of elective course in that group.

For example –

Core/compulsory course, Elective course, Laboratory course, Seminar, Project

****C101, ****E101, ****F101, ****L101, ****S301, ****P401

Where,

First four digits (letters) ***: indicates program name Fourth digit (letter)

C: indicates Core/Compulsory course; F: Indicate

Foundation

E: indicates Elective course

L: indicates laboratory course;

S: indicates Seminar

P: indicates Project

Fifth digit (number) 1/2/3/4: indicates year in which that course to be studied Sixth and

Seventh digit (number) 01: indicates serial number of course.

Eighth digit (number) 1/2/3/4: indicates serial number of elective course in a group.

The first four letters used in coding of courses indicates respective programmes.



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11. EXAMINATION / ASSESSMENT AND GRADING

11.1 Components of Evaluation:

Each Subject will be evaluated out of 100 marks. The Subjects will normally have the following components of evaluation:

11.1.1 Theory Subjects:

Internal Assessment (IA)	30 marks
End-Semester Examination (ESE)	70 marks

11.1.2 Practical Subjects including Seminar, Lab Posting, Project, etc.

Internal Assessment (IA)	30 marks
End-Semester Examination (ESE)	70 marks

11.2 Grading of Performance

In each Subject, based on the combined performance in all assessments in a particular semester as per the curriculum/syllabus, the student is awarded a letter grade. These letter grades not only indicate a qualitative assessment of the learner's performance but also carry a quantitative (numeric) equivalent called the Grade Point. The letter grades and their equivalent grade point applicable for undergraduate programmes are given below:

Percentage of Marks Obtained	Letter	Grade Points	Performance
85.00 and above	O	10	Outstanding
80.00 – 84.99	A	9	Excellent
75.00 – 79.99	B	8	Very Good
65.00 – 74.99	C	7	Good
60.00 – 64.99	D	6	Fair
55.00 – 59.99	E	5	Average
50.00 – 54.99	P	4	Pass
Less than 50.00	F	0	Fail

11.3 Schedule of Examination:

There shall be one main University Examination after the completion of each semester Examinations will be 3 hours. The schedule of which shall be provided by the University.

11.4 Re-examination of End Semester Examination will be conducted as per the schedule planned by the University.



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11.5. Assessment:

It shall be based on evaluation of periodic tests assignments, clinical presentations, Viva, etc., regular periodic examinations should be conducted throughout the course. There will be a minimum of two **(2) internal examinations.**

The break-up of IA (30 Marks) shall be as follows:

Theory Subjects:

- | | | |
|--|---|----------|
| (i) Average of Two Internal Examination: | - | 20 Marks |
| (ii) Teacher's Assessment | | |
| (a) Tutorial /Assignment /Quizzes | - | 05 Marks |
| (b) Attendance | - | 05 Marks |

Practical Subjects:

- | | | |
|-----------------------------------|---|----------|
| (i) One Midterm viva –voce /tests | - | 20 Marks |
| (ii) Teacher Assessment | | |
| i. Lab Record | - | 05 Marks |
| ii. Attendance | - | 05 Marks |

11.5.1. Internal assessment of the subject shall be added to compute subject percentage.

11.5.2. Final summary of the internal marks obtained by the student shall be displayed on the notice board.

The students may improve their internals assessment by appearing for "Improvement Sessional Examination."

12. Qualifying Standards:

12.1 Marks obtained in internal assessment of the Theory and Practical will be merged with the Theory & Practical marks of the University examination, separately so as to pass the examination.

12.2 In an individual subject the minimum pass marks (including internal assessment) shall be 50% in theory and 50% in practical separately. The marks obtained in the University Examination and in the internal assessment of the subject shall be added to compute subject percentage.

12.3 To clear Subsidiary subjects, a candidate shall secure 40% of the total marks prescribed for the subject. Marks of Subsidiary subject will not be included in the grand total.

13. Promotional Rules:



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- 13.1** A student shall be declared pass in a semester when he/she is pass in all the theory and practical subjects.
- 13.2** A student failing to satisfy the passing standards of one or more subjects in the semester shall be permitted to pursue course of the next semester and clear the back paper in the subsequent odd/even semester examination.
- 13.3** Students shall be allowed to keep term for Semester III if she/he passes each of Semester I and Semester II.

OR

She/he fails in 50% or not more than 50% heads of passing of which not more than **five** shall be in End Semester Examinations of Semester I and Semester II taken together.

- 13.4** Students shall be allowed to keep term for Semester IV irrespective of grades obtained in each course of Semester III.
- 13.5** Students shall be allowed to keep term for Semester V if she/he passes in all heads of Semester I, Semester II, Semester III and Semester IV.
- 13.6** A student shall be eligible to undertake internship only when he/ she has cleared all the subject of all the final and pre-final years.
- 14. Grace Mark:** A student can be awarded 'Grace Marks' not exceeding a maximum 5 marks either in theory or practical or both, which can be shared by not more than two subjects. The grace marks shall not be added to the aggregate marks. No grace marks in subsidiary subjects.

15. Declaration of Result:

- 15.1** The result of a candidate shall be declared by the University on the basis of the performance of Theory, Practical and Viva-Voce examination.
- 15.2** In an individual subject the minimum pass marks (including internal assessment) shall be 50% in theory and 50% in practical separately. The marks obtained in the University Examination and in the internal assessment of the subject shall be added to compute subject percentage.

16. Award of Division:

- 16.1** His/her division shall be awarded on the basis of all Semester result.
- 16.2** If a candidate passes all examinations in first attempt without grace and secures 75% or more marks, he/she shall be placed in 'First Division with Honors.'
- 16.3** If a candidate passes all examinations in first attempt and secures 60% or more marks, he/she shall be placed in First Division.

17. Award of Rank:



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On the basis of Final year result, the top ten candidates shall be awarded rank according to their merit provided they pass all examinations in first attempt.

18. Award of Degree:

18.1 The student shall be eligible for award of **BMLS** degree on successful completion of prescribed course of study i.e. he/ she must have been declared pass in final result and completed Six months Rotatory internship.

18.2 Degree will be awarded only after clearing all subsidiary subjects and after satisfactory completion of Six months internship.

19. Scrutiny and Re-evaluation:

19.1 Scrutiny shall be allowed in only theory papers of two subjects.

19.2 Re-evaluation of theory/practical papers is not permitted.

20. Subsidiary Subjects:

20.1 To clear Subsidiary subjects, a candidate shall secure 40% of the total marks prescribed for the subject.

20.2 Marks of Subsidiary subject are not included in the grand total.

20.3 Degree will be awarded only after clearing all subsidiary subjects and after satisfactory completion of internship.

20.4 **No External Exam for Subsidiary Subject.**

21. Unfair means: All cases regarding reported use of Unfair Means in the examination shall be forwarded to the University for Necessary Action.

22. Cancellation of admission:

a) The admission of a student at any stage of study shall be cancelled if: a) He/she is not found qualified as per U.P. State Medical Faculty norms and guidelines or the eligibility criteria prescribed by the University.

b) He/she is found involved in creating indiscipline in the Institution/College or in the University

c) He /she is involved in an act of ragging.

23. Power to Amend the Ordinance:

The '**Academic Council**' shall have the powers to relax, amend any or all the provisions of the Ordinances, subject to the approval of the '**Executive Council**' of the University.



HUMAN RESOURCES & INFRASTRUCTURES

1. HUMAN RESOURCES REQUIRMENT FOR COMMENCING B. M.L.S. DEGREE PROGRAM

Teaching faculty: Teacher student ratio must be 1:10 (Teacher: student)

Non-teaching staff: office clerical staff (Lower divisional clerk, upper divisional clerk, office superintendent), library staff, computer operator, lab. Assistant, Driver, guards, peon, housekeeping staff (sweeper) etc.

Pay scale of teaching and non-teaching staff: As per latest UGC norms.

Teaching faculty and staff:

The importance of providing an adequate learning environment for students needs be emphasized. Both the physical infrastructure and the teaching staff must be adequate.

2. ACADEMIC QUALIFICATIONS, TEACHING EXPERIENCE AND OTHER ELIGIBILITY REQUIREMENT FOR APPOINTMENT OF FOR B.M.L.S. COURSE

1. Assistant Professor:

A Master degree with minimum of 55% marks (or an equivalent grade in a point-scale, wherever the grading system is followed) at the Master degree (M.Sc. M.L.T./M.Sc. Pathology/M.Sc. Microbiology/M.Sc. Biochemistry, relevant/allied subject from an Indian University, or an equivalent degree from an accredited foreign university) shall be the essential qualification for direct recruitment of faculty.

2. Associate Professor:

- Essential:** A good academic record, Master degree with at least 55% marks (or an equivalent grade in a point-scale, wherever the grading system is followed) in (M. Sc. M.L.T./M.Sc. Pathology/M.Sc. Microbiology/M.Sc. Biochemistry, relevant/allied subject from an Indian University, or an equivalent degree from an accredited foreign university).
- A minimum of eight years of experience of teaching and / or research in an academic/research position equivalent to that of Assistant Professor in a University, College or Accredited Research Institution/Industry with a minimum of three publications in the peer-reviewed or UGC-listed journals.

Desirable: Ph.D. Degree in the concerned/allied/relevant disciplines.



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3. Professor:

A.

Essential: An eminent scholar having Master degree (M.Sc. M.L.T./M.Sc. Pathology/M.Sc. Microbiology/M.Sc. Biochemistry, relevant/allied subject from an Indian University, or an equivalent degree from an accredited foreign university) and minimum of ten years of teaching experience in university/college as Assistant Professor/Associate Professor/Professor, and / or research experience at equivalent level at the University/National Level Institutions.

Desirable: Ph.D. degree in the concerned/allied/relevant discipline, and published work of high quality, actively engaged in research with evidence of published work with, a minimum of 05 research publications in the peer-reviewed or UGC-listed journals.

B.

An outstanding professional, having Ph.D. Degree in the concerned/allied/relevant disciplines, from any academic institutions (not included in A above) / industry, who has made significant contribution to the knowledge in the concerned/allied/relevant discipline, supported by documentary evidence provided he/she has ten years' experience.

4. College Principal /Dean:

A.

Essential:

Master degree (M. Sc. M.L.T./M.Sc. Pathology/M.Sc. Microbiology/M.Sc. Biochemistry, relevant/allied subject from an Indian University, or an equivalent degree from an accredited foreign university) with total ten years of experience teaching/research in Universities, Colleges and other institutions of higher education. Senior most professor shall be designated as principle/Dean.

Desirable:

Higher qualification like Ph.D. degree in M.Sc. M.L.T./ Pathology/ Microbiology/ Biochemistry, relevant/ allied subject from an Indian University, or an equivalent degree from an accredited foreign university).

A minimum of 10 research publications in high slandered peer-reviewed or UGC-listed journals.



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B. Tenure

i) A College Principal shall/Dean be appointed for a period of five years, extendable for another term of five years on the basis of performance assessment by a Committee appointed by the University, constituted as per these regulations.

ii) After the completion of his/her term as Principal, the incumbent shall join back his/her parent organization with the designation as Professor and in the grade of the professor.

5. Vice Principal

An existing senior faculty member may be designated as Vice-Principal by the Governing Body of the College on the recommendation of the principal, for a tenure of two years, who can be assigned specific activities, in addition to his/her existing responsibilities. During the absence of the principal, for any reason, the vice -principal shall exercise the powers of the principal.

3. DEPARTMENT-WISE AND YEAR-WISE FACULTY REQUIREMENT

Teaching staff (fulltime):

It is recommended that a faculty and student ratio of 1:3 is to be followed for the post graduate (MMLS) programmes and 1:10 for the under graduate programmes (BMLS).

Required teaching staff year wise bachelor course (B. M.L.S.) for 60 intakes

(Proposed by Uttar Pradesh State Allied and Healthcare Council)

For bachelor course year wise	Principal/Dean	Professor	Associate Professor	Assistant Professor
First & second year	01	01	03	06
Third year		01	02	04
Total (18)	01	02	05	10

Required teaching staff year wise master course (M.M.L.S.) for 15 intakes specialization (Proposed by Uttar Pradesh State Allied and Healthcare Council)

For bachelor course year wise	Professor	Associate Professor	Assistant Professor
First year	01	02	04
Second year	01	02	04
Total (14)	02	04	08

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Technical staff (Proposed by Uttar Pradesh State Allied and Healthcare Council)

Technical staff	Lab. Technician	Lab. assistant
For B. M.L.S.	03	03
For M.M.L.S.	02	02

Administrative staff for B. M.L.S. and M.M.L.S.

(Proposed by Uttar Pradesh State Allied and Healthcare Council)

Administrative staff	Number of staff
Administrative officer	01
Office superintendent	01
PA to principal/Dean	01
Accountant/cashier	01

Ancillary staff for B. M.L.S. and M.M.L.S.

(Proposed by Uttar Pradesh State Allied and Healthcare Council)

Ancillary staff	Number of staff
Upper divisional clerk	02
Lower divisional clerk	02
Record clerk	01
Librarian	01
Lab attendant	03
Library attendant	02
Steno typist Hindi	01
Steno typist English	01
Office attendant	02
Audio-visual technician	01
Class room attendant	04
Peon	02
Security guard	02
Driver	01
Housekeeping staff (sweeper)	05



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4. ACADEMIC FACILITIES:

A. Infrastructure required:

(Proposed by Uttar Pradesh State Medical Faculty Lucknow)

The importance of providing an adequate learning environment for students needs be emphasized. Both the physical infrastructure and the teaching staff must be adequate.

