

**COURSE STRUCTURE AND
MODE OF EVALUATION OF**

**B. Sc.
In
CLINICAL LABORATORY SCIENCE (CLS)**

Revised on January 30, 2008

Conducted by

**S.N.D.T. UNIVERSITY FACULTY OF SCIENCE
S.N.D.T. Women's University
Santacruz (W)
Mumbai – 400 049**

Eligibility for admission to 1st Year

A candidate must have obtained at least 50% marks in PCB at the H.S C. or its equivalent, with Science and Mathematics or Diploma in Medical Laboratory Technology after S. S. C.

Eligibility for admission to 2nd Year

A candidate must have obtained diploma in Medical Laboratory technology (DMLT) of 3 years after H.S.C. These students are eligible to seek admission to second year of B.Sc- CLS

Attendance requirement

- a) A student shall be required to attend at least 75% of the number of lectures and 75% of the number of practicals / tutorials, separately from actual number of classes conducted in each subject during each semester.
- b) The principal of the college shall have the discretion to condone 10% of the attendance in theory and or practicals of any one subject or subjects (overall) if she is fully convinced of the student's absence on grounds of ill-health or for reasons beyond her control. Such intimation with relevant supporting documents must be submitted while student is absenting herself. A delayed submission will not be considered.
- c) The Vice-chancellor however, reserves the right to condone the additional absence up to 5% if fully represented by the student and submitted through the principal. Pending the decision of the Vice-chancellor on the above matter, the student may be permitted to appear for the examination provisionally. The student shall have to give an undertaking in writing that the decision of the Vice-chancellor will be final and binding on her and that in case the decision is adverse, the examination result will stand cancelled and the examination fees will not be refunded.
- d) A student must remain present on 1st day of each semester. Failing it, the admission will be cancelled.

Guidelines

- All examinations to be based on Semester System.
- All examinations on Credits: 1 Credit = 25 Marks
- All Theory papers 100 marks: 4 Credits
- All practical / Tutorial Examinations: 50 Marks (25 TW + TW Viva Voce) 2 credits (TW = Team work)
- 25 Marks TW is 2 tests of 5 marks each, 5 marks for attendance, and 10 marks on continuous assessment of assignments etc.
- Each semester has typically 5 Min to 6 Max Courses ie, 400 marks to 600 marks or 16 Credits to 24 credits .(Extreme cases could have 8courses / semester. However the load needs to be assessed.)
- Theory is a head of passing
- Practically is head of passing
- Uniformity in Grades: 4 Point Scale.

Passing rules

- Admission to 1st and 2nd semester is automatic
- Admission to 3rd Semester: Backlog of any 4 head of passing in 1st and 2nd semester.
- Admission to 4th semester is automatic
- Admission to 5th Semester: Backlog of any 4 heads of passing in 3rd and 4th Semester and fully cleared 1st and 2nd Semester.

- Admission to 6th Semester is automatic.
- Admission to 7th Semester: Backlog of any 4 heads of passing in 5th and 6th and fully cleared 1st and 2nd, 3rd, 4th Semester.
- Admission to 8th Semester automatic.

Class to be awarded on the final two semesters.

Class improvement to be given for 3 successive attempts where all theory papers need to be attempted again.

Passing to be 40% in all heads of passing at both UG and PG level. (However requirements of statutory bodies to be taken care of)

Schedule

- Schedule for Odd Semester, Yearly and repeaters Examinations: 15 October to 15 November
- Schedule for even Semester, Yearly and repeaters Examinations: 15 April to 15 May
- An academic term to be planned for 15-16 weeks/ Semester
- All practical examination to be completed in the last week of the academic term.
- Repeater examination for all examinations to be conducted by the university

Q PAPERS

- 1) Each paper setter will set one paper independently & will hand over typed hard copy to the confidential section of the University examination department.
- 2) 3 paper setter/ Q paper instead of 3 sets of Q papers/ paper setter.
- 3) Sections in the question papers should be avoided unless the sections are disparate.
- 4) For a 100 marks paper seven (7) questions needs to be set & students are suppose to answer five (5) of them (20 marks each) There may be sub questions within a 20 marks question.
- 5) For the total marks other than 100 the above condition may be used on a proportionate basis. Rounding off marks may be done on examiners discretion.
- 6) Typed manuscripts should only be submitted to confidential section of the examination house.
- 7) The paper setters should give clear guidelines/ instructions for each paper on the top of the question paper.
- 8) Marks should be mentioned against each question clearly.
- 9) Question paper manuscripts to be signed by examiners.
- 10) PC to be provided at Exam House for paper typing by examiners if required.

Pattern of Semester examinations

- * College examination at the end of –
 - I Semester (Theory & Practical)
 - II Semester (Theory & Practical)
 - III Semester (Theory & Practical)
 - V Semester (Theory & Practical)
- * University examination at the end of -
 - VI Semester (Theory, Practical)

Note: Semester IV is meant for Internship

PASSING RULES

Admission to 1st & 2nd Semester is automatic.

Admission to 3rd Semester: Backlog of any 4 heads of passing in 1st & 2nd

Admission to 4th Semester is automatic.

Fully cleared 1st & 2nd Semester.

Admission to 5th Semester: Backlog of any 4 heads of passing in 3rd & 4th

Admission to 6th Semester is automatic.

Fully cleared 1st & 2nd, 3rd, 4th Semester.

Admission to 7th Semester: Backlog of any 4 heads of passing in 5th & 6th.

Admission to 8th Semester is automatic.

Class (Marks and Grades) to be awarded on the basis of final two semesters.

Class improvement to be given for 3 successive attempts where all theory papers are to be attempted again.

Passing to be 40% in all heads of passing at both UG & PG level. (However requirements of statutory bodies to be taken care of).

For all exams coming under semester pattern from this academic year, the following ATKKT rules will be applicable.

- a) Not more than 40% heads of passing will be carried forward (if the number comes to a fraction less than 0.5, it will be rounded off to the immediate lower digit. If the number is 0.5 or more, it will be rounded off to the next immediate higher digit. For example 2.48 will become 2 and 2.5 or 2.51 will become 3)
- b) Theory (internal +external marks combined) and practical/ tutorial in the same subject will be ahead of passing. (for example 3 theory and 3practicals in the same or different subjects will mean the number of heads of passing ;will be 3)
- c) Re-examination /re-assessment of internal examination for up gradation /betterment of marks is totally PROHIBITED. Internal marks communicated to the university should be signed by the Principal or I/C Principal only and cannot changed communicating to the University.

Format to be used for setting up Question Papers

Instructions

- 1) Question 1 is Compulsory.
- 2) Answer any 4 questions from remaining six questions.
- 3) Answer should be legible.
- 4) All answers to be written in the same answer book.
- 5) Figures to the right indicate marks.

		Question detail	Marks
Q 1	A		
Q 2	B		

Internship Programme:

- a) Eligibility for Internship
 - * Semesters to be cleared fully - I, II, and III
 - * All Internal Exams should be cleared.
- b) If the internship placement does not work out for a student in spite of willingness of the management with whom she is placed, the student may be given one more chance for her placement.

A Chart below given Grades/ G.P.A. & Percentage of Marks.

Letter Grade	Grade Point (GP)	%	Notes
A+	4.0	80 & above	
A	3.9	75 to less than 80	
A-	3.4 - 3.8	70 to less than 75	Students may be awarded an Honors designation on of a parchment if semester & cumulative grade point average of 3.7 is achieved on the first attempt of courses required towards graduation of major. In addition, students will need to complete graduation requirements within specific time restrictions.
B+	3.3	65 to less than 70	
B	3.0 – 3.2	61 to less than 65	
B-	2.7 – 2.9	56 to less than 61	
C+	2.3 – 2.6	52 to less than 56	
C	2.0 – 2.2	47 to less than 52	Minimum general semester & commutative grade point average to progress without Academic Probation or Withdrawal status. Certain faculties may require higher grade point averages to remain in faculty.
C-	1.7 – 1.9	45 to less than 47	
D+	1.3 – 1.6	40 to less than 45	
D	1.0 – 1.2	35 to less than 40	Minimum general passing letter grade to receive credit for a course. Certain faculties may require higher grade to receive course credit.
F	Less than 1	Less than 35	

To calculate G.P.A. in letter as well as figure for each semester the following formula be implemented.

- i) Assign grade point to grade of each subject offered in the semester
- ii) Total the Grade Points
- iii) Total the credits assigned to each subject offered in the semester
- iv) Divide Total no. of grade points by Total no. of credits.
- v) The result arrived at in the figures is again converted into letter grade as per the above table.

G.P.A. for Semester: $\frac{\text{Total of Grade point of all the Subjects offered in the Semester}}{\text{Total No. Of Credits of all the Subjects offered in the Semester}}$

G.P.A. for Degree: $\frac{\text{Total of G.P.A.S. of semesters V \& VI}}{\text{Total No. of Credits for semester V \& VI}}$

Submission of results to the University

The college will be required to send the record of internal assessment at least one week before the university exam commences for the subjects for which the university is conducting the exams.

The college shall also prepare a statement for each student indicating her letter grade and Grade Point Average for all the semester examinations conducted by the college.

The mode of declaring results

The college shall prepare the result sheet of all the students for the exams conducted by the college. The university shall then supplement the result of the examinations conducted by the university and declare the result as follows:

- 1) List of courses for the semester examinations conducted by the college and/or university.
- 2) Grade obtained in each head of passing
- 3) Credits for each head of passing
- 4) Semester wise G. P.A.
- 5) Grade points of Semester V and Semester VI (Third year, i.e. last year) only will be considered for the declaration of B. Sc. CLS University final results.

Number of academic working day per Semester 90 Days/ Semester.

SYLLABUS FORMAT

Faculty Name: Science

Course Name: Clinical Laboratory Science

SCHEME: Semester- I

	Subjects	L	P / T	D	TP	TW	P / V	T
1	Biochemistry	3	4	3	100	25	25	150
2	Microbiology	3	4	3	100	25	25	150
3	Hematology + Phlebotomy	2	4	2	50	25	25	100
4	Clinical Pathology	1	4	2	25	25	25	75
5	Anatomy-Physiology	2	----	2	50	---	---	50
6	Language Communication	2	----	2	50	---	---	50
7	Basic Computer Skills	---	4	---	---	---	50	50
Total		13	20	14	375	100	150	625

SCHEME: Semester- II

	Subjects	L	P / T	D	TP	TW	P / V	T
1	Biochemistry	3	6	3	100	25	25	150
2	Microbiology	3	6	3	100	25	25	150
3	Hematology+ Phlebotomy	1	4	2	25	25	25	75
4	Clinical Pathology	1	4	2	25	25	25	75
5	Anatomy-Physiology & Orientation to Medicine	2	---	2	50	---	---	50
Total		10	20	12	300	100	100	500

SCHEME: Semester- III

	Subjects	L	P / T	D	TP	TW	P / V	T
1	Biochemistry	3	4	3	100	25	25	150
2	Microbiology	3	6	3	100	25	25	150
3	Hematology+ Phlebotomy	1	4	2	25	25	25	75
4	Histopathology	1	4	2	25	25	25	75
5	Laboratory Management	1	---	2	25	---	---	25
Total		9	18	12	375	100	100	475

SEMESTER - IV**INTERNSHIP- 16 Weeks**

(With Government, Private Hospital Pathology Laboratories and Laboratories of Specialty Health care Centers)

Note: 40 hrs of Internship = 1 Credit

SR.NO	SUBJECT	Internship/ No of Hrs	Weeks	Credits	P / V	T
1	Biochemistry	160	4	4	50	50
2	Microbiology	160	4	4	50	50
3	Hematology	160	4	4	50	50
4	Clinical Pathology	160	4	4	50	50
5	Blood Banking	80	2	2	50	50
6	Histopathology	80	2	2	50	50
Total Internship (Semester- IV) Credits = 20						

SCHEME: Semester – V

	Subjects	L	P / T	D	TP	TW	P / V	T
1	Biochemistry	2	4	2	50	25	25	100
2	Microbiology	2	4	2	50	25	25	100
3	Hematology+ Phlebotomy	1	6	2	25	25	25	100
4	Immunology	2	4	2	50	25	25	100
5	Molecular Biology	2	2	2	50	12	13	75
6	Transfusion Medicine	1	4	2	25	25	25	75
Total		10	24	12	225	137	138	550

SCHEME: Semester – VI

	Subjects	L	P / T	D	TP	TW	P / V	T
1	Biochemistry	2	4	2	50	25	25	100
2	Microbiology	2	4	2	50	25	25	100
3	Hematology+ Phlebotomy	1	6	2	25	25	25	75
4	Immunology	2	4	2	50	25	25	100
5	Molecular Biology- Cytogenetics	2	2	2	50	12	13	25
Total		9	20	10	200	112	113	400

L = No. of lectures/ week, P/ T = Practical / Tutorial in hrs, D = Duration of Theory Paper for examination in hrs, TP = Theory paper-marks, TW = Term work- marks, P/V = Practical / Viva Voce- marks, T = Total

Note: 1) Duration of lecture = 1 Hrs
2) Duration of Practical = 2 Hrs

Qualification of staff members for B.Sc – CLS (Clinical Laboratory Science)

1) Head of Department:

M.D. in Pathology with at least 2 years Clinical experience and 2 years teaching experience.

