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 GraduateCurriculum for Bachelor of Science in Imaging 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.)
In Imaging 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. Imaging 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)

SDUAHER

Declared under Section 3 of UGC Act, 1956, MHRD GOI No.F.9-36/2006-U.3(A) Dt. 25th May 2007
POST BOX NO.62, TAMAKA, KOLAR-563 101, KARNATAKA, INDIA
Ph:08152-243244, 210604, 210605, Fax:08152-243008, E-mail: registrar@sduu.ac.in/office@sduu.ac.in, website: www.sduu.ac.in

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. Imaging 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 Fundamentals of Physics 9. Radiation safety 10. Medical Physics			SEC-1 (SAFE-I)	-	-
IV	11. Basic Radiographic and fluoroscopy 12. Dark room processing 13. Special procedures. Contrast media reactions and its management		Constitution of India	-	-	-
V	14. Physics of ultrasound with PCPNDT act 15. Physics of CT & Imaging technique 16. Mammography and Nuclear medicine			SEC-2 Medical Ethics	-	-
VI	17. MRI Physics and instrumentation 18. MRI Imaging basics and advances in MRI 19. Interventional radiological procedures (Vascular and non- vascular)	-	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	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 A203	Physiological functions of the body	30	**02**	30	**01**	30	**01**	90	**04**
	Paper –II A204	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	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 (01 credit) and transportation						**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. Fundamentals of Physics
2. Radiation safety
3. Medical Physics
4. Skill Enhancement course
   SAFE -i

Table 8 Third semester B.Sc. in Imaging 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	Fundamentals of Physics	40	**02**	60	**02**	40	1	40	**02**	180	**07**
	Paper-II C202	Radiation safety	40	**02**	-	**-**	40	1	40	**02**	120	**05**
	Paper-III C203	Medical Physics	40	**02**	-	**-**	40	1	40	**02**	120	**05**
Skill enhancement course (SEC)	C204	Skill Enhancement Course (SAFE-i)	30	**03**	-	**-**	-	-	-	**-**	30	**03**
		Total	150	**09**	60	**02**	120	03	120	**06**	450	**20**

Table 9 Third semester B.Sc. in Imaging 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	Fundamentals of Physics	100	30	20	150	40	10	50	200
	Paper-II C202	Radiation safety	100	30	20	150	-	-	-	150
	Paper-III C203	Medical Physics	100	30	20	150	-	-	-	150
Skill enhancement course (SEC)	C204	Skill Enhancement course (SAFE-i)	50	-	-	-	-	-	-	50
		Total	**350**	**90**	**60**	**450**	**-**	**-**	**-**	**500**

Table 10 THIRD SEMESTER PROGRAM STRUCTURE

Semester	Course Opted	Course Name	Credits
Third Semester	**Core courses-**	1. Fundamentals of Physics	07
		2. Radiation safety	05
		3. Medical Physics	05
	Skill Enhancement course	Safe i	03

SEMESTER-III
B.Sc. in Imaging Technology program Syllabus
Paper 1 Subject: Fundamentals of Physics
Paper Title: Fundamental of physics
Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit –I 12 Hours

Electromagnetic Radiation, Atomic Structure and Radioactivity:

- Electromagnetic waves and their properties, Inverse square law.
- The quantum theory of Radiation (Planck's concept of quanta, Photon and its characteristic properties), the electromagnetic spectrum, Florescence and Phosphorescence, Photoelectric emission, Photocell, Intensity and quality of electromagnetic radiation.
- The structure of the Atom: Nucleus, Atomic number (Z), Mass number (A), Ionization & Excitation, Isotopes, And the Periodic Tables.
- Radioactivity, Properties of alpha, beta, gamma radiation, Radioactivity transformation process (Radioactivity displacement law), Radioactivity decay (Radioactive disintegration law), decay constant, half-life, Units of Radioactivity.
- Radioactive disintegration process and radiation emission and daughter products.
- Properties of radium and its daughter elements.
- Radioactive equilibrium.

Unit -2 **13 hours**

Fundamentals of Electricity (Basic of Electronics)

- Electric charges and units of electric charge, Coulombs law, Electric induction, electric potential & potential difference, Capacitance and Capacitors, Resistance.

- Conductors, Insulators and Semiconductors, Electric current, Ohm's law& Kirchhoff's law, circuit laws (Combination of Potential differences in series and parallel, meters, Electrical energy & Power, heating effect of a current.

- The magnetic effects of an electric current (Electromagnetism), electromagnetic induction, Mutual indication and Self-induction

- Alternating current, The A.C. transformer theory, and construction, Types of transformers its practical aspects, Transformer losses and regulation and rating. Types of transformers used in X-ray equipment.

