YENEPOYA

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

YENEPOYA (DEEMED TO BE UNIVERSITY)

Deralakatte, Mangaluru -575018

REGULATIONS AND CURRICULUM GOVERNING

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE NEUROSCIENCE TECHNOLOGY

(CURRICULUM - EFFECTIVE FROM 2020-21)

ATTESTED

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Ref: No. Y/REG/ACA/38-ACM/2020

14.05.2020

NOTIFICATION – 38-ACM/12 /2020 dtd. 14.05.2020

Sub: Revised curriculum of the existing B.Sc. (Tech) programmes and Starting of additional programmes under the Faculty of Allied and Healthcare Professions

Ref: Resolution of the Academic council at its 38th meeting held on 27.04.2020, vide agenda - 23

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The Academic Council at its 38th meeting held on 27.04.2020 and subsequently the Board of Management at its 49th meeting held on 30.04.2020 have resolved to approve the revised curricula and regulations of existing 08 B.Sc. Technology Programmes (Anaesthesia & O.T. Technology, Renal Dialysis Technology, Respiratory Care Technology, Medical Laboratory Technology, Medical Imaging Technology, Cardio Vascular Technology, Perfusion Technology, Optometry Technology) and starting of 04 new programmes under the Faculty of Allied & Healthcare Professions

1. B.Sc. in Physician Assistant
2. B.Sc. in Clinical Psychology
3. B.Sc. in Emergency Medicine Technology
4. B.Sc. in Neuro Science Technology

All these programmes shall follow Choice Based Credit System.

This notification will supersede all the earlier notifications issued on this subject.

REGISTRAR

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CC to:

1. Dean, Faculty of Allied and Healthcare Professions
2. Controller of Examinations
3. File copy

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Yenepoya (Deemed to be) University,

Regulations & programme curriculum for

B.Sc. Medical Imaging Technology under Choice Based Credit System.

1. Preamble

Health care sector has become one of the largest employment generation sectors in India and abroad. Rapidly changing and expanding horizon of the health care sector demands formal training programs in all its allied areas. Advanced complex instrumentation & equipment require technologists not only to operate but also to care & maintain these instruments and equipment. These technologists should possess a strong scientific foundation to be able to perform these tasks at a much higher level than the traditionally trained technicians of the past used to perform. The students who are trained in the technological aspects of medical care with a good scientific foundation will be in a position to competently assist the Physician or Surgeon. Hence to prepare the students to meet the demands of the healthcare sectors and in accordance with Ministry of Human Resource Development (HRD), Govt. of India education system, Choice based Credit system is introduced from the academic year 2020- 21 onwards.

Medical Imaging plays a very important role in Diagnosis of patients. After the discovery of X-ray in 1895, Radiology has become an indispensible tool in medical community. From the humble but effective X-ray to the advanced imaging modality like MRI and CT, the advances has be rapid and highly technical. Knowledge not only is Biology but also in physics and its principles play an important role in operating these modalities. So along with the skills of doctors and nurses, the skills of the technologist also matters in a successful patient outcome. Hence, hospital needs a qualified and skilled Medical Imaging Technologist.

2. Programme Outcome:

Upon successful completion of the undergraduate course, students will have developed a broad knowledge in the field of evaluation, diagnosis and management of different conditions of the eye.

In particular they will:

PO1: Function as competent entry level medical imaging technologists

PO2: Demonstrate the ability to use theoretical knowledge and critical thinking skills in clinical practice

PO3: Select appropriate technical factors for exposure related to the positioning

PO4: Provide patient care before, during and after the procedures

PO5: Perform appropriate examination required for patients

PO6: Select and operate different modalities as per to the need of physician

PO7: Understand the various diagnostic and therapeutic modalities based on the patients history and examination findings

Expected skill to be acquired by the end of the programme:

PO 8: Prepare the patient as per the need of the procedure to be performed

PO 9: Provide best clinical information to the physician

PO 10: Modify the protocols according to the demand and need

PO 11: Assist radiologists during minimally invasive procedures under the imaging guidance

PO 12: Demonstrate effective oral and written communication skills

PO 13: Use of radiation protective devices to limit the radiation dose for both patient and radiation personnel

3. Duration of the Programme:

The duration of the programme shall extend over 8 semesters (three academic years with one year internship) each semester comprising minimum of 15 weeks with the minimum of 90 actual working days of instruction in each semester. The successful completion of the Undergraduate program, along with internship as applicable will lead to Bachelor's degree in Medical Imaging Technology (B.Sc. MIT).

4. Semester:

An academic year shall consist of two semesters;

Odd Semester 1st, 3rd, 5th& 7th	July/August to December/January
Even semester 2nd, 4th, 6th& 8th	January/February to June/July

5. Medium of Instructions:

The medium of instruction and examination shall be English.

6. Eligibility for admission:

To be eligible for admission in B.Sc Medical Imaging Technology, a candidate should have passed two-years Pre University examination/ Pre Degree examination/ two years after ten years of schooling or its equivalent as recognized by the Yenepoya (Deemed to be) University with Physics, Chemistry and Biology as principal courses of study.

Candidate needs to secure 40% or above marks in the qualifying examination to be eligible for admission. For SC/ST/OBC candidate's minimum marks required in the qualifying exam is 35% marks.

7. Semester System and Choice Based Credit System:

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

8. Definition of Key words:

a. **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

b. **Choice Based Credit System**: The CBCS provides choice for students to select from the prescribed courses (Core, Ability Enhancement, Skill enhancement, Self learning and Discipline specific courses).

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

d. **Credits:** Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, normally in each of the courses, credits will be assigned on the basis of the number of lectures/tutorial laboratory work and other forms of learning required, to complete the course contents in a 15-20week schedule: One credit =1 hour of lecture per week/ two hours of Laboratory or practical/three hours of clinical rotation, field work/posting. All courses need not carry the same credits.

	Lecture - L	**Tutorial - T**	**Practical - P**	**Clinical Training/ Rotation CT/CR**
1 Credit	1 Hour	1 Hour	2 Hours	3-5 Hours

e. **Programme:** An educational program leading to award of a degree, diploma or certificate.

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

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

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

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

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

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

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

9. Types of Courses

Courses in a programme may be of three kinds:

- Core Course
- Ability Enhancement Compulsory Course (Foundation course)
- Elective Course

9.1 Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. This is the course which is to be compulsorily studied by a student as a core requirement to complete the program of study in a said discipline.

9.2 Ability Enhancement Compulsory Courses (AECC): Ability enhancement compulsory courses (AECC) are the courses based upon the content that leads to knowledge enhancement.

Example:

1. Environmental science
2. English/ MIL communication

These are mandatory for all disciplines.

9.3 Elective Course (EC):

9.3.1 Generic elective

9.3.2 Skill enhancement course

9.3.3 Self-learning courses (SWAYAM/MOOC)

9.3.4 Discipline Specific Elective courses

9.3.1 Generic elective: An Elective Course chosen from pool of courses which are unrelated from unrelated discipline/subject with intention to seek exposure beyond disciplines of choice. The purpose of this is to offer the students the option to explore disciplines of interest beyond the choices they make in core and discipline specific elective courses.

9.3.2 Skill enhancement course: SEC courses are value-based and/or skill- based and are aimed at providing hands-on-training, competencies and skills. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

9.3.3: Self – learning course: with respect to- UGC (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2021. New Delhi, the 25th March, 2021. Vide No.F.1-100/2016 (MOOCs/e-content)

The List of MOOCS (Massive open online courses) and SWAYAM (Study webs of active learning for young aspiring minds) will be finalized by the faculty of allied health professions as per subject to time-to-time UGC notification and will be submitted to the academic council

of the DU. Yenepoya(Deemed to be university) shall adopt the regulation of UGC governing MOOCS/ SWAYAM courses as amended from time to time.
The college/ department will designate course coordinator/facilitator to guide the students throughout the course to facilitate the completion of the chosen course.

