SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH
(A Deemed to be University Declared under Section 3 of UGC Act, 1956)
Comprising Sri Devaraj Urs Medical College
[Constituent Unit of Sri Devaraj Urs Educational Trust for Backward Classes (Regd.)]
TAMAKA, KOLAR-563103, KARNATAKA, INDIA
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(With effect from 2016-17 batches)

Choice Based Credit System Based Graduate Curriculum for Bachelor of Science in Medical laboratory Technology

Dean
Faculty of Allied Health Sciences
Sri Devaraj Urs Academy of
Higher Education & Research
Tamaka, Kolar-563 101

Approved as per BOM-41-2016,(Resolution No-XLI-05(3)/16) Dated-19/10/2016

REGULATIONS GOVERNING THE BACHELOR OF SCIENCE (B.Sc.) DEGREE UNDER CHOICE BASED CREDIT SYSTEM

2016

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH
(Declared as Deemed - to - be University u/s 3 of the UGC Act
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REGULATIONS GOVERNING

THE BACHELOR OF SCIENCE (B.Sc.)

DEGREE

UNDER CHOICE BASED CREDIT SYSTEM

2016

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REGULATIONS GOVERNING THE DEGREE OF BACHELOR OF SCIENCE (B.Sc.)

CHOICE BASED CREDIT SYSTEM IN ALLIED HEALTH SCIENCES

INTRODUCTION

The University Grants Commission has brought in numerous measures to enhance equity, efficiency and excellence in the higher education system in the country. Consequently, has set considerable effectiveness with noticeable improvements in higher education system. Even though, there existed diversity in the evaluation system in Universities in India and to mitigate tremendous diversity adapted in Universities, UGC issued circular D.O.No. F.1-2/2008 (XI Plan) dated March 2009 and further in its circular D.O.No.F-1-1/2014 dated 12th November 2014 has directed all the Universities in the country to implement the Choice Based Credit system (CBCS) scheme to all the undergraduate and post graduate level degrees Programs mandatorily.

In compliance to the above, Sri Devaraj Urs Academy of Higher Education and research [SDUAHER] has notified with vide No SDUAHER/KLR/ADMN/2063/16-17 dated 20.10.16 and introduced CBCS for undergraduate Programs (B.Sc.) in order to achieve academic excellence, quality improvement and as administrative reforms. Based on this background, SDUAHER has framed REGULATION governing B.Sc. Programs under Faculty of Allied Health Sciences.

This facilitates flexible learning; multifaceted development of students with wide variety of courses viz core, electives in discipline specific, Ability enhancement and open to enhance their knowledge and skills. This qualitative change in the Programs is to the global requirements and aspiration of students and stake holders for mobility both within and across the geographical jurisdiction.

CBCS implementation brings desired uniformity in grading system and method for computing semester grade point average (SGPA) for semester performance and cumulative Grade Point average (CGPA) for overall program performance of students in the examinations.

DEFINITIONS OF KEY WORDS

Applicable to undergraduate, postgraduate level degree, diploma and certificate Programs under the choice based credit system in semester scheme.

1. University: Sri Devaraj Urs Academy of Higher Education and Research Tamaka, Kolar

2. **Academic Year** consists of two consecutive semesters a) Even semester (scheduled from January to June) b) Odd semester (scheduled between July to December).

3. S**emester:** Each semester will consists of 15-18 weeks of academic work equivalent to 90 actual teaching days.

4. **Choice Based Credit System (CBCS):** Provides choice for students to select from the prescribed courses/papers such as core, elective or minor or soft skill courses offered in a Program.

5. **Credit Based Semester System (CBSS):** Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

6. **Program:** An educational program leading to award of a Degree, diploma or certificate.

7. **Course** usually referred to as 'papers' is a component of a program. *All courses May not carry the same weight.* The courses should define learning objectives and Learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory Work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

8. **Branch:** Specialization or discipline of B.Sc. Degree Programs are like Medical Laboratory technology, Imaging technology, optometry, renal dialysis technology, operation theater technology, radiotherapy technology etc.

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

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

11. **Credit:** Each course shall carry certain number of credits. Credits normally represent the weightage of a course and are a function of teaching, learning and evaluation strategies such as number of contact hours, the course content, teaching methodology, learning expectations, etc. In the proposed Programs, credit is a unit by which course work is measured. Credit determines the number of hours of instructions required per week, generally, one credit is equivalent to one hour of teaching [lecture or tutorial] or 2 hours of practical work /field work per week.

12. **Credit Point:** It is the product of grade point and number of credits for a course.

13. **Semester Grade Point Average (SGPA):** It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester.
It shall be expressed up to two decimal places.

14. **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative Performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

15**. First Attempt**: A student who has completed all formalities of the semester becomes eligible to attend the examinations and has passed in first sitting; such attempt shall be treated as first attempt.

16 **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade Certificate shall be issued to all the registered students after every semester. The grade Certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

B.Sc. PROGRAMS STRUCTURE

Semester	Program structure
I	Basic medical sciences Common to all disciplines as mandatory core courses (CC), Compulsory foundation course (FC) Discipline specific elective (DSE)
II	Basic medical sciences Common to all disciplines as mandatory core courses (CC), Compulsory foundation course (FC) Discipline specific elective (DSE) Ability enhancement course (AEC)
III	Core courses discipline wise (CCD) Skill enhancement course (SEC)
IV	Core courses discipline wise Ability enhancement course (AEC)
V	Core courses discipline wise (CCD) Skill enhancement course(SEC)
VI	Core courses discipline wise (CCD) Ability enhancement course (AEC)
VII	Internship

In CBCS, UG degree Programs offered in University are structured to have 7 semesters will have credits in the range of 20 to 26 an average of 23 credits per semester and a total of around 120-156 credits per under graduate program.

STRUCTURE OF B.Sc. PROGRAMS UNDER CBCS SCHEME

Semester	Core courses (1-19)	Discipline specific elective (DSE)	Ability enhancement Compulsory Course (AEC)	Skill enhancement courses (SEC)	Open elective (OE)	Foundation course
I	Paper 1 Paper 2 Paper 3 Paper 4	DSE-1 DSE-2 DSE-3 DSE-4	-	-	-	Basic Computer Application
II	Paper-1 Paper 2 Paper 3	DSE-1 DSE-2 DSE-3 DSE-4 DSE-5 DSE-6	Environmental science	-	-	English communication
III	Paper-1 Paper 2 Paper 3	-	-	SEC-1 (SAFE-I)	-	-
IV	Paper 1 Paper 2 Paper 3	-	Constitution of India	-	-	-
V	Paper 1 Paper 2 Paper 3	-	-	SEC-2 Medical Ethics		-
VI	Paper 1 Paper 2 Paper 3	-	Quality control	-	-	-
VII	Internship					

Types of courses. 3 types, such as core, elective and foundation

Core courses: This is the course/paper which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in a said discipline of study.

Foundation Course: 2 kinds:
1**. Compulsory Foundation courses**: mandatory to all disciplines, which based upon the content that leads to Knowledge enhancement.
2. **Elective foundation courses**: are value-based and are aimed at man-making education.

Elective courses:
This can be chosen from a pool of electives listed in University. It is expected to Support to the discipline of study, provide an expanded scope, enable an exposure to some other discipline/domain and nurture student's proficiency/skill.
An elective may be "Discipline centric" or may be chosen from an unrelated discipline. It may be called an "Open Elective."

3. CREDIT STRUCTURE FOR COURSE
Example : SEMESTER-I

courses	Lectures hours /week In a semester	Tutorials hours /week in a semester	Lab work hours /week in a semester	credits	Total credits
Course-I	02	01	02	2:1:1	04
Course-II	02	01	02	2:1:1	04
Course-III	02	01	02	2:1:1	04
Course-IV	02	01	02	2:1:1	04
Compulsory Foundation course	02	-	02	2:0:1	03
Discipline specific Elective	01	-	-	0:0:1	01
				Total	20

Course-1 Anatomy paper-1
Course-II anatomy paper 2
Course-III Physiology paper1
Course-IV Physiology paper2
Compulsory foundation course: Basics in computer applications
Discipline Specific electives (anatomy histological techniques and Physiology PFT and ECG)

REGULATIONS GOVERNING THE DEGREE OF B.Sc. PROGRAMS AS PER CHOICE BASED CREDIT SYSTEM UNDER THE FACULTY OF ALLIED HEALTH SCIENCES

1. TITLE

The undergraduate programs known as Bachelor of Science abbreviated as B.Sc.

B. Sc. Programs are as under

- Bachelor of science in Medical laboratory Technology
- Bachelor of science in Imaging Technology
- Bachelor of Science in Optometry
- Bachelor of Science in operation Theater Technology
- Bachelor of Science in Renal Dialysis technology
- Bachelor of Science in Radiotherapy Technology

2. DURATIONS

The duration of the under graduate Programs shall be three and half years consists of 7 semesters including internship.

3. CALENDAR OF EVENTS

The calendar of events in respect of each program of study shall be fixed by the University from time to time. The examination in all programs of study shall be conducted at the end of each semester.

4 ELIGIBILITY FOR ADMISSION

A Candidate seeking admission to B.Sc. program

Shall have passed two years Pre University examination conducted by the pre University board of Karnataka state, with English as one of the subject and physics, chemistry and biology as optional subjects.

OR

Shall have passed any other examination conducted by Boards/councils/intermediate examination established by state Government/central Government and recognized as equivalent to two year pre University examination by the Rajiv Gandhi University of health sciences/Association of Indian Universities (AIU) , with English as one of the subjects and physics, chemistry and biology as optional subjects and the candidate shall have passed subjects of English, physics, chemistry and biology individually.

OR

Shall have passed intermediate examination in science of an Indian university/ Boards/council or other recognized examining bodies with physics ,chemistry and biology which shall include a practical test in these subjects and also English as compulsory subject.
the candidate shall have passed subjects of English, physics, chemistry and biology individually.

OR

Candidates with regular three years diploma in respective discipline recognized by Rajiv Gandhi University of health sciences

OR

The minimum marks for the purpose of eligibility shall be forty percent (40%) in optional subjects in case of students belonging to SC/ST and OBC students from Karnataka or as decided by the Government of Karnataka. Provided further that, the student shall have studied and passed English as one of the subjects.

Candidates who have completed diploma or vocational course through correspondence shall not be eligible for Bachelor of Science Programs.

5 LATERAL ENTRY

Candidates passing diploma in concerned discipline and 10+2 or PUC shall be eligible for Lateral entry i.e. admission to II year / semester –III of the B.Sc. Program. However, this will be entertained only if vacancies are available. Applicants should possess minimum of 45 % aggregate marks in PUC (PCMB).

6 ATTENDANCES

Each course comprising theory & Practical and tutorials shall be treated as single unit for the purpose of calculation of attendance. A student shall have to attend a minimum of 75% attendance of the total instruction hours in a course (theory/practical/tutorials) in each semester from the date of commencement of the semester to last working day as notified by the University.

The students shall be informed about their attendance status periodically by the department of Allied health sciences. So that, the students shall be cautioned to make up the shortage. The Department of Allied Health sciences shall submit the list of students who have been eligible to appear examinations and list of detained students due to shortage of attendance by the end of the semester to the Controller of Examinations.

Students lacking in the prescribed attendance and progress in any subject(s) in theory and practical should not be permitted to appear for the examination. Such student shall repeat the course in which he/she is deficient with attendance.

7. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMS

The candidate shall complete the program generally within the twice the number of years of the program from the date of commencement of the program i.e. within six years from the date of admission. If the candidate fails to complete the program with in the period permitted he/she will be discharged from the University. However, fee to be paid for repeating the semesters.

8. **MEDIUM OF INSTRUCTION:** The medium of instruction shall be English.