Total land and building area required:

Depending on the location of college/institute land area requirement will be as given below-

Land area required	Building/covered area	Hospital requirement
For urban area 4000 sq meter or 43040 sq ft while for rural area 8000 sq meter or 86080 sq ft is required. The land should be in the name of society. In case of more than one course there must be additional 2000 sq meter area required for each course.	There must be 1000 sq meter or 10760 sq ft Building/covered area. In case of more than one course there must be additional 200 sq meter Building/covered area will be required for each course.	The Institution should be in the vicinity of a functional medical college (100 bed) or University and has an attached hospital for purpose of practical exposure and internships of the students.

Planning and layout:

(Proposed by Uttar Pradesh State Allied and Healthcare Council)

Administrative block- 1700 sq.ft			
Space required for	Area required per unit up to 50 intakes	No of units required	Total required build-up area in sq.ft.
Principal office	300sq.ft	1	300sq.ft
Main administrative office	500sq.ft	1	500sq.ft
Reception	200sq.ft	1	200sq.ft
Wash room	200sq.ft	1	200sq.ft
Others	500sq.ft	1	500sq.ft
Faculty office – 1600sq. ft.			



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Administrative block- 1700 sq.ft			
Space required for	Area required per unit up to 50 intakes	No of units required	Total required build-up area in sq.ft.
Professor's office	150sq.ft	4	600sq.ft
Associate Professor's office	100sq.ft	4	400sq.ft
Assistant Professor's office	75sq.ft	8	600sq.ft
Academic block			
Class room (with LCD projector, audio-visual aids)	750sq.ft	2	1500sq.ft
Conference room with LCD projector, audio-visual aids)	300sq.ft	2	600sq.ft
Laboratory	500sq.ft	3	1500sq.ft
Library (20 students)	1200sq.ft	1	600sq.ft
Computer room with high-speed internet	300sq.ft	1	300sq.ft
Seminar room with A.V. aids	300sq.ft	1	300sq.ft
Store room	200sq.ft	1	200sq.ft
Auditorium/multipurpose hall	1500sq.ft	1	1500sq.ft
Museum	500sq.ft	1	500sq.ft
Students common room for girls	1000sq.ft	1	1000sq.ft
Students common room for boys	250sq.ft	1	250sq.ft
Wash room female	200sq.ft	1	200sq.ft
Wash room male	200sq.ft	1	200sq.ft
Electricity	20KVA		
Power generator	10KVA		
Water cooler	25L	2	
Telephone/PCO		1	
Vehicle Parking		1	
Canteen/cafeteria		1	
			4500sqft

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Administrative block- 1700 sq.ft			
Space required for	Area required per unit up to 50 intakes	No of units required	Total required build-up area in sq.ft.
Microbiology laboratory	1200sq.ft	1	1200sq.ft
Biochemistry laboratory	1200sq.ft	1	1200sq.ft
Laboratory for histopathology and cytology	1200sq.ft	1	1200sq.ft
Recreational area	1000sq.ft.	1	1000sq.ft.
Hostels for girls	mandatory	Separate/shared with medical college	
Hostels for girls	mandatory	Separate/shared with medical college	

B. Hospital requirement:

The Institution/college should be in the vicinity of a functional medical college (100 beds) or University. Institution/college should have its own hospital/attached hospital for purpose of practical exposure and internships of the students. Institution shall have to satisfy themselves that satisfactory infrastructure facilities of Pathology Laboratory exist in the Institute/Hospital where the internship training has to be undertaken.

SPORTS FACILITIES:

Outdoor and Indoor facilities for sports should be available for the students to lead a balanced life style and to enhance leadership skills. The Institution must have adequate Sports, Cultural, Gymnasium and Yoga infrastructure facilities for overall development of students. Sports activities such as basketball court, cricket, football, athletics, kabaddi and indoor playground for table tennis, badminton, chess, carom, etc. Separate gymnasium for boys and girls should be provided in the hostel.

Wi Fi Setup

The campus should be well equipped with a Next Generation Network (NGN) Wi Fi facility.

CCTV Setup in Campus

CCTV should be installed in campus and in hostel.



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Syllabus

Bachelors in Science Medical Laboratory Science (BMLS)

First Semester (0-6 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS-101	Basic computer & information science	3	1	-	30	70	100	4
BMLS-102	English Communication and soft skills	3	1	-	30	70	100	4
BMLS-103	Introduction to Quality & Patient Safety	3	1	-	30	70	100	4
BMLS-104	Medical Law & Ethics	3	1	-	30	70	100	4
BMLS-105	Basic Preventive Medicine and Community Health Care	3	1	-	30	70	100	4
BMLS-106	Environment Science	3	1	-	30	70	100	4
Total		18	6	24	180	420	600	24
Total Hours in Semester		550						









Subject Name: Basic computers and information science

Subject Code: BMLS-101

Unit- 1

(10 Hrs.)

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.

Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).

Unit- 2

(10 Hrs.)

Processor and memory: The Central Processing Unit (CPU), main memory.

Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

Unit- 3

(10 Hrs.)

Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.

Unit- 4

(10 Hrs.)

Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.

Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

Unit- 5

(10 Hrs.)

Introduction of Operating System: introduction, operating system concepts, types of operating system

Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.

Unit- 6

(10 Hrs.)

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. Application of Computers in clinical settings.

RECOMMENDED BOOKS:

1. A first Course in Computers: Saxena, Vikas Publishing House
2. Fundamentals of Computer science - M. Afshar Alam
3. Fundamental of Information Technology by 'D. S. Yadav- New age Internationa



Subject Name: English Communication & Soft Skills

Subject Code: BMLS-102

Learning Objectives: To comprehend and communicate in simple English.

Unit-1: (10 Hrs.)

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
3. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc.

Unit-2: (10 Hrs.)

1. Basic compositions, journals, with a focus on paragraph form and organization.
2. Basic concepts & principles of good communication.
3. Special characteristics of health communication.

Unit-3: (10 Hrs.)

1. Types & process of communication – verbal, non-verbal and written communication.
2. Upward, downward and lateral communication.
3. Therapeutic communication: empathy versus sympathy.

Unit-4: (10 Hrs.)

1. Communication methods for teaching and learning.
2. Communication methods for patient education.
3. Barriers of communication & how to overcome.

Learning Outcomes: Students will realize the significance of English for their career progression. Students will be able to understand distinct sounds and improve pronunciation. Students will improve their English vocabulary of daily usage. Students will be able to form simple sentences to talk about themselves, friends and relatives. Students will be able to imbibe the pre-requisites of personality development.

Suggested Reading:

1. Raman, Meenakshi & Sharma, Sangeeta. Technical Communication
2. Konar, Nira. Communication Skills For Professionals, PHI Learning Pvt. Ltd – 2011
3. Board of Editors. Written and Spoken Communication in English, University Press 2007
4. Lata, Pushp & Kumar, Sanjay. Communicate or Collapse :A Handbook of Effective Public Speaking , Group Discussions and Interviews, PHI Learning Pvt. Ltd -2011
5. Duck, Steve & McMahan, David T. The Basics of Communication : A Relational Perspective, Sage Publication-2012



Subject Name: Introduction to Quality & Patient Safety

Subject Code: BMLS-103

Learning Objectives: The subject will introduce the students to the basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system. It will sensitize them in basic emergency care, infection prevention & control with knowledge of bio-medical waste management and antibiotic resistance.

Unit-1: (10 Hrs.)

1. Quality assurance and management
2. Concepts of Quality of Care
3. Quality Improvement Approaches, Standards and Norms, Quality Improvement Tools,
4. Introduction to NABH guidelines.

Unit-2: (10 Hrs.)

1. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED).
2. Initial recognition and response to heart attack and stroke are also considered part of BLS.
3. Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs)
4. Choking, rescue breathing methods, One- and Two-rescuer CPR, Using an AED (Automated external defibrillator) ,Managing an emergency including moving a patient.

Unit-3: (10 Hrs.)

1. Bio medical waste management and environment safety
1. Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW,
2. Radioactive waste, Metals / Chemicals / Drug waste, BMW Management & methods of disinfection
3. Modern Technology for handling BMW
4. Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices).

Unit-4: (10 Hrs.)

1. Infection prevention and control
2. Evidence-based infection control principles and practices



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3. Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)
4. Prevention & control of common healthcare associated infections, Components of an effective infection control program, and Guidelines (NABH and JCI) for Hospital Infection Control.

Unit-5:

(10 Hrs.)

1. History of antibiotics, How resistance happens and spreads,
2. Types of resistance- intrinsic, acquired, passive, Trends in drug resistance, Actions to fight resistance, Bacterial persistence
3. Antibiotic sensitivity, Consequences of antibiotic resistance
4. Antimicrobial Stewardship – Barriers and opportunities, tools and models in hospitals.

Unit-6:

(10 Hrs.)

1. Disaster preparedness and management
2. Fundamentals of emergency management, Psychological impact management, Resource management, Preparedness and risk reduction
3. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction)
4. Information management, incident command.

Suggested readings:

1. The Essentials of Patient Safety by Charles Vincent
2. Laboratory quality control and patient safety by De Gruyter


April 2022







Subject Name: Medical Law & Ethics

Subject Code: BMLS-104

Learning Objectives: Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical science, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

Unit-1:

(10 Hrs.)

1. Medical ethics, Definition, Goal, Scope.
2. Introduction to Code of conduct
3. Basic principles of medical ethics, Confidentiality
4. Malpractice and negligence, Rational and irrational drug therapy

Unit-2:

(10 Hrs.)

1. Autonomy and informed consent - Right of patients
2. Care of the terminally ill- Euthanasia
3. Organ transplantation
4. Medico legal aspects of medical records

Unit-3:

(10 Hrs.)

1. Medico legal case and type- Records and document related to MLC
2. Ownership of medical records - Confidentiality Privilege communication
3. Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
4. Professional Indemnity insurance policy

Unit-4:

(10 Hrs.)

1. Development of standardized protocol to avoid near miss or sentinel events
2. Obtaining an informed consent.
3. Ethics in the profession of Medical Laboratory Science

LEARNING OUTCOME: Student will abide by the rule and regulation of the medicine and have abundant knowledge on professional attitude and communication among the colleague, patients and co-parties.

Suggested readings:

1. Medical Law and Ethics by Bonnie F Fremgen
2. Medical Law and Ethics by Jonathan Herring



Subject Name: Community Health Care

Subject Code: BMLS-105

Learning Objectives: The students will learn about the knowledge of various types of diseases and functioning of various programmes. The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world.

Unit-1: Introduction: (10 Hrs.)

1. Definition and concepts of health, important public health acts
2. Health problems of developed and developing countries, environment and health.
3. Definition and concepts of epidemiology, diseases, types and use of epidemiology.
4. Basic emergency care and first aid.

Unit-2: Communicable Diseases : (10 Hrs.)

1. Epidemiology, etiology, pathogenesis and control of communicable disease like malaria, cholera,
2. Tuberculosis, leprosy,
3. Diarrhoea, poliomyelitis,
4. Viral hepatitis, measles, dengue, rabies, AIDS.

Unit-3: National Health Policy & Programs : (10 Hrs)

1. National Health Policy and Programs: DOTS, National AIDS control programme
2. National cancer control programme, Universal immunization programme etc
3. Nutrition and major nutritional problems, etiology, manifestations and prevention, components of RCH care.
4. Examination of water, food adulteration, role of regular exercise and yoga in prevention and management of various diseases.

Unit-4: National Population Problem: (10 Hrs)

1. Population, problems of population growth, birth rates
2. Death rates, fertility rates, MMR., CPR
3. Approaches and methods of contraception, Reproductive and child health.
4. Hygiene and sanitation, sanitation barriers, excreta disposal.

Unit-5: Immunization & Health Planning: (10 Hrs)

1. Immunization programme, various national immunization programs and vaccine schedules
2. Family welfare and planning, communicable and non-communicable disease
3. Health planning in India including various committees, national health policy and health goals.
4. Objectives and goals of WHO, UNICEF, Indian Red Cross Society, UNFPA, FAO, ILO



Suggested Readings:

1. K.Parks & Sunder Lal, (2015),Textbook of Preventive Social Medicine ,3rd edition, Bhanot Publications

Subject Name: Environmental Science

Subject Code: BMLS- 106

Learning Objectives: The student will be made aware of our environment in general, natural resources, ecosystems, environmental pollution and social issues related to environment.

Unit-1: Natural resources: Renewable and non-renewable resources:(10 Hrs.)

1. Water Resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.
2. Mineral Resources: Use and exploitation, environmental effects of extracting and using minerals resources, case studies.
3. Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer -pesticide problems, Water logging, Salinity, case studies.
4. Energy Resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.
5. Land Resources: Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification. - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable life styles.

Unit-2: Ecosystem:

(10 Hrs.)

1. Concept of an Ecosystem, Structure and Function of an Ecosystem
2. Producer Consumer and decomposers
3. Energy flow in the Ecosystem
4. Ecological Succession.

Unit-3: Environmental Pollution:

(10 Hrs.)

1. Definition, Causes, effects and control measures of-Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards



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2. Solid Waste Management: Causes, effects and control measures of urban and Industrial Wastes.
3. Role of an Individual in prevention of pollution.
4. Pollution case studies & Disaster Management: floods, earthquake, cyclones and landslides.

Unit-4: Social Issues & Environment: (10 Hrs.)