9.3.3.1 Evaluation and Certification of MOOCs:

Evaluation will be based on predefined norms and parameters and announced in the overview of the Course at the time of offering the course. Formative continuous online assessments and end of course proctored exams shall be completed by the student.
The Yenepoya (Deemed to be) University incorporate the marks/grade obtained by the student, as communicated by the Host Institution through the PI of the SWAYAM course in the marks sheet of the student that counts for final award of the degree by the University.

9.3.3.2 Credit Mobility of MOOCs:

The Yenepoya(Deemed to be) University will give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform in the credit plan of the program.

In case a student fails to complete the MOOCS course He/ She may be allowed to complete the course requirements by registering for another course online in subsequent semester or opt for a course offered at this Yenepoya (Deemed to be) University.

10. Assigning Credit Hours per Course

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

- Every Core course shall be restricted to a maximum of 4 credits.

- The elective course offered by the Yenepoya (Deemed to be) University shall be restricted to a maximum of 2 credits.

- A candidate shall compulsorily complete total Twelve Credits of Elective courses

- These courses shall be selected either from the Generic Electives, Skill enhancement courses offered by Yenepoya (Deemed to be) university or from the SWAYAM/MOOC/NPTEL courses notified by the UGC time to time and enlisted by the faculty of Allied Health Care Professions. A Candidate shall have freedom to choose the courses of once own choice and at their own pace from the external online platform (SWAYAM/MOOC) or a mix of courses offered by Yenepoya (Deemed to be) University but, require to complete before appearing the Sixth semester end examination.

- A candidate who is desirous to add more credits shall be permitted to do so during the academic duration. Extra credits earned by a candidate shall be included in the marks card on submission of course completion certificate. However, it shall not be considered for awarding the Grade in the UG programme.

- The credits assigned to the course are indicated as L: T: P format. For example, for a 4 credit course format could be: 4:0:0 or 1:2:1 or 3:1:0 or 0:0:4etc.

11. Assigning Total Credits for a Programme

The UGC, in its notification No.F.1-1/2015 (Sec.) dated 10/4/15 has provided a set of "Model curricula and syllabi for CBCS programmes. In conformation with this notification, at Yenepoya (Deemed to be University), for UG programs with duration of 3years study period or 6 semesters, the total credits shall be a maximum of 140 credits and for the UG programme with duration of 4 years study period or 8 semesters, the total credits shall be a maximum of 162 credits.

12. CBCS Program Coding System

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

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

12.2. Course code shall have prefix denoting semester number followed by an alphabet of respective type of courses such as C = Core, AECC= Ability Enhancement Compulsory, GE=Generic Elective, SE= Skill Enhancement, SL = Self -Learning, P=Practical followed by numbers denoting number of courses taught-

1st SEM: 1C1, 1C2, 1C3, 1AECC1, 1AECC2, GE1/SE1/SL1 1P1 etc.
2nd SEM: 2C1, 2C2, 2AECC1, A2ECC2, GE2/SE2/SL2, 2P1, etc.
3rd SEM: 3C1, 3C2, 3AECC1, 3AECC2, GE3/SE3/SL3, 3P1, 3P2etc.
4th SEM: 4C1, 4C2, 4C3, 4P1, 4P2, GE4/SE4/SL4etc.
5th SEM: 5C1, 5C2, 5GE1/5SE1, 5P1, 5P2, 5P3, GE5/SE5/SL5etc.
6th SEM: 6C1, 6C2, 6GE1/6SE1, 6P1, 6P2, 6P, GE6/SE6/SL6etc.
7th SEM: 7C1 (Internship)
8th SEM: 8C1 (Internship)

13. Attendance:

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

13.2 There shall be no provision for condonation of shortage of attendance.

13.3 For SWAYAM/MOOC/NPTEL it shall be as per the regulations governing the courses of implementing authority.

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

14. Scheme of examination

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

14.2 .The components of CIA (Continuous Internal Assessment) may include Two Internal Assessment tests, Assignment and Conduct/discipline.

14.3 The marks for CIA shall be 40% and SEE shall be 60%.

14.4 There shall be no minimum marks for CIA for a pass, but the minimum marks for pass per course shall be 50% CIA and SEE added together.

14.5 There shall be examinations at the end of each semester ordinarily during December/January for odd (1^{st} and $3^{rd)}$ semesters and during June/July for even (2^{nd} and 4^{th}) semesters. The SEE for 5^{th} and 6^{th} Semester will be held during December/January and June/July of each year

14.6 The SEE duration shall be three hours.

14.7 The question paper pattern shall be decided by the Board of Studies (BOS) of the respective departments.

Internal assessment format per course (distribution of marks)

Internal Assessment Components	**Maximum Marks**
Two IA tests	20
Assignment	10
Conduct/discipline	10
Total Marks	**40**

First Internal assessment shall be held in the 6^{th} week of the semester and the second Internal Assessment will be held one month before the semester end university examination.

Question Paper Pattern for Core course SEE

	SUBJECTS HAVING MAXIMUM MARKS = 60				**Duration**
Type of question	**Number of questions**	**To be Answered**	**Marks for each question**	**Total**	
LONG ESSAY TYPE	02	01	10	10	180 minutes
SHORT ESSAY TYPE	10	08	05	40	
SHORT ANSWERS	07	05	02	10	
			Total	**60**	

Question Paper Pattern for AECC SEE

	SUBJECTS HAVING MAXIMUM MARKS = 40				Duration
Type of question	**Number of questions**	**To be Answered**	**Marks for each question**	**Total**	
LONG ESSAY TYPE	02	01	10	10	90 minutes
SHORT ESSAY TYPE	05	03	05	15	
SHORT ANSWERS	07	05	03	15	
			Total	**40**	

Practical examination

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

PARTICULARS OF PRACTICAL, VIVA-VOCE

- Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a specialist.
- Viva- Voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence &oral communication skills.
- OSCE/OSPE- shall have minimum of 4 stations.

15. Evaluation of Answer Scripts

15.1. Each theory examination shall have single evaluation. There shall be provision for re-evaluation on a payment of a fee. An external examiner shall value the paper, if the difference is more than 15% of previous marks the answer script shall be sent for third evaluation. In such an event, the average of the best two out of the three scores will be taken as the final score.

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

16. Classification of Successful candidates:

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

16.1. Letter Grades and Grade Points:

16.1.1. The Deemed to be University would be following the absolute grading system, where the marks are compounded to grades based on pre-determined class intervals.

16.1.2. The UGC recommended 10-point grading system with the following letter grades are given below:

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)/ RA (Reappear)	0
Ab (Absent)	0
Not Eligible (NC) detained	0

16.1.3A student obtaining Grade RA/ Ab shall be considered failed and will be required to reappear in the end semester examination.

16.2. The Semester Grade Point Average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester.

For example, if a student takes five (Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a student has a F or ABS grade in program 4, the SGPA shall then be computed as:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4 * ZERO + C5G5}{C1 + C2 + C3 + C4 + C5}$$

16.3. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VI semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VI semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the program(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier.

The CGPA is calculated as:

$$CGPA = \frac{C1S1+C2S2+C3S3+C4S4+C5S5+C6S6}{C1+C2+C3+C4+C5+C6}$$

Where C1, C2, C3,… is the total number of credits for semester I,II,III,…. and S1, S2, S3….is the SGPA of semester I, II, III,…..