9. TEMPORARY DISCONTINUATION OF THE PROGRAM

A student, who wishes to temporarily discontinue the program and continue the same subsequently, has to obtain prior permission from the University by applying through the head of the department. Such students have to take readmission to the same semester/year in the subsequent session. However, the student shall complete the course as per the maximum period fixed by the University

10. HOURS OF INSTRUCTION PER WEEK

These number of hours of instruction for each course is defined which includes lectures, tutorials, practical and assignments, as specified to individual courses.

11. COURSE PATTERN

The number of credits per semester may vary from 20 to 26, an average of 23 credits per semester and a total of around 120-153 credits for the program. Generally 1 credit per hour of instruction in theory and 1 credit for 2 hours of practical or project work or internship per week.

The courses offered in a program are divided in to core, foundation, and elective courses. The program patterned indicating hours of instruction in all semesters defined under section -3

12. THE SCHEME OF EXAMINATION

There shall be examinations at the end of each semester as per the calendar of events notified by the university.

13. INTERNAL ASSESSMENT

Regular internal assessment examinations should be conducted on each course in a semester.
There should be a minimum of at least 03 internal assessments examinations in each semester, the number of examination on each course is left to the department. An average of the best two internal assessment examinations should be taken in to consideration during calculation of marks of internal assessment.

The weightage given to the internal assessment is 20% out of the total marks assigned to the course.
Student must secure at least 35% of total marks fixed for internal assessment examination of that course to be eligible to appear for the examination

14. REGISTERING FOR THE EXAMINATIONS

Candidate to be eligible to appear for University examination, shall have undergone satisfactorily the semester of the study, shall have to obtain 75% attendance in theory and practical/tutorial jointly to become eligible to appear for examination in the subject/course,
Shall secure at least 35% of internal assessment from the total marks fixed for IA in a particular subject in order to become eligible for examination, shall fulfil any other requirement that may be prescribed by the University from time to time.
And shall pass in all the courses of that semester. Such eligible students will be allotted Registration Number.

15. VALUATION OF ANSWERSCRIPTS

Each written paper shall be valued by one internal examiner and one external examiner. Each practical examination shall be jointly conducted and evaluated by one internal examiner and one external examiner or two external examiners if there are no internal examiners. But not by two internal examiners. If the difference in marks between two valuations is more than 15% of the maximum marks, the Registrar (Evaluation) or his nominee shall check the entries and the total marks assigned by the two valuers. If there is any mistake in totalling, it shall be rectified. While checking the total, if it is observed that any one or more of the answers is not valued by one of the valuers, the Chairman, BOE shall advise internal members of the Board of Examiners to value that answer. After receiving the marks, the Chairman, BOE shall make the necessary corrections. Despite all these corrections, if the difference between the two valuations is still more than 15%, the Chairman, BOE shall arrange for third valuation by examiners from the approved panel of examiners.

In case of two valuations, the average of the two valuations and if there are three valuations, the average of the nearest two valuations shall be taken for declaring results.

16. RESULTS CLASSIFICATION OF SUCCESSFUL CANDIDATES

The results of successful candidates at the end of each semester shall be declared on the basis of Percentage of Aggregate Marks, converted to grade point and alpha – sign grade for each course on the basis of 10 point scale recommended by UGC.
The following table 1 and 2 shows the final results with grade description and grades

Table 1: Final Result/Grades Description

Semester/ Program % of marks	Semester GPA / Program CGPA	Alpha-Sign/ Letter Grade	Result/Class Description
90.0-100	9.00-10.00	O (Outstanding)	Outstanding
80.0-<90.0	8.00-<9.00	A+ (Excellent)	First Class Exemplary
70.0-<80.0	7.00-<8.00	A (Very Good)	First Class Distinction
60.0-<70.0	6.00-<7.00	B+ (Good)	First Class
55.0-<60.0	5.50-<6.00	B (Above Average)	High Second Class
50.0-<55.0	5.00-<5.50	C (Average)	Second Class
40.0-<50.0	4.00-<5.00	P (Pass)	Pass Class
Below 40	Below 4.00	F (Fail)	Fail/ Reappear
Absent	0	Ab (Absent)	

Table 2 point grading system with letter grade

Grade Point	0	0	4	5	6	7	8	9	10
Letter Grade	Ab	F	P	C	B	B+	A	A+	O
	Absent	Fail	Pass	Average	Above average	Good	Very good	Excellent	Outstanding

17. COMPUTATION OF SEMESTER GRADE POINT AVERAGE (SGPA) AND CUMULATIVE GRADE POINT AVERAGE (CGPA)

17.1 Calculation of SGPA

The following procedure to compute the Semester Grade Point Average

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$\textbf{SGPA}\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$$

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Note: Grade point denotes the decimal of percentage of marks scored

Example for SGPA (20 Credits)

Papers/courses	P1	P2	P3	P4	P5	Total
Max. marks	100	100	100	100	100	500
% Marks Obtained	77	73	58	76	64	348
Grade Points Earned (GP)	7.7	7.3	5.8	7.6	6.4	-
Credits for the Course(C)	4	4	4	4	4	20
Credit points= GP x C	31	29	23	30	26	139

Semester Aggregate Marks : 348 / **500 = 69.60 %**

Classification of Result **:** First Class

Illustration for SGPA

Course /Core paper	Credit	Grade letter As per 10 point scale	Grade point As per 10 point scale	Credit point (Credit X Grade point)
Course 1	04	A	7.7	4X7.7= 31
Course 2	04	B+	7.3	4X7.3=29
Course 3	04	B	5.8	4X5.8=23
Course 4	04	O	7.6	4X7.6=30
Course 5	04	C	6.4	4X26.4=26
	20			**139**
	SGPA	139/20 = 6.95		

The SGPA shall then be computed by dividing the total credit points of all the courses of a semester of the study by the total credits for the semester.

SGPA = Total credit points / Total Credits = 139 / 20 = **6.95**

Semester Alpha Sign Grade: **B**

17.2 Calculation of CGPA

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$\textbf{CGPA} = \Sigma(Ci \times Si) / \Sigma Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Example for CGPA

The Cumulative Grade Point Average (CGPA) at the end of the fourth semester shall be calculated as the weighted average of the semester GPW. The CGPA is obtained by dividing the total of GPW of all the four semesters by the total credits for the program.

ILLUSTRATION I

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**Total**
Total Marks per Semester	500	500	500	500	500	500	3000
Total Marks Secured	348	460	466	450	400	400	2524
Semester Alpha Sign Grade	B+	O	O	O	A+	A+	-
SGPA	6.95	8.0	7.77	8.5	7.0	7.0	-
Semester total Credits	20	26	24	24	24	24	142

Aggregate Percentage of Marks = 2524 / 3000 = 84.1 **%**

Classification of Result**: Excellent (First class with exemplary)**

Illustration for CGPA

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**	**Semester 5**	**Semester 6**
Credit 20	Credit 26	Credit 24	Credit 24	Credit 24	Credit 24
SGPA 6.95	SGPA 8.0	SGPA 7.77	SGPA 8.5	SGPA 7.0	SGPA 7.0

$$CGPA = \frac{20(6.95)+26(8.0)+24(7.77)+24(8.5)+24(7.0)+24(7.0)}{\text{Total credits of programme } 142}$$

CGPA = 139+ 208+186.5+ 204+ 168+168 = 1073.50 / 142= 7.56

CGPA 7.56 A (very good) First class with distinction

18. TRANSCRIPT (SCORE CARD /MARKS SHEET) FORMAT

University will issue a transcript format indicating semester performance in terms of score, grade points, SGPA and CGPA. Where the SGPA and CGPA shall be rounded off to 2 decimal places and reported in the Transcripts.

19. MINIMUM FOR A PASS

A candidate shall be declared to have passed the UG, if he/she secures at least a CGPA of 4.0 (Course Alpha-Sign Grade C) in the aggregate of both internal assessment and semester end examination marks put together in each unit such as theory papers / practical / project work / dissertation / viva-voce.

However, candidate has to secure minimum of 35% marks in written theory and practical examination separately and 40% as subject aggregate to be declared as pass. Where the subject has no practical, Viva-voce, internal assessment component, passing criteria is 40%.

20. GRACE MARKS

Any student who completes all the courses in a semester, but failed in any one of the course with a shortage of 5 or less than 5 marks, such candidates will be awarded to maximum of 5 grace marks.

21. CARRY OVER PROVISION

In the first year, candidates who fail in a first semester examinations may go to the second semesters and take the examinations. But he/she has to complete the first year courses before enters to 2^{nd} year 3^{rd} semester. However, candidate is allowed to carry subjects of 3^{rd} and 4^{th} semesters to 5^{th} semester. . But before entering for the 6^{th} semester, he/she has to complete all the carried subjects along with 5th semester courses. However a carryover provision restricted to the maximum period offered to a candidate for completion of the program as per the clause 7.0

22. REVALUATION

There is no revaluation permissible in the regulation

23. POWER TO REMOVE DIFFICULTIES:

i) If any difficulty arises in giving effect to the provisions of these regulations, the Vice-Chancellor may by order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, as appears to be necessary or expedient to remove the difficulty.

ii) Every order made under this rule shall be subject to ratification by the Appropriate University Authorities.

a)

PREVIEW ONLY, NOT FOR PRINTING

GRADE CARD

SEMESTER - I B.Sc. IMAGING TECHNOLOGY (C.B.C.S)
January 2018 Examination

Register Number : 17IMT001

Student Name : Abhijith K P
Father's Name : Pramod K Das
Mother's Name : Rekha Pramod

Sl. No.	Subject / Paper		Theory / Practical		I.A. / Viva		Total		Cr. Hrs.	Gr. Pts.	Cr. Pts.	Remarks
			Max.	Sec.	Max.	Sec.	Max.	Sec.				
	Core Course											
01	**Anatomy-I :** General Anatomy, Histology and Embryology	Th. Pr.	050 020	041 012	025 005	020 003	075 025	061 015	004	7.6	30.4	Pass
02	**Anatomy-II :** Systemic Histology and Gross Anatomy	Th. Pr.	050 020	027 013	025 005	020 003	075 025	047 016	004	6.3	25.2	Pass
03	**Physiology-I :** Physiological functions of the body	Th. Pr.	050 020	041 018	025 005	021 005	075 025	062 023	004	8.5	34.0	Pass
04	**Physiology-II :** Physiology of Hormonal and Regulatory function	Th. Pr.	050 020	038 017	025 005	021 004	075 025	059 021	004	8.0	32.0	Pass
	Foundation Course											
05	Basic Computer Applications	Th. Pr.	050 020	023 020	- -	- -	050 020	023 020	003	6.1	18.4	Pass
	Discipline Specific Elective											
06	Physiology (ECG)	Th.	030	028	-	-	030	028	001	9.3	09.3	Pass
	Grand Total						**500**	**375**	**020**		**149.4**	

S.G.P.A : 7.47 | **Grade : A (Very Good)**

35% in each Theory and Practical Examination and 40% in Subject aggregate.
College / Department : Allied Health Sciences, SDUAHER

Name & Signature of verifier

Date : 04/04/2018

Controller of Examinations

Percentage of Marks	SGPA/CGPA	Alpha-Sign/Letter Grade	Result/Class Description
90.0-100	9.00-10.00	O (Outstanding)	Outstanding
80.0-<90.0	8.00-<9.00	A+ (Excellent)	First Class Exemplary
70.0-<80.0	7.00-<8.00	A (Very Good)	First Class Distinction
60.0-<70.0	6.00-<7.00	B+ (Good)	First Class
55.0-<60.0	5.50-<6.00	B (Above Average)	High Second Class
50.0-<55.0	5.00-<5.50	C (Average)	Second Class
40.0-<50.0	4.00-<5.00	P (Pass)	Pass Class
Below 40	Below 4.00	F (Fail)	Fail/Reappear
Absent	0	Ab	

SDUAHER

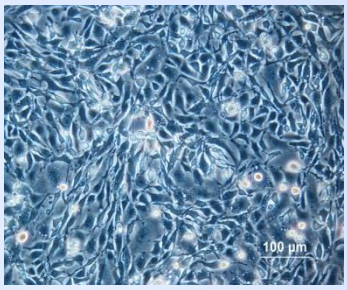
SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

(Deemed to be University u/s 3 of the UGC Act, 1956)

BACHELOR OF SCIENCE (B.Sc.)