1. Resettlement and Rehabilitation of people; its problems and concerns, case studies.
2. Environmental ethics: issues and possible solutions
3. Green house effect and global Warming, effects of acid Rain and their remedial measures and ozone Layer depletion.


Unit-5: Human Population & Environment: (10 Hrs.)

1. Population growth variation among nations, Population Explosion, Family welfare programme
2. Environment and Human Health
3. Human Rights.
4. HIV/AIDS, Women and Child welfare
5. Role of Information Technology in Environment and Human Health, Case studies.

Learning Outcome: Students will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development.

Suggested Readings:

1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner.
2. Jadhav, H &Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284 p.
3. Rao M. N. &Datta A.K. 1987. Waste water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
4. Daniel D. Chiras 2010. Environmental Science. 1st Indian Edition, Jones and Bartlett India Pvt. Ltd. 4262/3, Ansar Road, Daryaganj, New Delhi.
5. Principle of Environment Science by Cunningham, W.P.
6. Essentials of Environment Science by Joseph.
7. Environment Pollution Control Engineering By Rao, C.S.







Second Semester (6-12 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -201	General Clinical Microbiology	3	1	-	30	70	100	4
BMLS -202	Basic Haematology & Clinical Pathology	3	1	-	30	70	100	4
BMLS -203	Basic Clinical Biochemistry	3	1	-	30	70	100	4
BMLS -204	Human Anatomy and Physiology	3	1	-	30	70	100	4
BMLS -205	General Clinical Microbiology – (P)	-	-	4	30	70	100	2
BMLS -206	Basic Haematology & Clinical Pathology – (P)	-	-	4	30	70	100	2
BMLS -207	Basic Clinical Biochemistry – (P)	-	-	4	30	70	100	2
BMLS -208	Human Anatomy and Physiology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						



Subject Name: General Clinical Microbiology

Subject Code: BMLS-201

Learning Objectives: This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e. microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

Unit-1: Introduction to Medical Microbiology: (12 Hrs.)

1. Definition , History, Host - Microbe relationship
2. Glasswares Used in Microbiology- Introduction, Care and handling of glassware, Cleaning of glassware.
3. Equipment used in clinical Microbiology Laboratory: Introduction, Care and maintenance including calibration.
4. Microscopy: Introduction and history, Types, principle and operation mechanism of following microscopes-
Light microscope, DGI, Fluorescent, Phase contrast, Electron microscope: Transmission/ Scanning

Unit-2 : Sterilization:

1. Definition, Types and principles of sterilization methods
2. Heat (dry heat, moist heat with special Reference to autoclave)
3. Radiation, Filtration
4. Efficiency testing to various sterilizers

Unit-3: Antiseptics and Disinfectants: (12 Hrs.)

1. Definition, Types and properties.
2. Mode of action - Uses of various disinfectants
3. Precautions while using the disinfectants - Qualities of a good disinfectant
4. Testing efficiency of various disinfectants
5. Types of the waste generated – Segregation – Treatment – Disposal

Unit-4: General characteristics & classification of Microbes & Nutrition: (12 Hrs.)

1. Classification of microbes with special reference to prokaryotes & eukaryotes
2. Morphological classification of bacteria, Bacterial anatomy (Bacterial cell structures).
3. General nutritional & other requirements of the bacteria
4. Classification of bacteria on the basis of their nutritional requirements
5. Physical conditions required for growth, Normal growth cycle of bacteria (growth curve).



Unit-5: Types of microbial cultures & Immunology: (14 Hrs.)

1. Culture media: Introduction
2. Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selective differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media
3. Quality control in culture media, Automation in culture media preparation
4. Aerobic & anaerobic culture methods: Concepts, Methods Used for aerobic cultures, Methods used for anaerobic cultures
5. Introductions to Immunology: Immunity, Antigens and Antibodies
6. Care & handling of laboratory animals: Introduction, General care & handling.
7. Ethics & legality in use of laboratory animals.

Learning Outcomes: This course make the students to know handling of instruments and sterilization techniques, able to make Various Culture media to improve quality of Investigation by Followed Quality Control. Students also having knowledge about Immunology.

Suggested Readings:

1. Practical Medical Microbiology by Mackie and McCartney
2. Text book of Microbiology by Ananthanarayan
3. Medical Microbiology by Panikar & Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. District Laboratory Practice in tropical countries Vol II Microbiology by Monica Cheesbrough
6. Text book of Microbiology by Prescott
7. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh



Subject Name: Basic Haematology & Clinical Pathology

Subject Code: BMLS-202

Learning Objectives: Students will be made aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

Unit-1: Introduction to Haematology: (12 Hrs.)

1. Definition, Importance Important equipment used.
2. Laboratory organization and safety measures in Haematology Laboratory
3. Introduction to blood, its composition, function and normal cellular components
4. Anticoagulants: types, mode of action and preference of anticoagulants for different hematological studies

Unit-2: (12 Hrs.)



1. Collection and preservation of blood sample for various hematological investigations
2. Formation of cellular components of blood (Haemopoiesis), Erythropoiesis, Leucopoiesis, Thrombopoiesis.
3. Hemoglobin: definition, types, structure, synthesis and degradation
4. Morphology of normal blood cells

Unit-3: (12 Hrs.)

1. Normal Hemostasis & physiological properties of coagulation factors.
2. Quality assurance in Haematology
3. Internal and external quality control including reference preparation
4. Routine quality assurance protocol
5. Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision

Unit-4: (12 Hrs.)

1. Preparation of thin and thick smears and its uses; staining of blood smears;
2. Differential leucocytes count by manual and automated method; Physiological and pathological variations in leukocyte values;
3. Theory of erythrocyte sedimentation rate; Measurement of ESR - manual and automated method;
4. Hematocrit and red cell indices - Its use in clinical practice; Principle of automated blood cell counter;
5. Reticulocyte count - Stains used; normal values; use of reticulocyte count in clinical practice;







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Unit-5:

(12 Hrs.)

1. Collection, transport and preservation of clinical specimens other than blood; Processing of various clinical Specimens; CSF examination in clinical practice
2. Semen analysis in clinical practice; Sputum examination as relevant to Pathology lab; Stool examination as relevant to Pathology lab
3. Mechanism of coagulation, coagulation factors; Common disorders of bleeding and coagulation;
4. Approach to a patient with bleeding disorder; Bleeding time, clotting time, Platelet count
5. Prothrombin time, Prothrombin concentration, INR; Clot retraction test and APTT

Learning Outcomes: Students will be able to collect, preserve and process blood samples. They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-haematological investigations and coagulation profile tests. They will be able to handle automated instruments.

Suggested Readings:

1. Text book of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's Clinical Haematology in Medical Practice



Subject Name: Basic Clinical Biochemistry

Subject Code: BMLS-203

Learning Objectives: The main objective of the subject is to impart the knowledge of apparatus, units, equipment, and volumetric analysis in the laboratory of clinical Biochemistry.

Unit-1:

(12 Hrs.)

1. Introduction to Medical lab. Technology, Role of Medical lab Technologist
2. Ethics and responsibility, Safety measures, First aid
3. Cleaning and care of general laboratory glass ware and equipment: Steps involved in cleaning soda lime glass, Steps involved in cleaning borosil glass
4. Preparation of chromic acid solution, Storage

Unit-2:

(12 Hrs.)

1. Method of preparation of distilled water, Type of water distillation plants, Storage of distilled water
2. Units of Measurement: S.I unit and CGS units, Conversion
3. Strength, molecular weight, equivalent weight
4. Normality, Molarity, Molality, Numerical

Unit-3:

(12 Hrs.)

1. Calibration of volumetric apparatus: Flask, Pipettes, Burettes, Cylinders
2. Analytical balance: Principle, Working, Maintenance
3. Concept of pH: Definition, Henderson Hassel batch equation, Pka value, pH indicator
4. Methods of measurement of pH: pH paper, pH meter, Principle, working, maintenance and calibration of pH meter

Unit-4:

(12 Hrs.)

1. Volumetric analysis: Normal and molar solutions
2. Standard solutions
3. Preparation of reagents
- 4 Storage of chemicals



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Unit-5: (12 Hrs.)

1. Osmosis: Definition, Types of osmosis, Factors affecting osmotic pressure
2. Specimen collection and Processing of Blood, Urine and CSF, Separation of Serum and Plasma for Biochemical Analysis
3. Deproteinization of sample, Handling of specimens for Testing, Transport of specimen
4. Preservation of specimen, Factors affecting the Clinical results, Effects of Storage on sample

Learning Outcomes: Students will comprehend the basics of Reagent preparation, Instrumentation and Sample analysis.

Students will able to collect various specimens for Biochemistry Investigation, They will able to Calibrate and maintain Various instruments and Glasswares.

Suggested Readings:

1. Text book of Medical Laboratory Technology by P. B. Godker
2. Medical Laboratory Technology by K.L. Mukherjee volume III
3. Practical Clinical Biochemistry by Harold Varley
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chatterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer









Subject Name: Human Anatomy and Physiology

Subject Code: BMLS-204

Learning Objectives: Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

Unit-1: Introduction to human Anatomy and Physiology (12 Hrs.)

1. Cell and cell organelles: Structure and classification, Function, Cell division (Mitosis and Meiosis)
2. Tissues: Definition, Classification with structure and Functions
3. Epithelial tissues, Connective tissues, Muscular tissues, Nervous tissue
4. Blood: Composition & Function of blood

Unit-2: Muscular skeletal system & Lymphatic System (10 Hrs.)

1. Introduction, Classification, Structure and function of skeletal system, muscles and joints
2. Various movements of body
3. Lymphatic system: Introduction, Structure and function, Lymph nodes
4. Spleen, Thymus gland, Tonsils

Unit-3: Respiratory System & Sense Organs (10 Hrs.)

1. Introduction, Structure, Function
2. Mechanism of breathing and respiration
3. Various terms involved in respiratory System: Vital capacity, Total Volume, Reserve volume, Total lung capacity
4. Structure and function of sense organ: Eye Ear, Nose Tongue

Unit-4: Cardiovascular System & Endocrine System (10 Hrs.)

1. Anatomy and physiology of heart
2. Blood circulation: Arteries and veins
3. Conductive system of heart, Cardiac cycle, Introduction to ECG
4. Endocrine system: Endocrine & exocrine glands, their location, structure & functions



Unit-5: Body fluids and their significance

(08 Hrs.)

1. Important terms, types of body fluid, total body water, Avenues by which water leaves and enters body, general principles for fluid balance
2. Cardinal principle, How body fluids maintain Homeostasis, Electrolytes & ions
3. Function of electrolytes, How electrolyte imbalance leads to fluid imbalance

Unit-6: Digestive system:

(08 Hrs.)

1. Organization; accessory organs; structure & function (Mouth, Tongue, Teeth, Esophagus, Pharynx, Stomach, Intestine, Rectum, Anus)
2. Digestive glands; physiology of digestion of carbohydrates, lipids & proteins
3. Liver: structure and function

Unit-6: Genital system & Urinary System:

(10 Hrs.)

1. Structure of male and female reproductive system,
2. Gametogenesis in male, female, menstrual cycle.
3. Placenta and extra embryonic membranes.
4. Urinary system: Main parts, Structure & function of kidney, structure of nephron,
5. Physiology of excretion & urine formation, urine.

Unit-7: Nervous system:

(06 Hrs.)

1. Parts, function & structure; brain, spinal cord, spinal & cranial nerves
2. All none principle, role of neurotransmitters in transmission of nerve impulse

Learning Outcomes: This curriculum can stimulate the students to understand the basic anatomy of included system and the resultant unified organization thereupon.

Students will be able to understand functioning of various systems as well as its applied aspects.

Suggested readings:

1. Anatomy & Physiology- Ross and Wilson
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Anatomy and Physiology for nurses by Evelyn Pearce
4. Anatomy and Physiology for nurses by Sears
5. Anatomy and Physiology for nurses by Pearson
6. Anatomy and Physiology by N Murgesh



Subject Name: General Clinical Microbiology- (Practical)

Subject Code: BMLS-205

1. To demonstrate safe code of practice for a Microbiology laboratory
2. To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.
3. To demonstrate the working & handling of Compound microscope.
4. To demonstrate the method of sterilization by autoclave including its efficacy testing.
5. To demonstrate the method of sterilization by hot air oven including its efficacy testing.
6. To demonstrate the method of sterilization of media/solution by filtration.
7. Demonstration of Antiseptics, Spirit, Cetrimide & Povidone-Iodine.
8. To demonstrate the use of disinfectants.
9. Demonstrate the precaution while using disinfectants.
10. To prepare working dilution of commonly used disinfectants.
11. To demonstrate the different morphological types of bacteria
12. Preparation of one culture media from each type
13. To demonstrate aerobic culture
14. To demonstrate anaerobic culture
15. Visit to animal house & demonstrate about care of laboratory animals



Subject Name: Basic Haematology & Clinical Pathology- (Practical)

Subject Code: BMLS-206

1. Preparation of various anticoagulants :

1.1 EDTA

1.2 Sodium Citrate

1.3 Oxalate with Fluoride

2. Collection of blood sample for various Lab Investigations

3. Familiarization and working of routine Haematology Lab.

4. Instruments

4.1 Microscopes

4.2 Haemocytometers

4.3 Colorimeter

4.4 Spectrophotometer

4.5 Glass pipettes & Auto pipettes

4.6 Glassware

4.7 Sahli's Apparatus

5. Identification of Normal blood cells

6. Urine Analysis:

6.1 Routine biochemistry of Urine for:

Physical Examination

Biochemical Examination

Microscopic Examination of Urine

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Subject Name: Basic Clinical Biochemistry - (Practical)

Subject Code: BMLS-207

1. Cleaning of the laboratory glass ware (Volumetric and non-volumetric)
2. Preparation of distilled water
3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaOH solution.
5. To prepare 0.2N HCl solution.
6. To prepare 0.1 molar H₂SO₄
7. To prepare 0.2 Molar Sodium carbonate solution.
8. Demonstration of osmosis and dialysis.