Calculation of GPA & CGPA: An example (1st semester)

Program Code	Course	Credits (a)	Grade Obtained	Credit Value (b)	Grade Points (axb)
	Course 1	4	B	8	32
	Course 2	4	B	8	32
	Course 3	4	O	10	40
	Course 4	2	C	7	14
	Course 5	2	A	9	18
	Total	16	-	-	136

1st Semester GPA = Total Grade Points / Total Credits = 136 / 16 = 8.5 2nd Semester GPA = 7 with respect to 18 Credits

Then 1st Year CGPA = (8.5 x 16) + (7 x 18) / 16 + 18 = 7.7

17. Declaration of Class

The class shall be awarded on the basis of Cumulative marks scored in all the Courses

First Class with Distinction= Aggregate Marks 75% and above

First Class = Aggregate Marks 60 to 74.9%

Second Class = Aggregate Marks 50 to 59.9%

17.1 Promotion Criteria

- The students are allowed to carry over any number of courses till sixth semester. But student is eligible to appear for the End semester exam of sixth semester if he/she has

cleared all the Courses both Core and AECC of first, second, third & fourth semesters. If student has any pending course of first to fourth semesters he/she is not eligible to appear for the end semester exam of the sixth semester. However, Fifth semester courses are allowed to club with sixth semester end examination. But, all the Core courses and AECC Courses of first to fourth semester should be completed to be eligible for 6th end semester exam.

- Candidate should also complete 12 credits of elective course to be eligible for the 6^{th} (in case of 3 year program) end Semester Examination.

- Candidate should clear all Courses (Core, AECC & Elective courses) of all the semester, to be eligible to start the one year of mandatory internship.

- A fail in any one Course will mean the student has to reappear for the exam in that Course only.

- A candidate who passes the semester examinations in parts is eligible for only CGPA and letter grade but not for Class/ ranking/award/medal from the University.

18. Internship

A candidate has to mandatorily complete 1 year (2 semesters) of internship. The total credit per semester is 18 and for two semesters it is 36.

The internship time period provides the candidate the opportunity to develop confidence and increased skill in simulation and treatment delivery. Candidate will demonstrate competence in basic and intermediate procedures and will observe the advanced and specialized treatment procedures. The candidate will complete the clinical training by practicing all the skills learned in classroom and clinical instruction. The candidate is expected to work for minimum 8 hours per day and this may be more depending on the need and the healthcare setting.

18.1 Eligibility

A candidate should have passed in all the courses (Core, AECC and Electives) amounting to 122 number of credits before entering in to internship.

19. Eligibility for the award of Degree

A candidate shall have passed in all the Courses of all six semesters and should have successfully completed one year of mandatory internship (02 semesters) as required for the programme.

20. Maximum Period for Completion of Programme:

A candidate shall complete six semesters (Three Years) programme within Six years from the date of admission. Hence, the maximum period for completion of the programme is seven years.

21. Minimum for a pass:

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

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

21.3. The results of the candidates who have passed the sixth semester examination but not passed the lower semester examinations shall be declared as NCL (Not Completed Lower semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

21.4. A candidate who passes the semester examinations in parts is eligible for only CGPA and Alpha-Sign Grade but not for ranking.

21.5. There shall be no minimum in respect of internal assessment and viva-voce marks.

22. Re-Entry after Break of the study:

22.1. Candidates admitted to a program abstaining for more than 3 months must seek readmission into the appropriate semester.

22.2. The candidate shall follow the syllabus in vogue (currently approved/is being followed) for the program.

22.3. All re-admissions of candidates are subject to the approval of the University.

Program Structure

Semester I

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	Anatomy	40	60	100	4	-	-	4
2	Core	Physiology	40	60	100	4	-	-	4
3	Core	Biochemistry	40	60	100	4	-	-	4
4	Core	Basic Physics	40	60	100	4		-	4
5	AECC	English & Communication	10	40	50	2	-	-	2
6	AECC	Constitution of India	10	40	50	2	-	-	2
Total					500				20

Note: Of the total available 36 hours per week for teaching learning processes, 22 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/Value added courses/Extracurricular activities etc.

Semester II

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	General pathology	40	60	100	4	-	-	4
2	Core	Microbiology	40	60	100	4	-	-	4
3	Core	Radiation and Medical Physics	40	60	100	4		-	4
4	AECC	Environmental Studies	10	40	50	2	-	-	2
5.	AECC	Health care	10	40	50	2	-	-	2
6	AECC	Medical Ethics	10	40	50	1	-	-	1
7	AECC	Sociology	10	40	50	1			1
Total					400				18

Note: Of the total available 36 hours per week for teaching learning processes, 18 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/Value added courses/Extracurricular activities etc.

Semester III

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	Radiographic photography andimage processing	40	60	100	4	-	-	4
2	Core	General Pharmacology	40	60	100	4	-	-	4
3	Core	Radiographic Positioning - 1	40	60	100	4	1	-	5
4	Core	Radiation Protection	40	60	100	3	-	-	3
6	Core	Clinical Radiology - 1	40	60	100	-	-	8	4
7	AECC	Kannada	10	40	50	2	-	-	2
Total					450				21

Note: Of the total available 36 hours per week for teaching learning processes, 18 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/Value added courses/Extracurricular activities etc.

Semester IV

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	Radiological Positioning - 2	40	60	100	4	1	-	5
2	Core	Radiological Procedure - 1	40	60	100	4	1	-	5
3	Core	USG & Doppler	40	60	100	4	-	-	4
4	Core	Clinical Radiology II	40	60	100	-	-	8	4
5	AECC	Environmental Studies	10	40	50	2	-	-	2
6	AECC	Human Rights and Gender Equity	10	40	50	2	-	-	2
7	AECC	Biostatistics	10	40	50	2	-	-	2
Total					500				22

Note: Of the total available 36 hours per week for teaching learning processes, 18 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/ Value added courses/Extracurricular activities etc.

Semester V

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	Radiological Procedure - 2	40	60	100	4	1	-	5
2	Core	Nuclear Medicine &Interventional Radiology	40	60	100	4	-	-	4
3	Core	Patient Care	40	60	100	4	-	-	4
5	Core	Clinical Radiology III	40	60	100	-	-	8	4
Total					500				17

Note: Of the total available 36 hours per week for teaching learning processes, 18 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/Value added courses/Extracurricular activities etc.

Semester VI

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per week			Credits
			IA	SEE		L	T	P	
1	Core	Basic and Advanced Instrumentation of Computed Tomography	40	60	100	4	2	-	6
2	Core	Basic and Advanced Instrumentation of Magnetic Resonance Imaging	40	60	100	4	2	-	6
3	Core	Clinical Radiology IV	40	60	100	-	-	8	4
Total					300				16

Note: Of the total available 36 hours per week for teaching learning processes, 18 hours per week is dedicated to Core and AECC courses. Remaining Hours are available for Electives/Value added courses/Extracurricular activities etc.

Semester VII

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per day			Credits
			IA	SEE		L	T	P	
1	Core	Internship I	40	60	100	-	-	6	1
Total					100				18

Semester VIII

Sl. No	Category	Course Name	Max Marks		Total Marks	Hours Per day			Credits
			IA	SEE		L	T	P	
1	Core	Internship II	40	60	100	-	-	6	1
Total					100				18

Total credit		**114**
Elective		**12**
Internship		**36**
Total Credit of the program		**162**

SEMESTER I

ANATOMY

Course: Core

Credits: 04 **Number of hours: 60**

Course objectives:

- Identify and locate each of the body systems to apply anatomical knowledge to perform minor technical procedural skills.
- Know the normal disposition of the structures in the body while clinically examining a patient and while conducting clinical procedures.
- Describe the functions of each body system
- Discuss the interrelationship of systems in maintaining homeostasis.
- Know the anatomical basis of disease and injury

Course Content:

Unit I: Introduction: Human body as a whole **2 Hours**

- Definition of anatomy and its divisions. Terms of location, positions and planes. Cell and its organelles.
- Epithelium: definition, classification, describe with examples, function. Glands: classification, describe serous & mucous glands with examples. Basic tissues: classification with examples
- Demonstration: Histology of types of epithelium. Histology of serous, mucous & mixed salivary gland.