OR

Ph. D in Biochemistry or Life Sciences or Ph. D. after M. Sc. In CLS with two years experience in Clinical practice and minimum five years experience in teaching at Degree level.

2) Lecturer in Hematology:

M.D. in Hematology or Pathology with at least one to two year of teaching experience. Or M.Sc. DMLT, or M. Sc. after B. Sc. CLS with at least experience of one year teaching.

3) Lecturer in Clinical Pathology:

M.D. in Pathology with at least one to two year of teaching experience. Or M.Sc. DMLT, or M. Sc. after B. Sc. CLS with at least experience of one year teaching.

3) Lecturer in Microbiology:

Ph. D. or M.Sc. in Microbiology or M. Sc. after B. Sc. CLS and with at least 2 years of teaching experience at Degree level.

4) Lecturer in Anatomy and Physiology:

M.B.B.S.or M. Sc. after B. Sc. CLS with at least 2 years teaching experience, or M.Sc. DMLT with 2 years teaching experience.

5) Lecturer in Language Communication:

M.A. in English Literature with 2 years teaching experience.

6) Lecturer in Immunology:

Ph.D. or M.Sc. in Biochemistry or Microbiology or M. Sc. after B. Sc. CLS and at least 1 year experience in immunology practice and two of teaching experience.

7) Lecturer in Molecular Biology:

Ph.D. or M.Sc. in Biochemistry or Microbiology or M. Sc. after B. Sc. CLS with 1 years teaching experience in Molecular Biology.

8) Lecturer in Transfusion Medicine:

M.D. in Pathology, Ph.D. in life sciences, or M.Sc, DMLT or M. Sc. after B. Sc. CLS with at least 1 year experience in Blood Banking and Transfusion Medicine.

9) Lecturer in Biochemistry:

Ph.D. or M.Sc. in Biochemistry or life science or M. Sc. after B. Sc. CLS with at least 1 year experience in teaching at Degree level and Clinical Practice.

10) Lecturer in Personality Development:

Masters Degree in management or M.B.A. with at least 1 years teaching experience

11) Instructor in Basic Computer Skills:

B.Sc. in Computer Engineering with at least 2 years teaching experience.

12) Instructor in Medical Laboratory Technology:

B.Sc DMLT with 2 years teaching experience

OR

B.Sc. CLS with 1 year experience in teaching and Clinical Practice.

13) Laboratory assistant: S.S.C. and DMLT.

SYLLABUS OF B. Sc- CLS

SEMESTER – I

SR.NO	SUBJECTS	No. of Hrs/ week		Credits	
		Theory	Practicals	Theory	Practicals
1	Biochemistry	3	4	4	2
2	Microbiology	3	4	4	2
3	Hematology+ Phlebotomy	2	4	2	2
4	Clinical Pathology	1	4	1	2
5	Anatomy Physiology	2	---	2	---
6	Language- Communication	2	---	2	---
7	Basic Computer Skills	---	4	---	2
	Total	13	20	15	10
		33		25	

Note: Additional 4 Hrs for Preparation of Projects and 3 Hrs for Library Reference work per week.

SEMESTER – II

SR.NO	SUBJECTS	No. of Hrs/week		Credits	
		Theory	Practicals	Theory	Practicals
1	Biochemistry	3	6	4	3
2	Microbiology	3	6	4	3
3	Hematology+ Phlebotomy	1	4	1	2
4	Clinical Pathology	1	4	1	2
5	Anatomy Physiology & Orientation to Medicine	2	----	2	---
	Total	10	20	12	10
		30		22	

Note: In the time table of semester II one two hour slot should be kept for the following topics –

- 1) Personality development
(Mind Management , Managing Emotions, Self Esteem, Goal Setting, Time Management, Communication Skills, Public Speaking, Documentation & Its Importance, Setting Vision & Mission, and public speaking).
- 2) Basic yoga exercises
- 3) Seminars

SEMESTER – III

SR. NO	SUBJECTS	No. of Hrs/ week		Credits	
		Theory	Practicals	Theory	Practicals
1	Biochemistry	3	4	4	2
2	Microbiology	3	6	4	3
3	Hematology +Phlebotomy	1	4	1	2
4	Histopathology	1	4	1	2
5	Laboratory Management	1	---	1	---
	Total	9	18	11	9
		27		20	

SEMESTER - IV**INTERNSHIP- 20 Weeks**

(With Government, Private Hospital Pathology Laboratories and Laboratories of Specialty Health care Centers)

Note: 40 hrs of Internship = 1 Credit

SR.NO	SUBJECT	Internship/ No of Hrs	Weeks	Credits
1	Biochemistry	160	4	4
2	Microbiology	160	4	4
3	Hematology	160	4	4
4	Clinical Pathology	160	4	4
5	Blood Banking	80	2	2
6	Histopathology	80	2	2
Total Internship (Semester IV) Credits = 20				

SEMESTER – V

SR. NO	SUBJECTS	No. of Hrs/ week		Credits	
		Theory	Practicals	Theory	Practicals
1	Biochemistry	2	4	2	2
2	Microbiology	2	4	2	2
3	Hematology +Phlebotomy	1	6	1	3
4	Immunology	2	4	2	2
5	Molecular Biology	2	2	2	1
6	Transfusion Medicine	1	4	1	2
		10	24	10	12
	Total	34		22	

SEMESTER – VI

SR. NO	SUBJECTS	No. Of Hrs/ week		Credits	
		Theory	Practicals	Theory	Practicals
1	Biochemistry	2	4	2	2
2	Microbiology	2	4	2	2
3	Hematology +Phlebotomy	1	6	1	3
4	Immunology	2	4	2	2
5	Molecular Biology	2	2	2	1
		9	20	9	10
	Total	29		19	

Total number of credits: 128

FIRST YEAR

SEMESTER- I

BIOCHEMISTRY – (THEORY)

No. of hrs. / week : 3
Credits : 3

Topics	No of Hrs	% Wtg
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General Biochemistry

- 1) Structure, components and their respective functions of following cells --- Human cell, Bacterial cell, Red blood cell. (3) (6)
- 2) The composition of cell membrane of following cells: Eukaryotic and Procaryotic. (3) (6)
- 3) Functions of cell membrane. Transportation of various substances through the cell membrane : Simple diffusion, facilitated of various substances. Uniport, symport & antiport types. (4) (10)
- 4) Buffer systems of the cell (Buffers and pKa values). Importance in maintaining normal pH of cellular constituents. (2) (6)
- 5) Carbohydrate chemistry: Definition importance, classification, properties, structural formulae of various mono- and disaccharides, Isomerism, Digestion and absorption of carbohydrates. (3) (10)

Clinical Biochemistry

- 1) Basic laboratory principles and procedures: Introduction, Laboratory management system, Various types of Laboratories, laboratory set-up, Laboratory safety, First Aid measures. Responsibilities of technicians and students, Laboratory mathematics. (5) (12)
- 2) Glassware and Plasticware: Composition, General types, Standardization of pipettes, Care and maintenance. (3) (6)
- 3) Solutions and reagents: Basic requirements, Reagent grade water, Preparation of Normal, Molar, Percent, Complex reagents, Buffers, Indicators and Primary standards. Use of diagnostic kits. (10) (15)
- 4) Commonly used Equipments, Instruments and Procedures: (10) (25)
General use, various components and their uses, principal on which working is based, and care and maintenance of: various types of balances, hot plate-magnetic stirrers, centrifuges, hot air ovens, incubators, water baths, dispensers, photometers, spectrophotometers, nephelometers, pH meters, flame photometer, water distillation apparatus, etc. Beer-Lambert's law, Standardization of photometers and biochemistry methods, End point and rate of reaction methods, turbidimetry and nephelometry.
- 5) Introduction to Clinical Biochemistry: Major factors responsible for causing diseases in humans. (2) (4)

Reference books:

45 / 100%

- 1) Text book of medical laboratory technology: Dr. P. B. Godkar
- 2) Biochemistry by U. Satyanarayana
- 3) Shaum's outline Biochemistry

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- I

BIOCHEMISTRY – (PRACTICALS)

No. of hrs. / Week : 4
Credits: 2

Topics

- 1) Introduction to the Biochemistry laboratory, responsibilities and related safety measures.
- 2) Introduction to various types of glassware and maintenance of glassware
- 3) Determination of normality of 10% sodium hydroxide and learning pipetting and dispensing techniques.
- 4) Standardization of 1.0ml volumetric pipette and learning use, care and maintenance of various balances.
- 5) Preparation of primary normal solution (1N sodium carbonate).
- 6) Preparation of normal solutions (1 N hydrochloric acid, 1 N sodium hydroxide and 2/3 N sulphuric acid)
- 7) Preparation of percent solution (V/V): 2% (V/V) acetic acid (WBC diluting fluid)
- 8) Preparation of molar solutions (M/15 Sodium phosphate solutions) for the preparation of a buffer solution: phosphate buffer (M/15, PH 7.45) Learning use, care and maintenance of a pH meter
- 9) Preparation of protein free filtrate, separation of serum and plasma from appropriate blood and Learning use, care and maintenance of a centrifuge.
- 10) Preparation of anticoagulated bulbs and learning use, care and maintenance of hot air oven water bath and incubator.
- 11) Preparation of a complex reagent (e.g. Benedict's qualitative reagent) and learning use, care and maintenance of hot plate and magnetic stirrer.
- 12) Learning operation of a photometer and care and maintenance.
- 13) Standardization of a photometer
- 14) Learning operation and care and maintenance of a spectrophotometer
- 15) Learning a multi-step quantitative method (Folin-wu's method)
- 16) Learning a mono-step method (GOD/POD)
- 17) Learning a turbidimetric method (Determination of CSF and urinary proteins)

Objectives:

At the end of semester I, students will learn the basic requirements of a biochemistry laboratory, preparation of various reagents and use, care and maintenance of glassware, reagents, equipments and instruments.