Subject Name: Human Anatomy and Physiology - (Practical)
Subject Code: BMLS-208

1. Demonstration of various parts of body
2. Demonstration of tissues of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of skin
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system (Demonstration from models)
8. Examination of blood film for various blood cells from stained slides
9. Blood pressure estimation
10. Demonstration of various parts of nervous system (brain and spinal cord)(Model)
11. Structure of eye and ear (demonstration from models)
12. Demonstration of reflex action
13. Demonstration of structural differences between skeletal, smooth and cardiac muscles (permanent mounts)
14. Demonstration of various bones and joints
15. Demonstration of various parts of reproductive system (Male and female from models and charts)
16. To study circulatory system from charts and transverse section (TS) of artery and vein from permanent slides.
17. To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.
18. Study of Urinary system (charts)
19. Study of Genital system (male & female) from charts and TS of testis and ovary from permanent slides.
20. To study nervous system (From models / charts)
21. To study various body fluids.

Note: Demonstrations can be done with the help of models, charts and histological slides



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Third Semester (12-18 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total.	
BMLS -301	Systematic Bacteriology	3	1	-	30	70	100	4
BMLS -302	Basics of Haematological diseases	3	1	-	30	70	100	4
BMLS -303	Biochemical metabolism	3	1	-	30	70	100	4
BMLS -304	Fundamentals of Histology	3	1	-	30	70	100	4
BMLS -305	Systematic Bacteriology– (P)	-	-	4	30	70	100	2
BMLS -306	Basics of Hematological diseases – (P)	-	-	4	30	70	100	2
BMLS -307	Biochemical metabolism – (P)	-	-	4	30	70	100	2
BMLS -308	Fundamentals of Histology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						









Subject Name: Systematic Bacteriology

Subject Code: BMLS-301

Learning Objectives: This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

Unit-1: Bacterial culture & staining techniques in bacteriology: (10 Hrs.)

1. Instruments used to seed culture media, Culture procedures – seeding a plate.
2. Significance of staining in bacteriology-
3. Principle, Reagent preparation, procedures and interpretation of- Simple staining, Gram staining , Negative staining, Albert's staining , Neissre's staining , Ziehl- Neelsen staining,
4. Capsule staining, Spore Staining, Flagella staining, Fontana stain for spirochetes.

Unit-2: Biochemical tests for identification of different bacteria: (10 Hrs.)

1. Principle, procedures and interpretation of the following biochemical tests- Catalase , Coagulase , Indole , Methyl Red
2. Principle, procedures and interpretation of the following biochemical tests- Voges Proskauer , Urease , Citrate , Oxidase
3. TSIA , Nitrate reduction , Carbohydrate fermentation , Hufe and Leifson , Bile solubility
4. H₂S production , Demonstration of motility , Decarboxylases , CAMP , Hippurate hydrolysis , Nagler's reaction , Cholera-red reaction.

Unit-3: Definition, Classification, Various, pathogenesis and laboratory diagnosis of the following bacteria:- (10 Hrs.)

1. Staphylococcus , Streptococcus
2. Pneumococcus , Neisseria gonorrhoea and Neisseria meningitis
3. Haemophilis , Corynebacterium
4. Escherichia coli, Klebsiella, Citrobacter, Enterobacter

Unit-4: Definition, Classification, Various, pathogenesis and laboratory diagnosis of the following bacteria:- (10 Hrs.)

1. Proteus, Salmonella, Shigella, Yersinia enterocolitica and Yersinia pestis .
2. Vibrio, Aeromonas and Plesiomonas
3. Clostridia of wound infection
4. Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae



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Unit-5: Definition, Classification, Various, pathogenesis and laboratory diagnosis of the following bacteria-: (10 Hrs.)

1. Spirochetes – Treponema, Borrellia and leptospira
2. Bordetella and brucella , Mycoplasma and Ureaplasma , Rickettsia , Chlamydia ,
3. Actinomyces, Pseudomonas and Burkholderia
4. Brief introduction about non sporing anaerobic cocci and bacilli

Learning Outcomes: Students will know basics and procedure of different parameters used to assess Characteristics of different kinds of bacteria.

Students will perform different Biochemical & special test to identify various bacteria.

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker & Satish Gupte
4. Medical laboratory Technology Vol. I, II, III by Mukherjee
5. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh

N. Upadhyay

April 2022



Subject Name: Basic of Haematological Diseases

Subject Code: BMLS-302

Learning Objectives: The students will be made aware of various diseases like anemia, quantitative disorders of Leucocytes, morphological alterations in blood cells, bleeding disorders.

Unit-1: Anemia: (10 Hrs.)

1. Introduction, Classification, Clinical Features, Evaluation and Investigation.
2. Microcytic hypochromic anemia
3. Macrocytic anemia
4. Normocytic normochromic anemia

Unit-2: Anemia: (10 Hrs.)

1. Quantitative disorders of Leukocytes Cause and significance
2. Granulocytic and Monocytic Disorders
3. Lymphocytic Disorders
4. Morphologic Alterations in Neutrophils ,Toxic granulation , Cytoplasmic vacuoles , Döhle bodies , May–Hegglin anomaly Alder–Reilly anomaly , Pelger–Huët anomaly , Chédiak–Higashi syndrome.

Unit-3: Bleeding disorders: (10 Hrs.)

1. Introduction, definition, types and Causes of bleeding.
2. Vascular defect, Platelet defect
3. Factor deficiency
4. Inhibitors, Hyper fibrinolysis

Unit-4: Types of bleeding disorders: (10 Hrs.)

1. Inherited bleeding disorders
2. Acquired bleeding disorders
3. Thrombosis: Introduction & Causes of thrombosis
4. Monitoring of Anticoagulants, Oral anticoagulants by INR, Heparin

Unit-5: Evaluation of bleeding disorders: (10 Hrs.)

1. Patient History, Clinical Features
2. BT,CT , Platelets Count
3. PT, APTT, PTT
4. D-Dimer test , Fibrinogen Assay



Learning Outcomes: This course made the students competent enough to perform various laboratory test related to acute and chronic hematological disorders and Bleeding Disorders.

Suggested Readings:

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical Laboratory Technology by K L Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice
7. Wintrobe's Clinical Haematology– 2013 by John P. Greer, Daniel A. Arber, Bertil E. Glader, Alan F. List



Subject Name: Biochemical Metabolism

Subject Code: BMLS-303

Learning Objectives: This subject shall give information about all the major metabolic pathways occurring in our body. The students will learn the details about metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes & the deficiency diseases related to them.

Unit-1: Carbohydrate Metabolism: (10 Hrs.)

1. Introduction, Importance and Classification
2. Digestion and Absorption
3. Metabolism: - Glycolysis, Citric acid cycle, Gluconeogenesis, Glycogenolysis, Glycogenesis
4. Disorders of carbohydrate metabolism.

Unit-2: Protein Metabolism: (10 Hrs.)

1. Introduction, Importance and classification, Important properties of proteins
2. Digestion & absorption of Proteins
3. Protein synthesis, Metabolism of proteins
4. Disorders of protein metabolism and Urea Cycle

Unit-3: Lipids : (10 Hrs.)

1. Introduction & Classification
2. Digestion & absorption of fats
3. Lipoproteins
4. Fatty acid biosynthesis & fatty acid oxidation

Unit-4: Nucleic Acid & Vitamins: (10 Hrs.)

1. Introduction & Functions of Nucleic acid
2. Brief about structure of DNA & RNA, DNA Replication, & Transcription
3. Advances in Genetic Engineering
4. Vitamins : Definition, classification, functions dietary sources, daily requirement & Deficiency disorders .



Unit-5: Enzymes & Hormones: (10 Hrs.)

1. Introductions, Importance Classifications & Properties of enzymes
2. Mechanism of enzyme action, Factors affecting enzyme action
3. Enzyme kinetics & enzyme inhibitors
4. Hormones: Introduction Definition & Classification of hormones. Mechanism of hormone action, Effects of hormones on various metabolism & hormonal disorders

Learning Outcomes: Students will know about various metabolism and different biochemical cycles, their production, lyses, requirements and uses.

Suggested Readings:

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chaterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer



Subject Name: Fundamentals of Histopathology

Subject Code: BMLS-304

Learning Objectives: The student will study diseases associated with different body organs and systems.

Unit-1: Alimentary & Digestive System: (14 Hrs.)

1. Diseases of mouth, Diseases of Esophagus- Esophageal varices.
2. Digestive System: Gastritis, Peptic ulceration, Appendicitis microbial diseases, food poisoning, hernia, Intestinal obstructions & mal absorption.
3. Accessory Digestive glands: Salivary glands- mumps Liver – hepatitis, liver failure, cirrhosis. Pancreas-pancreatitis.
4. Gall Bladder- Gall stones, jaundice and cardiovascular diseases.

Unit-2: Circulatory & Respiratory System: (14 Hrs.)

1. Diseases of Blood vessels- Atheroma, Arteriosclerosis, heart block.
2. Disorders of Blood Pressure-Hyper & Hypotension.
3. Respiratory System: Upper respiratory tract infection, Bronchi, Asthma
4. Pneumonia, Lung abscess, Tuberculosis, Lung Collapse.

Unit-3: Urinary & Reproductive System: (14 Hrs.)

1. Glomerulonephritis, Nephrotic syndrome, renal failure, renal calculi
2. Urinary obstruction, Urinary tract infection.
3. Reproductive system: Sexually transmitted diseases, Pelvic inflammatory disease
4. Disorder of cervix (CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility.

Unit-4: Nervous, Endocrine System & Sense Organs: (14 Hrs.)

1. Neuronal damage, ICP, Cerebral Infarction, head injury, Alzheimer's disease, dementia.
2. Endocrine System , Pituitary: Hyper & Hypo secretions.
3. Thyroid: Goiter , Adrenal: Cushing Syndrome, Addison Disease , Pancreas: Diabetes.
4. Ear: Otitis , Eye: Cataract.

Learning Outcomes: Students will able to identify the gross sections as per the nature of organs, tissue and diseases.

Suggested readings:

1. Anatomy & Physiology – Ross and Wilson
2. Human Anatomy and Physiology by Pearce
3. Di Fiore's Atlas of Histology
4. Medical Laboratory Technology by KL Mukherjee-Volume III
5. Text book of Pathology by Robbins



Subject Name: Systematic Bacteriology- Practical

Subject Code: BMLS-305

1. To demonstrate the instruments used to seed culture media
2. To learn techniques for Inoculation of bacteria on culture media
3. To isolate specific bacteria from a mixture of organisms.
4. To demonstrate simple staining (Methylene blue)
5. To prepare India ink preparation to demonstrate negative staining.
6. Bacterial identification: To demonstrate reagent preparation, procedure and interpretation for
 - 6.1 Gram stain
 - 6.2 Albert stain
 - 6.3 Neisser's staining
 - 6.4 Z-N staining
 - 6.5 Capsule staining
 - 6.6 Demonstration of flagella by staining methods
 - 6.8 Spore staining
 - 6.8 To demonstrate spirochetes by Fontana staining procedure
7. To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria:
 - 7.1 Catalase
 - 7.2 Coagulase
 - 7.3 Indole
 - 7.4 Methyl Red (MR)
 - 7.5 VogesProskauer (VP)
 - 7.6 Urease
 - 7.7 Citrate
 - 7.8 Oxidase
 - 7.9 TSIA
 - 7.10 Nitrate reduction
 - 7.11 Carbohydrate fermentation
 - 7.12 Huger and Leifson
 - 7.13 Bile solubility
 - 7.14 H₂S production
 - 7.15 Demonstration and motility
 - 7.16 Decarboxylases
 - 7.17 CAMP
 - 7.19 Hippurate hydrolysis
 - 7.19 Nagler's reaction
8. To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples i.e.
 - 8.1 Staphylococcus
 - 8.2 Streptococcus
 - 8.3 Corynebacterium
 - 8.4 Escherichia coli
 - 8.5 Klebsiella
 - 8.6 Citrobacter
 - 8.7 Enterobacter
 - 8.8 Proteus
 - 8.9 Salmonella
 - 8.10 Shigella
 - 8.11 Vibrio cholera
 - 8.12 Mycobacterium tuberculosis



Subject Name: Basic of Haematological Diseases- Practical
Subject Code: BMLS-306

1. Parts of microscope; its functioning and care
2. Parts of centrifuge; its functioning and care
3. General Blood Picture
4. TLC Count
5. DLC Count
6. Platelets Count
7. Demonstration of Normal & Alternatives forms of RBC,s
8. Demonstration of Normal & Alternatives forms of WBC,s
9. PT, APTT,PTT Test
10. BT,CT & Fibrinogen Assay
11. Haemoglobin estimation methods (Sahli's, Oxyhaemoglobin, and cyanmethaemoglobin)
12. Preparation of thick and thin blood smear for malarial parasite (Leishman/Giemsa/JSB)



Subject Name: Biochemical Metabolism

Subject Code: BMLS-307

1. To determine the presence of carbohydrates by Molisch test.
2. To determine the presence of reducing sugar by Fehling solutions
3. To determine the presence of reducing sugar by Benedicts method.
4. To determine starch by Iodine test.
5. Determination of Glucose in serum & plasma
6. Estimates of blood Glucose by Folin & Wu method
7. Determination of Urea in serum, plasma & urine.
8. Determination of Creatinine in serum or plasma
9. Determination of serum Albumin
10. Determination of Cholesterol in serum or plasma

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Subject Name: Fundamentals of Histopathology-Practical

Subject Code: BMLS-308

1. To study squamous cell from cheek cells (Buccal mucosa)
2. To study stained slide preparation from organs of digestive system
3. Study of stained slides of liver, pancreas, gall bladder
4. Study of various types of microscope and draw diagram in practical notebook
5. To study stained slide preparation from organs of circulatory system
6. To study stained slide preparation from organs of Respiratory system
7. To study stained slide preparation from organs of Nervous system
8. To study stained slide preparation from organs of Urinary system
9. To study stained slide preparation from organs of Endocrine system



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Fourth Semester (18-24 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -401	Applied Bacteriology	3	1	-	30	70	100	4
BMLS -402	Applied Haematology – I	3	1	-	30	70	100	4
BMLS -403	Analytical Clinical Biochemistry	3	1	-	30	70	100	4
BMLS -404	Applied Histopathology – I	3	1	-	30	70	100	4
BMLS -405	Applied Bacteriology– (P)	-	-	4	30	70	100	2
BMLS -406	Applied Haematology - I – (P)	-	-	4	30	70	100	2
BMLS -407	Analytical Clinical Biochemistry – (P)	-	-	4	30	70	100	2
BMLS-408	Applied Histopathology - I – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

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April 2020

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Subject Name: Applied Bacteriology

Subject Code: BMLS-401

Learning Objectives: This part will cover the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

Unit-1: (14 Hrs.)