Medical Laboratory Technology

2016



SYLLABUS UNDER

CHOICE BASED CREDIT SYSTEM

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

KOLAR KARNATAKA

SDUAHER

Adoption of Choice based credit system for Bachelor of Science in Allied Health Science Programme

B.Sc. Medical Laboratory Technology

UNDER FACULTY OF ALLIED HEALTH SCIENCES

As per University Grants Commission

2016-17

At a glance this logo is abstract, yet it contains the vital ingredients for an institution like Sri Devaraj Urs Academy of Higher Education and Research.

The institution's medical background, humanitarian values, Compassion, approachability, social commitment and the subsequent research towards the most precious thing, the human life, is the core theme.

The graphic form of a person in the centre of a bud represents the humanity. It denotes the growing process of life and its existence. And the two hands safeguarding them show the care and a sense of security. It is also capable of holding something within the vast expanse of knowledge by the university for the people's benefit. Hence, the motto " Knowledge for Posterity" is very appropriate and gives a punch in Red. The four light blue half circles (smaller to bigger) depict the unending quest for knowledge and imparting it to a wider horizon, growing higher and higher.

And finally, the whole unit is embedded in a "D" shaped graphic template as background to give it a corporate identity.

COLORS USED:

Deep Blue: Credible, Confident and dependable. Represents Peace, tranquility, stability, harmony, trust, security, cleanliness and loyalty.

Light Blue: For sky and water (colour scheme for 4 half circles)

Red: A dominant colour for strengths.

Green: For nature, health and generosity. It's cool quality soothes and has great healing powers.

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

VISION

"**UNIVERSITY OF EXCELLENCE - KNOWLEDGE FOR POSTERITY**"

MISSION

- To be a global center of excellence for Teaching, Training and Research in the field of Higher Education.
- To inculcate scientific temper, research attitude and social accountability amongst faculty and students.
- To promote with value based education for the overall personality development and leadership qualities to serve the humanity.

OBJECTIVES

- To provide need based infrastructure and facilities to students to become responsible professionals with social commitment and accountability.
- To implement effectively innovative programmes in teaching learning and evaluation.
- To impart scientific and socio cultural temperament among students to forge National identity and needs.
- To provide instruction and training in basic and advanced branches of learning.
- To provide facilities for research for the advancement and dissemination of knowledge.
- To undertake extra mural studies, consultancy, extension programmes and field outreach services for the development of society.
- To collaborate with other Universities, Institutions of excellence and Research Organizations within the country and outside for the purpose of teaching, training and research.
- To undertake need based activities for the betterment of socially and educationally backward society.

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH
Comprising Sri Devaraj Urs Medical College
(A-Deemed-To-Be-University)

Declared under Section 3 of UGC Act, 1956, MHRD GOI No.F.9-36/2006-U.3(A) Dt. 25th May 2007
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No: SDUAHER/KLR/ADMN/ 2063 / 2016-17 **Date: 20.10.2016**

NOTIFICATION

Sub: Implementation of **Choice Based Credit System** for the Undergraduate degree programs under the Faculty of Allied Health science.

Ref: 1.UGC Guideline D.O. No F.1-1/2014 dated 12th Nov.2014
2. Proceedings of the 16th meeting of Board of studies of Health science subjects held on 25.08.2016
3. Proceedings of the committee of the Academic Council meeting held on 13.10.2016
4. Proceedings of the 41st meeting of Board of Management held on 19.10.2016

Sri Devaraj Urs Academy of Higher Education and Research after establishing a department of Allied health sciences has been offering B.Sc. courses in the Medical laboratory Technology, Imaging Technology, Operation Theater technology, Renal Dialysis Technology, Ophthalmic technology and Radiotherapy Technology. All these courses are under semester system but have not followed CBCS as recognized by University Grants Commission. However, in the light of the UGC letter referred above, the University has taken necessary steps to implement CBCS from the Academic Year 2016-17. Accordingly, the subject was placed in the meetings of the authorities of the University as cited above and the University is pleased to announce that the undergraduate courses offered in the Department of allied health Sciences shall follow Choice Based credit system with effect from the Academic year 2016-17 onwards.

By Order,

Sd/-
Registrar

Structure of B.Sc. Medical Laboratory Technology Programme under CBCS scheme

Semester	Core courses (1-19)	Discipline specific elective (DSE)	Ability enhancement Compulsory Course (AEC)	Skill enhancement courses (SEC)	Open elective (OE)	Foundation course
I	1&2.Anatomy –I & II 3&4.Physiology – I & II	DSE-1 DSE-2 DSE-3 DSE-4	-	-	-	Basic Computer Application
II	5.Biochemistry 6.Microbiology 7.Pathology	DSE-1 DSE-2 DSE-3 DSE-4 DSE-5 DSE-6	Environmental science	-	-	English communication
III	8.Biochemistry-1 9.Biochemistry-2 10.Biochemistry-3			SEC-1 (SAFE-I)	-	-
IV	11.Microbiology-1 12.Microbiology-2 13.Microbiology-3		Constitution of India	-	-	-
V	14.Pathology-1 15.Pathology-2 16.Pathology-3			SEC-2 Medical Ethics	-	-
VI	17.Applied aspects of Biochemistry 18.Applied aspects of Microbiology 19.Applied aspects of pathology	-	Quality control	-	-	-
VII	Internship					

SEMESTER-I

Papers

1. General Anatomy, Histology & Embryology
2. Systemic Histology & Gross anatomy
3. Physiological functions of the body
4. Physiology of hormonal and regulatory function
5. Basic Computer Application
6. Discipline specific electives (DSE)
    a. Histology Techniques preparation of slides & stains
    b. Museum Preparation
    c. Electro Cardiogram (ECG)
    d. Pulmonary Function Test (PFT)

First semester distribution of hours and credits- CBCS scheme

Subject	Paper & Code	Subjects	Theory		Practical		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
CC-Anatomy	Paper-I A201	General Anatomy, Histology & Embryology	30	**02**	30	**01**	30	**01**	90	**04**
	Paper –II A202	Systemic Histology & Gross anatomy	30	**02**	30	**01**	30	**01**	90	**04**
CC-Physiology	Paper-I A204	Physiological functions of the body	30	**02**	30	**01**	30	**01**	90	**04**
	Paper –II A205	Physiology of hormonal and regulatory function	30	**02**	30	**01**	30	**01**	90	**04**
CF-Compulsory foundation course	A207	Basic computer application	30	**02**	30	**01**	-	**-**	60	**03**
		Total	170	**11**	150	**05**	120	**04**	440	**19**
	A208 A209	Discipline specific electives (DSE)	Anatomy*	1 Histology Techniques preparation of slides & stains (01 credit) 2 Museum preparation (01 credit)						**01**
	A210		Physiology *	1 ECG (01 credit)						
	A211			2 Pulmonary function test (01 credit)						
				Grand Total						**20**

Note: Each student has to choose any one discipline specific elective (DSE) offered during first semester in the core subject.

First semester distribution of marks- CBCS scheme

Subject	Paper &code	Subject	Theory	Theory IA	Viva voce	Practical	Practical I.A	Grand total	
CC-Anatomy	Paper-I A201	General Anatomy, Histology & Embryology	50	10	-	-	-	60	UNIVERSITY LEVEL EXAM
	Paper –II A202	Systemic Histology & Gross anatomy	50	10	-	-	-	60	
	A203	Anatomy common Practical	-	-	30	40	10	80	
CC-Physiology	Paper-I A204	Physiological functions of the body	50	10	-	-	-	60	
	Paper –II A205	Physiology of hormonal and regulatory function	50	10	-	-	-	60	
	A206	Physiology common Practical	-	-	30	40	10	80	
Compulsory foundation course	A207	Basic computer application	50	-	-	20	-	70	
Discipline specific electives (DSE)	A208	Histology Techniques preparation of slides & stains	30	-	-	-	-	30	
	A209	Museum preparation							
	A210	Electrocardiogram (ECG)							
	A211	Pulmonary Function Test (PFT)							
			280	40	60	100	20	500	

Note: As per the following

1. Proceedings of the 19th meeting of the board of Undergraduate and Post graduate studies in Allied Health Sciences held on 9th February 2018. (Agenda No. AHS/XIX-11/18)
2. 17th meeting of Faculty of Medicine held on 24th February 2018.
3. Proceedings of 31st meeting of Academic council held on 3rd November 2018 (Agenda No. AC/XXXI-02/18)
   The two separate physiology practical with respect to physiology theory paper I & II is modified to single practical.
   Similarly the two separate Anatomy practical with respect to Anatomy theory paper I & II is modified to single practical.
   The decision is in effect to 2018-19 admission.

DETAILS OF THE COURSES

Core courses- Anatomy

1. General Anatomy, General Histology, General Embryology,
2. Gross Anatomy, Systemic Histology

Discipline Specific Elective – Anatomy

1. Histology Techniques preparation of slides & stains
2. Museum preparation

Core courses – Physiology

1. Physiological functions of the body
2. Physiology of hormonal and regulatory function

Discipline Specific Elective Physiology

1. Electrocardiogram (ECG)
2. Pulmonary function Tests

Ability enhancement course

-

Compulsory foundation course

1. Basic Computer Application

FIRST SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
First Semester	**Core courses- Anatomy**	1. General Anatomy, General Histology, General Embryology,	04
		2. Gross Anatomy, Systemic Histology	04
	Discipline specific elective – Anatomy	1. Histology Techniques preparation of slides & stains	01
		2. Museum preparation	01
	Core courses – Physiology	1. Physiological functions of the body	04
		2. Physiology of hormonal and regulatory function	04
	Discipline specific elective Physiology	1. Electrocardiogram (ECG)	01
		2. Pulmonary function Tests	01
	Ability enhancement course	-	
	Compulsory foundation course	1. Basic Computer Application	03

SEMESTER-I
B.Sc. Allied Health Science Programmes (Medical Laboratory Technology)
Syllabus
Subject: Anatomy
Paper-I
Paper Title: (General Anatomy, General Histology, General Embryology)
Credits (Theory 02, Practical 01)

Theory lectures: 30

Unit –1

Introduction human body as a whole **08 hours**

Definition of anatomy & its divisions, Terms of location, positions & planes, **Cell** & its organelles, **Basic tissues**- classification with examples, **Epithelium**- definition, classification, describe with examples, functions, **Glands**-classification, describe serous & mucous glands with examples

Unit-2

Locomotion & support **10 hours**

Connective Tissue- components and classification, **Cartilages-** types with example & histology, **Bone**- classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, Vertebral column, Invertebral disc. **Joints**-Classification of joints with examples. **Muscular system**-structure & classfication of muscular tissue. **Nervous System** Neuron, Classification of CNS,

Unit-3

Cardiovascular system **10 hours**

Heart-Size, Location, Chambers, Exterior & Interior, Blood Supply Of Heart, Pericardium Systemic & Pulmonary Circulation, Branches Of Aorta, Common Carotid, Subclavian , Axillary , Brachial , Femoral and Internal Iliac artery, Portal Vein, Great Saphenous vein, Dural Venous Sinuses. **Lymphatic System** Thoracic duct Lymphoid organs- Primary & secondary, Names of regional Lymphatics, Axillary & Inguinal Lymph nodes

Unit-4

General Embryology **02 hours**

Spermatogenesis & oogenesis, Ovulation, Fertilization. Placenta.