- Thermionic emission. The vacuum diode, Variation of anode current with anode voltage and filament temperature in the vacuum diode, the effect of gas in the diode, the thermionic gas diode. Meaning of rectification (full wave & half wave rectification).

- Principles of semiconductors, p-n junction diode, High voltage rectifier circuits (self-rectifying circuit, Half-wave pulsating voltage circuit, Full-wave pulsating voltage circuits, shock proofing. Advantages of semiconductor devices over thermionic devices.

Unit - 3 **10 Hours**

X-rays (Basic of Radiation Physics):

- Conductivity of electricity through gases at low pressure, Cathode rays – production and properties. Sources of electrons (Discharge through gases, Thermionic emission and photoelectric emission), Discovery of an electron, Concept of electron volt.

- Discovery of X-rays, Production & properties of X-ray, Bremsstrahlung, Factors influencing the intensity and quality of X-ray, Construction and working of Modern X-ray tube (fixed anode and rotatory anode tubes), The physics of X-spectra i,e., the spectrum of radiation from an X-rays tube (Continuous spectrum and line or characteristic spectrum), Factors upon which the X-rays emission depends, Soft and Hard X-rays, Distribution of X-rays in space, The diagnostic X-ray, tubes (inserts and shields), Filament design, anode design (fixed and rotatory), methods of cooling, Basic X-ray Circuit. Linear accelerator-Transmission type target.

SEMESTER-III
B.Sc. in Imaging Technology program Syllabus
Paper I1 Subject: Radiation safety
Paper Title: Radiation safety
Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Common Syllabus for the training on "Radiation Safety in Radio diagnosis as per AERB Guide lines

Unit 1 **7 hours**

Basic Radiation Physics

Atomic structure, Nucleus, Atomic No, Electron orbit and energy levels, Isotopes and isobars, Radioactivity, Radioactive decay, Half-life, Particles radiation, Electromagnetic Radiation, Production of X-rays, Continuous X-ray spectrum, Bremsstrahlung radiation Characteristics X-rays, Filters, Quality of X-rays, Effect of voltage and current on the intensity of X-rays, Properties of X-rays.

Unit 2 **5 hours**

Interaction of Radiation with Matter

Photoelectric effect, Compton Effect, pair production, Ionization of matter, energy absorbed from X-rays, X-rays scattering, X-rays transmission through the medium, linear and mass attenuation coefficient, HVT and TVT, Interaction of charged particle and neutrons with matter.

Unit 3 **3 hours**

Radiation Quantities and Units

Radioactivity, Flux, Fluency, Karma, Exposure, Absorbed Dose, Equivalent dose, weighting factors, effective dose, natural background radiation, occupational exposure limits, dose limits to public.

Unit 4 **10 hours**

Radiation Hazard evaluation and control

Philosophy of radiation protection, effect of time, distance and shielding, calculation of workload, calculation of weekly dose to the radiation worker and general public, good work practices in diagnostic radiology and /or radiotherapy practices (including tele therapy and Brachytherapy), Planning consideration for radiology and/or radiotherapy installation including work load, use factor & occupancy factors, effect of different shielding material.

Unit 5 **5 hours**

Biological effects of radiation

The cell, effect of ionizing on cell, chromosomal aberration and its application for the biological dosimeter, Somatic effects and hereditary effects, stochastic and deterministic effects Acute exposure and chronic exposure, LD 50/60.

Unit 6 **10 hours**

Detection and measurement of radiation & measuring instruments

Ionization of gases, Fluorescence and phosphorescence, effect on photographic emulsion, Ionization chambers, Proportional counters, G.M counters, Scintillation detectors, liquid scintillator, Pocket dosimeters, TL dosimeter and their use in personnel monitoring badges. Advantages and disadvantages of various detectors, appropriateness of different types of detectors for different types of radiation measurement.

SEMESTER-III
B.Sc. in Imaging program Syllabus
Paper II1 Subject: Medical Physics
Paper Title: Medical Physics
Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit 1 **3 hours**
Mains Supply

Generation of electrical energy, Distribution of electrical energy, Use of electrical energy, polyphone Supplies, Availability of different voltages, Line Voltage Drop; Mains Switches, Fuses, Circuit breakers. Earthling, Insulation, High tension cables construction, design.

Unit 2 **5 hours**

Diagnostic High Tension Circuits

Self-Rectified, Half-Wave, Full-Wave, 4 Rectifier, 3 Phase, Capacitor Discharge, Constant Potential. Main Voltage Compensation, Mains Resistance Compensation, Compensations, For Mains Frequency Variation. Control of Tube Voltage, Kilovolt age Compensation; Filament Circuit, Control of Tube Current, Space Charge Compensation. High Tension (Tube Selector) Switch. Meters-Function; Use of Shunts. Meters Commonly Found In Diagnostic X-Ray Equipment, position In Circuits.