Unit II: Locomotion and support **12 hours**

- Bone: classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, inter-vertebral disc, fontanelles of fetal skull.

- Joints: classification of joints with examples, synovial joint (in detail for radiology). Muscular system: classification of muscular tissue & histology, names of muscles of the body.
- Demonstration: Bones & joints. Histology of compact bone (TS & LS). Demonstration of all muscles of the body. Histology of skeletal, smooth &cardiac muscle (TS & LS). Histology of the 3 types of cartilage. Demo of all bones showing parts, radiographs of normal.

Unit III: Cardiovascular system **8 hours**

- Heart: size, location, chambers, exterior & interior, blood supply of heart. Systemic &pulmonary circulation, branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery, peripheral pulse, inferior vena cava, portal vein, Porto-systemic anastomosis, great saphenous vein, Dural venous sinuses. Lymphatic system: cisterna chyli& thoracic duct, histology of lymphatic tissues, names of regional lymphatics, axillary and inguinal lymph nodes in brief
- Demonstration of heart and vessels in the body. Histology of large artery, medium sized artery & vein, large vein. Histology of lymph node, spleen, tonsil & thymus. Normal chest radiograph showing heart shadows. Normal angiograms

Unit IV: Gastro-intestinal system **8 hours**

- Parts of GIT, oral cavity, lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, radiographs of abdomen
- Demonstration of parts of gastro intestinal system. Normal radiographs of gastro intestinal system. Histology of gastro intestinal system.

Unit V: Respiratory system **4 hours**

- Parts of RS, nose, nasal cavity, larynx, trachea, lungs, broncho-pulmonary segments, histology of trachea, lung and pleura, names of paranasal air sinuses.
- Demonstration of parts of respiratory System Normal radiographs of chest. -Histology of lung and trachea

Unit VI Peritoneum **1 hour**

- Description in brief. Demonstration of reflections.

Unit VII Urinary system **2 hours**

- Kidney, ureter, urinary bladder, male and female urethra. Histology of kidney, ureter and urinary bladder
- Demonstration of parts of urinary system. Histology of kidney, ureter, urinary bladder. Radiographs of abdomen-IVP, retrograde cystogram.

Unit VIII Reproductive system **2 hours**

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology). Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology). Mammary gland: gross
- Demonstration of section of male and female pelvis with organs in situ. Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube, ovary. Radiographs of pelvis, hysterosalpingogram.

Unit IX Endocrine glands **2 hours**

- Endocrine glands: pituitary gland, thyroid gland, parathyroid gland, suprarenal glad (Gross & Histology).
- Demonstration of the glands. Histology of pituitary, thyroid, parathyroid, suprarenal glands.

Unit X Nervous system **12 hours**

- Neuron, classification of nervous system, cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology), meninges, ventricles & cerebrospinal fluid, names of basal nuclei, blood supply of brain, cranial nerves. Sympathetic trunk & names of parasympathetic ganglia
- Histology of peripheral nerve & optic nerve. Demonstration of all plexuses and nerves in the body. Demonstration of all parts of brain. Histology of cerebrum, cerebellum, spinal cord.

Unit XI: Sensory organs **3 hours**

- Skin: histology, appendages of skin. Eye: parts of eye & lacrimal apparatus. Extra-ocular muscles & nerve supply. Parts of ear: external, middle and inner ear and contents.
- Histology of thin and thick skin. Demonstration and histology of eyeball. Histology of cornea & retina.

Unit XII: Embryology **4 hours**

- Spermatogenesis & oogenesis. Ovulation, fertilization. Fetal circulation. Placenta, Demonstration of models.

Course Outcome:

- Demonstrate the structure of various organs in the human body and correlate the structure with the functions to know how both structure and function are modified by disease.
- Identify and locate all the structures of the body.
- Identify the microscopic structures of various tissues and organs in the human body and correlate the structure with the functions for understanding the altered state in various disease processes.
- Understand the basic principles of embryology including major variations, abnormalities and the congenital anomalies involved in development of the organs and systems.

Recommended Books

- Chaurasia BD. BD Chaurasia's Human Anatomy. CBS Publishers & Distributors PVt Ltd.; 2010.
- Sampath Madhyastha, Manipal Manual of Anatomy for Allied Health Sciences, New Delhi ,CBS publishers &distributors
- Waugh A, Grant A. Ross & Wilson Anatomy and physiology in health and illness E-book. Elsevier Health Sciences; 2014 Jun 25.
- Dilly PN. Essentials of Human Embryology. Postgraduate Medical Journal. 1984 Jun;60(704): 447.
- Inderbir S. Textbook of human histology with color atlas. New Delhi: Jaypee Brothers Medical Publishers. 2006.

PHYSIOLOGY

Course: Core **Number of Hours: 60 Hours**

Course objectives:

- To broadly understand the physiological structure of each organ system and its physiological functions.
- To understand broadly the clinical abnormalities of organs and its clinical physiological implications

COURSE CONTENT:

Unit I: General Physiology **2 hours**

- Introduction to physiology
- Homeostasis: Definition, Positive feedback, negative feedback.
- Body Fluid Compartments Transport mechanisms (brief)

Unit II: Blood **7 hours**

- Introduction: composition and function of blood.
- Blood Cells: types, Normal Count, Red blood cells: function. Erythropoiesis: Definition, Stages, Factors affecting, Hemoglobin: Function, concentration Physiological variation of RBC Count and Hb Structure of Hb, methods of estimation
- White blood cells: different types, functions, normal count, differential count Immunity(brief)
- Platelets: origin, normal count, functions Morphology
- Haemostasis: definition, steps, clotting factors, mechanism of clotting, disorders of clotting, Blood groups: ABO system, Rh system: Rh factor, Rh incompatibility. Blood grouping & typing, cross matching. Blood transfusion: indication, universal donor and recipient concept. Selection criteria of a blood donor, transfusion reactions. *Anticoagulants: classification, examples and uses*
- Anemias: definition, Symptoms and signs (brief). Blood indices: color index, MCH, MCV, MCHC (def and Normal Values). ESR and PCV: normal values, definition, determination (methods).

- Morphological and etiological classification of Anemia Plasma proteins: types and concentration, functions of albumin, globulin, fibrinogen, prothrombin. Blood volume: normal value, determination of blood volume Regulation of blood volume (brief), Functions of Lymph

Unit III: Muscle Nerve physiology **5 hours**

- Introduction, Classification and structure of muscle, sarcomere contractile proteins
- Neuromuscular junction, Transmission across neuromuscular junction, Excitation contraction coupling. Mechanism of muscle contraction, rigor mortis, Fatigue

Unit IV: Cardiovascular system **8 hours**

- Heart: physiological anatomy, nerve supply. Properties of cardiac muscle Cardiac cycle: definition, systole, diastole, phases, JVP (brief) Cardiac output, stroke volume, EDV (only definitions). Heart sounds, normal heart sounds, mechanism and features, areas of auscultation.

- Intra-ventricular pressure curves, Significance of Heart sounds
- Blood pressure: definition, normal value, clinical measurement of blood pressure, hypotension, hypertension Heart rate: Physiological variations, regulation (brief), radial pulse, Electrocardiogram (ECG): Definition, Normal ECG, Causes of ECG waves, Uses of ECG. Cardiac shock: Definition, Types (brief), Triple response.