PRACTICAL

Experiments **(Credits 01 , Hours 30)**

1. Histology of types of epithelium
2. Histology of serous, Mucous & mixed salivary glands
3. Histology of 3 types of cartilages,
4. Demonstration of all bones showing parts, radiographs of normal bones & joints.
5. Histology of compact bone (TS & LS)
6. Histology of skeletal (TS& LS), smooth & cardiac muscle
7. Histology of peripheral nerve
8. Demonstration of heart & vessels in the body,
9. Histology of large, medium sized arteries, & Large vein,
10. Histology of lymph node, Spleen, Tonsil & Thymus
11. Demonstration of embryology models

Syllabus
Subject: Anatomy
Paper-II
Paper Title: (Gross Anatomy, Systemic Histology **)**
Credits (Theory 02, Practical 01)

Theory lectures: 30

Unit –1

Gastro- Intestinal System **05 hours**

Parts of GIT, Oral Cavity(lip, tongue with histology), Tonsil, Dentition, Pharynx, Salivary glands, Waldeyer's ring, Oesophagus, Stomach, Small & large intestine, Liver, Gall Bladder, Spleen and Pancreas. Thoraco abdominal Diaphragm

Unit-2

Peritoneum 02 hours

Describe in brief Peritoneal folds

Unit-3

Respiratory System **03 hours**

Parts of Respiratory system , Nose, Nasal cavity, Larynx, Trachea, Pleura, Lungs, Broncho pulmonary Segments

Unit-4

Urinary System 03 hours

Gross Anatomy of Kidney, Ureter, Urinary bladder, male & female urethra,

Unit –5

Reproductive System **04 hours**

Male reproductive system - Testis, Vas deferens, epididymis, prostate (gross & histology)
Female reproductive system- Uterus, Fallopian tubes, ovary (gross & histology)
Mammary gland- gross

Unit –6 04 hours

Endocrine glands

Names of all endocrine glands, Pituitary gland, Thyroid gland, Parathyroid gland,Supra renal glands- (gross & Histology)

Unit –7

Neuroanatomy **04 hours**

Cerebrum, Cerebellum, midbrain, pons, medulla oblongata, Spinal cord with spinal, Nerves, Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei, Blood supply of brain, Cranial nerves,

Unit-8

Sensory Organs **05 hours**

Skin- Histology, Appendages of Skin **Eye-** Parts of Eye & Lacrimal Apparatus, Extra ocular muscles & nerve supply **Ear-** parts of Ear-External, Middle and inner ear and contents.

PRACTICAL

Experiments **(Credits 01 , Hours 30)**

1. Demonstration of Gastro intestinal system, Histology of GIT
2. Demonstration of part of Respiratory System. Histology of lung & trachea
3. Demonstration of parts of Urinary system, Histology of kidney, Ureter, Urinary bladder
4. Demonstration of section of male & female pelvis with organs in situ, Histology of testis, Vas deferens, epididymis, prostate, Uterus, Fallopian tube, ovary
5. Demonstration of glands, Histology of pituitary Thyroid, Parathyroid, Suprarenal glands
6. Demonstration of all nerve plexus and palpable nerves in the body.
7. Demonstration of all parts of brain. Histology of Optic nerve, Cerebrum, Cerebellum, Spinal cord.
8. Histology of Thin and Thick Skin, Demonstration of eye ball, Histology of Cornea & Retina.

Reference Books - Anatomy

1. William Davis (P) understanding Human anatomy and Physiology MC Graw Hill
2. Chaurasia –A text book of Anatomy T.S Ranganathan –A text book of human Anatomy .
3. Fattana, Human anatomy Description & applied) Saunder's & C P Prism publishers, Banglore
4. ESTER.M.Grishcimer, physiology & anatomy with practical Considerations J.P. Lippin cott. Philadelphia.
5. Bhatnagar Essentials of Human Embryology –Revised Edition Orient Blackswan Pvt.Ltd.
6. B.D.Chaurasia Human anatomy CBS publishers
7. Patrick W.Tank and Thomas R Gest Atlas of anatomy Lippincot williams and Wilkins
8. Hollinshed Text book of Anatomy Harper and Row Publishers
9. Willium J Larson Human embryology 3rd edition Churchill Living stone
10. Indebir Singh. Human neuro Anatomy Jaypee brothers
11. Halim A Surface and Radiological Anatomy CBS publishers

SEMESTER-I
B.Sc. Allied Health Science Programmes
Syllabus
Subject: Physiology
Paper-I
Paper Title: (Physiological functions of the body)
Credits (Theory 02, Practical 01)

Theory lectures: 30

Unit –1

Blood **10 hours**

Composition and functions of blood, Plasma proteins types and function, RBC- formation, function physiological variation, Anemia classification-morphological and etiological effects of anemias on the body, Blood indices –colour index, MCV, MCH, MCHC, ESR normal value PCV normal value, WBC- function, life span, normal value, Immunity, Hemoglobin- functions normal value, Types of Hemoglobin, Jaundice, Platelets morphology normal value and function, Blood groups- basis of blood grouping, clinical importance, blood banking and transfusion, Haemostasis, Definition, normal values of clotting and bleeding time mechanism disorders, Anticoagulants

Unit-2

Renal System **05 hours**

Structure and function of nephron, types of nephron, classify nephrons. Steps of urine formation, define GFR, GFR normal value, factors affecting GFR. Micturition reflex. Diuretics Water diuresis and osmotic diuresis, define role of kidney in regulation of Blood pressure.

Unit-3

Digestive System **05 hours**

Basic structure of Digestive system, Composition and functions of Salivary secretion, Gastric secretion, Pancreatic secretion, Intestinal secretion, Bile & Gastro-intestinal movements

Unit-4

Cardiovascular System **05 hours**

List the Properties of cardiac muscle, conducting system of heart. List the events of Cardiac cycle & Heart sounds. Define Cardiac output and give normal value. Effect of exercise on heart. List the mechanism of Regulation blood pressure. Electrocardiogram-physiological basis and applications. Defined shock signs and symptoms of hypovolemic shock

Unit-5

Respiratory System **05 hours**

Functional anatomy, Mechanics of normal respiration, functions of surfactants and lung function test, Lung volumes and capacities, definitions of Hypoxia, cyanosis, dyspnea, asphyxia, artificial respiration, partial pressure of oxygen and carbon dioxide in arterial and venous blood.

PRACTICAL

Experiments **(Credits 01 , Hours 30)**

Hematology Experiments

1. Estimation of Hemoglobin
2. Bleeding time
3. Clotting time
4. PCV
5. ESR
6. Preparation of Peripheral smear.

Syllabus
Subject: Physiology
Paper-II
Paper Title: (Physiology of hormonal and regulatory function)
Credits (Theory 02, Practical 01)

Theory lectures: 30

Unit –1

Muscle And Nerve Physiology **02 hours**

Structure and functions of a neuron and neuroglia. Transmission of nerve impulse, Structure and transmission across neuro-muscular junction, Myasthenia gravis, Types of muscle fibers, Rigor mortis

Unit-2

Endocrinology **09 hours**

Definition, classification of endocrine hormones, Estimation and assessment of Hormones, function of Pituitary hormone, Thyroid hormone, Parathyroid hormone, Adrenal hormone, Pancreatic hormones. List the disease associated with hyper secretion and hypo secretion.

Unit-3

Reproductive System **05 hours**

Male reproductive system: Functions of testis, list the step of Spermatogenesis & factors influencing it. **Female reproductive system:** function of ovary, Ovulation tests, define menstrual cycle, give the average duration, name the hormones influencing menstrual cycle Physiological changes during pregnancy, Pregnancy diagnostic tests. Define contraception. Describe contraceptive methods in males and females.

Unit-4

Central Nervous System **09 hours**

Organization of nervous system, define synapse, synapse receptor, action potential, list sensory nerves and sensations that carry, list the motor tracts, comment on sensation of spinal cord. Higher functions- memory learning speech, Cerebro spinal fluid formation, composition and functions. Lumbar puncture. Reflex arc, functions of cortex, cerebellum, hypothalamus, basal ganglia. Limbic system- components of anterior nervous system and action of heart.

Unit-5

Special Senses **05 hours**

List the special senses and their receptor, visual pathway, Colour vision, refractive errors Visual reflexes-pupillary and light reflex. structure of the middle ear and inner ear, Mechanism of hearing, Pathway of taste, primary taste sensations, receptor for smell.

PRACTICAL

Experiments **(Credits 01, Hours 30)**

Clinical Physiology

1. Pulse
2. Blood pressure
3. Spirometry
4. Pulmonary function tests
5. Electro Cardio Gram (ECG)
6. General physical examination

Reference Books Physiology

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism publishers
2. Chatterjee(CC) Human Physiology Latest Ed. Vol-1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book,
4. Ganong (William F) Review of Medical Physiology. Latest Ed . Appleton
5. Pal G.K. Text book of Medical physiology Avichal publishing company
6. Campbell FJM Clinical physiology ELBS
7. Schmidi R.F. and Thews G Human physiology Springer verlong
8. Parvathi Pal A text book of practical physiology

SEMESTER-II

Papers

1. Elementary aspects of Biochemistry
2. Elementary Microbiology
3. Basics of General ,Systemic, Clinical, hematology and histopathological technique
4. English for Communication
5. Environmental Science
6. Discipline Specific Electives (DSE)
    a. Basic aspects of research
    b. Sample collection, preservation and transportation
    c. Sterilization
    d. disinfection
    e. Antibiotic resistance
    f. Phlebotomy
    g. Museum Technology

Second semester distribution of hours and credit- CBCS scheme

Subject	Paper & Code	Subjects	Theory		Demonstrations/ assignments		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
Core course (CC)	Paper-I B201	Elementary aspects of biochemistry	40	**02**	40	**01**	40	**02**	160	**05**
	Paper-II B202	Elementary microbiology.	40	**02**	40	**01**	40	**02**	160	**05**
	Paper-III B203	Basics of general ,systemic, clinical, hematology and histopathological technique	40	**02**	40	**01**	40	**02**	160	**05**
Compulsory foundation Course (FC)	B204	English for communication	30	**02**			-	-	30	**02**
Ability enhancement course (AEC)	B205	Environmental science	30	**02**	Field visit-	**01**	-	-	30	**03**
		Total	180	**09**	240	**07**	120	**03**	540	**20**
Discipline specific electives (DE)	B206 B207	Biochemistry*		1 Basic aspects of research (01) credit 2 Sample collection, preservation and transportation (01 credit)						**01**
	B208 B209 B210	Microbiology*		1. Sterilization and disinfection (01 credit) 2. Antibiotic resistance (01 credit) 3. Specimen collection and transportation (01 credit)						
	B211 B212	Pathology*		1.Phlebotomy (01 credit) 2. Museum Technology (01credit)						
				Grand Total						**21**

Note: choose any one elective from DSE during second semester in the subject *

Second semester distribution of marks- CBCS scheme

Subject	Paper/code	Subjects	Theory				Practical			
			Theory	Viva voce	I.A	Sub total	Practical	I.A	Sub total	Grand total
CC Bio chemistry	Paper-I B201	Elementary aspects of biochemistry	80	-	20	100	-	-	-	100
CC Micro biology	Paper-II B202	Elementary microbiology.	80	-	20	100	-	-	-	100
CC Pathology	Paper-III B203	Basics of general ,systemic, clinical, hematology and histopathological technique	80	-	20	100	-	-	-	100
Compulsory foundation course (CF)	B204	English for communication	50	-	-	50		-	-	50
Ability enhancement course (AEC)	B205	Environmental science-	60-	--	20	80	--	-	-	80
Discipline specific electives (DE)	B206 Biochemistry B207	1. Basic aspects of research 2.Sample collection, preservation and transportation	30	-	-	30	-	-	-	30
	B208 B209 B210	1.Sterilization and disinfection 2.Antibiotic resistance 3.Specimen collection and transportation								
	B211 Pathology B212	Phlebotomy (01 credit) 3.Museum Technology (01credit)								
		Total	**380**		**80**	**460**	-	-	-	**460**