Unit 3 **5 hours**
X-Ray Tubes

Rotating Anode X-Ray tubes, Design, Rating, and Use of rating charts, Care of The X-Ray tubes; Inherent filtration and additional filtration ; Practical Considerations in the choice of Focus; Speed of anode rotation; Angle of Anode Inclination. Grid-controlled X-Ray tube.

Unit 4 **7 hours**
Control of Scattered Radiations

Cones, Tube Diaphragms,. Single and multiyear Grids, structure and Materials; Grid ratio and lines *fCm*. Parallel and focused Grids, stationary Grids, Crossed hatched Grids. Gridded Cassettes, Grid movement, Potter-Bucky Diaphragms; Single stroke, Reciprocating And Oscillating Mechanisms; Beam centering devices – Centre finders, Optical centering devices, Light beam collimators.

Unit 5 **7 hours**

Fluoroscopy and Image Intensifiers:

Equipment

Direct Fluoroscopy, Fluoroscopy Image, Fluoroscopic Screen, Exploratory (Serial Changers, Spot Film Devices) and Accessories. Radiation Protection Including integrating timer. Tilting tables. Principles and construction of image intensifiers, Television cameras tubes And cathode Ray tubes. Recording the Intensified Image, Method of viewing the Intensified Image, Equipment for fluorography and Cine-Fluorography. Radiographic and fluoroscopic Tables, Tele commands Tables.

Unit 6 **5 hours**

Equipment for Special Procedures:

Special trolleys and chairs, Portable and mobile X-Ray units, Cordless mobile X-Ray Equipment, Capacitor discharge mobile Equipment, Equipment for O.T. Bi-Plane Radiography, Cranial and Dental Equipment, Skull Tables, Mammography, Mass-Miniature Radiography, Tomography, Rapid cassette changer, rapid film changer, Magnification radiography, subtraction Radiography.

Unit 7 **8 hours**

Care and Maintenance of X-Ray Equipment's:

General Principles of cleaning routines. General care in use and special care or mobile equipment's. Simple test. Uses of Spinning Top and Step Wedge, Checks on generator Output; check for Integrity of Tomographic equipment; Procedure for obtaining radiograph of the focal area. Use of Ma and Timer Wisconsin Test Tool, test of kilo voltage, Wisconsin test cassette, Use of focal spot test tool, Testing light beam diaphragm, Failures of X-Ray Tubes And Ht Cables.

PRACTICAL for Fundamental of Physics

(Experiments +charts+ Viva-voce) 60 Hours

List of experiments

1. Study of temperature dependence of total radiation
2. Demonstration of half wave and full wave rectifiers
3. Characteristics of Transistors in CE, CB and CC configuration
4. Study of survey meter and dosimeter circuits
5. Determination of sensitivity of cathode rays oscilloscope
6. Study of Raman spectrum using LASER as an excitation source
7. Analsysis of given band spectrum
8. Study of transformers used in diagnostics
9. Film study using x-rays and reason for image sharpness and unsharpness
10. Study of semiconductors (PNP, NPN model)
11. Study of radioactive nucleus in periodic table
12. Determination of Radiation units and calculations
13. Calculation of photon beam attenuation for a) lead b) Concrete c) wood d) Aluminum
14. Safety and management of radiation protection
15. Radiation safety
16. Hazards of Radiation
17. X-ray Tube, Filaments, and Instrumentation
18. Control of scatter radiation
19. Care and Maintenance of x-ray equipment

Reference Books

1. Christinsen, curry and Dowdey: An Introduction of the physics of Diagnostic radiology [Leafebiger] 2nd edition D.N. and M.O. Chesney, X-ray Equipment for student radiographers

2. W.J. Meredith and J.B. Massey; Fundamental Physics of Radiology [Varghese publishing house] Faiz M. Khan, Physics of Radiation therapy [Williams and Wilkins]

3, S.S. Kapoor and Ramamoorthy; Nuclear Radiation Detectors.

Semester-IV

Papers

1. Basic Radiographic and fluoroscopy
2. Dark room processing
3. Special procedures. Contrast media reactions and its management
4. Constitution of India

Table 11 Fourth semester B.Sc. in Imaging 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 D201	Basic Radiographic and fluoroscopy	40	**02**	40	**02**	40	1	40	**02**	160	**07**
	Paper-II D202	Dark room processing	40	**02**	40	**02**	40	1	40	**02**	160	**07**
	Paper-III D203	Special procedures. Contrast media reactions and its management	40	**02**	40	**02**	40	1	40	**02**	160	**07**
AECC	D204	Constitution of India	30	**02**	-	-	-	-	-	-	30	**02**
	D205	Total	150	**08**	120	**06**	120	03	120	**06**	510	**23**