Reference books:

- 1) Text book of medical laboratory technology by Dr. P. B. Godkar

Instructions for teacher:

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- I

MICROBIOLOGY – (THEORY)

No. of hrs. / week : 3
Credits : 3

Topics	No of Hrs / % Wtg
1) Introduction to Microbiology The science of microbiology, Biologic principle illustrated by microbiology, prokaryotic cell structure.	(3) (6)
2) Classification of Bacteria, The growth, survival and death of Microorganisms.	(3) (6)
3) Clinical Microbiology, Principles of diagnostic Medical Microbiology.	(2) (4)
4) Clinical Bacteriology Laboratory and related techniques: Safety in the laboratory, Sterilization and disinfection, basic requirements.	(2) (6)
5) Microscopy: Optical principle, structure, use and applications of compound microscope, Dark ground illumination phase contrast microscope, Fluorescent microscope, Electron microscope.	(4) (12)
6) Disinfection: Chemical. Sterilization. Physical methods of sterilization, Dry heat, Moist heat Filtration Techniques, Radiations, Indicators of sterilization.	(4) (12)
7) Instrumentation: Structure, Principle and Application of Incubator, Hot-air oven, Autoclave, Inspissator, Filters, Water bath, pH meter, V.D.R.L. Shaker, Anaerobic jar, etc.	(4) (12)
8) Staining Methods: Principle and Clinical significance. Gram staining, Acid- Fast staining, Metachromatic granule staining, India-ink preparation.	(4) (10)
9) Aseptic techniques: Use of inoculating hood and laminar flow. Use and maintenance of Microscope.	(3) (6)
10) Use and preparation of media: general purpose, enrichment, enriched, selective, transport and biochemical media.	(4) (12)
11) Identification of Bacteria.	(5) (6)
	----- 45 100%

Reference books:

- 1) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- 2) Microbiology by Dr. Ananthanarayana
- 3) Shaum's outline Microbiology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- I

MICROBIOLOGY – (PRACTICALS)

No. of hrs. / Week : 4
Credits : 2

Topics

- 1) Professional ethics and Responsibilities of students, Role of Laboratory technician in laboratory diagnosis.
- 2) Basic principles of laboratory work.
Personal safety against various accidents and hazards. Knowledge of first aid.
Care in handling dangerous materials.
Glassware: Types and uses for microbiological purpose,
Cleaning and Sterilization.
- 3) Principles of working of various laboratory instruments and their uses, care and Maintenance.
- 4) Microscopy: Compound microscope: Parts, function and care of the microscope.
- 5) Staining Procedures and quality control measures:
Gram staining.
Ziehl- Neelson's staining.
Metachromatic granule staining.
India – ink preparation.
- 6) Special staining procedures: Chance's and Ringer method
Capsule staining, Fontana's method, Dorner's and Schaffer-Fulton's method.
- 7) Sterilization and disinfection.
Physical methods of sterilization: heat, filtration and radiations.
Chemical disinfection.
Indicators of sterilization: Biological and chemical.
Disinfection of specimen, and laboratory equipments.

Objective:

At the end of semester I, students will learn basic requirements, techniques, safety, sterilization and disinfection, preparations and quality control in a microbiology laboratory

Reference book:

Text book of medical laboratory technology by Dr. P. B. Godkar

• **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- I

HAEMATOLOGY – (THEORY)

No. of hrs. / week : 2
Credits: 2

Topics	No of hrs / % Wtg	
1) Introduction to 'Hematology' and hematology section of a pathology laboratory .	(1)	(4)
2) Blood and hematopoietic system of the body	(2)	(6)
3) Components of blood and their functions, various techniques of blood collection, use of various anticoagulants, Effects of storage of blood on cell morphology, waste disposal.	(3)	(10)
4) Hemoglobin: synthesis, iron metabolism. Various hemoglobins. Determination of hemoglobin by various methods.	(3)	(10)
5) Erythropoiesis: Factors influencing erythropoiesis Red blood cells morphology. Total erythrocyte count by hemocytometry. Clinical significance.	(3)	(10)
6) Leucopoiesis: Factors influencing leucopoiesis. White blood cell morphology. Total leukocyte count by hemocytometry. Clinical significance.	(2)	(7)
7) Thrombopoiesis Morphology of platelets. Determination of platelet count. Clinical significance.	(2)	(7)
8) Haematocrit: Determination by different methods Clinical significance.	(2)	(7)
9) Erythrocyte Indices-- Calculations Clinical significance	(2)	(7)
10) Study of blood smears for differential leukocyte count and cell morphology. Clinical significance	(4)	(12)
11) Study of abnormal erythrocytes and leukocytes in peripheral blood smear.	(2)	(6)
12) Determination of Erythrocyte Sedimentation rate Principle, various methods, clinical significance.	(2)	(7)
13) Study of complete Hemogram.	(2)	(7)

Reference books:

30 / 100%

- 1) Text book of Medical Laboratory technology by Dr. P. B. Godkar
- 2) Dacie and Lewis practical hematology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- I

HAEMATOLOGY – (PRACTICAL)

No. of hrs. / week : 4

Credits : 2

Topics

- 1) Introduction to Hematology Laboratory set-up and Laboratory safety.
- 2) Use of Hb, WBC and RBC pipettes and maintenance.
- 3) Use of improved Neubauer's chamber and maintenance.
- 4) Preparation of blood smears and staining by Wright's stain. Observation of blood smears under microscope.
- 5) Use and maintenance of Westergren and Wintrobe's tubes
- 6) Determination of hemoglobin by copper sulphate and Sahli's methods
- 7) Preparation of Drabkin's reagent and determination of hemoglobin.
- 8) Preparation of WBC diluting fluid and determination of total WBC count.
- 9) Determination of total RBC count.
- 10) Determination of PCV, MCV, MCH and MCHC
- 11) Determination of differential WBC count by using Wright's stain and Field's stains.
- 12) Study of blood smears for RBC morphology.
- 13) Determination of ESR by Westergren's methods.
- 14) Determination of ESR by Wintrobe's method.
- 15) Phlebotomy technique.
- 16) Determination of Platelet count.

Objective:

At the end of semester I students will get oriented to the hematology laboratory and will learn basic requirement, glassware, reagents, equipments, techniques and safety precautions in the laboratory.

Reference books:

- 1) Text book of medical laboratory technology by Dr. P. B. Godkar
- 2) Dacie and Lewis practical hematology

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER – I

CLINICAL PATHOLOGY (THEORY)

No. of hrs. / week : 1
Credits : 1

Topics	No of Hrs / % Wtg	
1) Introduction to clinical pathology section of pathology laboratory: Various types of specimen analyzed in the laboratory and laboratory safety.	(1)	(6)
2) Introduction to Routine urine examination: Role of kidneys in the maintenance of homeostasis. Formation of urine, Composition of normal urine, hormonal regulation of kidney function.	(1)	(6)
3) Collection of urine, containers, storage, changes in composition after storage, Preservatives.	(1)	(12)
4) Physical examination of urine, various aspects and clinical significance.	(1)	(12)
5) Chemical examination of urine, various aspects and clinical significance.	(1)	(6)
6) Determination of other urinary substances for special circumstances (Porphyrins, porphobilinogen, phenyl pyruvic acid, etc) and clinical significance.	(1)	(6)
7) Chemical examination of urine by using urine-strips.	(1)	(10)
8) Microscopic examination of urine-various findings.	(2)	(12)
9) Chemical examination of urinary calculi	(1)	(6)
10) Pregnancy test	(1)	(6)
11) Routine sputum examination: General consideration	(1)	(6)
12) Physical and Microscopic examination of sputum.	(1)	(6)
13) Routine sputum examination (Complete)	(2)	(6)

Reference books:

15 / 100%

- 1) Text books of medical laboratory technology by Dr. P. B. Godkar.
- 2) John Bernard Henry's clinical diagnosis and management by laboratory methods

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- I

CLINICAL PATHOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Introduction, Laboratory safety
- 2) Routine urine examination: General consideration.
- 3) Physical examination of urine.
- 4) Chemical examination of urine by chemical methods.
- 5) Chemical examination of urine by uristix methods.
- 6) Microscopic examination of urine.
- 7) Routine urine examination (complete)
- 8) Routine sputum examination: General consideration.
- 9) Physical examination of sputum.
- 10) Microscopic examination of sputum.
- 11) Routine sputum examination (complete)
- 12) Examination of urinary stones
- 13) Pregnancy tests (various types)

Objectives:

At the end of semester - I students will learn basic requirements and techniques of laboratory tests in clinical pathology and microscopic examinations.

Reference books:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box and other requirements.
- 2) Writing rough note book, SOP / and safety requirements.
- 3) Writing Journals.

SEMESTER- I

ANATOMY AND PHYSIOLOGY/ ORIENTATION TO MEDICINE

No. of hrs. / week : 2
Credits : 2

Topics

<i>Anatomy and Physiology</i>	No. of Hrs /	% Wtg
1) Scope of Anatomy & physiology.	(1)	(4)
2) Introduction to the body as a whole. Level of structural complexity, The internal environment & homeostasis, Survival need of the body, Introduction to the study of illness	(2)	(10)
3) Elementary tissues of the body.	(7)	(14)
4) Blood and circulatory system Blood vessels, Heart, Blood pressure, Pulse, Circulation of the blood, Summary of the main blood vessels.	(3)	(4)
5) Urinary system. Kidneys, Ureters, Urinary bladder, Urethra, Micturition	(5)	(12)
6) Lymphatic system. Lymph, Lymph vessels, Lymphatic organs & tissues.	(3)	(8)
7) The respiratory system. Nose & nasal cavity, Pharynx, Larynx, Trachea, Lungs, Bronchi & bronchioles, Respiratory bronchioles & alveoli, Respiration.	(3)	(16)
8) Skeletal system Bone, Axial skeleton, Appendicular skeleton, Joints, Main synovial joints of the Limbs, Muscle tissue, Principle skeletal muscles.	(3)	(16)
	30 /	100%

Reference book:

- 1) Shaum's outline – Anatomy and physiology
- 2) Ross and Wilson Anatomy and Physiology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER –I

Pathology Laboratory Oriented COMPUTER SKILLS

No. of hrs. / week : 2
Credits: 2

Topics

- 1) Introduction to computer and windows 2000.
 - 2) Introduction to DOS commands.
 - 3) Introduction to MS-word, and typing.
 - 4) Introduction to Power point and preparation of simple presentations.
 - 5) Introduction to MS-Excel and preparation of statistical data and graphs related to patient's reports.
 - 6) Use of Internet for preparing Projects.
 - 7) Preparation of Pathology Laboratory reports related to various subjects of Clinical Laboratory Science such as Biochemistry, Microbiology, Serology, Hematology, Clinical Pathology, Blood banking & Histopathology.
 - 8) Introduction to software related to Laboratory Management
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SEMESTER- I

SKILLS IN LANGUAGE COMMUNICATION

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs / % Wtg	
1) Introduction to course contents.	(2)	(1)
2) Informal letter writing.	(2)	(6)
3) Comprehension of abstract ideas.	(2)	(6)
4) Descriptions of an abstract kind.	(2)	(6)
5) Simple, compound and complex sentences.	(2)	(12)
6) Learning interview techniques.	(2)	(10)
7) Comprehension from medical books.	(2)	(6)
8) Medical terms.	(2)	(6)
9) Complaint letters.	(2)	(6)
10) Enrichment of vocabulary through picture, composition, exercise and dictionary work.	(2)	(12)
11) Practice in statement of opinion, logical development of an idea.	(5)	(5)
12) Group discussion.	(2)	(6)
13) Report Writing.	(2)	(6)
14) Reply to complaint letters.	(2)	(6)
15) Placing laboratory requirement orders.	(2)	(6)
	30 /	100%

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

Topics	No of Hrs	% Wtg
1) Training the technician: Preparation of specimen collection, patient preparation, Basic steps for drawing a blood specimen, specimen collection, patient after care, specimen rejection criteria, hemolysis of blood, chemical tests affected by hemolysis, arterial puncture, deciding specimen types and anticoagulants, preservation, transportation, changes in specimen on storage, use of vacutainers, various types and advantages of vacutainers, physiological factors affecting the composition of body fluids.	(9)	(20)
2) Chemistry of carbohydrates: Carbohydrates, Definition, Important functions, Classification, Properties of carbohydrates, Isomerism, Epimers, Digestion of carbohydrates, Absorption of carbohydrates, Metabolism of carbohydrates, general metabolism, Glycolysis, glycogenesis, HMS-pathway, Gluconeogenesis and Lipogenesis, the Cori cycle, formation of Ketone bodies, Role of hormones, deranged glucose metabolism, Detection of diabetes, types of diabetic, criteria for diagnosis of diabetes, Diabetic profile tests, hypoglycemia, diabetes self-testing, Importance of determination of Insulin, pro-insulin and C-peptide assays, Determination of urinary, plasma and other body fluid glucose, various methods, merits, demerits, clinical significance, use of semi-automated method for determination of plasma glucose, importance of determination of micro-albuminuria and glycosylated hemoglobin.	(9)	(20)
3) Chemical tests in kidney disease: General consideration, Urea metabolism, Creatine- metabolism, Lohmann reaction, Importance of nucleic acids, nucleotide, nucleotides bases, formation of nucleoside and nucleotide, Structure of DNA, Structure of RNA, denaturation of DNA, nucleoproteins and Uric acid metabolism, various Laboratory tests for the determination of blood/Plasma/ Serum ,urea, creatinine & uric acid.	(9)	(20)
4) Chemistry of proteins: Definition, importance, structure of proteins, classification of proteins, amino acids present in proteins, Important properties of proteins and amino acids, Structure-function relationship of proteins, various types of proteins, plasma proteins, function of plasma proteins, role of other proteins, Digestion and absorption of proteins, amino acid metabolism, body's amino acid pool sources and utilization, disorder affecting amino acid metabolism, Laboratory methods for the determination of amino acids and proteins in serum and other body fluids and clinical significance of respective tests.	(9)	(20)
5) Enzymes: Introduction, enzymes as catalysts, enzyme specificity, enzyme catalysis, the nature of enzyme catalysis, active site of enzymes, factors which affect enzyme activity, enzyme kinetics, Lineweaver-Burk plot, enzyme inhibitors, reversible inhibition, competitive inhibitors, noncompetitive inhibitors, irreversible inhibition, organic positive modifiers, inorganic negative modifiers, co-enzymes, isoenzymes, enzyme classification and nomenclature, enzyme- end point reaction methods, clinical significance, units for measuring enzyme activity, laboratory tests for the determination of SGPT, SGOT, alkaline and acid phosphatases, amylase and LDH. Clinical significance of each test (as mentioned above).	(9)	(20)