Note: No practical examinations in semester –II Biochemistry, pathology and microbiology

DETAILS OF THE COURSES

I. CORE COURSES- BIOCHEMISTRY

1. Elementary aspects of Biochemistry.

Discipline specific elective biochemistry

1. Basics aspects of Research
2. Sample collection, preservation and transportation

II CORE COURSES – MICROBIOLOGY

1. Elementary Microbiology.

Discipline specific elective Microbiology

1. Sterilization and Disinfection
2. Antibiotic resistance
3. Specimen collection and transportation

Ability enhancement course

1. Environmental Science

Compulsory foundation course

2. English Communication

III CORE COURSES – PATHOLOGY

1. Basics of general, systemic, clinical, hematology and histopathological technique

Discipline specific elective Pathology

1. Phlebotomy (01 credit)

2. Museum Technology (01credit)

SECOND SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
second semester	**Core courses- Biochemistry**	**1. Elementary aspects of Biochemistry**	05
	Discipline specific elective – Biochemistry	1. Basics aspects of research	01
		2. Sample collection, preservation and transportation	
	Core courses – Microbiology	**1. Elementary Microbiology.**	05
	Discipline specific elective Microbiology	1. Sterilization and Disinfection	01
		2. Antibiotic resistance	
		3. Specimen collection and transportation	
	Ability enhancement course	1. Environmental science	03
	Compulsory foundation course	1. English communication	02
	Core courses pathology	**1. Basics of general, Systemic, Clinical, hematology and histopathological technique**	05
	Discipline specific elective Pathology	1. Phlebotomy (01 credit) 2. Museum Technology (01credit)	01

Note: choose any one elective from DSE during second semester in the subject *

SEMESTER-II
B.Sc. Allied Health Science Programmes Syllabus
Subject: Biochemistry
Paper-I
Paper Title: (Elementary aspects of Biochemistry)

Credits (Theory 02, Demonstartion 01)

Theory lectures: 40

Unit –I
04hour
Laboratory hazards and its prevention
Common laboratory accidents and ways for its prevention. First Aid in the Clinical laboratory, Laboratory precautions, storage and handling of dangerous chemicals, safety measures. Conventional and SI Units

Unit-2 **02 hours**
Definition of Atomic weight, Molecular weight and Equivalent weight of elements and compounds

Unit-3 **05 hours**
Normality, Molarity, Molality – definition and preparation of solutions with examples

Unit 4
Acids and Bases **06hour**
Definition. Properties, theories, Classification, examples of strong and weak acids.
Basic concepts of Acid base reaction, Ionization of water, pH- definition, Henderson's Hassel Bach's equation, its applications and measurement.

Unit-5 **02hour**
Indicators
Definition, concepts, mechanisms of an indicator, use and its limitations, Commonly used indicators and their pH range. Ideal pH indicators used in different titrations. Universal indicators

Unit-6: **04hour**
Buffers
Definition, mechanism of action, various types of buffers with example and applications, Preparation of Buffer solutions using pH meter

Unit-7 **02hour**

Normal values and its interpretations

Unit 8 **06hour**

Biophysics

Various grades of chemicals, reagents and water. Biomedical waste management Waste disposal in the laboratory. Medico legal aspects of laboratory technicians and laboratory ethics

Unit-9 **05hour**

Specimen collection preservation and transportation-blood urine and other body fluids.

Unit 10 **04hours**

Quality control

Definition, types, IQAS and EQAS. Calculation of mean, standard deviation and percentage of coefficient of variation.

SEMESTER-II
B.Sc. Allied Health Science Programmes
Syllabus
Subject: Biochemistry
Paper-I
Paper Title: (1.Elementary aspects of biochemistry)

Demonstrations **(01 credit)**

Unit-1 **08 hours**

Introduction to laboratory apparatus
Pipettes, Types Calibration
Burettes, beakers, petri dishes, depression plates, funnels
Flask, Bottles, Measuring cylinders, test tubes, centrifuge tubes, dispensers, tripod stand, wire gauze, Bunsen burner, desiccator, stop watch (Types - reagent bottles, wash bottles , specimen bottles)

Cuvettes (Types, precautions, uses and limitations)

Maintenance of glassware and apparatus, Significance of borosilicate glass, Care and cleaning of glass ware and plastic ware, Different cleaning solution

Unit-2 **12 hours**

Introduction to instruments
Water bath, Oven, Incubators, Water distillation plant and water deionizers (Use, care and maintenance)
Refrigerators, Cold box, Deep freezers Reflex condenser (Use, care and maintenance)
Centrifuges (Types, Principle, procedure, RPM, Use, care and maintenance, limitations)
Laboratory balances (Types, Use, care and maintenance, procedure for weighing different chemicals)

pH meter (Principle, procedure, types of electrodes use, care, maintenance)

Unit-3 **4 hour**

Dilutions, Reagent dilution techniques, calculating the dilution of a solution (Preparation of 0.1 N NaCl, 1 N Hcl etc.)

Unit –4 **4 hour**

Stock solution, working standard, saturated and super saturated solutions

Preparation of glucose, urea etc. Volumetric flask- uses, limitations in preparing standard solutions

Unit-5 **4 hour**

Preparations of normal solutions Preparation of molar solutions, % solutions, v/v, w/v solutions Conversion of % solution into molar solutions
(Preparation of 1 N Na2 Co3, 1 NaOH, 0.1 N HCl etc)

Unit-6 **02 hours**

Titration of simple acid using a base
Demo- Titration of oxalic acid using NaOH

Unit-7 **02 hours**

Normal values & interpretations –
(Normal reference range)

Reference Books Biochemistry

1. Varley – Clinical chemistry
2. TEITZ – Clinical chemistry
3. Kaplan – Clinical chemistry
4. Ramakrishna(S) Prasanna(KG), Rajna ® Text book of Medical Biochemistry Latest Ed Orient longman Bombay
5. Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students , LatestEdn
6. DAS (Debajyothi) Biochemistry Latest ED Academic, Publishers, Culcutta
7. Rajagopal G & Ramakrishna –Practical Biochemistry for Medical Students oriental Blackswan Pvt. Ltd.

8.Shivarjshankara Y.M Practical Biochemistry

9.Murray R.K harpers Biochemistry Mc graw Hill

10.Pankaj Naik Biochemistry Jaypee publication..

SEMESTER-II

B.Sc. Allied Health Science Programmes Syllabus

Subject: Microbiology

Paper Title: (Elementary Microbiology)

Credits (Theory 02, Demonstration 01)

Theory lectures: 40

Unit-1 **05 hour**

Bacterial cell*: Anatomy, labeled diagram,

Antibiotics* : Commonly used antibiotics, target sites , misuse of antibiotics
Penicillin, Ceftriaxone, ceftazidime, ciprofloxacin, streptomycin, Erythromycin

Unit-2 **06 hour**

Sterilization & Disinfectants* :

- Define sterilization and disinfection
- Enumerate the different physical methods of sterilization
- Diagram of Autoclave , principle , articles to be sterilized
- Diagram of Hot Air oven, principle , articles to be sterilized
- Enumerate the commonly used chemical disinfectants & their uses.
  Phenol, Aldehydes, halogens, Ethylene oxide, detergents, antiseptics
- Describe disinfection of operation theatre

Unit-3 **03 hour**

Infection :

Types: acute, chronic , Primary, reinfection, secondary, cross, nosocomial, iatrogenic, subclinical, latent, atypical Source and modes of transmission with examples.

Types of infectious diseases : outbreak, endemic, epidemic , pandemic,

Unit-4 **02 hour**

Immunity :

Antigen & its properties
Humoral immunity: classes of immunoglobulins and its biological role
Primary Immune response :
Secondary Immune response / Booster response
Vaccines:
Killed : DPT, IPV
Live : BCG, OPV, MMR
Cell mediated immunity : cells involved , biological role

Unit-5 **04 hour**

Hypersensitivity*

Describe the clinical picture of anaphylaxis and mechanisms of anaphylaxis with clinical importance. Contact dermatitis: mechanism with examples

Unit-6 **02 hours**

Bacterial infections / diseases: *

Draw a map of human body and mark the different lesions/ diseases caused by the following bacteria :

- Mycobacterium tuberculosis
- Vibrio cholera
- Salmonella typhi
- Leptospira
- Treponema pallidium
- Coynebacterium diphtheria
- Staphylococcus ,
- Streptococcus,
- Pneumococcus
- E. coli
- Klebsiella ,
- Pseudomonas

Describe the modes of transmission, cardinal clinical manifestations & samples to be collected in the above infections

Unit-7 **08 hours**

Viral infections / diseases:*

Draw a map of human body and mark the different lesions/ diseases caused by the following Viruses :

- Hepatitis A, B ,C viruses ,
- Rabies ,
- HIV
- Arboviruses – Dengue , chikungunya ,
- Measles , Mumps ,
- Influenza ,
- Herpes, Chicken pox

Describe the modes of transmission , cardinal clinical manifestations & samples to be collected in the above infections

Unit-8 **02 hour**

Fungal infections / diseases :*

Draw a map of human body and mark the lesions / diseases caused by opportunistic fungus

- Candida,
- Cryptococcus,
- Aspergillus,
- Penicillium,
- Mucor ,
- Rhizopus

Describe the modes of transmission , cardinal clinical manifestations & samples to be collected in the above infections

Unit-9 **04 hours**

Parasitic infections / diseases :*

Draw a map of human body and mark the lesions / diseases caused by the following parasites :

- Entamoeba
- Plasmodium
- Leishmania
- Trichomonas,
- Giardia ,
- Heliminths : Hook worm , Round worm , Pork Tape worm , Beef Tape worm, Dog Tape worm , Pin worm , Filarial worms

Describe the modes of transmission , cardinal clinical manifestations & samples to be collected in the above infections

Describe the preventive & control measures against the heliminths

Unit-10 **04 hours**

Bio safety

Describe the standard precautions to be followed in the work place

Describe the hand hygiene technique
Describe the segregation and appropriate color coded containers for biomedical waste
Describe the post exposure prophylaxis against HIV, Hepatitis B and Rabies
Describe blood spill management

Note: * these chapters can be asked for long essay

Electives:

- Sterilization and Disinfectants
- Antibiotic Resistance
- Specimen collection and transportation

Reference Books Microbiology

1. Ananthanarayana & Panikar Text book of Medical Microbiology Universities press
2. Text book of Microbiologgy by C.P.Baveja
3. Chatterjee- Parasitology – Interpretation to clinical medicine.
4. Basic laboratory methods in Parasitology, 1st Ed, J.P.boros, New Delhi-199.
5. Basic laboratory procedures in clinical bacteriology 1st Ed, JP.Brothers, New Delhi.
6. Practical microbiology methods for LAB Technicians.
7. Bhatia R : Essentials of medical Microbiology Jay pee New delhi
8. Vandepitte J Basic laboratory procedures in clinical bacteriology Jay pee publications
9. Colle JG Practical Medical Microbiology USA
10. Chatterjee K D parasitology Chatterjee medical publishers

SEMESTER-II

B.Sc. Allied Health Science Programmes Syllabus

Subject: Pathology

Paper-I Paper Title: (Basics of Hematology, clinical pathology and histopathological techniques**)**

Credits (Theory 02, Demonstration 01) **Theory lectures 40**

Unit-1
(Basics in General Pathology)

Cell injury: agents causing cell injury, cellular adaptations (hypertrophy, atrophy, hyperplasia, metaplasia) reversible and irreversible injury.