Unit V: Respiratory system **6 hours**

- Introduction: Functions of respiratory system, physiological anatomy of respiratory system, respiratory tract Respiratory organs: lungs, alveoli, respiratory membrane Mechanism of breathing: Inspiration and Expiration, muscles involved, Mechanism.
- Surfactant: Composition, Function, intra pulmonary pleural pressure, surface tension
- Transport of oxygen: forms of transport, Oxygen Hemoglobin Curve. Lung volumes and capacities: Spirogram, Definitions and normal Volumes. Regulation of respiration: Nervous and chemical regulation, respiratory Centre, Herring Breurreflexes. Hypoxia: Definition, Classification, Description (in brief). Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea. (Definition Only)

Unit VI: Digestive System **5 hours**

- Introduction Physiological anatomy of gastro intestinal tract (All Structures in brief), functions of digestive system. Functions of Saliva Deglutition: definition, stages
- Stomach: functions Gastric secretion: composition, function, Phases of secretion Pancreas: Functions (exocrine), pancreatic juice: composition and regulation. Secretin and CCK-PZ
- Liver: Functions, Bile secretion, composition, function of bile; Bilirubin metabolism, types of bilirubin, Vandenberg reaction, Jaundice: types, significance. Gall bladder: Functions.
- Small intestine: functions, digestion and absorption, movements. (brief)Large intestine: functions, defecation reflex

Unit VII: Renal System **5 hours**

- Introduction: Functions of kidneys, composition of urine, nephron, cortical and juxta-medullary nephrons (comparison), Juxta Glomerular Apparatus: structure and function. *Vasa recta*
- Mechanism of urine formation GFR: Definition, Normal Values, factors effecting GFR, Measurement (Creatine, Inulin Clearance). Tubular reabsorption, TMG, Tubular secretion (brief).
- Mechanism of urine concentration: Counter-current mechanisms, Role of ADH Diuresis, Diuretics, Micturition, innervation of bladder, cystometrogram.

Unit VIII: Skin and Body temperature **1 hour**

- Structure and function of Skin *Sweat Glands* Body Temperature: physiological variation. Regulatory mechanisms: Mechanisms Activated by Heat/Cold Role of hypothalamus, and fever.
- Body temperature measurement, hypothermia

Unit IX: Endocrine System **5 hours**

- Introduction: Definition, classification of endocrine glands & their hormones.

- Hypothalamic- pituitary Axis Pituitary hormones: anterior and posterior pituitary hormones, Functions of Growth hormone,
- Thyroid gland: Thyroid Hormones: physiological function, regulation of secretion, disorders: hypo and hyper secretion of hormone. Physiological anatomy of Thyroid
- Adrenal cortex: functions of Cortisol and Aldosterone Adrenal medulla: functions of Adrenaline and Noradrenaline. Physiological anatomy of Adrenal
- Pancreas (Endocrine): Hormones of pancreas. Insulin: functions, regulation of blood glucose level, Diabetes mellitus Abnormalities of pancreatic hormones(brief)Regulation of Calcium Metabolism: Hormones involved, actions of PTH, Calcitonin, Vit D3Tetany

Unit X: Reproductive system **4 hours**

- Introduction, Function of reproductive system, Changes during puberty.
- Sex Differentiation
- Male reproductive system: functions of testes Spermatogenesis: Definition, site, stages, factors influencing, Endocrine functions of testes Sperm, semen. Androgens: testosterone functions.
- Female reproductive system, Menstrual cycle: Definition, changes, ovulation Functions of progesterone and estrogen Hormonal Regulation Physiological changes during pregnancy, Lactation(brief), milk ejection reflex

Unit XI: Nervous system **8hours**

- Introduction: Parts of CNS and PNS, Functions of nervous system
- Neuron: definition, structure Nerve Fiber: classification, conduction of impulses continuous and saltatory. Neuroglia
- Synapse: Definition, structure, types, properties (brief). Receptors: definition, classification, properties (brief). Reflex: Definition, Reflex Arc, Examples.
- Babinski's sign. Tone, Posture (definition), Spinal cord nerve tracts: Diagram and Functions: Lateral Spino Thalamic Tract, Dorsal Column, Pyramidal Tract. UMN and LMN lesion, Hemiplegia, Stroke (brief) Functions of: Cerebral cortex, Cerebellum, Hypothalamus, Basal Ganglia EEG, Parkinsonism
- Cerebro Spinal Fluid (CSF): site of formation, circulation (brief), functions. Lumbar puncture. Autonomic Nervous System: Sympathetic and parasympathetic distribution and functions (brief).

Unit XII: Special senses **4 hours**

- Vision: Functions of different parts (brief) Optic Pathway, Dark Adaptation, Color vision. Structure of eye, Structure of retina.
- Hearing: Function of Middle Ear, Functions of inner ear, mechanism of hearing (brief).
- Chemical Senses: Taste: types, receptor, Smell: physiology, receptors.

Course Outcome:

- To broadly understand the physiological structure of each organ system and its physiological functions
- To understand broadly the clinical abnormalities of organs and its clinical physiological implications

Recommended books:

- Guyton (Arthur): Text Book of Physiology. Latest Ed. Prism publishers.
- Ganong William F: Review of Medical Physiology. Latest Ed. Tata McGraw Hill
- Chatterjee CC: Human Physiology Latest Ed. Vol-1, Medical Allied Agency. ChoudharySujith K: Concise Medical Physiology Latest Ed. New Central Book.

BIOCHEMISTRY

Course: Core

Credit: 04 **Number of hours: 60**

Course objective

- To classify various bio molecules like carbohydrates, lipids, proteins, nucleic acids vitamins and minerals
- To know about specimen collection and various other safety measures.
- To learn how to prepare various types of dilutions in the laboratory.
- To know about various terms used in quality control like specificity and sensitivity etc.
- A brief idea about acid base balance and biomedical waste management.

Course Contents

Unit I: Introduction and scope of Biochemistry **2 hours**

Unit II: Specimen collection: **4 hours**

- Pre-analytical variables. Collection of blood. Collection of CSF & other fluids. Urine collection.
- Use of preservatives. Anticoagulants.

Unit III: Safety measurements, Conventional and SI units **2 hours**

Unit IV: Dilutions **2 hours**

- Diluting solutions: e.g. preparation of 0.1 N NaCl from 1 N NaCl & from 2N NaCl etc., preparing working standard from stock standard, body fluid dilutions, reagent dilution techniques, calculating the dilution of a solution, body fluid reagent etc., saturated and supersaturated solutions

Unit V: Carbohydrate chemistry **4 hours**

- Classification, Isomerism, General reactions of carbohydrates

Unit VI: Lipids **4 hours**

- Chemistry of fatty acids, triglycerides, cholesterol, phospholipids, lipoproteins-
- Classification and functions.

Unit VII: Protein chemistry, structure 4 **hours**

Unit VIII: Plasma Proteins **2 hours**

- Concentration, biochemical changes in disease, interpretation

Unit IX: Enzymes **6 hours**

- Definition, classification, coenzymes, cofactors, factors effecting enzyme activity, inhibitors, units of measurements, isoenzymes, biological interpretation

Unit X: Vitamins **6 hours**

- Definition, classification, sources, functions, deficiency disorders

Unit XI: Minerals **6 hours**

- Na, K, Ca, P, Fe, Cu, selenium- sources, daily requirements, availability and properties

Unit XII: Nutrition **3 hours**

- Calorific value, nitrogen balance, respiratory quotient, basal metabolic rate, dietary fibers, nutritional importance of lipids, carbohydrates and proteins, vitamins. Nutrition, nutritional support with special emphasis on parental nutrition.

Unit XIII: Quality control **2 hours**

- Accuracy, precision. Specificity, sensitivity, limits of error allowable in laboratory, percentage error. Normal values and Interpretations.