Table 12 B.Sc. in Imaging 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	Basic Radiographic and fluoroscopy	100	-	20	120	-	-	-	120
	Paper-II D202	Dark room processing	100	-	20	120	-	-	-	120
	Paper-III D203	Special procedures with contrast media reactions and management	100	-	20	120	-	-	-	120
	D204	Common Practical semester IV	-	30	-	30	60	10	70	100
	AEC D205	Constitution of India	50	-	-	50	-	-	-	50
		Total	**350**	**30**	**60**	**440**	**60**	**10**	**70**	**510**

Table 13 FOURTH SEMESTER PROGRAM STRUCTURE

Semester	Course Opted	Course Name	Credits
Fourth Semester	**Core courses-**	1. Basic Radiographic and fluoroscopy	07
		2. Dark room processing	07
		3. Special procedures. Contrast media reactions and its management	07
	AECC	Constitution of India	02

SEMESTER-IV
B.Sc. in Imaging program Syllabus
Paper I Subject: Basic Radiographic and fluoroscopy
Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Theory 40 hours (Credits 02)

Unit 1
Principles of Radiography: 04 hours

Preparation of the Room, Apparatus and Instruments
Position of the Patient: Erect , Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc.,
Relative Position of X-Ray Tube and Patient, Relative Exposure Factors. Use of Accessories such as Radiographic Cones, Grid and Positioning Aids.
Anatomic and Physiological basis of the Procedure, Association with Theory with practical work.
Radiographic Appearances, Both Normal and common Abnormal Conditions where Elementary Knowledge of the Pathology involved will ensure the application of the appropriate Radiographic Technique. Modifications in Techniques for various Disabilities and types of Subject. Radiation Protection, Use of Gonnd Shield, Practical Methods; Redoing Radiation Dose to the patient.

Unit 2
Upper limb: 03hours

Routine Projections for the whole Hand, Fingers, Wrist Joint, Forearm, Elbow Joint and humerus. Supplementary Projections for Scaphoid, Carpal Tunnel Ball Catchers Projections, Head of the Radius, Supracondylar Fracture and Olecranon Process.

Unit 3
Lower limb: 03 hours

Routine projections for the whole foot, toes, calcaneum, ankle Joint, leg, knee-Joint, Patella and femurs. Supplementary Projections For T Alo-Calcaneal Joint, Forced Projections for torn Ligaments, Flat Feet, Club Feet, Intercondylar Projections For Loose Bodies In The Knee, Axial Projection For Patella.

Unit 4

Shoulder Girdle and Thorax: 05 hours

Routine Projections for the Shoulder Joint, Scapula, Acromion-Clavicular Joint, Clavicle, Sterno-clavicular Joint, Sternum and Ribs.

Supplementary Projections for the Axial Projection of Clavicle, Bicipital Groove Carotid Process, Classification of Tendons, Subluxation, Upper Ribs, Lower Ribs and Axillary Ribs.

Unit 5

Pelvic Girdle and Hip Region: 05 hours

Routine Projections for the Whole Pelvis, Sacroiliac Joints, Hip Joint and Neck of Femur.

Supplementary Projections For The greater and Lesser Trochanters of Femur. Frog Leg projections, Ischeum symphysis pubis, ileum, Acetabulum And Congenital Dislocation Of Hip Arthrodesis.

Unit 6

Vertebral Column: 04hours

Routine Projections for Atlanto Occipital Joint, cervical spine, cervico thoracic Junction, Thoracic Spine, Lumbar Spine, Lumbo Sacral Region, Sacrum and Coccyx

Supplementary Projections for the Intervertebral Foramina, Posterior Arch, of Atlas, Flexion and Extension of Cervical Spine, Scoliosis And Kyphosis, Sacro Ileac Joint.

Unit 7 04hours

Skeletal Survey:

Skeletal Survey for Metabolic Bone Diseases, Metastases, Hormonal Disorders, Renal Disorders.

Unit 8 04hours

Skull:

Routine Projections For Cranium And Facial Bones. Supplementary Projections For Trauma, Towne's & Method, Sella, Turcica, Optic Foramina, Jugular Foramina, Temporal Bones, Mastoids Petrous Bone, Zygomatic Arches, Orbits, Maxillae, Nasal Bones, Mandible, Temporomandibular Joints.

Unit 9 03hours

Nasal Sinuses:

Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, Erect and Horizontal Projections for Fluid Levels.

Unit 10 **03hours**

Teeth:

Routine projections of all teeth- intra oral and extra oral projections. Supplementary projections for localization of roots, children's, edentulous subjects and use of occlusal and bitewings, orthopantomography.

Unit 11 **03hours**

Chest:

Routine projections for lungs, cardia and diaphragm. Supplementary projections for opaque swallow, thoracic inlet, soft tissue neck, decubitus, apicugrams, pediatric cases.