Inflammation: cardinal signs of inflammation, acute and chronic inflammation. Laboratory tests in inflammation.
Hemodynamics: edema, thromboembolism, shock
Neoplasia: definition of neoplasm, differences between benign and malignant tumors, carcinogenesis
Infections: tuberculosis, leprosy Environmental pollution

Unit-2
(Basics in systemic pathology)
Cardio vascular system (CVS): Atherosclerosis and its complication, hypertensive heart disease, Myocardial infarction.
Leucocytes: causes for leukocytosis and leucopenia, leukemia
Respiratory system; Pneumonia, Lung cancer
GIT: peptic ulcer, gastric cancer
Liver: viral hepatitis, Gall stones
Kidney: UTI Urinary stones
Breast: Fibroadenoma, breast carcinoma
CNS: meningitis

Unit –3
(Basics of hematology and blood banking)
Blood collection, hemoglobin, ESR,PT/aPTT
RBC's: Definition of anemia,iron deficiency anaemia and megaloblastic anaemia
Blood grouping and Rh typing

Unit-4
(Clinical Pathology)
Urine examinations
Collection and transport of various clinical specimens

Unit-5 (Techniques in pathology)
Basics in tissue processing, FNAC, staining techniques.

DEMONSTRATIONS

Hemoglobin estimation.

Erythrocytes sedimentation Rate (ESR)

Urine examination

H&E staining

Blood grouping

Rh typing

Reference Books Pathology

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred Greg – Diagnostic cytopathology
5. Orell – Cyto Pathology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie & Lewis – Practical Haematology
8. Ramanic Sood, Laboratory Technology (Methods and interpretation) 4th Ed.J.P. Bros, New Delhi
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi
10. Sachdev K.N. Clinical Pathology and Bacteriology 8th Ed, J.P. Bros, New Delhi-
11. Krishna - Text book of Pathology, Orient Longman PVT Ltd.

SEMESTER-III

Papers

1. Biochemistry-1

   Chemistry of Cellular Bio-molecules and Enzymes

2. Biochemistry-2

   Metabolism and Metabolic disorders

3. Biochemistry-3

   Clinical chemistry, Organ Function tests, techniques

4. Skill Enhancement Course
   SAFE -I

Third semester B.Sc. in Medical Laboratory Technology distribution of hours and credit-CBCS scheme

Subject	Paper	Subjects	Theory		Practical		Demonstrations/ assignments		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
Core course (CC)	Paper-I C201	Biochemistry (Chemistry of cellular biomolecules and enzymes)	40	**02**	40	**01**	40	1	40	**02**	180	**06**
	Paper-II C202	Biochemistry (Metabolism and metabolic disorders)	40	**02**	40	**01**	40	1	40	**02**	180	**06**
	Paper-III C203	Biochemistry (clinical chemistry, organ function tests, techniques)	40	**02**	40	**01**	40	1	40	**02**	180	**06**
Skill enhancement course (SEC)	C205	Skill Enhancement course	30	**03**	-	**-**	-	-	-	**-**	30	**03**
		Total	150	**09**	180	**03**	120	03	120	**06**	570	**21**

Third semester B.Sc. in Medical Laboratory Technology distribution of marks - CBCS scheme

Subject	Paper/code	Subjects	Theory				Practical			
			Theory	Viva voce	I.A	Sub total	Practical	I.A	Sub total	Grand total
Core course (CC)	Paper-I C201	Biochemistry* (Chemistry of cellular biomolecules and enzymes)	80	-	20	100	-	-	-	100
	Paper-II C202	Biochemistry* (Metabolism and metabolic disorders)	80	-	20	100	-	-	-	100
	Paper-III C203	Biochemistry* (clinical chemistry, organ function tests, techniques)	80	-	20	100	-	-	-	100
	C204	Biochemistry Practical	-	30	-	30	60	10	70	100
Skill enhancement course (SEC)	C205	Skill Enhancement course	50	-	-	50	-	-	-	50
		Total	**290**	**30**	**60**	**380**	**60**	**10**	**70**	**450**

Note: Common Practical for all theory papers*

THIRD SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
Third Semester	**Core courses- Biochemistry**	1. Chemistry of cellular biomolecules and enzymes	06
		2. Metabolism and metabolic disorders	06
		3. Clinical chemistry, organ function tests, techniques	06
	Skill Enhancement course	SAFE i	03

SEMESTER-III
B.Sc. in Medical Laboratory Technology programme Syllabus
Paper 1 Subject: Biochemistry

Paper Title: Chemistry of cellular biomolecules and functions

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1 **3 hours**
Cell – Subcellular Organelles with functions, Fluid mosaic model of Plasma membrane and transport across the Cell membrane

Unit-2 4 hours
Blood Chemistry- Hemoglobin, Plasma proteins

Unit-3 2 hours
Urine Chemistry – Physiological and Pathological constituents

Unit-4 4 hours
Chemistry of Carbohydrates –

- Introduction, Definition, Properties of Carbohydrates
- Classification with examples
- Biomedical importance

Unit-5 4 hours

Chemistry of proteins –

- Amino Acids, Classification & Properties
- Biologically important peptides
- Introduction, Definition, Classification –Proteins

Unit-6 4 hours

Chemistry of Lipids

- Introduction, Definition, Properties of Lipids
- Classification with examples
- Biomedical importance

Unit-7 3 hours

Chemistry of Nucleic Acids-

- Introduction, Definition , Classification
- DNA & RNA- structure and function

Unit-8 6 hours

Enzymes

- Classification with examples, Mechanism of enzyme action,
- Factors affecting enzyme activity, Enzyme Inhibition
- Cofactors, Coenzymes and Isoenzymes

Unit- 9 6 hours

Vitamins – Fat Soluble and Water Soluble Vitamins

Unit-10 4 hours

Nutrition-

- Calorific value of Carbohydrates, Lipids, Proteins
- RQ , BMR, SDA, RDA
- Nutritional importance of Carbohydrates, Lipids, Proteins
- Dietary fibre
- Balanced diet
- Nutritional disorders

Practical 40 hours

Experiments

1. Urine analysis Physiological constituents (Organic and inorganic)
2. Urine analysis Pathological constituents (Reducing substance, Albumin, Acetone, Bile salts, Bile pigments, Blood)
3. Reactions of Carbohydrates – Monosaccharides (Glucose, fructose)
4. Reactions of Carbohydrates – Disaccharides (Sucrose, lactose, maltose)
5. Reactions of Carbohydrates- Polysaccharides (starch)
6. Identification of unknown carbohydrate of Physiological importance
7. Color reactions of proteins (Albumin, casein, gelatin, peptone)
8. Identification of unknown protein of Physiological importance
9. Precipitation reactions of proteins (albumin)

SEMESTER-III
B.Sc. in Medical Laboratory Technology programme Syllabus
Paper II Subject: Biochemistry

Paper Title: Metabolism and metabolic disorders

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1 2 Hours

- Digestion & absorption – Carbohydrates, Lipids, Proteins

Unit-2 6 hours

Metabolism of Carbohydrates

- Glycolysis & Gluconeogenesis, Glycogen metabolism
- HMP Shunt pathway & its significance
- Blood glucose and its regulation, diabetes mellitus
- GTT
- Inborn Errors of Metabolism

Unit-3 4 hours

Metabolism of Proteins-

- Urea cycle and its disorders
- Creatinine and its significance
- Urea and creatinine clearance
- Inborn errors of metabolism of Amino Acids

Unit-4 5 hours

Metabolism of Lipids –

- Beta-oxidation of fatty acids.
- Ketone body metabolism and disorders
- Compounds derived from cholesterol
- Lipoproteins, its function and reference range
- Disorders of Lipid Metabolism- Atherosclerosis, Obesity
- Fatty liver and lipotropic factors

Unit 5 2 hours

Citric Acid cycle , Intermediate metabolism

Unit 6 5 hours

Biological Oxidation – Substrate level phosphorylation
Oxidative Phosphorylation, uncouplers

Unit-7 3 hours
Metabolism of nucleic Acid- Uric Acid metabolism, Gout

Unit-8 5 hours
Heme metabolism and its disorders

Unit-9 5 hours
Mineral Metabolism- Calcium, Iron, Magnesium, copper
Zinc, selenium, Iodine

Unit 10 3 hours
Metabolism of Xenobiotics

Practical - III semester 40 hours
Experiments

1. Colorimetry- Principle and Instrumentation
2. Estimation of Blood Glucose by GOD- POD method
3. Estimation of Blood Urea by DAM method
4. Estimation of Urinary Creatinine by Jaffe's Method
5. Estimation Inorganic Phosphorus by Fiske Subbarow method
6. Estimation of serum bilirubin by kit method
7. Estimation of AST and ALT by kit method
8. Estimation of Calcium by kit method (Demonstration)
9. Estimation of Cholesterol (Demonstration)

SEMESTER-III
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper III Subject: Biochemistry

Paper Title: Clinical biochemistry, organ function tests and techniques

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1 4 Hours

Acid Base balance

- Blood pH, regulation of blood pH
- Acid Base disorders
- ABG

Unit-2 10 hours

Biochemical techniques

- Colorimetric
- Spectrophotometry
- Turbidometry
- Flame photometry
- ISE
- CLIA, ECILA, ELISA, EIA, RIA
- Electrophoresis and chromatography
- Separation and purification of proteins, techniques

Unit 3 3 hours

- Sample collection, transportation and Storage

Unit-4 4 hours

Biostatistics-

- Mean, Median, Mode
- Correlation coefficient
- SD, Standard Error of mean , % CV

Unit-5 8 hours

Quality control

- Preanalytical , Analytical, Post Analytical Errors
- Quality check of instruments
- Preparation and Interpretation of LJ Charts
- Different rules with respect to QC
- IQAS & EQAS , Accuracy, Precision , specificity , sensitivity , total allowable error.

Unit-6 3 hours

Automation of Analytical processes -Individual Steps required in detail

Unit-7 8 hours

Organ Function Tests

Practical - III semester 40 hours

Experiments

1. Measurement of pH
2. Case Charts – Acid base disorders
3. Case Charts- Organ Function tests
4. Quality Control Charts
5. Statistics in quality control

SEMESTER-IV

Papers

1. Microbiology-1
   Systemic bacteriology
2. Microbiology-2
   Parasitology
3. Microbiology -3
   Mycology & Virology
4. Ability Enhancement compulsory course
   Constitution of India

B.Sc. in Medical Laboratory Technology Fourth semester distribution of hours and credit-CBCS scheme

Subject	Paper	Subjects	Theory		Practical		Demonstrations/ assignments		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
Core course (CC)	Paper-I D201	Microbiology Systemic bacteriology	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-II D202	Microbiology Parasitology	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-III D203	Microbiology Mycology & Virology	40	**02**	40	**01**	40	1	40	**02**	160	**06**
AECC	D205	Constitution of India	30	**02**	-	**-**	-	-	-	**-**	30	**02**
		Total	150	**08**	120	**03**	120	03	120	**06**	510	**20**

B.Sc. in Medical Laboratory Technology Fourth semester distribution of marks - CBCS scheme

Subject	Paper/code	Subjects	Theory				Practical			
			Theory	Viva voce	I.A	Sub total	Practical	I.A	Sub total	Grand total
Core course (CC)	Paper-I D201	Microbiology Systemic bacteriology	80	-	20	100	-	-	-	100
	Paper-II D202	Microbiology Parasitology	80	-	20	100	-	-	-	100
	Paper-III D203	Microbiology Mycology & Virology	80	-	20	100	-	-	-	100
	D204	Microbiology Practical	-	30	-	30	60	10	70	100
AECC	D205	Constitution of India	50	-	-	50	-	-	-	50
		Total	**290**	**30**	**60**	**380**	**60**	**10**	**70**	**450**