Reference books:

- 1) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- 2) Biochemistry by U. Satyanarayana
- 3) Shaum's outline Biochemistry

45 / 100%

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

BIOCHEMISTRY – (PRACTICALS)

No. of hrs. / week : 6
Credits: 3

Topics

- 1) Standardization of Benedict's qualitative reagent.
- 2) To identify reducing substances in urine.
- 3) Quantitative determination of urine glucose by Benedict test.
- 4) Determination of plasma glucose by Folin-Wu's method.
- 5) Determination of plasma glucose by Glucose Oxidase method.
- 6) Demonstration of glucose tolerance test
- 7) Determination of plasma urea by DAM method.
- 8) Determination of plasma urea by Berthelot reaction method.
- 9) Determination of serum creatinine by alkaline picrate method.
- 10) Determination of urine creatinine by alkaline picrate method.
- 11) Determination of serum uric acid by Henry-Caraway's method.
- 12) Determination of serum uric acid by uricase method.
- 13) Determination of urine uric acid..
- 14) Determination of serum proteins, albumin, globulins, A/G ratio.
- 15) Determination of urine and CSF proteins.
- 16) Standardization & determination of SGPT by end point reaction method.
- 17) Standardization & determination of SGOT by end point reaction method.
- 18) Standardization and determination of serum alkaline phosphates by end point reaction method.
- 19) Standardization & determination of serum acid phosphates by end point reaction method.
- 20) Standardization & determination of serum amylase by end point reaction method.
- 21) Standardization & determination of Serum LDH by end point reaction method.

Reference textbook:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar

• **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

MICROBIOLOGY (THEORY)

No. of hrs. / week : 3

Credits : 3

Topics	No of Hrs / % Wtg	
(1) Classification of Bacteria (Revision of Sem I)	(1)	(2.5)
(2) The growth, survival and death of microorganisms (Revision of Sem –I)	(1)	(2.5)
(3) Cultivation of microorganisms Normal flora	(6)	(10)
(4) Microbial metabolism	(6)	(10)
(5) Use and preparation of various types of media (general purpose, enrichment, enriched, selective, transport and biochemical media)	(12)	(20)
(6) Pathogenesis of bacterial infection	(5)	(10)
(7) Introduction to diagnostic medical microbiology and identification of bacteria	(3)	(4)
(8) Study of Gram negative bacilli: Morphological, Cultural and Biochemical study of E.coli, Pseudomonas, Klebsiella, Proteus sp, Serratia sp, Enterobacter sp, Providencia sp, Citrobacter sp	(20)	(40)
	<u>54</u>	<u>100%</u>

Reference book:

- (1) Ananthnarayana's Text Book of Microbiology
- (2) Jawetz, Melnick and Adelberg's Medical Microbiology
- (3) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- (4) Shaum's outline - Microbiology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

Topics

- 1) Preparation of various types of media and quality control
 - (a) Preparation of nutrient agar
 - (b) Preparation of culture plates
 - (c) Preparation of agar slants
- 2) Sterilization of nutrient agar, culture plates and agar slants
- 3) Study of following important biochemical properties of bacteria
 - (a) Bile solubility test
 - (b) Catalase test
 - (c) Hydrogen sulphide production
 - (d) Indole test
 - (e) Nitrate reduction test
 - (f) Oxidase test
 - (g) Oxidation Fermentation test
 - (h) Urease test
 - (i) Voges-Proskaur(VP) test
 - (j) Methyl red test
- 4) Study of Biochemical reactions on TSI agar slants
- 5) Study of following Gram negative rods in pure cultures
 - (a) E.coil
 - (b) Klebsiella sp
 - (c) Pseudomonas sp
 - (d) Serratia marcescens sp
 - (e) Proteus sp
 - (f) Enterobacter sp
 - (g) Providencia sp
 - (h) Citrobacter sp
 - (i) Salmonella sp
 - (j) Shigella sp
 - (k) Vibrio sp
- 6) Antibiotic sensitivity test.

Reference books:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar

• **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- II**HAEMATOLOGY (THEORY)**

No. of hrs. / week : 1
Credits: 1

Topics	No of Hrs	% Wtg
1) Clinical significance of complete blood count	(1)	(8)
2) Clinical significance of absolute eosinophil count, reticulocyte count and platelet count.	(1)	(4)
3) Introduction to hemostasis and coagulation	(1)	(4)
4) Mechanism of coagulation The intrinsic pathways The extrinsic pathways	(1)	(8)
5) The final common pathway of blood clotting, conversion of fibrinogen to fibrin	(1)	(8)
6) The fibrinolytic system and first line tests in acute haemostatic failure	(1)	(8)
7) Routine coagulation tests and clinical significance Bleeding time, Coagulation time, Clot retraction and clot lyses time, Prothrombin Time, Plasma recalcification time, Partial thromboplastine time, Activated partial thromboplastim time , Thrombin time , Thromboplastin generation test, Protamine sulphate test, Platelet aggregation test.	(1)	(4)
8) Introduction to Immunohematology	(1)	(8)
9) Human blood group systems.	(1)	(4)
10) ABO antibodies, inheritance of the ABO blood groups and formation of A, B and H antigens	(1)	(8)
11) Rhesus blood group system, Rh antigen, Rh and Preganancy	(1)	(8)
12) Other blood group systems	(1)	(4)
13) Blood grouping and Rh typing, laboratory test principles	(1)	(4)
14) Determination of Du by tube method	(1)	(4)
15) Indirect and Direct coomb's tests	(1)	(4)
16) The compatibility test and determination of anti – D antibody titre	(1)	(4)
Reference books:	17 /	100%

1) Text book of medical laboratory Technology by Dr. P. B. Godkar

2) Dacie and Lewis practical hematology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- II

HAEMATOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits: 2

Topics

- 1) Orientation to Phlebotomy & revision of study of blood smears
- 2) Determination of absolute eosinophil count
- 3) Determination of platelet count
- 4) Determination of bleeding time.
- 5) Determination of clotting time.
- 6) Determination of clot retraction and lysis time.
- 7) Determination of prothrombin time.
- 8) Determination of plasma recalcification time.
- 9) Determination of partial thromboplastin time (PTT).
- 10) Determination of activated partial thromboplastin time (APTT).
- 11) Determination of thrombin time.
- 12) Protamine sulphate test.
- 15) Qualitative test for ABO grouping with antisera.
- 16) Determination of ABO grouping by tube method.
- 17) Determination of D (Rho) antigen on human red blood cells.
- 18) Indirect antiglobulin (Coomb's) test.
- 19) The compatibility test.
- 20) Antiglobulin cross-matching.
- 21) Quantitative determination of anti-D antibody titre.
- 22) Determination of fibrinogen.

Reference books:

- 1) Text book of medical laboratory technology by Dr. P.B.Godkar

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- II**CLINICAL PATHOLOGY (THEORY)**

No. of hrs. / week : 1
Credits: 1

Topics	No of Hrs	% Wtg
1) Introduction to Parasitology and safety in the laboratory.	(1)	(6)
2) Classification of human parasites (Based on the life cycles)	(1)	(6)
3) Protozoal infections, Life cycles of E. histolytica and G. lamblia in man. Amebiasis, Giardiasis and related laboratory tests: stool examination results.	(2)	(12)
4) Helminths. Life cycles of nematohelminths and platyhelminths. Related laboratory tests: Stool examination results.	(4)	(20)
5) Routine stool examination: collection, precautions, preservatives, containers, storage, Gross examination.	(1)	(10)
6) Physical and chemical examination of feces and related clinical significance.	(1)	(10)
7) Microscopic examination of stool specimen by routine and concentration methods and waste disposal	(2)	(12)
8) Routine examination of CSF, Formation of CSF, normal composition, specimen collection physical, chemical and microscopic examination of CSF and related clinical significance.	(2)	(12)
9) Semen examination: Physiology of seminal fluid, Brief anatomy of male reproductive system, normal composition of semen, specimen collection, preservation. Physical, chemical and microscopic examination of semen and related clinical significance, pregnancy test. Study of cavity fluids: Peritoneal, Plural, Pericardial & Synovial.	(3)	(12)
	17 /	100%

Reference books:

- 1) Text book of Medical Laboratory Technology by Dr. P. B. Godkar.
- 2) John Bernard Henry's Clinical Diagnosis And Management By Laboratory Methods

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- II

CLINICAL PATHOLOGY – (PRACTICAL)

No. of hrs. / week : 4
Credits: 2

Topics	No. of Hrs
1. Introduction to routine examination of faeces: Specimen collection, containers, precautions, preservatives, storage	(2)
2. Gross and physical examination of stool	(2)
3. Chemical examination of faeces: Determination of pH and occult blood	(2)
4. Microscopic examination of stool specimen (by routine and concentration method)	(8)
5. Physical and microscopic examination of CSF	(4)
6. Chemical examination of CSF. quantitative determination of glucose, proteins and Chlorides.	(4)
7. Routine examination of semen: Introduction, physical examination of semen	(2)
8. Quantitative determination of semen fructose	(2)
9. Microscopic examination of semen	(4)
10. Pregnancy test.	(1)

Reference books:

- 1) Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- II

ANATOMY – PHYSIOLOGY & ORIENTATION TO MEDICINE – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs / % Wtg
1) Digestive system. Organs of the digestive system, Basic structure of the alimentary canal, Mouth, Salivary glands, Pharynx, Oesophagus, Stomach, Small intestine, Large intestine (colon), rectum & anal canal, Pancreas, Liver, Biliary tract, Summary of digestion & absorption of nutrients, Brief metabolism	(2) (12)
2) Nervous system. Neurones, Central nervous system, Brain, Spinal cord, Peripheral nervous system, Autonomic nervous system, Response of nervous tissue to injury.	(3) (10)
3) Reproductive system. Female reproductive system, Male reproductive system	(3) (10)
4) Endocrine system. Pituitary gland & hypothalamus, Thyroid gland, Parathyroid glands, Adrenal (suprarenal) glands, Pancreatic islets, Pineal gland or body, Thymus gland, Local hormones.	(4) (16)
5) Special senses – tongue, nose, eye, ear, skin.	(3) (8)

Text book: Ross and Wilson: Anatomy and Physiology

ORIENTATION TO MEDICINE:

Topics

1) General practitioner’s approach in the examination of a patient.	(1) (2)
2) Clinical observations: Temperature, the pulse, respiration, blood pressure cough and sputum	(1) (2)
3) General causes of disease	(1) (2)
4) General effects of disease on the body	(1) (2)
5) Infectious illnesses: Acute infections, fevers, General Principles of treatment	(1) (4)
6) Tropical diseases: Malaria, Cholera, Typhus fever, Leprosy, Diagnosis and treatment	(2) (8)
7) Skin and Sexually transmitted diseases: Syphilis, Gonorrhoea, AIDS, Ringworm etc. Diagnosis and treatment	(4) (8)
8) Diseases of the respiratory system: Acute bronchitis, Pneumonia, Pulmonary tuberculosis, Asthma, Diagnosis and treatment	(4) (8)
9) Approach of a General Practitioner in the case of Anemia and Thalassemia	(2) (8)

Reference book:

Toohy’s medicine by Stephen R. Bloom

32 / 100%

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- II**ENVIRONMENTAL STUDIES – (THEORY)**

No. of hrs. / week : 2
Credits: 2

Topics	No of Hrs / % Wtg	
1) The multidisciplinary nature of environmental studies, Definition, Scope, Importance, Need for public awareness	(2)	(12)
2) Renewable & non-renewable resources: Forest resources, Water resources, Mineral resources, Food resources, Land resources	(12)	(24)
3) Ecosystem: Concept, structure & functions, Energy flow Food chains	(4)	(16)
4) Biodiversity & its conservation: Introduction, definition, Generic species & ecosystem diversity, Threats to Biodiversity, Endangered endemic species of India.	(4)	(16)
5) Environmental pollution: Causes, effects & control Measures of – Water, Air, Soil, Marine, Noise, Thermal – pollution, nuclear hazards.	(4)	(16)
6) Human population & environment: Population Explosion, family welfare program, human rights, Women & child welfare, role of information technology in environment	(4)	(16)
	30	/ 100%

Reference books:

- 1) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner
- 2) Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB).