Unit 12 **03hours**

Abdomen:

Kub, erect abdomen and decubitus projection, supplementary projeaions for acute abdomen.

Reference Books

1. Philip W.Ballinger: Atlas Of Radiographic Positioning And Radiological Procedures (Mosby) Ra Swallow, E Naylor: Clarks Positioning In Radiography E J Roebuck, A S Whitley
2. Sante Lr: Roentgenologic Technique (Edwards Inc) Goldman: A Radiographic Index Ross And Gailway: A Handbook Of Radiography (Lewis) Glenda J.Bryan: Diagnostic Radiography (Mosby) Piles: Medical Radiographic Technique (Thoms).

SEMESTER-IV

B.Sc. in Imaging program Syllabus

Paper I1 Subject: Dark room processing

Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit 1

Dark Room Processing:

For A Small Hospital, For a Large Hospital Location of Dark Room, Construction of Dark Room, Ventilation, Wall Protection , Entrance To Dark Room –Single Door, Double Door, Labyrinth

Unit 2

Dark Room:

Instruction To Staff, Dry Bench, Hopper, Drawer, Cupboard Loading And Unloading Cassettes Hangers, Types Of Hangers And Storage of Hangers, Printing Wet Bench Cleanliness, Control of Dust, Dark Room sink, Hatches, Drier, Safe Lights, Direct And Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests Viewing Room, Film Dispensing.

Unit 3

X-Ray Films:

Glass, cellulose and polyester bases structure of x-ray films-emulsion, gelatin, base and super coating types of x-ray films, single coated, duplitised, spectral sensitivity, colour sensitivity, graininess of films, speed of films, screen & non screen films, Various Formats of films, Films for special procedures.

Unit 4

Storage of Films Materials and Radiographs:

Record of Film Stock and Radiographs Deterioration of Films on Storage Characteristic Curves-Uses of Step Wedge Information on Basic Fog, Film Latitude, Effect on Development

Unit 5

Intensifying Screens:

Fluorescence-Phosphors Phosphors Employed-Calcium Tungstate,-Barium Fluochloride,-Rare Earths

Unit 6

Construction of Intensifying Screens:

The Influence of Kilo voltage in Different Phosphors, Intensification Factor Resolving Power of Intensifying Screens Speed of Screens, Screen Film Contact Tests Types of Intensifying Screens Advantages and Limitations of Intensifying Screens

Unit 7

X-Ray Cassette:

Construction of X-Ray Cassette Types of Cassette Mounting Intensifying Screens on Cassettes Identification of Cassettes, Care of Cassettes

Unit 8

Photochemistry

Chemistry of Image Formation, Formation of Latent Image, Conversion of Latent Image to Visible Image, Meaning of PH, Importance of PH in Processing Films.

Unit 9

Processing Methods

Preparation of Solution, Manual Processing Apparatus, Control of Temperature, Rapid Processing

Unit 10

Automatic Processor:

Principle and Features, Water Supply, Use of Thermostat, Regeneration of Solutions, Maintenance, Advantages and Limitations. Processing of Cut, Films and Roll Films.

Unit 11

The Radiographic Image:

The Emergent Beam Related to Densities on Film Contrast-Objectives and Subjective. Long Scale and Short Scale Radiation, Contrast, Film Contrast and Radiographic Contrast

Unit 12

Density:

Sharpness Sources of Unharness, A voiding different un-sharpeners.

Unit 13

Resolution:

Factors Affecting Resolution, Choice Of Kilovoltage and Milliamperage, Choice of Short Focus and broad focus, selection of focus to film distance and object to film distance selection of cassettes, avoiding scatter radiation, magnification, distortion, penumbra presentation of a radiograph-identification markers, name printer viewing equipment magnifiers for cut films and roll films.

Unit 14
Developer:
Constituents Characteristics, Manual and Automatic Processors, Effect on developing time, temperature, agitation, Replenisher Exhaustion.

Unit 15
Rinsing:
Acid Stop-Bath Method Objects

Unit 16
Fixer:
Constituents characteristics, Manual and automatic processors, fixing time and clearing time, Factors Affecting Fixing Time, Replenisher exhaustion.

Unit 17
Washing and Drying:
Objects Methods, Factors Affecting Washing and Drying Wetting Agents, Comparison of different Methods

Unit 18
Day Light Film Handling:
Day Light System Using Cassettes, Day light system without Cassettes.

Unit 19
Film Faults:
Fog-various fogging in films, Causes and Prevention. Stains-Types, Causes and Prevention, Spots and Splashes-Types causes and Prevention, marks And Prints-Types, Causes and Prevention, Drying marks- Types causes and Prevention. Faults in Automatic Processor- Types, Causes.