1. Laboratory strategy in the diagnosis of various infective syndromes: Samples of choice, collection, transportation and processing of samples for laboratory diagnosis of the following
 - 1.1 complications:Septicemia and bacteremia
 - 1.2 Upper Respiratory tract infections
 - 1.3 Lower respiratory tract infections
 - 1.4 Wound, skin, and deep sepsis
 - 1.5 Urinary tract infections
 - 1.6 Genital Tract infections
 - 1.7 Meningitis
 - 1.8 Gastro intestinal infections
 - 1.9 Enteric fever
 - 1.10 Tuberculosis (Pulmonary and Extra-pulmonary)
 - 1.11 Pyrexia of unknown origin

Unit-1: Antibiotic susceptibility testing in bacteriology: (14 Hrs.)

- 2.1 Definition of antibiotics
- 2.2 Culture medium used for Antibiotic susceptibility testing
- 2.3 Preparation and standardization of inoculum
- 2.4 Control bacterial strains
- 2.5 Choice of antibiotics
- 2.6 MIC and MBC: Concepts and methods for determination
- 2.7 Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method



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Unit-3:

(14 Hrs.)

1. Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR)
2. Automation in bacterial culture detection and antimicrobial susceptibility testing: Principles and importance.
3. Bacteriological examination of water, food.
4. Introduction and importance of other bacteria considered as indicators of fecal contamination

Unit-4: Examination of Milk and milk products :

(14 Hrs.)

1. Basic Concepts regarding gradation of milk, Various tests for Bacteriological examination of milk
2. Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc.
3. Various tests for Bacteriological examination with special reference to food poisoning bacteria
4. Examination of Air, Significance of air bacteriology in healthcare facilities, Collection processing and reporting of an air sample

Unit-5: Sterility testing of I/v fluids & Nosocomial Infection:

(14 Hrs.)

1. Collection, transportation and processing of I/v fluids for bacterial contamination, Recording the result and interpretation
2. Nosocomial Infection: Introduction, sources and types of nosocomial infections.
3. Surveillance of hospital environment for microbial load, Role of microbiology laboratory in control of nosocomial infections
4. Epidemiological markers: Introduction, Types, Serotyping, Phage typing and Bacteriocin typing

Learning Outcomes: Understanding the significance of microorganisms in biogeochemical cycling of nutrients, sustainable development and bioremediation of pollutants for developing strategies of environmental conservation and remediation.

To learn various methods for their isolation, detection and identification of microorganisms in food and dairy and employ in industries.

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker & Satish Gupte



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4. Medical laboratory Technology Vol. I ,II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough
6. Hospital Acquired Infections-Power strategies for clinical practice by Dr. V Muralidhar and SumathiMurlidhar
7. Control of Hospital infection-A practical Handbook by GajAyliffe, A.P. Fraise, A.M. Geddes, K. Mitchell
8. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh

N. Upadhyay



Subject Name: Applied Haematology-I

Subject Code: BMLS-402

Learning Objectives: The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in Haematology laboratory.

Unit-1:

(14 Hrs.)

1. Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits
2. Haemocytometry: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors.
3. RBC,s & WBC,s Count
4. Platelets & Absolute Eosinophils Count

Unit-2:

(10 Hrs.)

1. Principle mechanism and different methods with merit and demerits for the measuring ESR.
2. Principle mechanism and different methods with merit and demerits for the measuring PCV.
3. Preparation of thin and thick smears and its uses; staining of blood smears
4. Differential leucocytes count by manual and automated method

Unit-3:

(10 Hrs.)

1. **Romanowsky Stain:** Principle, composition, preparation of staining reagents and procedure of the following stains: Giemsa's stain, Leishman's stain
2. Wright's stain, Field's stain, JSB stain.
3. Differential leucocytes count by manual and automated method
4. Physiological and pathological variations in leukocyte values

Unit-4:

(14 Hrs.)

1. **Semen analysis:** Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.
2. **CSF analysis:** Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.
3. **Pleural Fluid analysis:** Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.
4. **Others Fluid analysis:** Sample Collection, Transportation Preservation, Physical Examination, and Biochemical Examination & Microscopic Examination.



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Unit-5:

(10 Hrs.)

1. Preparation of Reagents for coagulation studies: M/40 Calcium chloride, Brain Thromboplastin
2. Preparation of Reagents for coagulation studies: Cephalin, Adsorbed Plasma
3. Screening Tests for coagulation Studies and their significance

Learning Outcomes: Students will be able to collect, preserve and process blood samples. They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-haematological investigations and coagulation profile tests.

Suggested Readings:

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology by G.A. McDonald
6. De Gruchy's Clinical Haematology in medical practice



Subject Name: Analytical Clinical Biochemistry

Subject Code: BMLS-403

Learning Objectives: The students will learn basic principles/mechanisms, procedures and various types of techniques commonly performed in analytical biochemistry

Unit-1: Spectrophotometry and colorimetry: (10 Hrs.)

1. Introduction, Theory of spectrophotometry and colorimetry,
2. Lambert's law and Beer's law
3. Applications of colorimetry and spectrophotometry.

Unit-2: Photometry: (10 Hrs.)

1. Introduction, General principles of flame photometry
2. Limitations of flame photometry, Instrumentation
3. Applications of flame photometry
4. Atomic absorption spectroscopy – Principle & applications.

Unit-3: Chromatography: (10 Hrs.)

1. Paper Chromatography & Gel Chromatography: Introduction, principle, types, details for qualitative and quantitative analysis, application.
2. Thin layer chromatography: Introduction, experimental techniques, application of TLC, limitations, High performance thin layer chromatography.
3. Column chromatography & Gas chromatography: Introduction, principle column efficiency, application of column chromatography.
4. Ion exchange chromatography: Introduction, Definition and principle, cation and anion exchangers, application.

Unit-4: Electrophoresis: (10 Hrs.)

1. Introduction, Principle, Instrumentation, Applications
2. Types of electrophoresis, Paper electrophoresis
3. Gel electrophoresis.



Learning Outcomes: students will be able to:

1. Describe and compare a range of analytical chemistry methods and explain the underlying theoretical principles;
2. Explain the broad role of analysts in quality control and assessment of experimental measurements from various application contexts;
3. Employ a variety of analytical methods to prepare, separate and characterise samples from various matrices;
4. As part of a team or individually, conduct, analyse and interpret results of a chemical analysis and effectively communicate these in written reports and other formats;
5. Work safely and competently in an analytical laboratory setting.

Suggested readings:

1. Practical Clinical Biochemistry by Harold Varley
2. Text book of Medical Laboratory Technology by P. B. Godker
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chatterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer



Subject Name: Applied Histopathology-I

Subject Code: BMLS-404

Learning Objectives: In this section, students will be made aware of terminology used in histotechnology, various instruments and their maintenance and also learn the processing of various samples for histopathological investigations.

Unit-1: Introduction: (10 Hrs.)

1. Introduction to Histotechnology
2. Compound microscope: Optical system, magnification and maintenance.
3. Applications of various types of microscopes i.e. dark field, polarizing, phase contrast, interference and fluorescent microscope
4. Care and maintenance of laboratory equipment used in histotechnology

Unit-2: Fixation & Decalcification: (10 Hrs.)

1. Safety measures in a histopathology laboratory
2. Basic concepts about routine methods of examination of tissues: Collection and transportation of specimens for histological examination
3. Basic concepts of fixation: Various types of fixatives used in a routine histopathology laboratory, Simple fixatives, Compound fixatives Special fixatives for demonstration of various tissue elements
4. Decalcification: Criteria of a good decalcification agent, Technique of decalcification followed with selection of tissue, fixation.

Unit-3: Tissue Processing: (10 Hrs.)

1. Processing of various tissues for histological examination, Steps & Methods.
2. Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing.
3. Components & principles of various types of automatic tissue: Processors
4. Embedding: Definition Various types of embedding media

Unit-4: Section Cutting: (10 Hrs.)

1. Section Cutting: Introduction regarding equipment used for sectioning
2. Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, various types of microtome and their applications
3. Freezing Microtome and various types of Cryostats.
4. Faults in paraffin section cutting with reason and remedy, spreading the sections and attachment or mounting of sections to glass slides.



Unit-5: Staining, Impregnation and Mountants:

(12 Hrs.)

1. Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasia
2. Preparation of Stains, solvents, aniline water and buffers etc.
3. General Staining Procedures for Paraffin Infiltrated and Embedded tissue, Nuclear Stains and Cytoplasmic stains
4. Equipment and Procedure for manual Staining and Automatic Staining Technique
5. Commonly used mountants in histotechnology lab, Mounting of Cover Slips, Labeling and Cataloguing the Slides

Learning Outcomes: Students will be able to identify the purpose, ingredients, function, and action of histological fixatives and the criteria for choosing the appropriate fixative.

Students will be able to demonstrate proper orientation and embedding of tissue specimens in paraffin.

Students will be able to demonstrate the ability to cut acceptable sections while performing routine microtomy of paraffin embedded tissue.

Suggested Readings:

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft



Subject Name: Applied Bacteriology-Practical

Subject Code: BMLS-405

1. Inoculation of different culture media
2. Isolation of pure cultures
3. Processing of following clinical samples for culture and identification of bacterial pathogens:
 - 3.1 Blood
 - 3.2 Throat swab
 - 3.3 Sputum
 - 3.5 Pus
 - 3.5 Urine
 - 3.6 Stool for Salmonella, Shigella and Vibrio cholerae
 - 3.7 C.S.F. and other body fluids
4. Demonstration of PCR
5. Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing
6. Antimicrobial susceptibility testing
7. Preparation and standardization of inoculums
8. To demonstrate reference bacterial strains
9. To determine MIC and MBC of known bacteria against a known antibiotic
10. To perform antibiotic susceptibility testing of clinical isolates by using
 - 10.2 Stokes method
 - 10.2 Kirby-Bauer method
11. Collection, transportation and processing of following articles for bacteriological examination:
Water, Milk, Food and Air
12. To demonstrate sterility testing of intravenous fluid with positive and negative controls
13. Demonstration of serotyping and bacteriocin typing
14. Demonstration of lyophilization and other available preservation methods



Subject Name: Applied Haematology-I-Practical

Subject Code: BMLS-406

1. Estimation of Haemoglobin
 - 1.1 Sahli's method
 - 1.2 Cyanmethaemoglobin method
 - 1.3 Oxyhaemoglobin method
2. Total leukocyte count
3. Platelets count
4. Absolute Eosinophil count
5. Preparation of smear and staining with Giemsa and Leishman stain.
6. ESR (Wintrobe and Westergren method)
7. Packed cell volume (Macro & Micro)
8. Routine Examination of CSF
9. Physical and Microscopic examination of seminal fluid including sperm count
10. Perform normal DLC



Subject Name: Analytical Clinical Biochemistry-Practical
Subject Code: BMLS-407

1. To demonstrate the principle, working & maintenance of spectrophotometer.
2. To demonstrate the principle, working & maintenance of colorimeter.
3. To demonstrate the principle, working & maintenance of flame photometer.
4. To demonstrate the principle, procedure of paper chromatography.
5. To demonstrate the principle & procedure of Gas chromatography.
6. To demonstrate the principle & demonstration of TLC.
7. To demonstrate the principle & procedure of column chromatography.
8. To demonstrate the principle & procedure of Electrophoresis.