- **Qualification of lecturer:** Ph.D or M. Sc. in life sciences, Microbiology, Biochemistry or Clinical Laboratory Science.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- II

- **Pathology laboratory and Hospital visits**

Day: Mainly Saturday (Or any other day as per time table)

Time: 8.30 AM to 1.30 PM

- Objectives Students will learn to correlate tests performed in the institute & in the practicing laboratory.

1) **Hospital Visits :**

Students will learn the following-

- Instructions given to patients
- Preparation and arrangement of specimen containers
- Materials used for Venipuncture
- Various anticoagulated bulbs
- Use of Vacutainers
- Proper Venipuncture practice
- Separation of Serum
- Separation of Plasma

2) **Pathology Laboratory Visits**

Students will learn the following-

- Comparison of tests performed in the college laboratories and in the pathology laboratory (Refer to the list of experiments provided by the department)
- Documenting the work performed and observed in the log book (Refer to the instructions provided by the department)
- Write a specific experiment in the journal
- Write attendance % at the end of working in a particular department (No of working days/no of days attended)

Submission of log books: Monday 10.30 AM

SECOND YEAR

SEMESTER- III

BIOCHEMISTRY – (THEORY)

No. of hrs. / week : 3
Credits : 3

Topics	No of Hrs / % Wtg
<u>General Biochemistry</u>	
1) Cell membrane chemistry, comparison of human normal cell with red blood cell and bacterial cell and an enveloped virus.	(5) (9)
2) Thermodynamics: Basic concepts. Systems: Open, closed and isolated Laws of Thermodynamics, enthalpy, entropy and Gibbs free energy, importance of high-energy phosphate compounds (ATP, ADP etc) in metabolism	(5) (9)
3) Chemistry of lipids (part 1): Definition, importance, properties, classification Digestion and absorption of lipids. Beta oxidation of fatty acids, general lipid metabolism, cholesterol absorption & synthesis	(8) (20)
4) Water and mineral metabolism: General consideration, body fluid distribution. Factors which influence distribution of water, mineral metabolism (Sodium, potassium, chlorides, calcium and inorganic phosphorus)	(6) (14)
<u>Clinical Biochemistry</u>	
5) Kidney function tests: General consideration, functions of kidneys, Hormonal regulation, Renin-angiotensin system, Acidification of urine, kidney function tests, clinical significance	(6) (17)
6) Liver function tests: General consideration, the liver microscopic anatomy of liver, flow of blood and bile through liver. Liver functions, synthesis & metabolism of bile pigments, bile salts, disordered bilirubin metabolism, hepatic, pre-hepatic and post-hepatic conditions, liver function tests, clinical significance.	(8) (20)
7) Automation in Biochemistry: Historical aspects, continuous and discrete types, semi-automated and fully automated of autoanalyzer, batch and random access analyzers.	(4) (6)
8) Various techniques used in Biochemistry laboratory: rate of reaction method, ELISA technique for the determination of thyroid hormones (T ₃ , T ₄)	(3) (5)
Reference books:	45 / 100%

- 1) Text book of medical laboratory technology; by Dr. P. B. Godkar
- 2) Harper's Biochemistry
- 3) Biochemistry by U. Satyanarayana
- 4) Schaum's outlines – Biochemistry

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER – III

BIOCHEMISTRY – (PRACTICAL)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Determination of serum creatinine by visible rate of reaction method.
- 2) Determination of serum urea by Berthelot reaction method.
- 3) Determination of creatinine clearance.
- 4) Determination of urea clearance.
- 5) Determination of serum bilirubin by Malloy-Evelyn's method.
- 6) Determination of SGPT by rate of reaction method.
- 7) Determination of SGOT by rate of reaction method.
- 8) Determination of alkaline phosphates by rate of reaction method.
- 9) Determination of serum total cholesterol.
- 10) Determination of HDL-Cholesterol.
- 11) Determination of serum-triglycerides.
- 12) Determination of serum sodium, potassium by flame photometry.
- 13) Determination of serum chlorides.
- 14) Determination of CSF and urine chlorides.
- 15) Determination of serum calcium.
- 16) Determination of inorganic phosphorus.
- 17) Identification of urine amino acids by paper chromatography.
- 18) Fractionation of serum proteins by agarose gel electrophoresis.
- 19) Working of Semi-autoanalyzer.

Ref: Text book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar

- **Laboratory Visits:**

Experiments to be observed: semi automated methods for the determination of Glucose, Urea, Creatinine, Total proteins, Albumin, S.bilirubin, T. cholesterol, HDL-Cholesterol, SGPT, SGOT, Alkaline phosphates, Flame photometry, serum calcium and inorganic phosphorus.

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER – III

MICROBIOLOGY – (THEORY)

No. of hrs. / week : 3

Credits : 3

Topics	No of Hrs / % Wtg
1) Revision of safety in microbiology laboratory and waste disposal.	(2) (4)
2) Study of Gram positive Bacteria, The Streptococci and Staphylococci:	(6) (12)
3) Non-spore forming Gram-positive Bacilli: <i>Corynebacterium diphtheriae</i>	(5) (12)
4) Study of Spore-forming Gram –positive bacilli: <i>Clostridium</i> species:	(5) (12)
5) Study of <i>Mycobacterium</i> : <i>Mycobacterium tuberculosis</i> and <i>Mycobacterium leprae</i> :	(10) (25)
6) Revision of study of Gram-negative bacteria: <i>E.coli</i> , <i>Salmonella</i> , <i>Shigella</i> sp, <i>Vibrio</i> sp.	(5) (10)
7) Diagnostic serology: Introduction, The immune system, Immunological reaction and related Terms, Antibodies- IgA, IgD, IgE, IgG, IgM. Immunity – natural acquired Passive immunity, Antigen antibody interaction Origin of immune cells, T-cell and B-cell, Complement system. Serological tests: VDRL and Widal tests	(12) (25)

Reference book:

45 / 100%

- 1) Microbiology by Dr. Ananthnarayana
- 2) Jawetz, Melnick and Adelberg's Medical Microbiology
- 3) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- 4) Shaum's outline - Microbiology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER - III

MICROBIOLOGY – (PRACTICALS)

No. of hrs. / week : 6

Credits : 3

Topics

- 1) Study of following Gram negative bacteria in pure culture: E. coli, Salmonella sp.,
- 2) Study of following Gram positive bacteria in pure culture: Streptococcus pyogenes, Streptococcus pneumonia, Streptococcus aureus, Corynebacterium diphtheriae.
- 3) Demonstration of culture of anaerobic bacteria in an anaerobic atmosphere.
- 4) Staining of sputum smear for the detection of Mycobacterium tuberculosis by Ziehl -Neelsen (Hot stain) Method for Mycobacterium leprae
- 5) Performing following serology tests of serum.
 - Antigen antibody reactions
 - Preparation of serial dilutions of serum
 - Study of Prozone effect
 - Study of flocculation test: VDRL test
 - Study of slide agglutination test: Widal test
 - Study of Tube agglutination test: Widal test

Reference test books:

- 1) Text book of Medical Laboratory Technology by Dr. P. B. Godkar.
- 2) Microbiology by Dr. Ananthnarayana.

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- III

HAEMATOLOGY – (THEORY)

No. of hrs. / week : 1

Credits : 1

Topics	No of Hrs / % Wtg
1) General aspects of blood cell formation: sites of blood formation, Development of blood cells, stem cells . Erythropoiesis, The erythroid series	(2) (15)
2) Granulopoiesis, formation of monocytes and macrophages, lymphopoiesis. The lymphoid series.	(1) (4)
3) T and B lymphocytes and thrombopoiesis. The megakaryocytic series	(1) (7.5)
4) Roll of erythropoetin in the regulation of hemopoiesis. Regulation of hemopoiesis, Regulation of granulopoiesis.	(1) (7.5)
5) Structure and metabolism of the red cell. Hemoglobin synthesis. Various factors which affect normal hemoglobin synthesis, Role of iron, vitamins and metallic ions in the synthesis of hemoglobin.	(2) (15)
6) Anemia: Defination, Clinical features, Morphological classification of anemia Causes of anemia. (only basic information of these topics)	(2) (15)
7) Automation in hematology. Cell counting by impedance measurement. Advantages of automation in hematology. General measurement parameters by Hematological autoanalyzer. Study of histograms related to iron deficiency anemia And thalassemia minor.	(2) (10)
8) Hematological special tests for the diagnosis of anemia – <ul style="list-style-type: none">• Complete Histogram.• Screening test for sickle cell anemia• Determination of fetal hemoglobin• Osmotic fragility test• Preparation of LE cell• Determination of G6PD• Determination of serum total iron and iron binding capacity• Hemoglobin electrophoresis	(4) (25)
<hr/> 15 / 100%	

Reference text books:

- 1) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- 2) Dacie and Lewis practical Hematology
- 3) Text book of Hematology by Dr. Tejinder singh.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER – III

HAEMATOLOGY – (PRACTICAL)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Revision of determination of hemoglobin by Cyanmethemoglobin method (2)
- 2) Revision of preparation of blood smears, staining and microscopic examination. (4)
- 3) Screening test for sickle cell anemia. (2)
- 4) Determination of fetal hemoglobin. (2)
- 5) Determination of osmotic fragility of red blood cells. (4)
- 6) Determination of G-6PD. (2)
- 7) Determination of iron and total iron binding capacity (TIBC) in serum (4)
- 8) Nestrof test. (2)
- 9) Hemoglobin electrophoresis. (4)
- 10) Demonstration of working of hemoglobin analyzer. Study of normal histograms and histograms of iron deficiency anemia and Thalassemia minor. (4)

Reference book:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER- III**HISTOPATHOLOGY – (THEORY)**

No. of hrs. / week : 1

Credits : 1

Topics	No of Hrs / % Wtg	
1) Introduction & orientation to Histopathology and cytological, Techniques.	(1)	(5)
2) The cell- i) Structure ii) cell division iii) Colloidal conception of tissue.	(1)	(5)
3) Methods of examination of tissues and cells.	(1)	(5)
4) Gross examination of organs.	(1)	(5)
5) Fixation - Introduction, aim of fixation.	(1)	(5)
6) Fixatives – Reagents used, advantages, disadvantages.	(1)	(5)
7) Gross fixation of different organs.	(1)	(5)
8) Decalcification – Technique, different types of fluids used.	(1)	(5)
9) Processing of tissue by manual methods.	(1)	(5)
10) Processing of tissue by using automatic tissue processor.	(1)	(5)
11) Paraffin section cutting.	(1)	(5)
12) Different types of cryostats.	(1)	(5)
13) Theory of staining.	(1)	(5)
14) Mountants, basic staining and mounting procedures.	(1)	(5)
15) Routine staining procedures and frozen section techniques.	(1)	(5)
16) Special staining techniques.	(1)	(5)
17) Exfoliative cytology techniques.	(1)	(5)
18) Museum techniques.	(1)	(5)
19) Immuno-histochemistry, introduction & technique.	(1)	(5)
20) Electron microscopic techniques & recent advances.	(1)	(5)
	20 /	100%

Reference test books:

- 1) Histological Techniques, a practical manual by Dr. K. Laxminarayana
- 2) Text book of Medical Laboratory Technology by Dr. P. B. Godkar

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- III

HISTOPATHOLOGY – (PRACTICALS)

No. of hrs. / week : 4

Credits : 2

Topics

- 1) Orientation and introduction to the Histopathology techniques.
- 2) Orientation, safety rules and personal care in Histopathology laboratory.
- 3) Use, care and maintenance of equipment and glassware used in Histopathology laboratory.
- 4) Gross examination of specimen preparation. Preparation of Histopathology card report.
- 5) Methods for examination of different specimen.
- 6) Preparation of different types of fixative.
- 7) Technique of fixation.
- 8) Decalcification-
Preparation of decalcifying fluid.
Different techniques of decalcification.
- 9) Processing-
Paraffin wax embedding technique.
Manual processing technique.
Automated processing technique.
- 10) Study of instruments: (By field visits)
Automatic tissue processor.
Microtome knives.
knife sharpening equipments & technique.
Different types of microtomes.
Cryostat section.
Electron microscope and its technique.
- 11) Paraffin wax embedding section cutting technique.
- 12) Cryostat section cutting technique.
- 13) Preparation of different reagents and staining solutions.
- 14) Haematoxyline and Eosin staining techniques.
- 15) Other special staining techniques.
- 16) Cytological specimen collection.
- 17) Pep staining technique.
- 18) Museum technique.
- 19) Immuno- histochemistry technique.