FOURTH SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
Fourth Semester	**Core courses- Microbiology**	1. Systemic bacteriology	06
		2. Parasitology	06
		3. Mycology & Virology	06
	AECC	Constitution of India	02

SEMESTER-IV
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper I Subject: Microbiology

Paper Title: Systemic bacteriology

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1 - Introduction to systematic bacteriology- morphology, cultivation, pathogenicity, diseases caused and lab diagnosis

Unit-2 – Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci

Unit-3 – Corynebacterium diphtheria, Mycobacteria, Clostridia, Bacillus

Unit-4 - Introduction to systematic bacteriology- morphology, cultivation, pathogenicity, diseases caused and lab diagnosis

Unit-5 – Shigella, Salmonella, Escherichia coli, Klebsiella, Proteus, Vibrio cholera, Pseudomonas, Spirochetes

Practical - IV semester 40 hours
Experiments

1. Staining – Gram staining, ZN Staining, Albert staining
2. Hanging Drop preparation
3. Culture methods – Streak, Lawn , Stroke, Anaerobic
4. Biochemical reactions –Gram positive cocci, bacilli, gram negative cocci and Mcobacteria
5. Antibiotic sensitivity testing –Kirby Bauer method
6. Serological tests –ASLO, CRP, RA
7. Serological tests –Widal RPR/VDRL

SEMESTER-IV
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper II Subject: Microbiology

Paper Title: Parasitology

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1 - Introduction to parasitology

Unit-2 - Entamoebahistolytica

Unit-3- Balantidium coli

Unit-4- Giardia lamblia

Unit-5- Toxoplasma

Unit-6 - Malaria

Unit-7 - Leishmania

Unit-8- Helminthology – cestodes –taenia, H nana and echinococcus

Trematodes- schistosoma , fasciola Nematodes

Practical - IV semester 40 hours
Experiments

1. Stool examination– Saline mount , Iodine mount
2. Stool concentration techniques

SEMESTER-IV
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper III Subject: Microbiology

Paper Title: Mycology and Virology

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit-1- Introduction to Mycology

Unit-2 - Superficial mycoses

Unit-3 - Subcutaneous mycoses

Unit-4 - Dermatophytes

Unit-5 - Systemic fungi

Unit-6 -Opportunistic fungi

Unit-7- Introduction of virology

Unit-8 - DNA Viruses

Unit-9 -RNA Viruses

Practical - IV semester 40 hours

Experiments

1. Mycology exercises – KOH Mount, LPCB, SLIDE Culture
2. Virology exercises – Spotters /Response station Slide

REFERENCES

1. AnanthanarayanaPanikarText book of Medical Microbiology Universities press
2. Text book of Microbiologgy by C.P.Baveja
3. Chatterjee- Parasitology – Interpretation to clinical medicine.
4. Basic laboratory methods in Parasitology, 1st Ed, J.P.boros, New Delhi-199.
5. Basic laboratory procedures in clinical bacteriology 1st Ed, JP.Brothers, New Delhi.
6. Practical microbiology methods for LAB Technicians.
7. Bhatia R : Essentials of medical Microbiology Jay pee New delhi
8. Vandepitte J Basic laboratory procedures in clinical bacteriology Jay pee publications
9. Colle JG Practical Medical Microbiology USA
10. Chatterjee K D parasitology Chatterjee medical publishers

SEMESTER-V

Papers

1. Advanced technique, Grossing and histopathological techniques
2. Cytology of genital, respiratoy, gastrointestinal and urinary tracts and body fluids
3. Cytology, cytogenetics and special aspects of blood banking
4. Skill enhancement course : Medical Ethics

B.Sc. in Medical Laboratory Technology Fifth semester distribution of hours and credit-CBCS scheme

Subject	Paper	Subjects	Theory		Practical		Demonstrations/ assignments		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
Core course (CC)	Paper-I E201	Advanced technique, Grossing and histopathological techniques	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-II E202	Cytology of genital, respiratoy, gastrointestinal and urinary tracts and body fluids	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-III E203	Cytology, cytogenetics and special aspects of blood banking	40	**02**	40	**01**	40	1	40	**02**	160	**06**
Skill enhancement course (SEC)	E205	Medical Ethics	30	**02**	-	-	-	-	-	-	30	**02**
		Total	150	**08**	120	**03**	120	03	120	**06**	510	**20**

B.Sc. in Medical Laboratory Technology Fifth semester distribution of marks - CBCS scheme

Subject	Paper/code	Subjects	Theory				Practical			
			Theory	Viva voce	I.A	Sub total	Practical	I.A	Sub total	Grand total
Core course (CC)	Paper-I E201	Advanced technique, Grossing and histopathological techniques	80	-	20	100	-	-	-	100
	Paper-II E202	Cytology of genital, respiratoy, gastrointestinal and urinary tracts and body fluids	80	-	20	100	-	-	-	100
	Paper-III E203	Cytology, cytogenetics and special aspects of blood banking	80	-	20	100	-	-	-	100
	E204	Pathology Practical	-	30	-	30	60	10	70	100
Skill enhancement course (SEC)	E205	Medical Ethics	50	-	-	50	-	-	-	50
		Total	**340**	**30**	**60**	**430**	**60**	**10**	**70**	**450**

FIFTH SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
Fifth Semester	**Core courses- Pathology**	1. Advanced technique, Grossing and histopathological techniques	06
		2. Cytology of genital, respiratoy, gastrointestinal and urinary tracts and body fluids	06
		3. Cytology, cytogenetics and special aspects of blood banking	06
	Skill enhancement course (SEC)	Medical Ethics	02

SEMESTER-V
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper I Subject: Pathology

Paper Title: Advanced technique, Grossing and histopathological techniques

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit 1 - Introduction to Histopathology, Receiving of Specimen in the laboratory, Fixatives, mode of action, preparation - Grossing Techniques, Decalcification, Tissue processing, Section cutting, Mounting techinques, Staining of tissues- H&E, Use and care of microscope

Unit 2 - Maintenance of records and filing, Biomedical Waste management

Unit 3 - Instrumentation in Histopathology:

(a) Automated Tissue Processor
(b) Microtomes, Knives, Knife sharpners and Ultramicrotome
(c) Freezing microtome and Cryostat
(d) Automatic slide stainer

Techniques :

(a) Routine paraffin section cutting
(b) Frozen section and Cryostat section studies and mounting techniques

Unit 4- Staining techniques: Special stains for Carbohydrates, Connective tissue, Nervous tissue, Bone tissue, Collage fibers, Elastic Fibers, Lipids, Organisms, fungi, parasites, pigments and deposits in tissues

Unit 5- Electron Microscope, Scanning electron microscope, Dark ground and Florescent microscope, Museum technology, Microphotography and its applications, Maintenance of records and filing of slides, ICDS Classification and coding, Application of computers in Pathology

Practical V semester 40 hours

Experiments

1. Physical examination of urine
2. Chemical examination of urine
3. Urine microscopy
4. Section cutting
5. H&E staining
6. Paraffin section cutting

Semester-V B.Sc in Medical Laboratory Technology programme Syllabus
Paper II Subject: Pathology

Paper Title: Cytology of genital, respiratoy, gastrointestinal and urinary tracts and body fluids

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit 1 Cytology

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Types of specimens, methods of collection & preparation of cell block
3. Different fixatives and methods of fixation
4. Staining : (a) Papanicoloau's stain- principle , preparation and staining techniques
   (b) May Grunwald Giemsa stain
   (c) Shorr's stain
   (d) Acetoorcin stain

Unit 2- Female Genital tract

1. Anatomy, Histology, Physiology & normal cytology
2. Techniques of collection of specimen for cervical cytology study
3. Hormonal cytology and cytological indices
4. Cervical cytology screening for malignant and benign conditions , Radiation changes & follow up
5. Cytology of Endometrium – normal , benign and in malignant conditions
6. Cytology in Ovarian cancers

Unit 3 - Respiratory tract, Gastrointestinal tract and Urinary tract

1. Anatomy, Histology and Physiology
2. Collection of sample, preparation of smears and staining
3. Cytology of normal, benign & malignant conditions

Unit-4 - C S F and Effusions

1. Cytology of CSF in inflammatory, benign & malignant conditions
2. Cytology of effusions in benign and malignant conditions

Practical V semester 40 hours

Experiments

1. Preparation of various cytology smears and fixation
2. Papanicoloau's staining
3. MGG staining
4. Hormonal cytology stain

Semester-V B.Sc in Medical Laboratory Technology programme Syllabus
Paper III Subject: Pathology

Paper Title: Cytology, cytogenetics and special aspects of blood banking

Credits (Theory 02, Practical 01, Demonstration 01)

40 hours

Unit 1 cytology

Glands – Breast, Thyroid, Salivary glands and Lymph nodes

1. Anatomy, Histology and Physiology
2. Fine needle aspiration cytology of glands and other soft tissue mass
3. Cytologic features in benign and malignant conditions of different glands and nipple discharges

Unit 2 Automation in Cytology

1. Flow cytometry
2. Image Analysis
3. Principles, Equipments, procedures & Evaluation

Unit 3 Cytogenetics

1. Introduction to cytogenetic, terminology, classification and nomenclature of human chromosomes
2. Methods of karyotypic analysis

(a) Culture of bone marrow cells, peripheral blood lymphocytes, solid tumors & skin fibroblasts, Direct preparation from tumor tissue

3. Characterization of human chromosomes by various banding techniques
4. Sex chromatin identification
5. Chromosomes in neoplastic and oncogenes

Unit 4 Immunocytochemistry

1. Basics concepts, monoclonal antibodies & preparation of buffer
2. Immunofluorescence and IHC staining

Unit 5

Immunohematology and Blood transfusion

1. ABO Blood group and Rh system
2. Subgroups of A and B , Other blood groups and Bombay group
3. HLA antigens and their significance

Unit 6

Principles of Blood transfusion:

(a) Blood donor selection
(b) Methods of bleeding donors
(c) Blood containers, anticoagulants and storage of blood
(d) Coomb's test and its significance
(e) Screening of blood for infective material
(f) Blood components, preparation & component therapy
(g) Autologous transfusion
(h) Transfusion reactions and work up
(i) Blood bank organization, standards, procedures, techniques and quality control

Practical 40 hours

Experiments

1 Blood grouping and Rh typing
2 Cross matching techniques
3 Screening of donor's blood for infective agents
4 Transfusion reaction work up
5 Preparation of blood components

Reference Books Pathology

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred Greg – Diagnostic cytopathology
5. Orell – Cyto Pathology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie& Lewis – Practical Haematology
8. RamanicSood, Laboratory Technology (Methods and interpretation) 4th Ed.J.P. Bros, New Delhi
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi
10. Sachdev K.N. Clinical Pathology and Bacteriology 8th Ed, J.P. Bros, New Delhi-
11. Krishna - Text book of Pathology, Orient Longman PVT Ltd.