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Subject Name: Applied Histopathology-I

Subject Code: BMLS-408

1. Demonstration of instruments used for dissection
2. Use of antiseptics, disinfectants and insecticides in a tissue culture processing laboratory
3. Reception and labeling of histological specimens
4. Preparation of various fixatives
 - 4.1 Helly's fluid
 - 4.2 Zenker's fluid
 - 4.3 Bouin's fluid
 - 4.4 Corney's fluid
 - 4.5 10% Neutral formalin
 - 4.6 Formal saline
 - 4.8 Formal acetic acid
 - 1.8 Pereyn's fluid
2. Testing of melting point of paraffin wax and perform embedding of given tissue in paraffin block
3. To process a bone for decalcification
4. To prepare ascending and descending grades of alcohol from absolute alcohol
5. Processing of tissue by manual and automated processor method
6. To demonstrate various part and types of microtome
7. To learn sharpening of microtome knife (Honing and stropping technique), and types of disposable blades in use (High and Low Profile).
8. To perform section cutting (Rough and Fine)
9. To practice attachment of tissue sections to glass slides
10. To learn using tissue floatation bath and drying of sections in oven (60-65C)
11. To perform & practice the Haematoxylin and Eosin staining technique
12. To perform & practice the Mallory's Phospho tungstic Acid Haematoxylin (PTAH)
13. To learn mounting of stained smears



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Fifth Semester (24-30 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS -501	Immunology & Bacterial serology	3	1	-	30	70	100	4
BMLS -502	Applied Haematology – II	3	1	-	30	70	100	4
BMLS -503	Applied Clinical Biochemistry – I	3	1	-	30	70	100	4
BMLS -504	Applied Histopathology - II	3	1	-	30	70	100	4
BMLS -505	Immunology & Bacterial serology – (Practical)	-	-	4	30	70	100	2
BMLS -506	Applied Haematology - II – (Practical)	-	-	4	30	70	100	2
BMLS -507	Applied Clinical Biochemistry – I- (Practical)	-	-	4	30	70	100	2
BMLS-508	Applied Histopathology-II – (Practical)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						



Subject Name: Immunology & Bacterial Serology

Subject Code: BMLS-501

Learning Objectives: This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

Unit-1: History and introduction to immunology: (10 Hrs.)

1. Immunity
2. Innate
3. Acquired immunity
4. Basic concepts about their mechanisms

Unit-2: Antigen & Antibody: (10 Hrs.)

1. Definition, types of antigens and determinants of antigenicity
2. Definition, types, structure and properties of immunoglobulin
3. Antigen-Antibody reactions: Definition, Classification, General features and mechanisms
4. Applications of various antigen antibody reactions

Unit-3: Techniques Used in Medical Microbiology: (10 Hrs.)

1. Principle, procedure and applications of under mentioned in Medical Microbiology:
Complement fixation test
2. Immuno- fluorescence, ELISA
3. SDS-PAGE
4. Western blotting

Unit-4: Serological Test & Complement System: (10 Hrs.)

1. Principle, procedure and interpretation of various serological tests:
Widal, VDRL, ASO
2. CRP, Brucella tube agglutination, Rose-Waaler
3. Complement system: Definition, Basic concepts about its components
4. Complement activation pathways



Unit-5: Immune Response, Hypersensitivity & Vaccines: (12 Hrs.)

1. Immune response: Introduction, Basic concepts of Humoral and Cellular immune responses
2. Hypersensitivity: Definition, Types of hypersensitivity reactions
3. Basic concepts of autoimmunity and brief knowledge about autoimmune diseases
Automation in diagnostic serology
4. Vaccines: Definition, Types, Vaccination schedule
5. Brief knowledge about Extended programme of immunization' (EPI) in India

Learning Outcomes: The ability to understand, implement and troubleshoot the concepts related to the fields of Immunology and Serology which will enable them to analyze and develop solutions to microbiology, immunology and Serology related problems using knowledge and hands-on skills in immunodiagnostics, screening for useful Serological Investigation in relevant protocols.

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker & Satish Gupte
4. Medical laboratory Technology Vol. I, II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough
Immunology by Riot
6. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites
7. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh



Subject Name: Applied Haematology-II

Subject Code: BMLS-502

Learning Objectives: The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, Karyo typing etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, L.E. cell phenomenon.

Unit-1: Automation in Haematology: (10 Hrs.)

1. Safety precautions in Haematology
2. Principle of automated blood cell counter; Uses, care, maintenance and calibration of automated blood cell counter
3. Automatic ESR analyzer, urine analyzer
4. Coagulometer

Unit-2: Bone Marrow Examination: (10 Hrs.)

1. Composition and functions, Aspiration of bone marrow (Adults and children)
2. Processing of aspirated bone marrow (Preparation & staining of smear)
3. Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios)
4. Processing and staining of trephine biopsy specimens

Unit-3: Red Cells Indices: (10 Hrs.)

1. Red cell anomalies
2. Morphological changes such as variation in size shape & staining character.
3. MCV, MCH, MCHC & RDW
4. Reticulocytes: Definition, different methods to count, Absolute reticulocyte count

Unit-4: L.E Cells & Factors Deficiency: (10 Hrs.)

1. Lupus Erythematosus (L.E) cell phenomenon: Definition of L.E. cell.
2. Demonstration of L.E. cell by various methods & Clinical significance.
3. Quantitative assay of coagulation factors : Principle, Procedure
4. Screening of inhibitors

Unit-5: Cytochemical Stains Used in Haematology: (10 Hrs.)

1. Karyotyping: Chromosomal studies in hematological disorders (PBLC and Bone marrow)
2. Cyto-chemical staining: Principles, method and significance
3. PAS, SBB, NAP & MPO
4. Biomedical waste management in Haematology laboratory (Other than Radioactive material)



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Learning Outcomes: They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-haematological investigations and coagulation profile tests. They will be able to handle automated instruments.

Suggested Readings:

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Practical Haematology by JB Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henery
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice







Subject Name: Applied Clinical Biochemistry-I

Subject Code: BMLS-503

Learning Objectives: The students will be taught about Hazards & safety measures in a clinical biochemistry lab, Quality control and quality assurance, Principles of assay procedures and Estimation of various Investigations in Biochemistry Lab.

Unit-1:

(10 Hrs.)

1. Hazards & safety measures in clinical Biochemistry laboratory
2. Quality control and quality assurance in a clinical biochemistry laboratory
3. Laboratory organization
4. Management and maintenance of records

Unit-2:

(10 Hrs.)

1. Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference values for: Glucose, Proteins
2. Urea, Uric acid
3. Bilirubin, SGOT & SGPT, ALP
4. Lipids

Unit-3:

(10 Hrs.)

1. Principles, procedures for estimation & assessment of the following including errors involved and their corrections: Sodium, Potassium
2. Chloride, Iodine
3. Calcium
4. Phosphorous and Phosphates

Unit-4:

(10 Hrs.)

1. Instruments for detection of Radioactivity
2. Applications of Radioisotopes in clinical biochemistry.
3. Enzyme linked immune sorbent assay (ELISA)
4. RIA



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Unit-5:

(10 Hrs.)

1. Acid base balance, action of buffer system
2. Hb buffers
3. Respiratory and metabolic acidosis, respiratory and metabolic alkalosis,
4. Arterial blood gas analysis, blood gas analyzer.

Learning Outcomes: They will be able to Diagnosis of clinical disorders by estimating biomarker, Determine various substances including substrates, enzymes, hormones, etc and their use in diagnosis and monitoring of disease are applied, evaluate the abnormalities which commonly occur in the clinical field, review the information from each category of tests and develop a protocol for disease diagnosis

Suggested Readings:

1. Text book of Medical Laboratory Technology by P.B. Godkar.
2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
4. Biochemistry, U. Satyanarayan & U. Chakrapani.
5. Text book of Medical Biochemistry by Chatterjee & Shinde.
6. Principal of Biochemistry by Lehninger
7. Biochemistry by Voet & Voet
8. Biochemistry by Stryer



Subject Name: Applied Histopathology-II

Subject Code: BMLS-504

Learning Objectives: Students will learn about various staining procedures for demonstration of different substances. The students will learn about special staining procedures, its handling & testing of various histological specimens in addition to cryostat sectioning and electron microscopic procedures.

Unit-1: (10 Hrs.)

1. Cryostat sectioning, its applications in diagnostic histopathology.
2. Connective tissue stains and staining methods , properties, PTAH, Reticulin, verhoff
3. Masson trichrome, VenGiesson, Heidemhain's Aniline Blue Method
4. Mucin: Types, various stains and staining methods PAS, alcian blue, Mucicarmin.

Unit-2: (10 Hrs.)

1. Lipids: Types, identification with various stains and staining method (Sudan ,oil red O).
2. Pigments: Various pigments, identification with various stains methods and staining (hemosiderin melanin).
3. Miscellaneous (calcium) Vonkossa's Stains
4. Amyloid :-Toludineblue, Metachromatic Stains.

Unit-3: (10 Hrs.)

1. Identification of microorganisms using various stains. Modified Giemsa Stains, Silver Nitrate GMS.
2. Demonstration of Proteins & nucleic acids.
3. Tissue requiring special treatment i.e. eye ball, bone marrow, and muscle biopsy
4. Under calcified or unclarified bones, whole brain, and whole lungs including other large organs.

Unit-4: (10 Hrs.)

1. Immuno histochemical and immuno cytochemical staining, quality control.
2. Enzyme histochemistry: Introduction, Diagnostic applications
3. Demonstration of Phosphatases, Dehydrogenases,
4. Demonstration of Oxidizes & Peroxidases.



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Unit-5:

(10 Hrs.)

1. Neuro-pathological techniques.
2. Museum techniques.
3. Electron Microscope: working principle and its components
4. Processing, embedding and ultra-microtomy

Learning Outcomes: Justify when to use cryopreservation to preserve tissue and how a cryostat functions; apply the correct stains to enhance particular cellular and tissue structures for examination; explain the underlying principles of microtomy and be able to apply them; and determine the features of common diseases under the microscope using the systems described above.

Suggested Readings:

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft



Subject Name: Immunology & Bacterial Serology- Practical
Subject Code: BMLS-505

1. Collection of blood sample by vein puncture, separation and preservation of serum
2. Performing Haemolysin titration for Rose-Waaler test
3. Preparation of Phosphate buffers, Verinol buffer, ASO buffer, Richardson's buffer, Buffers of different pH and Molarity, Tris buffer, Standardization of cell concentration by Spectrophotometer
4. Performance of Serological tests i.e.
Widal, Brucella Tube Agglutination,
VDRL (including Antigen Preparation),
ASO (Anti-Streptolysin 'O')
C-Reactive Protein (Latex agglutination)
Rheumatoid factor (RF) Latex agglutination
5. Demonstration of antigen/antibody determination by Immuno fluorescence (IF)
6. Immunodiffusion, precipitation in Agarose gel (Ouchterlony)
7. CCIEP, ELISA, SDS - PAGE and Western blotting.



Subject Name: Applied Haematology-II- Practical

Subject Code: BMLS-506

1. Review the morphology of Normal and abnormal RBCs
2. Review the morphology of normal and immature WBCs
3. Calculating INR and determining the ISI of thromboplastin
4. Quantitative Factor assays:
 - 1 Factor VIII
 - 2 Factor IX
 - 3 Factor VII
 - 4 Factor X
 - 5 Factor V
5. Quantification of inhibitors (Bethesda method)
6. APLA : Lupus Anticoagulant (LA)
7. Anti-cardiolipin antibodies (ACA)
8. Perform Euglobulin clot lysis test (ELT)
 - a. Urea clot solubility test for factor XIII.



Subject Name: Applied Clinical Biochemistry-I- Practical

Subject Code: BMLS-507

1. Estimation of Glucose in Urine and in Blood.
2. Estimation of Protein in Urine and Blood.
3. Estimation of Urea in blood.
4. Estimation of uric acid in blood.
5. Estimation of serum Bilirubin
6. Estimation of Total Cholesterol in blood.
7. Estimation of HDL Cholesterol.
8. Estimation of LDL Cholesterol.
9. Estimation of TG
10. Estimation of Creatinine in Blood
11. Estimation of serum calcium, Inorganic phosphate
12. To measure electrolytes Sodium, Potassium & Chloride.



Subject Name: Applied Histopathology-II- Practical

Subject Code: BMLS-508

1. To cut frozen section and stain for Haematoxylin and Eosin, Metachromatic stain
Toluidine blue and Oil Red O' staining for the demonstration of fat
2. To prepare Schiff's reagent in the lab and do Periodic Acid Schiff's (PAS) stain on a
Paraffin section
4. To stain a paraffin section for the demonstration of smooth muscle by Van Gieson's Stain
5. To perform Masson's trichrome stain on a paraffin section for the demonstration of
collagen fiber, muscle fiber and other cell elements.
6. To stain the paraffin section for the demonstration of the elastic fibers (EVG).
7. To stain Decalcified paraffin embedded section for the presence of calcium salts (Von
Kossa's method).
8. To stain a paraffin section for the following Mucicarmine, Alcian blue.
9. To stain a paraffin section for the demonstration of iron (Perl's stain)
10. To demonstrate the presence of bacteria and fungi in paraffin embedded sections using
The following staining procedures:
 - 10.1 Gram's staining
 - 10.2 AFB staining (Ziehl Neilsen's staining) for M. tuberculosis and leprae
 - 10.3 Grocott's stain for fungi
 - 10.4 Schmorl's reaction for reducing substances (melanin)
11. To stain for nucleic acid (DNA and RNA)
 - 11.1 Feulgen Staining
 - 11.2 Methyl Green-Pyronin Staining
 - 11.3 Enzymatic methods



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Sixth Semester (30-36 months)

Subject Code	Course Titles	Hours per			Marks			CR
		week			Internal	External	Total	
		L	T	P				
BMLS -601	Medical Parasitology & Entomology	3	1	-	30	70	100	4
BMLS -602	Advanced Haematology	3	1	-	30	70	100	4
BMLS -603	Applied Clinical Biochemistry – II	3	1	-	30	70	100	4
BMLS -604	Cytopathology	3	1	-	30	70	100	4
BMLS -605	Medical Parasitology & Entomology - (P)	-	-	4	30	70	100	2
BMLS -606	Advanced Haematology - (P)	-	-	4	30	70	100	2
BMLS -607	Applied Clinical Biochemistry – II-- (P)	-	-	4	30	70	100	2
BMLS-608	Cytopathology - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						



Subject Name: Medical Parasitology & Entomology

Subject Code: BMLS- 601

Learning Objectives: The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

Unit-1: Introduction to Medical Parasitology & Protozoology: (12 Hrs.)