Reference test books:

- 1) Histological Techniques, a practical manual by Dr. K. Laxminarayana
- 2) Text book of Medical Laboratory Technology by Dr. P. B. Godkar

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book lab coat, fractional weighed box, other requirements.
- 2) Writing rough note book, SOP \ and safety requirements.
- 3) Writing Journals.

SEMESTER – III

LABORATORY MANAGEMENT – (THEORY)

No. of hrs. / week : 1
Credits: 1

Topics	No of Hrs/	% Wtg
1) General laboratory Management, Basic concepts and Definitions Organization and operation of a laboratory, various types of laboratories.	(1)	(4)
2) Basic laboratory principles and procedures, Laboratory safety, the first Aid measures The responsibilities of laboratory staff, Waste disposal systems.	(1)	(4)
3) Role of managers, providing leadership by example and attitude, Human resource management, Building a positive culture, Developing a system for measuring performances, Forecasting, Planning and Decision making, formulating vision, and mission.	(1)	(6)
4) Importance of effective communication and documentation. Writing SOPs, Understanding medico-legal aspects of laboratory practice.	(1)	(6)
5) Introduction to financial management, key concepts like finance management, budgeting, test cost accounting, capital expenditure, expense reports, break-even analysis, understanding balance sheet, profit and loss statement, equity and cash flow.	(1)	(6)
6) Re-engineering work flow and technology changes.	(1)	(4)
7) Fundamentals of total quality management. Quality systems, Control of design, document, data, purchasing. Process control, control of inspection measuring and testing materials, concept of validation, Control of non-conforming areas.	(1)	(6)
8) TQM framework Control of quality records, Internal quality audits.	(1)	(4)
9) Current trends in laboratory accreditation. Understanding NABL and ISO regulations. The six sigma concept	(1)	(6)
Quality control		
1) Total quality management framework	(1)	(4)
2) Essential elements of quality assurance program	(1)	(6)
3) Internal quality control	(1)	(4)
4) Control of pre-analytical variables	(1)	(6)
5) Control of analytical variables	(1)	(6)
6) Control of post-analytical variables	(1)	(4)
7) Validation of methods	(1)	(6)
8) Documentation of analytical protocols	(1)	(6)
9) Verification of reference intervals	(1)	(4)
10) Reference materials and calibrating definitive methods	(1)	(4)
11) Sources of variations in laboratory test results	(1)	(4)
		20 / 100%

Reference test books:

- 1) Text book of Medical Laboratory Technology by Dr. P. B. Godkar

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- III

- **Pathology laboratory and Hospital visits**

Day: Mainly Saturday (Or any other day as per time table)

Time: 8.30 AM to 1.30 PM

- Objectives Students will learn to correlate tests performed in the institute & in the practicing laboratory.

3) **Hospital Visits :**

Students will learn the following-

- Instructions given to patients
- Preparation and arrangement of specimen containers
- Materials used for Venipuncture
- Various anticoagulated bulbs
- Use of Vacutainers
- Proper Venipuncture practice
- Separation of Serum
- Separation of Plasma

4) **Pathology Laboratory Visits**

Students will learn the following-

- Comparison of tests performed in the college laboratories and in the pathology laboratory (Refer to the list of experiments provided by the department)
- Documenting the work performed and observed in the log book (Refer to the instructions provided by the department)
- Write a specific experiment in the journal
- Write attendance % at the end of working in a particular department (No of working days/no of days attended)

Log book submission day: Monday 10.30 AM

SEMESTER - IV

INTERNSHIP PART

SEMESTER - IV

INTERNSHIP- 20 Weeks

(With Government, Private Hospital Pathology Laboratories and Laboratories of Specialty Health care Centers)

Note: 40 hrs of Internship = 1 Credit

SR.NO	SUBJECT	Internship/ No of Hrs	Weeks	Credits
1	Biochemistry	160	4	4
2	Microbiology	160	4	4
3	Hematology	160	4	4
4	Clinical Pathology	160	4	4
5	Blood Banking	80	2	2
6	Histopathology	80	2	2
Total Internship (Semester IV) Credits = 20				

Objectives: Students will learn about the basic laboratory principles & procedures of hospital & pathology laboratories (Infrastructure, organization, various levels of staff members, specimen collection and distribution and performance of various laboratory tests.

At the end of the tenure in a particular laboratory students will learn the following-

- Set-up of the laboratory
- Responsibilities of various types of laboratory staff
- Specifications of laboratory equipments and instruments
- Instructions given to patients
- Specimen collection
- Venipuncture
- Use of vacutainers and other types of materials
- Use of various types of instruments
- Separation of serum and plasma
- Distribution of tests(work load)
- Performing tests
- Preparation of reports and dispatch of reports
- Waste management

Note:

- 1) All the observations are documented in the log book day to day.
- 2) By using the data in the log book, projects are prepared in the last two week of the department
- 3) Logbook and projects should be submitted at the end of the tenure of the Department.
- 4) Write attendance % at the end of working in a particular department (No of working days/no of days attended)

Submission of log books and projects: Last Friday of the month. (January to April)

Time: 1.30 PM

THIRD YEAR

SEMESTER -V

BIOCHEMISTRY – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs	% Wtg
1) Chemistry of lipids: Part 2 Lipoprotein metabolisms, metabolism of VLDL, LDL , HDL, characteristic of major apoproteins. Important enzymes in lipoprotein metabolism , Cholesterol catabolism, Dyslipidemia, Criteria for diagnosis of hyperlipidemia, Primary and secondary dislipidemias, Fredrikson’s Classification of lipoproteins.	(8)	(25)
2) Cardiac Profile tests: Blood supply of heart, the cardiac cycle, electrical changes in the heart, Ischemic Heart disease , Atherosclerosis,Risk factors, The response to injury hypothesis, Cardiac profile tests, Cardic injury panel tests, Biochemical cardiac markers.	(5)	(20)
3) Chemistry of bone: Mineral & Bone metabolism, Calcium and bone metabolism, Role of hormones and vitamins. Metabolic bone disorders, bone profile tests. Spot test for urinary calcium. Iron selective technology for the determination of free calcium ions.	(5)	(15)
4) Acide –base balance: Introduction, diffusion of gases in the lungs, Action of buffer systems, The hemoglobin buffers, Bohr effect, Disturbance in acid base balance, Acidosis and Alkalosis , Determination of blood pH and blood gases .	(5)	(15)
5) Chemistry of Hormones: Introduction, Regulation of actions of hormones, General mechanism of action of hormones, Classification of hormones, Actions of secondary messengers, Chemistry of hormones, hormones of thyroid gland, Thyroid disorders, Thyroid profile tests	(5)	(15)
6) Various laboratory techniques: Fluorimetry, Radioimmuno assays, ELISA, Chemiluminescence and Bioluminescence	(2)	(10)
	<hr/>	<hr/>
	30 /	100%

Reference Text Book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER –V

BIOCHEMISTRY – (PRACTICALS)

No. of hrs. / week: 4
Credits: 2

Topics	No of Hrs
1) Lipid profile tests: S. total cholesterol, HDL. Cholesterol, LDL-Cholesterol VLDL-cholesterol, T.cholesterol /HDL Cholesterol ratio.	
2) Special Diabetic profile tests: Determination of Glycosylated hemoglobin, Microalbuminurea.	
3) Determination of Apolipoprotein A1, Lp(a) and Determination of Apolipoprotein B	
4) Determination of serum calcium, inorganic phosphorus and S. alkaline phosphatase as a part of bone profile tests	
5) Determination of cardiac injury panel tests: CK-T , CK-MB, SGOT, LDH and SHBD	
6) Determination of Troponin T and Troponin-I	
7) Determination of blood pH, PO ₂ ,PCO ₂ , and plasma bicarbonate.	
8) Determination of Thyroid profile tests: T ₃ , T ₄ , TSH, free T ₃ , free T ₄ , Thymoglobulin, TBG and TRH	

Laboratory Visits:

Observation and participation in the operation of random access analyzers for the determination Experiments 1 to 8

Reference text book:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

SEMESTER –V

MICROBIOLOGY – (THEORY)

No. of hrs. / week : 3
Credits: 3

Topics	No of Hrs	% Wtg
1) Study of spirochetes: Morphology, Identification , Pathogenesis, Pathology Clinical findings and related laboratory tests.	(4)	(16)
2) Study of Chlamydia, Rickettsia and Mycoplasma: Morphology, Identification Pathogenesis, Pathology, Clinical findings and laboratory tests.	(5)	(10)
3) Collection , Transport and Examination of Specimens –	(5)	(20)
<ul style="list-style-type: none"> • Urine • Urogenital Specimens • Throat and mouth specimens • Sputum • Blood 		
4) Viruses (Part –I) Introduction , Useful definitions, Classification, Structure and properties, Infection of host cells, General transmittance routes, Host response	(3)	(8)
5) Overview of DNA and RNA containing viruses Important viruses and related diseases. Viruses of medical Importance	(3)	(8)
6) Lentiviruses and AIDS: Introduction , Important properties of lentiviruses, Major gene products of HIV Pathogenesis and pathology, Prevention of HIV, Transmission of HIV, Clinical findings in HIV, Laboratory diagnosis.	(6)	(20)
7) Poxviruses: Introduction, Structure and composition, Classification replication, related diseases, pathogenesis and pathology, Laboratory diagnosis.	(2)	(10)
8) Picornaviruses: Introduction, Structure and composition, Classification, replication, related diseases, pathogenesis and pathology, Laboratory diagnosis.	(2)	(8)

Reference book:

30 / 100%

- 1) Medical microbiology by Dr. Ananthnarayana
- 2) Textbook of medical laboratory technology by Dr. P. B. Godkar.
- 3) Jawetz, Melnick and Adelberg’s medical microbiology.
- 4) Shaums outline Microbiology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- V

MICROBIOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

Examination of

- 1) Urine
- 2) Urogenital specimens.
- 3) Throat and mouth specimens.
- 4) Sputum.
- 5) Blood
- 6) Use of Versatrek system or Bacteck system
- 7) Use of Fully automated API system.
- 8) Mycobacterium culture (LJ method).
- 9) Determination of hepatitis markers
- 10) Detection of HIV-1 and HIV-II by screening methods.
- 11) Detection of Human Anti HIV-1 by Immunoblotting technique.