Unit XIV: Special Investigations **11 hours**

- Serum electrophoresis, immune globulins, drugs: digitoxin, theophylline's, regulation of acid base status, Henderson Hasselbach equations, buffers of the fluid, pH regulation, disturbance in acid base balance, anion gap, metabolic acidosis, metabolic

alkalosis, respiratory acidosis, respiratory alkalosis, basic principles and estimation of blood gases and pH, basic principles and estimation of electrolytes, water balance, sodium regulation, bicarbonate buffers,

Unit XV: Bio Medical waste management **2 hours**

Course outcome

At the end of the course students must demonstrate an understanding of

- Various biomolecules in our body and their classification
- Sample collection for various tests performed in laboratory
- Preparation of dilutions of chemicals and body fluids.
- Various terms used in quality control
- Biomedical wastes management
- Significance of various special investigations

Recommended Books:

- Varley H. Practical clinical biochemistry. Practical clinical biochemistry. 1954.
- Naithani M, Singh P. Teitz textbook of clinical chemistry & molecular diagnostics. Medical Journal, Armed Forces India. 2006 Apr;62(2):204.
- Kaplan LA, Pesce AJ, Kazmierczak SC. Clinical chemistry. Theory, analysis, correlation. 2003.
- Ramakrishna(S) Prasanna(KG), Rajna ® Text book of Medical Biochemistry Latest Ed Orient Longman Bombay –1980
- Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students, Latest Ed
- Das (Debajyothi) Biochemistry Latest ED Academic, Publishers, Calcutta – 1992
- Rajagopal G & Ramakrishna - 1983 Practical Biochemistry for Medical Students Oriental Blackswan Pvt. Ltd.
- Burtis CA and Ashwood ER, Tietz Fundamentals of Clinical chemistry, Harcort (India) Ltd, 7th Ed, 20154.

BASIC PHYSICS

Core : Basic Physics

Theory classes: 60 hours, Practical 60 Hours

Course Objectives:

- To memorize the fundamental physical phenomena of equipment in radiology
- To relate the working principle of components of various modalities

Syllabus

Unit-1 Fundamentals of electricity

- Electric charges & Units of electric charge
- Coulombs law
- Electric induction
- Resistance
- Conductors
- Insulators &Semiconductors
- Electric current
- Ohm's, EMF, Kirchhoff's law
- Alternating Current
- Charge and discharge of a Capacitor through a resistance and inductance.

Unit-2 Electromagnetic Radiation

- Maxwell's equation
- Electromagnetic induction
- Electromagnetic waves & their properties
- The Electromagnetic spectrum
- Spectrum of white light
- spectra- continuous, line & band spectra, Absorption spectra
- Luminescence
- Energy density and Intensity
- Quality of Electromagnetic Radiation.

- Radiation in atmosphere

Unit – 3 X-ray generators

- Transformers and its types,
- laws of transformers,
- transformer losses
- Filament circuit,
- high voltage circuit
- Rectification
- Types of generators
- Fuses, switches and exposure timers
- Interlocking circuits /thyristors
- circuit breakers, Meters
- Earthing, insulation,
- High tension cables construction & design.

Unit – 4 Fundamentals of magnetism

- Introduction
- The Bar magnet
- Magnetism
- Guass's law
- Magnetic force
- Magnetization and magnetic intensity
- Solenoid and toroid
- Magnetic properties of materials
- Permanent magnets, electromagnets
- Earth's magnetism

Unit - 5 sound

- The nature and propagation of sound wave
- Transverse and longitudinal waves
- Interference of sound waves

- Beats
- Decibel
- Speed of sound in material medium
- Intensity of sound
- Super imposition of the wave
- Doppler effect principle

Unit – 6 Atomic physics

- The structure of the Atom,
- Nucleus,
- Atomic Number(Z),
- Mass Number(A)
- Ionization & Excitation
- Alpha particle scattering
- Atomic models
- Atomic spectra
- Atomic masses and composition of nucleus
- Mass energy and nuclear binding energy
- Nuclear force and energy
- Radioactivity
- Nuclear reactor

Course Outcomes:

- To distinguish imaging modalities based on the phenomenon used

Recommended Books:

- Steve Adams. Advanced Physics. Jonathan Allday
- Resnick.Halliday. Fundamentals of Physics. Walker.walley India pvt.ltd.2016

ENGLISH AND COMMUNICATION

Course: AECC

Credits: 2 **Number of Hours: 30 hours**

Course Objectives:

The course is designed to enable students to enhance their ability to speak and write English required for effective communication in their professional work. Students will practise their skills in verbal and written English during clinical and classroom experience.

UNIT – I: PHONETICS **4 Hours**

- Brief introduction to the history of English Language & Phonetics
- Vowels, Diphthongs, Consonants
- Native pronunciation of English words

UNIT – II: Difference between American & British English

2 Hours

- Difference with regards to the Vocabulary, Accent, Grammar & Spellings.
- Syllables & Word Stress

UNIT – III: Grammatical Skills

10 hours

- Verb Tenses
- Appropriate Use of Prepositions
- Articles
- Subject Verb Agreement
- Appropriate usage of Punctuation and Capitalization
- Modals

- Transformation of Sentence structures
- Active Passive Voice
- Reporting skills
- Question Tags
- Homonyms & Homophones
- Degrees of Comparison
- One-word Substitution
- Linkers

UNIT – IV: Written Communication Skills

5 Hours

- Drafting of formal letters
- Email drafts – Do's and don'ts in professional emails.
- Article and Essay writing
- Notice writing
- Speech writing
- News Report writing
- Dialogue writing

UNIT – V : Oral Communication Skills

6 Hours

- Way of Communicating when we meet people.
- Face to Face Communication
- Tone of voice
- Body Language

- Small Talk
- Elevator Speech
- Etiquettes of Phone Conversation & Phone role play
- Basics of meeting online
- Video conference role play
- Group discussion
- First Impressions
- Interview Skills: Purpose of an Interview

  Do's & Don'ts of an Interview

UNIT-VI: Presentation Skills **3 Hours**

- Debating
- Speech Relay
- Presentations

Course Outcomes

On completion of the course, the students will be able to

- Apply the concepts and principles of English Language use in professional development such as pronunciation, vocabulary, grammar, paraphrasing, voice modulation, Spelling, pause and silence.
- Apply LSRW (Listening, Speaking, Reading and Writing) Skill in combination to learn, teach, educate and share information, ideas and results.

Recommended Books:

- Raymond Murphy. English Grammar in Use. Cambridge University. 2012.
- David Green. Contemporary English Grammar Structures and Composition. Macmillan Publishers. 2015.

CONSTITUTION OF INDIA

Course: Core

Credits: 02 Number of hours: 30 hours

Course Objectives: By the end of this course, a student will

- State and explain the constitution of India and its Constituent Assembly
- Explain fundamental rights and duties of citizen
- Identify union, state and federalism of India
- Knowledge of electoral process in India.
- State the basic concepts of Human Rights and its functions and authorities in society.

Course content

Unit I: Indian Constitution **5 hours**

- Meaning and Importance of Constitution
- The Constituent Assembly
- The Preamble
- Salient Features of Constitution

Unit II: Fundamental Rights and Directive Principles **3 hours**

- Meaning and Differences between Fundamental Rights and Directive Principles
- Fundamental Rights
- Rights Information Act Meaning, importance of RTI 2005

Unit III: Union Government **4 hours**

- President of India- Election, Powers and Position
- Prime Minister and council of Ministers
- Parliament – Lok Sabha, Rajya Sabha- Organizations and Powers

Unit IV: State Government **4 hours**

- The Governor
- Chief Minister and Council of Ministers

- State Legislature Vidhana Sabha, Vidhana Parishad – organization and Powers

Unit V: Federalism in India **2 hours**

- Meaning Federal and Unitary Features

Unit VI: The Judiciary **2 hours**

- The supreme Court – Organization, Jurisdiction and Role
- The High Court – Organization Jurisdiction and Role

Unit VII: Electoral Process in India **2 hours**

- Election Commission – Organization, Functions

Unit VIII: Local Governments **2 hours**

- Rural and Urban – Organization, Powers and Functions

Unit IX: Human Rights **3 hours**

- Human rights – Meaning
- Universal Declaration of Human Rights
- Remedies against Violation of Human Rights in India

Unit X: Special constitutional provisions **3 hours**

- Special Rights created in the constitution for: Dalits, Backwards, women and Children and the Religious and Linguistic Minorities.
- Constitution and Sustainable Development in India.
- Minority Commission in India

Course Outcome:

- This course is to keep the students abreast with the knowledge of the Constitution of India.
- To make the students understand the importance of human rights as citizens of India.