1. Introduction to Medical Parasitology with respect to terms used in Parasitology.
2. Protozoology/ Protozoal parasites: General characteristics of protozoa.
3. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp.
4. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Intestinal and vaginal flagellates i.e. Giardia, Trichomonas sp.
5. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasma sp.

Unit-2: Helminthology/ Helminthic parasites-I: (12 Hrs.)

1. General characteristics of Cestodes, Trematodes and Nematodes
2. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of : Taeniasolium and saginata
3. Echinococcusgranulosus, Hymenolepis nana
4. Chistosoma haematobium and mansoni

Unit-3: Helminthology/ Helminthic parasites-II: (12 Hrs.)

1. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of : Fasciola hepatica and buski
2. Trichuristrichura, Trichinellaspiales
3. Strongyloidesstercoralis, Ancylostomaduodenale, Enterobiusvermicularis
4. Ascarislumbricoides, Wuchereriabancrofti, Dracunculusmedinensis

Unit-4: Diagnostic Procedure-I: (12 Hrs.)

1. Examination of Stool for parasites For intestinal protozoal infections: Collection of stool samples, Preparation of material for unstained and stained preparations, Staining methods i.e. Iodine staining and permanent staining
2. For Helminthic infections: Concentration techniques i.e. Flotation and sedimentation techniques, Egg counting techniques
3. Examination of blood for parasites: Preparation of thin and thick blood film, Leishman stainin
4. Examination of thick and thin smear: Field's stain, JSB stain



Unit-5: Diagnostic Procedure-II:

(12 Hrs.)

1. Morphology, life cycle and lab-diagnosis of Malarial parasite with special reference to P.vivax and P. falciparum
2. Examination of blood film for Malarial parasite and Microfilariae
3. Laboratory diagnosis of hydated cyst and cysticercosis
4. Concentration techniques for demonstration of Ova and Cysts (Principles and applications)

LEARNING OUTCOME: Upon successful completion, students will have the knowledge and skills to:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Identify, describe and contrast unicellular parasites and parasitic worm
2. Prepare and observe live parasitic specimens and test students' own seropositivity for a particular parasitic infection
3. Report on observations of biological specimens such as parasites
4. Appraise the impacts of parasitic diseases on human societies
5. Assemble a presentation on a current topic in parasitology (literature research, selection of relevant sources of information, evaluation of the information/data, formulation of the research's results)

Suggested Readings:

1. Parasitology in relation to Clinical Medicine by K D Chatterjee
2. Medical Entomology by A.K. Hati, Pub. Allied Book Agency
3. Medical Parasitology by D.R. Arora
4. Clinical Parasitology by Paul Chester Beaver
5. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh



Subject Name: Advanced Haematology

Subject Code: BMLS- 602

Learning Objectives: The students will be made aware of different anemia, Leukemia, chromosomal studies, bleeding disorders and radiation hazards.

Unit-1: Anaemias-I: (12 Hrs.)

Definition , causes, changes in blood morphology due to the following anaemias and special tests-

1. Iron deficiency anemia
2. Megaloblastic anaemia,
3. Aplastic anaemia
4. Sideroblastic anaemia

Unit-2: Anaemias-II: (12 Hrs.)

Definition , causes, changes in blood morphology due to the following anaemias and special tests

1. Sickle cell anaemia, Autoimmune hemolytic anaemia,
2. Hereditary spherocytosis, G6PD deficiency anaemia
3. Thalassemia
4. Sickling test, Osmotic fragility test, Schilling test, Serum Iron, Iron binding capacity.

Unit-3: Leukemia: (12 Hrs.)

1. Definitions, morphology, identification of various abnormal cells in common Leukemia's
2. Acute Leukemia: AML, ALL
3. Chronic Leukemia: AML , CLL
4. Plasma cell myeloma.

Unit-4: Bleeding Disorders: (12 Hrs.)

1. Hemophilia A, B & Von-Willebrand disease
2. DIC,
3. Platelet disorder (Qualitative and quantitative)
4. Laboratory approach for investigating thrombosis.

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Unit-5: Radioisotopes Measurement:

(12 Hrs.)

1. Using radioisotopes measurement of: Blood volume
2. Determination of Red cell volume and Plasma volume
3. Red cell life span, Platelet life span
4. Radiation hazards and its prevention, Disposal of radioactive material

Learning Outcomes:

- Students will able to Differentiate and categorize the normal and abnormal morphology of the different cell types in the blood and bone marrow
- Analyze and compare the basic pathology related to these different abnormalities in the red and white blood cells
- Apply the basic knowledge in hematology for future professional training (e.g. Clinical Laboratory Scientist training program)
- Interpret the clinical and laboratory information to understand and classify different types of anemia.

Suggested Readings:

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Practical Haematology by JB Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice
7. Postgraduate Haematology by Hoffbrand



Subject Name: Applied Biochemistry-II

Subject Code: BMLS- 603

Learning Objectives: The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important enzymes & automation techniques.

Unit-1: Automation in clinical biochemistry: (12 Hrs.)

1. Automation in clinical biochemistry
2. Method of estimation and assessment for: Glucosetolerance test
3. Method of estimation and assessment for: Insulin tolerance test
4. Method of estimation and assessment for: Xylose excretion test.

Unit-2: Gastric analysis & Qualitative Test: (12 Hrs)

1. Gastric analysis.
2. Clearance test for renal function.
3. Qualitative test for: Urobilinogens, Barbiturates
4. Ketosteroids

Unit-3: Organ Profile Test: (12 Hrs)

1. Lipid Profile Test
2. Renal Function Test
3. Thyroid Function Test
4. Liver Function Test & Cardiac Function Test

Unit-4: Enzymes: (12 Hrs)

1. Enzymes: Principles, Clinical significance and Procedures for estimation:
Acid phosphatase, Alkaline phosphatase
2. Lactate dehydrogenase
3. Aspartate transaminase
4. Alanine transaminase & Creatine phosphokinase





Unit-5: Body Cavity Fluid:

(12 Hrs)

1. Qualitative analysis of Renal calculi.
2. Chemical examination of Cerebrospinal fluid.
3. Chemical examination of Ascitic fluidn & Pleural Fluid.
4. Brief knowledge about rapid techniques in clinical biochemistry

Learning Outcomes: Students will know basics and procedure of different parameters used to assess organ function. The students will learn to perform assay of clinically important enzyme: serum alkaline phosphatase, serum creatine phosphokinaseand serum acid phosphatase.

Suggested Readings:

1. Text book of Medical Laboratory Technology by P.B. Godkar.
2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
4. Biochemistry, U. Satyanarayan& U. Chakrapani.
5. Text book of Medical Biochemistry by Chaterjee&Shinde.
6. Principal of Biochemistry by Lehninger
7. Biochemistry by Voet&Voet
8. Biochemistry by Stryer



Subject Name: Cytopathology & Cytotechniques

Subject Code: BMLS- 604

Learning Objectives: The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures & handling & testing of various cytological specimens.

Unit-1: Introduction:

(12 Hrs.)

1. Introduction, Definition, Branches of Cytopathology.
2. Aspiration cytology- Principles, indications and utility of the technique with special emphasis on role of cytotechnician in FNAC clinics
3. Equipments used in FNAC clinics.
4. Exfoliative Cytology- Principles, indications and utility of the technique, Sample collection, labelling, preparation, processing of cervical, endometrial, respiratory tract, gastro intestinal tract and urinary tract sample, Smear preparation.

Unit-2: Diagnostic Cytopathology:

(12 Hrs.)

1. Fixatives and fixations: - types, uses, merits, demerits.
2. Cell Block preparation.
3. Cryostat sectioning, its applications in diagnostic cytopathology
4. Vital staining for Sex Chromatin

Unit-3: Enzyme Cytochemistry & Fluid Cytology:

(12 Hrs.)

1. Enzyme Cytochemistry: Diagnostic applications
2. Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases
3. Fluid Cytology :- Sample Collection, Assessment of smearing and staining
4. Urine, CSF, Body Fluids (Pleural, Pericardial, Ascitic).

Unit-4: Automation in Cytology & Staining:

(12 Hrs.)

1. Liquid based cytology: Principles and preparation
2. Cytoentrifuge, molecular cytology
3. Immune-cytochemistry
4. MGG & PAP Stainig



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Unit-5: Special Stains Used in Cytopathology: (10 Hrs.)

1. PAS
2. Alcian Blue
3. Mucicarmin
4. Giemsa, Sudan.

Learning Outcomes: Identifies various specimens and processing techniques employed in cytology
Students will able to collect and proceed various Specimens in different sections of Cytopathology lab.
The will able to used Automation in Cytopathology.

Suggested Readings:

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft
5. Diagnostic Cytology by Koss Volume -II

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Subject Name: Medical Parasitology & Entomology- Practical

Subject Code: BMLS- 605

1. Routine stool examination for detection of intestinal parasites with concentration methods:
 - 1.1 Saline preparation
 - 1.2 Iodine preparation
 - 1.3 Floatation method
 - 1.4 Centrifugation method
 - 1.5 Formal ether method
 - 1.6 Zinc sulphate method
2. Identification of adult worms from models/slides:
 - 2.1 Tapeworm
 - 2.2 Tapeworm segments
 - 2.3 Ascaris (Round worm)
 - 2.4 Hookworms
 - 2.5 Pinworms
5. Malarial parasite:
 - 3.1 Preparation of thin and thick smears
 - 3.2 Staining of smears
 - 3.3 Examination of smears for malarial parasites (P. vivax and P. falciparum)











Subject Name: Advanced Haematology- Practical

Subject Code: BMLS- 606

1. Study and interpretation of Histogram of Automated Blood cell counter
2. To estimate serum iron and total iron binding capacity.
3. Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD
4. To estimate Hb-F, Hb-A2 in a given blood sample.
5. To estimate plasma and urine Hemoglobin in the given specimens.
6. To demonstrate the presence of Hb-S by Sickling and Solubility tests.
7. Perform Hb electrophoresis (alkaline)
8. Perform osmotic red cell fragility.
9. Detection of Fibrin degradation products (FDPs)
10. To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test.
11. Peripheral Blood Lymphocyte Culture for chromosome studies in Leukemia.




Subject Name: Applied Clinical Biochemistry-II- Practical

Subject Code: BMLS- 607

1. Estimation of Glucose tolerance test (GTT).
2. Estimation of Insulin tolerance test (ITT).
3. Determination of Uric acid in Urine.
4. Determination of Creatinine clearance.
5. Determination of Urea clearance.
6. Determination of Serum acid phosphatase.
7. Determination of Serum Alkaline phosphatase.
8. Determination of Serum Lactate dehydrogenase.
9. Determination of T3, T4 and TSH









Subject Name: Cytopathology & Cytotechniques- Practical
Subject Code: BMLS- 608

1. To perform Papnicolaou's stain on cervical smear
2. To perform Guard's staining for demonstration sex chromatin (Barr bodies on a buccal smear)
3. To perform Shorr's staining for Hormonal assessment
4. To cut frozen sections of Gynaec tissue
5. To perform CSF sample and body fluids by cytospin
6. Should know the various stains used in Cytology lab:|| May Grunwald Giemsa, H&E, PAS, Grocott's.



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Seventh Semester (36-42 months)

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS-701	Medical Virology & Mycology	3	1	-	30	70	100	4
BMLS-702	Blood Banking & Genetics	3	1	-	30	70	100	4
BMLS-703	Immunopathology & Molecular Biology	3	1	-	30	70	100	4
BMLS-704	Research methodology and Biostatistics	3	1	-	30	70	100	4
BMLS-705	Principles of Laboratory Mangement	3	1	-	30	70	100	4
BMLS-706	Medical Mycology and Virology - (P)	-	-	4	30	70	100	2
BMLS-707	Blood Banking & Genetics- (P)	-	-	4	30	70	100	2
BMLS-708	Immunopathology & Molecular Biology – (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		15	7	12	240	560	800	26
Total Hours in Semester		550						

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Subject Name: Medical Virology & Mycology

Subject Code: BMLS-701

Learning Objectives: The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important Viruses & Fungi.

Unit-1: Introduction to Virology: (12 Hrs.)

1. Introduction to medical virology, Introduction to medically important viruses.
2. Structure and Classification of viruses
3. Collection, transportation and storage of sample for viral diagnosis.
4. Staining techniques used in Virology

Unit-2: Virus Culture: (12 Hrs.)

1. Processing of samples for viral culture (Egg inoculation and tissue culture).
2. Modes of viral transmission: Persistent, non-persistent, vertical and horizontal
3. Viral multiplication and replication strategies:
4. Interaction of viruses with cellular receptors and entry of viruses. Assembly, maturation and release of virions.