Reference Text Book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

• **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER – V

HAEMATOLOGY – (THEORY)

No. of hrs. / week : 2
Credits : 1

Topics	No of Hrs	% Wtg
1) Revision of Anemia and Classification of anemia.	(1)	(4)
2) Bone marrow examination, structure of bone marrow, sites of bone marrow aspirate, evaluation of bone marrow aspirate, various cells. Assessment of iron-stores.	(3)	(20)
3) Iron deficiency anemia(IDA), Introduction , Prevalence of IDA in India, Iron metabolism, Iron balance, causes of iron-deficiency, Bone marrow features, Differential diagnosis using histograms.	(2)	(12)
4) Hemolytic anemia Red cell destruction: Intravascular and extra vascular, laboratory findings Clinical manifestations, compensatory mechanism.	(3)	(20)
5) Megaloblastic anemia: Folate deficiency, Vitamin B12 deficiency, Pathogenesis, Clinical features, Peripheral blood findings , Bone marrow picture, Pernicious anemia.	(2)	(12)
6) Aplastic anemia, Pathogenesis, Hemotological findings, Clinical features, Course of the disease , Associated Laboratory findings.	(2)	(12)
7) Revision of Automation in hematology, Cell counting by impedance technique, General measurement parameters , Determination of RBC, WBC and platelet histograms. Fixed and automatic discriminators, Differential Methods, Laser technology, Importance of RWD-CV, study of histograms	(3)	(20)
	16 /	100%

Reference book:

- 1) Text book of hematology by Dr. Tejinder Singh.
- 2) Text book of Medical Laboratory Technology by Dr. P. B. Godkar

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- V

HAEMATOLOGY – (PRACTICAL)

No. of hrs. / week : 6
Credits : 3

Topics

- 1) Study of blood smears related to iron deficiency anemia.
- 2) Study of histograms related to iron deficiency anemia.
- 3) Determination of blood cell indices and RDW for the differentiation of IDA and Thalassemia minor.
- 4) Preparation of bone marrow smears and microscopic examination of stained smears.
- 5) Determination of plasma hemoglobin .
- 6) Sucrose lysis test.
- 7) Determination of hemoglobin, MCV, MCH, MCHC and RDW by autoanalyzer.
- 8) Determination of RBC count and related histogram by autoanalyzer.
- 9) Study of blood smears related to megaloblastic anemia.
- 10) Study of histograms related to megaloblastic anemia.
- 11) Study of histograms related to aplastic anemia.

Reference Text Book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

Note: Following practicals will also be conducted in the Hematology laboratory of the Department

Expt. No. 1, 2, 3, 4, 5, 6, 9, 10 & 11

(Supervisors (Senior Visiting faculty with one Department teacher).

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER –V

MOLECULAR BIOLOGY – (THEORY)

No. of hrs. / week : 1
Credits: 1

Topics	No of Hrs	% Wtg
1) Introduction to molecular biology & molecular pathology.	(2)	(4)
2) Nucleic acid Biochemistry and biology: Molecular composition and structure.	(4)	(8)
3) Replication of DNA, nucleic acid associated.	(2)	(4)
4) Transcription of DNA to RNA, post-transcriptional modifications.	(2)	(4)
5) Translation of RNA to protein (protein synthesis).	(2)	(4)
6) Transcriptional control, mechanism of DNA repair, DNA mutations.	(2)	(4)
7) Nucleic acid analysis, electrophoretic separation, nucleic acid hybridization.	(4)	(8)
8) Hybridization assays- Southern and Northern hybridizations.	(2)	(12)
9) In situ Hybridization.	(1)	(8)
10) Restriction fragment length polymorphism- based assays.	(2)	(4)
11) Target amplification methods, polymerase chain reaction.	(2)	(8)
12) Reverse-transcriptase PCR, branched DNA.	(1)	(8)
13) Hybridization array technologies, microarrays, oligonucleotide microarrays.	(2)	(8)
14) DNA microarrays, clinical applications of microarrays technology.	(2)	(8)
15) Molecular diagnosis of genetic diseases.	(2)	(8)
		<hr/> 30 / 100%

Reference Text Book: Henry's Clinical Diagnosis & Management by Laboratory Methods.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER –V

MOLECULAR BIOLOGY – (PRACTICALS)

No. of hrs. / week : 2
Credits : 1

Topics

- 1) Extraction of DNA from peripheral blood mononuclear cells.
- 2) Extraction of RNA from peripheral blood mononuclear cells
- 3) Performing polymerase chain reaction (PCR) of DNA
- 4) Isolation of DNA (after PCR)
- 5) Electrophoretic fractionation of DNA (southern blot technique)
- 6) Performing Northern blot technique
- 7) Performing western blot technique
- 8) Demonstration of PCR and RT – PCR for the determination of viral load and working of Facscan for CD₄ and CD₈ determination.

Reference Text Book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar
: PowerPoint presentations related to Molecular Biology & PCR

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- V

IMMUNOLOGY – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs / % Wtg	
1) The immune system, Immunity and immune response, Adaptive immunity, active and passive immunity.	(3)	(10)
2) Mechanisms of innate immunity, physiological barriers at the portal of entry, The skin , mucous membranes, Reticuloendothelial system. Phagocytes	(3)	(10)
3) Inflammatory response, possible mechanisms of fever production, Natural killer (NK) cells, Interferons	(3)	(10)
4) Origin of immune cells, T-cells, B-cells, Functions of T-cells, Functions of B-cells.	(3)	(10)
5) Antibodies : Immunoglobulin structure, Immunoglobulin classes, IgG, IgA ,IgM, IgD, IgE, Various functions of antibodies.	(4)	(15)
6) Immunoassays: Antigen – antibody interactions. Kinetics of antigen –antibodies, Reactions Binding forces, Binding sites on immunoglobulins. Precipitation methods, methods based on simple diffusion, Radial. Immunodiffusion, Immunoelectrophoresis.	(6)	(20)
7) Nephelometric Immunoassays for the determination of antibodies and other proteins in serum.	(4)	(15)
8) Enzyme immunoassays Homogeneous immunoassays, Heterogeneous immunoassays, Indirect ELISA, Use of biotin and avidin.	(4)	(8)

Reference book:

30 / 100%

- 1) Medical Microbiology by Jawetz et al
- 2) Text book of medical Laboratory Technology by Dr. P. B. Godkar.
- 3) Clinical diagnosis and Management by Laboratory methods by Henry.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER -V

IMMUNOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) RA tests
- 2) ASO test
- 3) VDRL test
- 4) C-reactive protein test
- 5) Determination of HBS Ag
- 6) Determination of HBc
- 7) Determination of HBe.
- 8) Determination of Dengue antibodies.
- 9) Study of working of mini-VIDAS.
- 10) Determination of CSF proteins by turbidimetric method.

Reference Text Book: Text book of Medical Laboratory Technology by Dr. P. B. Godkar

Note: Following practicals will also be conducted in the Microbiology laboratory.
No. 1, 2, 3, 4 & 10

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER –V**TRANSFUSION MEDICINE – (THEORY)**

No. of hrs. / week : 1

Credits: 1

Topics	No of Hrs	% Wtg
1) Blood collection Donor registration. Donor selection. Medical history and miniphysical examination. Phlebotomy. Donor reactions.	(2)	(14)
2) Blood processing tests ABO & Rh typing Antibody screening Transfusion-transmitted Disease Testing.	(2)	(10)
3) Blood preservation Anticoagulant & RBC additives. Biochemical changes during liquid storage. Storage of frozen RBCs	(2)	(10)
4) Preparation & selection of blood components & derivatives Preparation of blood components. Selection of blood components. Selection of blood derivatives.	(3)	(16)
5) Special situations Hemapheresis. Direct transfusions. Hemolytic disease of the newborn. Exchange transfusion.	(2)	(10)
6) Pretransfusion testing General consideration Antibody screen. The crossmatch Selection of units.	(2)	(10)
7) Infusion of Blood components Proper identification. Conditions affecting the infusions of blood components. Monitoring the patient.	(2)	(14)
8) Transfusion reactions Nonhemolytic transfusion reactions. Hemolytic transfusion reactions. Transfusion reaction investigations. Diseases transmitted through blood transmission. Transfusion-induced immunosuppression. Quality Management Waste Management	(2)	(16)
		<hr/> 17 / 100%

Reference Text Book: Henry's Clinical Diagnosis & Management by Laboratory methods.**Note:****On the first day of the new semester the teacher should provide following information to the students –**

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER –V

TRANSFUSION MEDICINE – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Collection of blood from the donor, basic requirements, Taking and giving sets in blood transfusion, donor preparation, blood collection storage of blood, Blood transfusion, Blood bank drives.
- 2) Blood processing tests
ABO & Rh typing
Antibody screen.
Indirect antiglobulin (Coomb's) test.
The compatibility test.
Antiglobulin cross-matching.
- 3) Quantitative determination of anti-D antibody titre.
Transfusion-transmitted Disease Testing.
- 4) Blood preservation
Anticoagulants & RBC additives.
Storage of frozen RBCs
- 5) Preparation & selection of blood components & derivatives
Preparation of blood components.
Selection of blood components.
Selection of blood derivatives.
- 6) Special situations
Hemapheresis (demonstration)
Direct transfusions (Observation)
Exchange transfusion (Observation)
- 7) Pretransfusion testing
Antibody screen test.
The crossmatch test
Selection of units.
- 8) Infusion of Blood components
Monitoring the patient.
- 9) Study of Transfusion reactions
Transfusion reaction investigations and laboratory tests.

Reference Text Book: Henry's Clinical Diagnosis & Management by Laboratory methods.

Note:

It is necessary to attend blood bank drives and document the following details:

- Blood bank drive : Place , Time
- Blood bank drive team (names and designations)
- Number of donors
- Screening methods
- Rejection criteria and data.
- Donor blood collection : Method and number of bags
- Transportation and storage data.
- Component separation data.
- Data of used blood bags.
- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- V

Pathology Laboratory and Hospital Laboratory Practical Training:

Students will visit on the following days:

Monday, Tuesday, Thursday and Friday (8.30 AM to 4.30 PM)

Students will attend the Institute for lectures on the following days:

Wednesday and Saturday

Note: Above schedule is subject to change as per time table of the Institute.

Objectives:

Students will learn working of autoanalyzers related to all the subjects of semester V while performing routine, profile and special types of semester V. Each student is required to prepare projects related to each subject with related autoanalyzers.

Pathology Laboratory & Hospital visits

Instructions

- 1) Students should observe or perform the experiments as per syllabus of semester – V related to each subject.
- 2) They should complete log books daily.
- 3) The experiment details should be written in the respective journals daily.
- 4) Log books & journals are submitted at the end of the training in a particular department.
- 5) Routine experiments should be listed in the log book (& not in the Journal).
- 6) Write attendance % at the end of working in a particular department (No of working days/no of days attended)

Log Book submission: Last Friday of the month at 1.30 PM (June to December)

THIRD YEAR

SEMESTER- VI

BIOCHEMISTRY – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs / % Wtg
1) Cancer and tumor markers: General consideration, the carcinogens, oncogenic viruses, activation of protooncogenes to oncogenes, oncogenes, mechanism of action of oncogenes, Importance of growth factors. Chromosomal translocation, gene amplification, Point mutation, Antioncogenes, Characteristic of growing tumor cells, Tumor markers and laboratory determinations	(5) (20)
2) Therapeutic drug monitoring and chemical aspects of toxicology: Introduction, metabolism and excretion of drugs, relation between plasma concentrations of drugs and their cellular effects, monitoring individual drug concentration– Digoxin, Phenytoin Cyclosporin, Lithium, Paracetamol, Salicylates, Ethanol and Methanol	(5) (20)
3) Hormones II: Hormones of pituitary gland & hypothalamus, Hormones of adrenal gland, Hormones of the gonads, the menstrual cycle, Human chorionic gonadotropin.	(5) (10)
4) Clinical Chemistry of pregnancy: Human pregnancy, Role of various hormones conception, embryo, fetus, amniotic fluid, functional development of fetus, complications of pregnancy.	(5) (10)
5) Vitamins and trace elements: Nutritional assessment and monitoring, Oil soluble vitamins, Water-soluble vitamins and related pathophysiology. Trace elements.	(5) (20)
6) Muscle and Nerve biochemistry: Introduction, Biomedical importance, Musle as major biochemical transducer, Fuctional unit of musle , Thick filaments, Roles of Actin and Myosin. Events occurring at the neuromuslular junction	(5) (20)
	<hr/> 30 / 100%

Reference book:

- 1) Text book of Medical Laboratory Technology by Dr. P.B.Godkar
- 2) Clinical Chemistry and molecular diagnosis: Tietz text book
- 3) Harper's Biochemistry

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- VI

BIOCHEMISTRY – (PRACTICALS)

No. of hrs. / week : 4

Credits : 2

Topics

- 1) Use of diagnostic kits.
- 2) Preparation and standardization of reagents.
- 3) Calibration of instruments in the biochemistry laboratory.
- 4) Standardization of a biochemistry method.
- 5) Demonstration of HCG.
- 6) Demonstration of Prolactin.
- 7) Determination of Acid phosphatase.
- 8) Determination of Prostate-Specific Antigen (PSA).
- 9) Demonstration of drug determination (any one as mentioned in theory).
- 10) Determination of standard deviation, CV & plotting of Levey. Jenning chart.