Unit 20
Reproduction of Radiographs:
Copying Radiographs, Magnification and Miniification, Contact Prints, Types of Paper Equipment.

SEMESTER-IV

B.Sc. in Imaging program Syllabus

Paper I1 Subject: Special Procedures

Credits (Theory 02, Practical 02, Demonstration 01)

Theory 40 hours

Unit 1

Introduction:

During Radiological procedures, preparation of patient for different produces. Contract Media-Positive and Negative, Ionic & Non-Ionic Adverse Reactions to Contract Media and Patient Management. Emergency drugs in the Radiology. Department Emergency Equipment in the Radiology Department. Asepsis Radiation Protection-Ten Day Rule

The following should be dealt with indication, contraindications, Patient Preparation, Contrast media used, Method of Administration of contrast Media, Accessories Required, Technique to be Adopted, Variation in Normal Techniques in Specific Circumstances, Films Taken, Complication's, Precautions and After-Caro of the Patient.

Unit 2

Gastro-Intestinal Tract:

Barium Swallow-Trachea-Esophageal Fistula Barium Meal-Single Contrast and Double Contrast Hypotonic Duodenography Barium Meal Follow through Small Bowel Enema. Barium Enema-Gastrograffin Enema for reducing intussusception Logogram. Additional Investigation-Computed Tomography, Radio Isotope Scanning Magnetic resonance and imaging.

Unit 3

Reproductive System:

Hysteron Salpingogram, Additional Investigations: Ultrasound Scanning, Computed Tomography Magnetic Resonance and Imaging

Unit 4

Cardio-Vascular System:

Angiography: Percutaneous Catheterization, Catheterization Sites, Asepsis Guide Wire, Catheter, Pressure Injector and Accessories. Use of digital subtraction, Single Plane and Biplane, Head and Neck arteriography, Pulmonary Arteriography, Coronary Arteriography, Ascending Aortography.

Unit 5

Additional Investigations

Radio Isotope scanning computed tomography Ultrasound Imaging. Magnetic Resonance and Imaging

COMMON PRACTICAL

(Basic Radiographic and fluoroscopy, Dark room processing & Special Procedures)

Radiography - Plain Views of Upper Limb
Hands, Fingers, Thumb, Wrists, Forearm, Elbow, Humerus

Radiography - Plain Views of Shoulder
Shoulder joint, Acromio - Clavicular joint

Scapula Various Views And Projections
Clavicle, Sterno - Clavicular Joint

Radiography - Plain Views of Lower.Limb
Foot ,Toes, Tarsus & Oscalcis, Ankle, Tibia, Fibula & Patella , Knee Joint, Femur, Hip Joint pelvis & Sacra-iliac joint.

Radiography of Vertebrae
Cervical spine Upper, Cervical spine lower, Cervico- Thoracic, Cervico-Middle, Thoraco lumbar, lumbo-Sacral, Sacrum & Coccyx, Ribs upper & lower, Sternum

Radiography of Skull Plain Views
Ap Lateral & Towns, Sinuses, Mandible, teeth in mastoids

Radiography of Chest
Lungs & Trachea; Heart-Diaphragm Radiography of G.I. Tract, Plain X-Rays Abdomen-Erect; Liver, Spleen.

Practical on

a. Cassette and intensifying screens
b. Chemical used in film processing
c. Films used in photography and printers
d. Dark room processing

Gastro-intestinal Tract:
Barium swallow, barium meal, barium follow through. Barium enema

Renal's:
IVU, RGU/MCU, KUB, Fistulogram, Sinogram.

Reproductive system:
Hysterosalpingogram

References

1. D.N. Chesney & M.O Chesney: Radiographic Imaging (Cbs) I.C.R.P.: Protection of the patient in Medical Radiography (Bergaman)
2. Derrick P. Roberts & Nigel L. Smith: Radiographic Imaging A practical Approach (Chruchill Uvingstone)
3. Stewart C. Suchong: Radiological Science (Work book and Laboratory Manual)
4. Kodak: Fundamentals of Radiographic Photography books 1,2,3,4,5 (Kodak Ltd.)
5. Seeman & Herman: Physical and photography principles of Medical Radiography (wiley) Hford: Manual of Photography
6. Bouthworth & Bently: Elementary Photogenic Chemistry (Pitmans) Longmore: Medical Photography (Focal Press) Kodak Data Books. Jackson: Developing

SEMESTER-V

Papers

1. Pre -Conception and pre –Natal Diagnostic techniques (PCPNDT) Act
2. Physics of CT & Imaging technique
3. Mammography and Nuclear medicine
4. Skill Enhancement course- Medical Ethics