VI semester

Papers

1. Applied aspects of Biochemistry
2. Applied aspects of Microbiology
3. Applied aspects of Pathology
4. Ability Enhancement compulsory course
   Quality control

B.Sc. in Medical Laboratory Technology Sixth semester distribution of hours and credits- CBCS scheme

Subject	Paper & Code	Subjects	Theory		Practical		Demonstrations/ assignments		Tutorials		Total	
			hours	**Credits**	hours	**Credits**	hours	**Credits**	hours	**Credits**	Hours	**Credits**
Core course (CC)	Paper-I F201	Applied aspects of biochemistry	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-II F202	Applied aspects of microbiology	40	**02**	40	**01**	40	1	40	**02**	160	**06**
	Paper-III F203	Applied aspects of pathology	40	**02**	40	**01**	40	1	40	**02**	160	**06**
AECC	Ability enhancement compulsory course F204	Quality control	30	**03**	-	**-**	-	-	-	**-**	30	**03**
		Total	150	**09**	120	**03**	120	03	120	**06**	510	**21**

B.Sc. in Medical Laboratory Technology Sixth semester distribution of marks - CBCS scheme

Subject	Paper/code	Subjects	Theory				Practical			
			Theory	Viva voce	I.A	Sub total	Practical	I.A	Sub total	Grand total
Core course (CC)	Paper-I F201	Applied aspects of biochemistry	80	30	20	130	40	10	50	180
	Paper-II F202	Applied aspects of microbiology	80	30	20	130	40	10	50	180
	Paper-III F203	Applied aspects of pathology	80	30	20	130	40	10	50	180
AECC	Ability enhancement compulsory course F204	Quality control	50	-	-	50	-	-	-	50
		Total	**290**	**90**	**60**	**440**	**120**	**30**	**150**	**590**

SIXTH SEMESTER PROGRAMME STRUCTURE

Semester	Course Opted	Course Name	Credits
Fifth Semester	**Core courses-**	1. Applied aspects of biochemistry	06
		2. Applied aspects of microbiology	06
		3. Applied aspects of pathology	06
	Ability enhancement compulsory course	Quality control	03

SEMESTER-VI
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper I Subject: Biochemistry

Paper Title: Applied aspects of Biochemistry

Credits (Theory 02, Practical 01, Demonstration 01)

SECTION I : CLINICAL BIOCHEMISTRY

Unit 1- Carbohydrates 25 hours

Regulation of blood glucose homeostasis.

Hyperglycaemia: Diabetes mellitus(DM), laboratory findings in type 1 and type 2 DM, gestational DM.

Diagnostic and monitoring criteria for Diabetes Mellitus.

The role of laboratory in differential diagnosis of patients with glucose metabolism alteration

a) Methods of glucose estimation
b) Glucose Tolerance test
c) Glycosylated Hemoglobin
d) Ketones
e) Microalbuminuria
f) Islets antibodies and insulin testing

Unit 2 - Proteins

Plasma proteins in health and disease.

Total protein abnormalities (hypo and hyper proteinemia)

Methods of protein analysis (total protein), electrophoresis, capillary electrophoresis , isoelectric - focussing,, immunochemical method

Unit 3 – Lipids

Classification of lipoproteins based on separation and electrophoretic mobility

Lipid lipoproteins, [lipid profile] estimation and interpretation: a) total cholesterol c)Tri Acyl Glycerol (TAG) d)High Density Lipoprotein (HDL) e)Low Density Lipoprotein (LDL) f) Lipoprotein a (Lp a)

g) Apo protein A (Apo A) & Apo Protein B (Apo B)

Unit 4 – Organ function test

Liver function tests(LFT), Renal function tests (RFT), Thyroid function test (TFT), Analysis of calculi-renal & gall-theory of formation and analysis

Unit 5 – Fluids

Fluids different types- Cerebro Spinal fluid (CSF), pleural fluid, ascetic fluid, peritoneal fluid
Composition and functions,
Clinical significance of fluid analysis,
Estimation of biochemical component in fluids

Unit 6-Biochemical techniques

- Colorimetry
- Spectrophotometry
- Turbidometry
- Flame photometry
- ISE
- CLIA, ECILA, ELISA, EIA, RIA
- Electrophoresis and chromatography
- Separation and purification of proteins

SECTION II: PRINCIPLES OF LABORATORY MANAGEMENT

Unit 1 15hrs

Ethical Principles and standards for a clinical Laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice(GLP), Introduction to Basics of GLP and Aims of GLP.

Unit 2

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart

Unit 3

Audit in a Medical Laboratory, Introduction and importance, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation, NABL & CAP, Responsibility , Planning , Horizontal , Vertical and Test audit, Frequency of audit, Documentation

Unit 4

Basic concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing.

Unit 5

Biostatistics

Representation of Data: Tabular, Graphical, Measurement of central tendency , Arithmetic mean, mode, median; Measures of dispersion, Range , mean deviation ,variation, standard deviation, standard error, Chi-square test**.**

Practical VI semester 40 hours

Experiments

1. Estimation of blood glucose by glucose oxidase peroxidase method
2. Estimation of protein by Biuret method
3. Estimation of serum creatinine by Jaffe's method
4. Estimation of urea in blood sample by DAM method
5. Estimation of Total cholesterol by cholesterol oxidase and peroxidase method
6. Estimation of Triglycerides by GOP/PA method
7. Estimation of HDL Cholesterol by precipitation method
8. Estimation of SGOT in blood sample by kinetic method
9. Estimation of SGPT in blood sample by kinetic method
10. Estimation of alkaline phosphatase in blood sample by kinetic method
11. Demonstration of Estimation of acid phosphatase in blood sample by kinetic method
12. Estimation of bilirubin in blood sample by kinetic method
13. Demonstration of Estimation of Na+, K+ & Ca++ by electrode analyser
14. Estimation of common parameters in urine through use of strips
15. Demonstration of Estimation of T3, T4 and TSH by Electrochemiluminesecence method.

SEMESTER-VI
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper II Subject: Microbiology

Paper Title: Applied aspects of Microbiology

Credits (Theory 02, Practical 01, Demonstration 01)

Unit 1 : Sterilization and disinfection

- Autoclave-Principle, uses, Maintenance
- Hot air oven-Principle, uses, Maintenance
- Incubators-Principle, uses, Maintenance

Unit 2: Culture media

- Preparation, Uses, IQC, storage

Unit 3: Biosafety in Microbiology lab

- Biosafety cabinet
- Immunization
- Disease acquired by respiratory route/through blood/through orofaecal route.
- Personal protective equipments
- Hand hygiene
- Spill management
- Needle stick injury & Post exposure prophylaxis

Unit 4: Diagnostic Microbiology

- Serological tests-Agglutination tests, ELISA, CLIA,
- Molecular Methods-PCR
- Culture methods-Bactec, Biochemical tests, Antibiotic sensitivity testing

Unit 5 : Applied Microbiology

- **Blood Stream infections**
  Sample collection, causative agents.
  Define CLABSI

- **Respiratory tract infections**
  Tuberculosis-update on diagnostic methods
  Pneumonia-Causative agents, sample collection and processing Define VAP
  Diphtheria

- **Urinary tract infection**
  Causative agents, Sample collection and processing
  Define CAUTI
- **Sexually transmitted infections**
  Causative agents, Sample collection and processing
  HIV update
- **Skin and soft infections**
  Causative agents, Sample collection and processing
- **Diarrhoea and Dysentry**
  Causative agents, sample collection and processing

Unit 6: NABL

- Documentation, Critical alerts

Practical:

40 hours

Experiments

Bacteriology

Staining: Grams, ZN, India Ink Preparation, Albert
Culture media, culture Methods, Antibiotic sensitivity testing

Serology

ASLO, CRP, ELISA, CLIA, Rapid card tests

Mycology

KOH wet mount, LPCB, Slide culture.

Parasitology

Stool Microscopy
Peripheral smear for Malaria Parasite

Reference books

1. Text book of Microbiology by Ananthnarayan, 6 th Edition, Orient Longman
2. Diagnostic Microbiology by Bailey & Scott 11th Edition; Mosby
   Medical Microbiology by Greenwood & Slack 16th Edition; Churchill Livinstone
3. The Short Textbook of Medical Microbiology by Satish Gupte 8th Edition; Jaypee
4. Text book of Medical Parasitology by Panikar 5th Edition; Jaypee
5. Colour Atlas and Textbook of Diagnostic Microbiology by Koneman 5th Edition,
   Williams Wilkins
6. District Laboratory in Tropical Countries, Monica Cheesbrough 1st Edition, Cambridge
7. Mackie & Maccarteney Practical Medical Microbiology 14th Edition; Churchill Livingstone
8. Essential Immunology, Roitts & Delves 10th Edition; Blackwel Science

SEMESTER-VI
B.Sc. in Medical Laboratory Technology Programme Syllabus
Paper III Subject: Pathology

Paper Title: Applied Aspects of Pathology

Credits (Theory 02, Practical 01, Demonstration 01)

Unit 1- Clinical Pathology
Collection, transport, preservation and processing of various clinical specimens
Urine examination, Physical, chemical and microscopic. Urine analysis by Strip method
Test for haemosiderin pigment.

Renal function tests. Stool examination – collection of specimen of faces
Macroscopic (Naked eye) inspection:
Concentration method , Flotation method .
Microscopic examination
Chemical examination

Strip method:
Test for Occult blood – Benzidine Test Sputum examination – collection of specimen
Physical examination, Microscopic – Gram's stain, Ziehl Neelsen stain for AFB
Chemical examination

Unit 2 - Immunopathology
Mechanism of Ab- mediated inactivation: direct and indirect
Eg. Diabetes mellitus, thyroid diseases, pernicious anemia, polyendocrinopathy, infertility, haemophilia, myasthenia gravis, anti-idiotypes and diseases.

Immunohaematologic diseases:
Transfusion reactions, erythroblastosis foetails, warm-antibody disesases, cold antibody diseases, drug and hemolytic diseases, agranulocytosis, thrombocytopenic purpura, immune suppression cytotoxic antibodies in vitro.

Immune couples reactions: arthus reaction, serum sickness, evaluation of circulating immune complexes. Atopic anaphyllactic reactions:
reaginic antibody, anaphylaxis, atopic allery –factors involved, asthma, hay fever, food allergy, insect allergy, atopic eczma, delayed hypersensitivity reactions, contact dematitis, viral infectionss, graft-host relationship in pregnancy.
Autoallergiiic diseases:
encephalomyelitis, multiple sclerosis, oorchitis, thyroiditis, sjogren's syndrome.

Unit 3- Cerebrospinal fluid analysis
Method of obtaining CSF, indications, contra indications.

Examination of CSF :
i. Physical examinatio
ii. Biochemical examination
iii. Microscopic examination
a. Cytological examination
b. Bacteriological examination

Body fluids:
Microscopic examination of Pleural, Pericardial, synovial, ascitic and peritonial fluid.

Pregnancy Test- Method, interpretation.

Bio-Medical waste: Types, potential risks and their safe management.

Practical 40 hours
Experiments

1. Urine examination, Physical, chemical and microscopic. Urine examination by Strip method
2. Urine Test for haemosiderin pigment. [Demonstration]
3. Benzidine Test- for occult blood
4. Sputum examination - Macroscopic, Microscopic and AFB
5. Histocompatibility testing.
6. Blood grouping &cross matching.
7. Coomb's Test - Direct & Indirect.
8. Setting up of Immuno histochemistry lab.
9. Examination of Cerebrospinal fluid [CSF] and body fluids.
10. Pregnancy Test
11. Examination of Semen.

Distribution of Type, Number and marks of Questions for Various Subjects

THEORY

Subjects having maximum marks = 100			Total
Type of question	Number of questions	Marks for Each question	
Essay type	02 (no choice)	10	20
Short essay type	12 (Answer any 10)	5	50
Short answer type	12 (Answer any 10)	3	30

Subjects having maximum marks = 80			Total
Type of question	Number of questions	Marks for Each question	
Essay type	02 (no choice)	10	20
Short essay type	8 (Answer any 6)	5	30
Short answer type	12 (Answer any 10)	3	30

Subjects having maximum marks = 50			Total
Type of question	Number of questions	Marks for Each question	
Essay type	02 (no choice)	10	20
Short essay type	5 (Answer any 3)	5	15
Short answer type	7 (Answer any 5)	3	15

Subjects having maximum marks = 40			Total
Type of question	Number of questions	Marks for Each question	
Essay type	01	10	10
Short essay type	4 (Answer any 3)	5	15
Short answer type	6 (Answer any 5)	3	15

-End-