Reference book:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER VI

MICROBIOLOGY – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No. of Hrs /	% Wtg
1) Collection ,Transport and examination of specimens : <ul style="list-style-type: none">• Revision of urine and blood• CSF• Ear specimen• Eye discharge• Pus from abscess materials, wounds,• Burns, sinuses• Skin and soft tissue• Feces	(5)	(20)
2) Clinical mycology : General consideration, Terms applies to fungi: Basic morphological classification, Parasitic fungi, Laboratory diagnosis of mycotic infections.	(3)	(6)
VIROLOGY- Part 2		
3) Hepatitis viruses: Clinical features of HAV, HBV, HCV , HDV , HEV Replication of hepatitis B virus, Pathology, Nomenclature and definitions of hepatitis viruses, Clinical findings, Epidemiology of –HAV, HBV, HCV, HDV, HEV Laboratory features of Infective hepatitis and related laboratory tests.	(3)	(6)
4) Coccidian Protozoan infections: Toxoplasma gondii, Morphology and Identification, cculture, Pathology and Clinical findings,Diagnostic laboratory tests	(4)	(8)
5) Herpesviruses, Introduction, Structure and composition, Classification replication, Related diseases, Pathogenesis and pathology, Laboratory diagnosis.	(5)	(20)
6) Paramyxoviruses and Rubella Virus: Introduction, Structure and composition, Classification, replication, related diseases, Pathogenesis and pathology, Laboratory diagnosis.	(5)	(20)
7) Orthomyxoviruses: Introduction, Structure and composition, Classification, replication, Related diseases, Pathogenesis and pathology, Laboratory diagnosis.	(5)	(20)
8) Host – virus interaction.		
9) Vaccines		

Reference books:

- 1) Microbiology by Dr. Ananthanarayana
- 2) Jawetz, Melnick and Adelberg's medical microbiology.
- 3) Text book of medical laboratory technology by Dr. P.B.Godkar
- 4) Shaum's outline Microbiology

30 / 100%

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER VI

MICROBIOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Examination of-
 - a) Blood
 - b) CSF
 - c) Ear specimen
 - d) Eye specimen
 - e) Pus from abscess material from wounds, burns and sinuses
 - f) Feces
- 2) Study of working of Versatreak system and Biotek system
- 3) Study of working of mini API system
- 4) Preparation and quality control of staining solutions, nutrient agar, culture plates, agar slants, blood agar and quality control.
- 5) Determination of Toxoplasma antibodies in serum.
- 6) Determination of Rubella antibodies in serum
- 7) Determination of CMV antibodies in serum
- 8) Determination of Varicella zoster antibodies in serum.
- 9) Routine examination of cavity fluids – Pleural, pericardial peritoneal & synovial fluid.

Reference book:

Text book of Medical Laboratory Technology by Dr. P. B. Godkar

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- VI

HEMATOLOGY – (THEORY)

No. of hrs. / week : 1
Credits : 1

1) The thalassemias: Introduction, Classification, Beta thalassemia syndromes, World distribution, Distribution in India, Genetics.	(2)	(12)
2) Thalassemia major: Pathophysiology, Bone marrow changes, Extramedullary hemopoiesis, Iron overload, clinical features.	(1)	(6)
3) Thalassemia Major: Clinical findings, special laboratory tests.	(1)	(6)
4) Thalassemia minor: Clinical features, Hematology findings, Bone marrow Changes, Tests for diagnosis of Thalassemia trait,	(1)	(6)
5) Prevention of thalassemia major, Alpha-thalassemias	(1)	(6)
6) Sickle cell disorders: Geographic distribution and prevalence, genetics of sickle cell disorder, Homozygous state (SS), Heterozygous state (AS) , Clinical features, related laboratory tests.	(2)	(12)
7) Leukemias : Introduction, The acute leukemias (ALL), Epidemiology, Pathogenesis., WHO classification of acute leukemias, Laboratory diagnosis.	(2)	(12)
8) Chronic Lymphocytic leukemia (CLL) - Pathogenesis, clinical and laboratory features.	(2)	(12)
9) Chronic Myelogenous leukemia (CML) - Pathogenesis, clinical and laboratory features.	(1)	(7)
10) Parasitic infections of blood – Malaria, Common species found in man, life cycle of malarial parasite . Laboratory tests.	(1)	(7)
11) Leshmaniasis - Life cycle of Leishmania species and related laboratory tests.	(1)	(7)
12) Use of autoanalyzers for the determination of Prothrombin time (PT), PTT, and APTT and related clinical significance.	(1)	(7)

Reference book:**16 / 100%**

- a. Text book of Medical Laboratory Technology by Dr. P.B.Godkar.
- b. Dacie and Lewis Practical hematology.
- c. John Bernard Henry's clinical diagnosis and management of laboratory methods.
- d. Text of hematology by Dr. Tejnder Singh.

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- VI**HEMATOLOGY – (PRACTICALS)**

Topics

- 1) Study of blood smears related to thalassemia minor & major
 - 2) Study of histograms related to thalassemia major & major
 - 3) Netroff test
 - 4) Electrophoretic fractionation of hemoglobin and study of fractionated patterns for Thalassemia major and minor.
 - 5) Determination of fetal hemoglobin.
 - 6) Study of blood smears related to various types of leukemia.
 - 7) Study of histograms related to various types of leukemia.
 - 8) Study of blood smears related to sickle cell anemia.
 - 9) Study of blood smears to examine blood parasites.
 - 10) Determination of WBC count by autoanalyzer (For 3 part differentiation). Compare a normal and one abnormal histogram.
 - 11) Determination of WBC count by flow cytometry. Study of one histogram related to iron deficiency anemia.
 - 12) Determination of Hemoglobin and RBC evaluation by Advia hematological analyzer.
 - 13) Determination of WBC count by Advia analyzer and evaluation of a histogram related to megaloblastic anemia.
 - 14) Determination of RBC count by haematological analyzer and evaluation of histogram related to aplastic anemia.
- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- VI

MOLECULAR BIOLOGY – (THEORY)

No. of hrs. / week : 2
Credits: 2

Topics	No of Hrs / % Wtg
1) Cytogenetics, Chromosome structure, Karyotype analysis.	(4) (10)
2) Computer-assisted Imaging, Fluorescence In Situ Hybridization (FISH) technique	(4) (10)
3) Chromosome abnormalities, Clinical applications.	(4) (10)
4) Cancer genetics.	(4) (20)
5) Cytogenetic disorder.	(4) (10)
6) Molecular Diagnosis of Genetic Diseases, Various techniques, Choice techniques, Various types of Applications, Specific disease examples, Use of DNA polymorphism and other genetic markers.	(4) (20)
7) Forensic Identity testing by DNA analysis.	(4) (20)

Reference book:

28 / 100%

- (1) John Bernard Henry's Clinical Diagnosis and Management of Laboratory methods
- (2) Human cytogenetic techniques and clinical applications by Dr. Hema Purandare and Dr. Amit Chakravarty

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- VI

MOLECULAR BIOLOGY – (PRACTICALS)

No. of hrs. / week : 2
Credits : 1

Topics	No of Hrs
<hr/>	
1) Observation of working of Laminar flow hood, carbon dioxide incubator, preparation of tissue culture media.	
2) Observation of general method of preparation of tissue culture	
3) Observation of a specific laboratory set-up for human cytogenetic techniques	
4) Observation of Basic principles of Cytogenetics procedures	
a) Specimen procurement and logging	
b) Short-term cultures	
c) Long-term cultures	
d) Harvesting	
e) Mitotic arrest	
f) Hypotonic treatment	
g) Fixation	
h) Centrifugation	
i) Slide making	
j) Slide preparation	
k) Microscopy	

Reference book:

- 1) Human cytogenetic techniques and clinical applications by Dr. Hema Purandare and Dr. Amit Chakravarty.

• Instruction for teacher :

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER- VI

IMMUNOLOGY – (THEORY)

No. of hrs. / week : 2
Credits : 2

Topics	No of Hrs / %Wtg
1) Overview of the Immune system	(1) (4)
2) The complement system, structure and function of the complement system. The classical pathway, The alternate pathway.	(3) (8)
3) Regulation of complement activation, complement receptors, complement and acquired immunity.	(3) (8)
4) Complement in disease states: Rheumatologic diseases, Renal diseases neurological diseases.	(3) (8)
5) Complement fixation test: Applicability in serological tests such as VDRL and Wassermann tests.	(3) (12)
6) Kinin and kinin-generating system.	(2) (10)
7) Cytokines and adhesion molecules. Interleukins, Transforming Growth factor, Tumor necrosis factor, Interferon-Gamma , Cell adhesion molecules- Integrins and selectins.	(4) (15)
8) Human leucocyte antigens (HLA): The major Histocompatibility complex of man. Composition of MHC. Genetics of MHC, Localization of MHC genes. Inheritance Class – I and Class – II molecules.	(4) (15)
9) Tissue/organ Transplantation, genetic basis of transplantation Histocompatibility matching, serum screening test Donor specific cross match'Indirect cross match Autoantibodies, B-cell antibodies.	(5) (20)

Reference book:

28 / 100%

- (1) John Bernard Henry's Clinical Diagnosis and Management of Laboratory methods
- (2) Shaum's outline-Immunology

Note:

On the first day of the new semester the teacher should provide following information to the students –

- 1) Orientation to the subject
- 2) Syllabus topics
- 3) Internal and semester examination systems
- 4) Library reference work
- 5) Attendance requirement

SEMESTER- VI

IMMUNOLOGY – (PRACTICALS)

No. of hrs. / week : 4
Credits : 2

Topics

- 1) Determination of IgA
- 2) Determination of IgE.
- 3) Determination of IgG.
- 4) Determination of IgM
- 5) Revision of all serological practicals of sem V, particularly, Widal test and HBSAg surface antigen test.
- 6) Determination of HIV – I and HIV –II by screening methods.
- 7) Detection of Human Anti – HIV – 1 by western blotting technique.
- 8) Study of working of AxSym and Immulite systems

Reference books:

- 1) Text book of Medical Laboratory Technology by Dr. P. B. Godkar.

- **Instruction for teacher :**

Note:

It is necessary for the teacher to give orientation regarding the following on the first day -

- 1) Requirements for practicals: Journal, rough note book, lab coat, fractional weight box, other requirements and safety requirements.
- 2) Writing rough note book, SOP.
- 3) Writing Journals.

SEMESTER - VI

Hospital and Pathology Laboratory Training

Objectives

Students will learn about the various aspects of quality control and total quality management along with performing routine and special types of tests i. e.-

- 1) Internal and external quality control
- 2) Use of Diagnostic kits
- 3) Calibration and validation procedures for glassware, equipments, instruments and reagents

Students will visit on the following days:

Monday, Tuesday, Thursday and Friday (8.30 AM to 4.30 PM)

Students will attend the Institute for lectures on the following days:

Wednesday and Saturday

Note: Above schedule is subject to change as per time table of the Institute.

Pathology Laboratory & Hospital visits

Instructions:

- 1) Students should observe or perform the experiments as per syllabus. of semester – V related to each subject.
- 2) They should complete log books daily.
- 3) The experiment details should be written in the respective journals daily.
- 4) Log books & journals are submitted at the end of the training in a particular department.
- 5) Routine experiments should be listed in the log book (& not in the Journal).
- 6) Write attendance % at the end of working in a particular department (No of working days/no of days attended).

Log Book submission: Last Friday of the month at 1.30 PM (January to April).