Table 14 Fifth semester B.Sc. in Imaging 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 E201	Physics of ultrasound with PCPNDT act	40	**02**	40	**02**	40	01	40	**02**	160	**07**
	Paper-II E202	Physics of CT & Imaging technique	40	**02**	40	**02**	40	01	40	**02**	160	**07**
	Paper-II E203	Mammography and Nuclear medicine	40	**02**	40	**02**	40	01	40	**02**	160	**07**
Skill enhancement course (SEC)	E205	Medical Ethics	30	**02**	-	**-**	-	-	-	**-**	30	**02**
		Total	150	**08**	120	**06**	120	03	120	**06**	510	**23**

Note: Pre -Conception and pre –Natal Diagnostic techniques (PCPNDT) Act

Table 15 Fifth semester B.Sc. in Imaging 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 E201	Physics of ultrasound with PCPNDT act	80	-	20	100	-	-	-	100
	Paper-II E202	Physics of CT & Imaging technique	80	-	20	100	-	-	-	100
	Paper-II E203	Mammography and Nuclear medicine	80	-	20	100	-	-	-	100
	E204	Common Practical semester V	-	30	-	30	60	10	70	100
Skill enhancement course (SEC)	E205	Medical Ethics	50	-	-	50	-	-	-	50
		Total	**290**	**30**	**60**	**380**	**60**	**10**	**70**	**450**

Table 17 FIFTH SEMESTER PROGRAM STRUCTURE

Semester	Course Opted	Course Name	Credits
Fifth Semester	**Core courses-**	1. Physics of ultrasound with PCPNDT act	07
		2. Physics of CT & Imaging technique	07
		3. Mammography and Nuclear medicine	07
	Skill enhancement course (SEC)	Medical Ethics	02

SEMESTER-V

B.Sc. in Imaging program Syllabus

Paper I Subject: Physics of ultrasound with Pre -Conception and pre –Natal Diagnostic techniques (PCPNDT) Act

Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit 1

Ultrasound Imaging:

History ultrasound characteristics-nature, propagation, frequency, wavelength, velocity, amplitude intensity, acoustic impedance, reflection, refraction

Unit 2

Interference with Medical,

Interface attenuation transducer-piezoelectric effect, construction, types of arrays-mechanical & electronic acoustic coupling media.

Unit 3

Ultrasound Instrumentation display Modes:

Modes-A, Mode, B Mode M Mode, Real Time Grey Scale Imaging doppler, Pulsed doppler, Duplex, Real time colour flow imaging.

Unit 4

Patient care and handling during Ultrasound procedure:-

Patient Preparation and Handling, Basic Diagnostic Aspects. Interventional Techniques-Transducer Sterilization, Needles, diagnostic Procedures, Therapeutic Procedures. documentation safety consideration-effects of healing, cavitation. quality assurance-phantoms, performance, accuracy, sensitivity, spatial resolution tests.

Unit 5

Ultrasound artifacts

SEMESTER-V

B.Sc. in Imaging program Syllabus

Paper II Subject: Physics of Computed Tomography & Imaging technique

Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Theory 40 hours

Unit 1

Imaging Techniques:

Computed Tomography,

History, Principle of computed tomography (CT)

Generations of Spiral Computer tomography.

Instrumentation Data Aquisition Data Presentation

Image Reconstruction 2 D and 3 D Images

Image Display Pixel and Voxel

C.T Number

Window Level and Window Width

Scan Artifacts

Patient Positioning in CT

Contrast Materials and administration

Basic Diagnostic aspects

Interventional C.T. guided procedures

Documentation

Safety consideration-Radiation Dose Quality Assurance

SEMESTER-V

B.Sc. in Imaging program Syllabus

Paper III Subject: Mammography and Nuclear medicine

Credits (Theory 02, Practical 02, Demonstration 01)

Unit 1

Computer Radiography (CR)

Principle, Processing, equipment, advantages, radiological information systems.

Digital Radiography (DR)

Principle, processing, equipment, advantages,

Picture Archiving & communication system (PACS)

History Advantages

Unit 2

Nuclear Medicine Imaging

History Isotopes and Radionuclides. Production of Radionuclides, Radio activity, Transformations, Specific activity, Radiopharmaceuticals and their Preparation. Precaution while handling Radiopharmaceuticals, Principles of Tracer techniques,

Instrumentation – Multihole collimator, Crystal Photomultiplier, Computer, Monitor Scanning Technique resolution – spatial Temporal Gamma camera Rectilinear Scanner.