Unit-3: Details of Viruses: (12 Hrs.)

1. Poxviruses, Herpesviruses, hepatitis viruses, retroviruses-HIV, Picorna viruses, rhabdoviruses
2. Orthomyxoviruses and paramyxo viruses, TORCH profile, Symptoms, mode of transmission, prophylaxis and control of Polio, Herpes, Hepatitis, Rabies, Dengue, HIV
3. Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis.
4. Introduction to oncogenic viruses, Types of oncogenic DNA and RNA viruses, concepts of oncogenes and proto-oncogenes
5. Prevention & control of viral diseases, antiviral compounds and their mode of action, interferon and their mode of action, General principles of viral vaccination

Unit-4: Introduction to Mycology: (12 Hrs.)

1. Introduction to Medical Mycology Basic concepts about superficial and deep Mycoses
2. Taxonomy and classification and general characteristics of various medically important fungi
Normal fungal flora.
3. Techniques used for isolation and identification of medically important fungi.
4. Direct microscopy in Medical mycology laboratory, Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids.



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Unit-5: Details of Fungi: (12 Hrs.)

1. Morphology, Diseases & lab diagnosis of: Candida, Dermatophytes, Mycetoma (Eumycetoma & Actinomycetoma), Cryptococcus, Histoplasmosis
2. Opportunistic Fungi, Blastomyces, coccidioidosis, Nocardia.
3. Methods for identification of yeasts and moulds, Dimorphism in fungi, Antifungal susceptibility tests.
4. Preservation of fungal cultures, Routine myco-serological tests and skin tests.

Learning Outcomes: Students will able to Explain viruses, fungi including their classification, morphology, and laboratory diagnosis and prevention measures, Perform laboratory investigations for the diagnosis of infectious diseases caused by viruses, fungi, Discuss various viral fungal diseases of human.

Suggested Readings:

1. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Panikar & Satish Gupte
4. Medical laboratory Technology Vol. I, II, III by Mukherjee
5. Medical Laboratory manual for tropical countries Vol. II Microbiology by Monica Cheesbrough
6. Medical Mycology by Dr. JagdishChander
7. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh

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Subject Name: Blood Banking & Genetics

Subject Code: BMLS-702

Learning Objectives: Blood banking will make students learn about blood grouping & blood, Transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various Infection Diseases. Genetics will make students learn about Fundamentals of Heredity. The students will learn about the concept of inheritance in various genetic diseases.

Unit-1: History & Discovery of Blood Group: (12 Hrs.)

1. History and discovery of blood group system
2. ABO and Rhesus blood group system
3. Cell and serum grouping
4. Various methods, interpretation of results.

Unit-2: Techniques: (12 Hrs.)


1. Discrepancies in blood grouping and resolving problems
2. Variants of D antigen and weak D typing.
3. Compatibility testing:- definition, indication methods.
4. Coombs test:- Direct, indirect, principle, procedure, interpretation, applications.

Unit-3: Blood Components: (12 Hrs.)

1. Blood component: Preparation, labeling, storage, cell separator
2. Preparation of packed cells and various fractions of blood for transfusion purposes.
3. Preparation of PRP, FP, FFP and Cryoprecipitate
4. Total quality management, documentation record keeping.

Unit-4: Transfusion Reactions: (12 Hrs.)

1. Transfusion reactions: Definitions, classification & Causes
2. Laboratory investigation of transfusion reactions and mismatched, transfusion reactions.
3. Compatibility tests in blood transfusion, complications and hazard of blood transfusion.
4. Transfusion transmissible diseases, screening methods (Sample collection, processing, handling and disposal).

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Unit-5: Genetics:

(12 Hrs.)

1. Continuity of life-heredity, variation
2. Mendel's laws of inheritance, Chromosomal basis of inheritance; other patterns of inheritance
3. Incomplete dominance, multi parallelism, quantitative inheritance.
4. Chromosomes-Bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination.
5. Molecular genetics: DNA as a genetic material- its structure and replication; structure of RNA and its role in protein synthesis, Vectors, plasmids, Human Genetics, Microbial genetics.

Learning Outcomes:

- Apply advanced blood bank and blood transfusion knowledge to make appropriate and effective on-the-job professional decisions.
- Perform and interpret commonly utilized procedures in the blood bank laboratory.
- Recognize normal and abnormal test results and correlate these data with appropriate pathologic conditions to accurately advise health care providers.
- Adapt immunohematology laboratory techniques and procedures when errors and discrepancies in results are obtained to effect resolution in a professional and timely manner.

Suggested readings:

1. Practical Haematology by J.B. Dacie
2. Transfusion Science by Overfield, Hamer
3. Medical Laboratory Technology by K.L. Mukherjee Volume-I
4. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein
5. Genes by Benjamin Lewin
6. Genetics by B.D. Singh
7. Principals of Genetics by Gardner
8. Instant Notes on Genetics by PC Winter, GI Hickey and HL Fletcher



Subject Name: Immunopathology & Molecular Biology

Subject Code: BMLS-703

Learning Objectives The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques. Molecular biology concerns the molecular basis of biological activity between biomolecules in the various systems of a cell, including the interactions between DNA, RNA and proteins and their biosynthesis, as well as the regulation of these interactions. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenges.

Unit-1: History & Introduction:

(12 Hrs.)

1. Historical background, general concepts of the immune system,
2. innate and adaptive immunity; active and passive immunity
3. Primary and secondary immune response.
4. Cells and Organs of the immune system, Lymphoid organs of the Immune system, MHC I & II

Unit-2: Antigen & Antibody:

(12 Hrs.)

1. Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity.
2. Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies
3. Ddifferent classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype,
4. Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody

Unit-3: HLA & Hypersensitivity:

(12 Hrs.)

1. HLA Typing & Cross matching
2. Transplant Immunology.
3. Hypersensitivity: Definition, Types, Mechanisms, Autoimmunity
4. Immune tolerance : Basic concepts.



Unit-4: Molecular Biology: (12 Hrs.)

1. Introduction to Molecular Biology
2. Relationship of Mol. Biology with other Science.
3. Molecular Biology Techniques: Principle, Reagents used, procedure and applications in Medical diagnostics.
4. Polymerase Chain Reaction and its advanced versions, Gel electrophoresis, Western blot.

Unit-5: Molecular Biology: (12 Hrs.)

1. Chemical composition of DNA , DNA replication.
2. DNA damage and repair.
3. Regulation of prokaryotic and eukaryotic gene expression
4. Cell Cycle.

Learning Outcomes:

- Demonstrate the basic knowledge of immunological processes at a cellular and molecular level
- Define central immunological principles and concepts
- Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate
- Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses
- Understand and explain the basis of immunological tolerance, autoimmunity and transplantation
- Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology
- Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology

Suggested Readings:

1. Immunology by Ivan Roitt, Jonathaan Brostoff and David Male
2. Immunology by Kuby
3. Medical Immunology by Daniel P Stites
4. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites
5. Elements of Biotechnology by PK Gupta
6. Watson Molecular Biology of Gene
7. Advanced Molecular Biology by R Twyman
8. Principles of Biochemistry by Lehninger

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Subject Name: Research Methodology & Biostatistics

Subject Code: BMLS-704

Learning Objectives: The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.

Unit-1: (08 Hrs.)

1. Research Methodology: Introduction to research methods
2. Identifying research problem.
3. Ethical issues in research- Research design
4. Basic Concepts of Biostatistics.

Unit-2: (08 Hrs.)

1. Types of Data
2. Research tools and Data collection methods
3. Sampling methods
4. Developing a research proposal

Unit-3: (08 Hrs.)

1. Biostatistics: Need of biostatistics, What is biostatistics: beyond definition
2. Understanding of data in biostatistics
3. How & where to get relevant data, Relation between data & variables.
4. Type of variables: defining data set, Collection of relevant data: sampling methods.

Unit-4: (08 Hrs.)

1. Normal Distribution
2. Standard deviation, Standard errors.
3. Coefficient of Variation
4. t-test, Chi square test.

Unit-5: (08 Hrs.)

1. Construction of study: population, sample, normality and its beyond (not design of study, perhaps)
2. Summarizing data on the pretext of underlined study.
3. Understanding of statistical analysis (not methods)

Suggested readings:

1. Statistical Methods by S.P. Gupta
2. Methods in biostatistics for medical students by B.K.Mahajan
3. RPG Biostatistics by HimanshuTyagi









Subject Name: Principles of Laboratory Management

Subject Code: BMLS-705

Learning Objectives: The objective of this module is to help the students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab & aware various Accrediting body.

Unit-1: (10 Hrs.)

1. Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals
2. Good Laboratory Practice (GLP), Introduction to Basics of GLP and Accreditation
3. Aims of GLP and Accreditation, Advantages of Accreditation
4. Brief knowledge about National and International Agencies for clinical laboratory accreditation

Unit-2: (10 Hrs.)

1. Awareness / Safety in a clinical laboratory, General safety precautions.
2. HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines;
3. Drug Resistant Tuberculosis Patient management for clinical samples collection, transportation and preservation.
4. Sample accountability, Purpose of accountability, Methods of accountability

Unit-3: (10 Hrs.)

1. Sample analysis: Introduction, factors affecting sample analysis.
2. Reporting results, basic format of a test report, reported reference range.
3. Clinical alerts, abnormal results, results from referral laboratories.
4. Release of examination results, alteration in reports

Unit-4: (10 Hrs.)

1. Quality Management system: Introduction, Quality assurance, Quality control system.
2. Internal and External quality control, quality control chart and importance of calibration and Validation of Clinical Laboratory instrument.
3. Ethics in Medical laboratory Practice, Ethics in relation to PreExamination procedures, Examination procedures, reporting of results, preserving medical records
4. Procurement of equipment and Inventory Control.



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Atal Bihari Vajpayee Medical University, U.P., Lucknow.

Unit-5:



(08 Hrs.)

1. Audit in a Medical Laboratory.
2. Introduction and Importance, NABL & CAP.
3. Responsibility, Planning, Horizontal, Vertical and Test audit.
4. Frequency of audit, Documentation

LEARNING OUTCOME: Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, ElsevierPublications
2. Bishop(2013),Clinical Chemistry,7th edition, WileyPublications
3. Henry's Clinical Diagnosis and Management by LaboratoryMethods,(2011),22ndedition, Elsevier







Subject Name: Medical Virology & Mycology-Practical

Subject Code: BMLS-706

1. To prepare culture media used routinely in mycology
2. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.
3. To identify given yeast culture by performing various identification techniques studied in theory.
4. To identify given mould culture by performing various identification techniques studied in theory.
5. To demonstrate dimorphism in fungi
6. To collect and process clinical samples for laboratory diagnosis of fungal infections i.e.
 - 6.1 Skin
 - 6.2 Nail
 - 6.3 Hair
 - 6.4 Body fluids and secretions
7. To demonstrate structure of viruses and their multiplication from charts etc.
8. To perform Giemsa stain, Seller's stain, immunofluorescent staining procedures for diagnosis of viral infections
9. Demonstration of fertilized hen egg
10. Demonstration of various inoculation routes in fertilized hen egg

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N. Upadhyay

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April 2022

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Subject Name: Blood Banking & Genetics- Practical

Subject Code: BMLS-707

1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions
2. Screening of blood donor: physical examination including medical history of the donor
3. Collection and preservation of blood for transfusion purpose
4. Screening of blood for Malaria, Microfilaria, HBs Ag, Syphilis and HIV
5. To determine the ABO & Rh grouping
 - 5.1 Direct or preliminary grouping
 - 5.2 Indirect or proof grouping
 - 5.3 Rh grouping and determination of Du in case of Rh negative
6. To perform Direct and Indirect Coomb's test
7. To perform cross matching
 - 7.1 Major cross matching
 - 7.2 Minor cross matching
8. Preparation of various fractions of blood.

N. V. Pathyay

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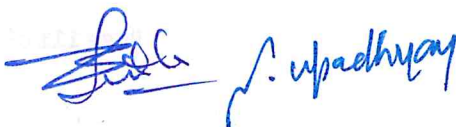
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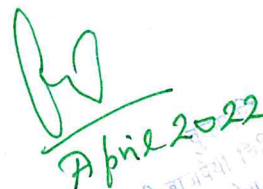
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Subject Name: Immunopathology & Molecular Biology-Practical
Subject Code: BMLS-708

1. Peripheral blood mononuclear cell (PBMC) isolation by gradient centrifugation
2. T and B cell separation
3. Immunofluorescence
 - 3.1 Anti- Nuclear Antibody (ANA)
 - 3.2 Anti- Neutrophil Cytoplasmic Antibody (ANCA)
4. AIDS Immunology and Pathogenesis (AIP)
5. Thyroid Microsomal antigen (TMA)- Agglutination reactions
6. Electrophoresis
7. Gel diffusion
8. Nephelometry
9. HLA
 - 9.1 Typing Serology & Cross match
 - 9.2 Molecular Typing
10. Nitro blue Tetrazolium Chloride Test (NBT)
11. FACS for CD4 and CD8
12. ELISA for lab. diagnosis of AIDS
13. Polymerase Chain Reaction and its advanced versions
14. Gel electrophoresis
15. Western blotting
16. Isolation of DNA and RNA
17. Estimation of DNA and RNA
18. Determination of molecular weight and quantification of DNA using agarose gel electrophoresis


Dr. N. Upadhyay


April 2022

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