Unit 3

Position Emission Tomography (PET):

Single photon emission computed Tomography (SPECT)
Radio Immune Assay (RIA)
Documentation in PET
Safety considerations-Radiation dose in PET
Quality Assurance (QA)

V Semester

COMMON PRACTICALS

- Identification of Ultrasound abdominal organs
- PCPNDT act
- Patient care and handling
- To perform CT scan of brain
- To perform CT scan of PNS
- Preparation of patient for the contrast CT procedures of thorax and abdomen
- Radiation hazards of CT scan
- CR
- DR
- TOCS

SEMESTER-VI

Papers

1. MRI Physics and instrumentation
2. MRI Imaging basics and advances in MRI
3. Interventional radiological procedures (Vascular and non- vascular)
4. Skill Enhancement course
   Quality control

Table 18 B.Sc. in Imaging Technology Sixth 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 F201	MRI Physics and instrumentation	40	**02**	40	**02**	40	**1**	40	**02**	160	**07**
	Paper-II F202	MRI Imaging basics and advances in MRI	40	**02**	40	**02**	40	**1**	40	**02**	160	**07**
	Paper-III F203	Interventional radiological procedures (Vascular and non-vascular)	40	**02**	40	**02**	40	**1**	40	**02**	160	**07**
Ability enhancement compulsory course	F205	Quality control	30	**02**	-	**-**	-	**-**	-	**-**	30	**02**
		Total	150	**08**	120	**06**	120	**03**	120	**06**	540	**23**

Table 19 B.Sc. in Imaging 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	MRI Physics and instrumentation	80	-	20	100	-	-	-	100
	Paper-II F202	MRI Imaging basics and advances in MRI	80	-	20	100	-	-	-	100
	Paper-III F203	Interventional radiological procedures (Vascular and non- vascular)	80	-	20	100	-	-	-	100
	F204	Common Practical semester VI	-	30	-	30	60	10	70	100
Ability enhancement compulsory course	F205	Quality control	50	-	-	50	-	-	-	50
		Total	**290**	**30**	**60**	**380**	**60**	**10**	**70**	**450**

Table 20 Sixth Semester Program Structure

Semester	Course Opted	Course Name	Credits
Sixth Semester	**Core courses-**	1. MRI Physics and instrumentation	07
		2. MRI Imaging basics and advances in MRI	07
		3. Interventional radiological procedures (Vascular and non-vascular)	07
	Ability enhancement compulsory course (AECC)	Quality control	02

SEMESTER-VI

B.Sc. in Imaging program Syllabus

Paper I Subject: MRI Physics and instrumentation

Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit 1

Magnetic Resonance and Imaging:

Magnetic Resonance and Imaging History

The Spinning Proton-Magnetization, precession,

Larmor Frequency, Radio Frequency Pulse and Proton-Resonance.

Free Induction Decay, Relaxation T-L & T-2

Instrumentation

Magnet, Shim Coils, Gradient Coils, Radio Frequency Transmitter and Receiver Coils, Computer.

Image Production-2D and 3D Pictures.

Image Quality-Signal to Noise Ratio, Contrast to Noise Ratio,.

Safety Consideration Quality Assurance.

SEMESTER-VI

B.Sc. in Imaging program Syllabus

Paper II Subject: MRI Imaging Basics and Advances in MRI

Credits (Theory 02, Practical 02, Demonstration 01)

Theory lectures: 40

Unit 1

Basic Sequences:-

- Pulse sequences:- saturation recovery, spin ectio, inversion recovery.
- Proton density,
- T1 and T2
- STIR-FLAIR

Unit II

Advance Sequence:-

- Diffusion
- Perfusion
- Spectroscopy
- Flow techniques-magnetic resonance angiography

Unit III

MRI Contrast agents

Paramagutic and ferromagnetic documentation

Unit IV

Mammography, Instrumentation, position and projections in mammography

Unit V

a) MRI Brain
b) MRI -spine

SEMESTER-VI

B.Sc. in Imaging program Syllabus

Paper III Subject: Interventional radiological procedures (Vascular and non- vascular)

Credits (Theory 02, Practical 02, Demonstration 01)

Unit 1

Special X-ray Tectiniques:

Thermography Duplication radiography, macro radiography High kilo voltage tectiniques, soft tissue roeliography, multiple radiography, subtraction radiography, foreign body localization, mobile radiography, theatre radiography, domiciliary radiography, forensic radiography, tomography digital subtraction angiography.

Unit II

Special procedures (Non vascular):

Choledoctiography pre-operative

Choledoctiography post-operative

Renal system

Percutancour renal puncture

Percutoncous Nephrostomy

Retrogradc pycloureterography

Unit III

Special interventional procedures (Vasulcer)

Cardio vascular system (CVS)

Venography

Peripheral venography-lower limb, upper limb

Internal jugular venography interventional vascular radiography

PRACTICAL:

1. MRI Protocal
2. MRI safety measures
3. Coils and posifioning of patient
4. MR artifacts
5. Contrast reacfion
6. Mammography positions and projections
7. Responsibilities during procedures
8. Catherferization techniques

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-