Recommended Books

- Basu, D.D, Constitution of India, New Delhi Himalaya Publication; 2001
- Dinesh Shelton, David P Stuart, International Human Rights in Nutshell. Thomas Burgenthel, West Nutshell Publisher; London; 2005.
- ParvathyAppaiah, Constitution of India, Mangalore DivyaDeepa Publication; 2005
- ParvathyAppaiah, Human Rights. DivyaDeepa Publication Mangalore; 2016
- RajRam. M, Constitution of India Himalaya Publication, New Delhi; 1999

SEMESTER II

GENERAL PATHOLOGY

Course: Core **No of Hours: 60 Hours**

Credits: 4

Course Objectives:

- To be able to define the medical terms, define and classify disease and understand the concepts of the disease.
- Able to describe the causes and mechanism of common diseases that occur during the routine work and also changes seen in different individuals and various organs and fluids.
- Able to enumerate the laboratory tests e.g.: urine, blood, body fluids and its application on various diseases.

Course Content:

Unit I: Introduction **8 Hours**

Unit II: Cellular Responses to Stress and Injury **12 Hours**

- Types of cellular responses to injury
- Cellular adaptations
- In brief cell injury and types of cell injury, intracellular accumulation
- Necrosis and apoptosis (brief)
- Pathologic calcification, hyaline change, pigments

Unit III: Acute Inflammation **12 Hours**

- Definition, cardinal signs and sequence of events in acute inflammation
- List chemical mediators of inflammation, outcomes of acute inflammation, morphological types/patterns of acute inflammation and briefly systemic effects of inflammation

- In brief cutaneous wound healing (primary and secondary) Factors that influence wound healing, complications of wound healing
- Types of chronic inflammation, Granulomatous diseases, briefly about tuberculosis, leprosy and syphilis

Unit IV: Hemodynamic Disorders, Thromboembolism and Shock 6 Hours

- Edema and thrombosis
- Embolism, infarction and shock (in brief)

Unit V: Diseases of the Immune System 8 Hours

- Introduction to immune system
- Hypersensitivity reactions (brief)
- Autoimmune diseases and systemic lupus erythematosus (in brief)
- Acquired immunodeficiency syndrome

Unit VI: Neoplasia 8 Hours

- Nomenclature of neoplasms and characteristics of benign and malignant neoplasms
- Metastasis and spread of tumors
- Etiology of cancer (carcinogenic agents)
- Laboratory diagnosis of cancer, staging grading and prognosis

Unit VII: Genetic Disorders 2 Hours

- Introduction of genetic disease and classification of genetic disorders

Unit VIII: Nutritional Disorders 4 Hours

- Common vitamin deficiencies -Fat-soluble vitamins
- Water-soluble vitamins—vitamin B complex

Course Outcome:

At the end of the course, the students will be able to

- Understand how body reacts to cellular responses and injuries.
- Have a basic knowledge about various laboratory tests and its application on various disorders.
- Define the medical terms, define and classify disease and understand the concepts of the disease.

Recommended Books

- Nayak R, Rai S, Gupta A. Essentials in hematology and clinical pathology. New Delhi: Jaypee Brothers Medical Publishers; 2012.
- Mohan H. Textbook of pathology. 8th ed. New Delhi, India: Jaypee Brothers Medical; 2018.

MICROBIOLOGY

Course: core **No of Hours: 60 Hours**

Credits: 4

Course Objectives:

- To become familiar with the foundation concepts of history of Microbiology & General Bacteriology.
- To understand the key concepts in Immunology.
- To gain the knowledge of common bacterial infections.
- To understand and implement biomedical waste management and tackle infections.

Course Content:

Unit I: General Bacteriology **8 hours**

- Introduction & History of Microbiology, Classification & Morphology of Bacteria, Growth & Nutrition, Culture Media & Methods, Sterilization & Disinfection, Fundamental aspects of antibacterial agents and antimicrobial susceptibility testing.

Unit II: Immunology **11 hours**

- Infection, Immunity, Immunization schedule, applications of antigen antibody reactions, Hypersensitivity, Tumour & Transplantation Immunology.

UNIT III: Systematic Bacteriology **13 hours**

- Common bacterial infections, Mycobacteria, Spirochaetes

UNIT IV: Virology **10 hours**

- Introduction to virology, viral hepatitis, poliomyelitis, Rabies, Human immunodeficiency virus.

UNIT V: Mycology & Parasitology **12 hours**

- Introduction to mycology, pathogenic yeasts & fungi, Introduction to parasitology, Amoebiasis, Malaria, Helminthic infections.

UNIT VI: Applied Microbiology **6 hours**

- Hospital acquired infections, biomedical waste management.

Course Outcome:

At the end of the course, the students will be able to

- Understand how the bacteria grow and how sterilization & disinfection works.
- Have a basic knowledge about Immunization schedules and bacterial infections.
- Define terms in virology, mycology and parasitology.

Recommended Books

- Baweja C. Textbook of microbiology. 1st ed. New Delhi: Arya Publications; 2005.
- Textbook of Medical Laboratory technology, Ramnik Sood, 4th edition, Jaypee Publications.
- Allied Health Sciences Laboratory Technology

RADIATION AND MEDICAL PHYSICS

Core: Course

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective:

- To summarize the production of x-rays
- To classify the equipment based on their uses in imaging

1. Production of X-rays:

Discovery of x-rays

X-ray Production & properties

Diagnostic x-ray tube and its construction

Thermionic emission

Space charge effect

Line focus principle

Heel effect

Saturation voltage

Grid controlled X-ray tube

Interaction of electron beam with X-ray tube target-

- Characteristic radiation and bremsstrahlung radiation.
- X-ray beam intensity.

Methods of X-ray tube cooling

2) Attenuation and absorption**,**

Reduction in intensity due to absorption & attenuation and the inverse square law (exponential formula), filtration, attenuation coefficients and half value layer.

Energy absorbed from x-rays, factors affecting transmission of a homogenous beam through an object (geometry, thickness, wavelength of beam, composition of an object), transmission of a heterogeneous x-ray beam.

3) Basic interactions between x-rays and matter

- Coherent scattering,
- Photoelectric Effect,
- Compton scattering,
- Pair production
- Photo disintegration.

4) Control of secondary radiations**:**

Filters- inherent filters, added filters, heavy metal filters

X-ray beam restrictors- aperture diaphragms, cones, cylinders and collimators Grids- evaluation of grid performance, grid cut off, types of grids

Air gap technique

5) Fluoroscopic imaging:

Direct fluoroscopy, fluoroscopy image intensifier

Image characteristics in fluoroscopy, automatic brightness control

Viewing and recording the fluoroscopic image- closed circuit television, vidicon, plumbicon camera, charged coupled device, cathode ray tube

6) Equipment for special procedures:

Portable and mobile x-ray units

Radiographic and fluoroscopic tables

Tele-command tables

Cranial and dental equipment

Skull tables

Mammography

Tomography

Rapid cassette changer

Rapid film changer

Course Outcomes:

- To list the advantages and disadvantages of radiation
- To relate the use of accessory devices to control primary and secondary radiation
- To provide best image quality with optimized radiation dose

Recommended Books

- Basic radiological physics: K.Thayalan
- Christinsens physics of diagnostic radiology, Curry and Dowdey:
- D.N. And M.O. Chesney, X-Ray Equipment for Student Radiographers(CBS)

ENVIRONMENTAL STUDIES

Core: AECC

Credits: 2 **No of hours: 30 hours**

Core Content:

Unit 1: Multidisciplinary nature of Environmental Studies **3 hours**

- Multidisciplinary nature of Environmental Studies
- Concept of sustainability and sustainable development

Unit II: Ecosystems **4 hours**

- What is an ecosystem? Structure and function of an ecosystem; Energy flow in the ecosystem; Food chains, food webs and ecological succession. Case studies of the following ecosystems:

  a. Forest ecosystem

  b. Grassland ecosystem

  c. Desert ecosystem

  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
- History of ecosystem ecology
- Ecosystem services

Unit III: Natural Resources: **5 hours**

Renewable and Non-renewable resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit IV: Biodiversity and its conservation **6 hours**

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hotspots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: ecological, economic, social, ethical, aesthetic and informational value.
- Nature Reserves, tribal populations and rights, Human wildlife conflicts in Indian context

Unit V: Environmental Pollution **6 hours**

Definition

• Cause, effects and control measures of: -

a. Air pollution

b. Water pollution

c. Soil pollution

d. Light pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear hazards

- Climate change, Greenhouse effect, Global warming, Acid rain, Ozone layer depletion.
- Solid waste Management: control measures of urban and industrial wastes.
- Pollution case studies.

Unit VI: Environmental Policies & Practices **3 hours**

- Environmental Laws: Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- International Agreements: Montreal protocol, Kyoto protocol, Convention on Biological Diversity (CBD)
- Environmental Impact Assessment
- Carbon footprint
- Sustainable Development Goals

Unit VII: Human communities and the environment **3 hours**

- Human Population growth – impacts on environment
- Resettlement and rehabilitation of project affected persons: case studies
- Disaster management – floods, earthquake, cyclone and landslides
- Environmental movements: Chipko, Silent Valley, Bishnois of Rajasthan
- Environmental ethics
- Consumerism and Environment

Environmental Communication and Public Awareness, Case Studies.

Unit VIII: Field work (Equal to 5 lecture hours)

• Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain

• Visit to a local polluted site-Urban/Rural/Industrial/Agricultural

• Study of common plants, insects, birds.

• Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

- Students learn to knowledge on Echo systems, biodiversity and environmental policies and practices.

Recommended books

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
4. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
7. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
8. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.

MEDICAL ETHICS

Course: AECC

Credit: 01 **Number of hours: 15 hours**

Course objectives:

- To understand the about the ethical importance in medicine
- Knowledge regarding ethical concepts and teaching/learning experience
- Understand the importance of informed consent and ethical issues in health care.

COURSE CONTENT

Unit I: Introduction to medical ethics

- What is ethics, what are values and norms, freedom and personal Responsibility?

Unit II: Definition of medical ethics

- Major principles of medic ethics.

Unit III: Perspective of medical ethics

- The Hippocratic oath, The Declaration of Helsinki, The WHO

Declaration of Geneva, International code of Medical Ethics (1993),

Medical Council of India, Code of Ethics (2002).

Unit IV: Ethics of the individual

- Truth and confidentiality, the concept of disease, health and healing, the Rightto health.

Unit V: The ethics of human life

- Prenatal sex determination.

Unit VI: The family and society in medical ethics

- Euthanasia, cancer and terminal care.

Unit VII: Death and dying

- Use of life-support systems, the right to die with dignity, suicide–the Ethical outlook.

Unit VIII: Professional Ethics

- Contract and confidentiality, malpractice and negligence.

Course Outcomes:

- Increasing the awareness and knowledge of students of the value dimensions of interactions with the patients, colleagues, relations and public.
- Fostering the development of skills of analysis, decision making and judgment.
- Making the students aware of the need to respect the rights of the patient.
- Duties and responsibilities of the technologists.

Recommended Books

- Tsai DF. The WMA medical ethics manual. Journal of Medical Ethics. 2006 Mar 1;32(3):163.

SOCIOLOGY

Core: AECC

Credits: 2 **No of hours: 15 hours**

Course Objective

- To develop the abilities of students to analyse the sociological concepts and their
- Relationship with social work practice.
- To understand Indian social problems and its impact on social development.
- To develop skills for social analysis.
- To develop an understanding of emerging issues of social concern and their impact on Society
- To develop basic understanding of health perspectives and their practice in social work

Course Content:

Unit I: Introduction to Sociology **3 hours**

- Meaning, definitions and scope of sociology.
- Importance of its study with special reference to health care professionals.
- Methods of Sociological investigations - Case study, social survey, questionnaire, interview and opinion poll methods.

Unit II: Society, Family, Community and Socialization **4 hours**

- Concept of society: Definition and characteristics.
- The family: Meaning, definitions and functions of family.
- Role of family on individual's health and nutrition,
- Meaning, definitions and types of communities: Rural, Urban and Tribal community

- Socialization: Meaning and characteristics, Process of socialization, Agencies of socialization and their role –Family, School, peer group, religion, media.

Unit III: Social Problems, Social Change, Social Planning, Social Work and Social security measures 5 hours

- Social Problems: Meaning, characteristics and their influence on health.
- Social Change**:** Meaning, definitions and characteristics.
- Social Planning: The role of social planning in the improvement of health and rehabilitation
- Social Work -Basic concepts of social work, definitions, objectives, values and basic methods. Role of social worker in health settings.
- Social Security: Social Security schemes for the disadvantaged sections in the society.

Unit IV: Socio-cultural factors in Health and Disease 3 hours

- Health: Concept, definitions and dimensions
- Meaning of social factors and role of social factors in health and disease.
- Culture and its influence on health and disease.

Course Outcome

- Able to understand the meaning of sociology, it relationship with other disciplines and also to gain knowledge on the sociological methods of investigations
- Able to understand social factors and its role in health and disease
- Able to understand the meaning, importance and agencies of socialization
- Able to understand the concept and role of social groups in health, sickness and rehabilitation
- Able to understand the meaning of family and its role in health, nutrition and sickness among members
- Able to understand the meaning, features and health hazards of rural and urban communities
- Able to understand the concept of culture and health and their relationship

- Able to understand the meaning of social change, factors of social change, social change and stress, social change and health
- Able to understand the meaning of social problems and types of social problems in the society
- Gain knowledge on the social security and social legislation measures for the disabled
- Able to understand the meaning of social work and role of medical social worker

Recommended books

1. VidyaBhushan, D R Sachdeva.An Introduction to Sociology, Kitabmahal- Allahabad
2. Roshni Jain, 2012. An Introduction to Sociology, First editionAITBS publishers- New Delhi
3. Krishna Gowda, 2010. Sociology for Nurses, Sixth edition. CBS Publishers & DistributorsPvt Ltd- New Delhi
4. Ram Ahuja .Social problems in India, third edition, 2014. PremRawat for Rawat Publication.
5. Mohammed Akram, Sociology of Health, 2014. PremRawat for Rawat Publication-Jaipur

HEALTH CARE

Core: AECC

Credits: 2 **No of Hours: 60 Hours**

Course Content:

Unit 1: Introduction to Health: Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept. National Health Policy. National Health Programmes (Briefly Objectives and scope) Population of India and Family welfare programme in India

Unit 2: Introduction to Nursing: What is Nursing? Nursing principles. Inter- Personnel relationships.

Unit 3: Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application.

Unit 4: Nursing Position and Bed making: Positioning patient prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Unit 5: Lifting and Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Unit 6: Bed Side Management: Giving and taking Bed pan, Urinal: Observation of stools, urine. Observation of sputum, understand use and care of catheters, enema giving.

Unit 7: Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods

Unit 8: Vital Parameter Recording: Recording of body temperature, respiration and pulse,

Unit 9: Asepsis: Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures

Unit 10: First Aid.

Course Outcome:

- Describe the concepts of health, illness and national health policy various welfare programmes in India.
- Explain the concepts of Nursing
- Explain the basic, special needs of the patient, bandaging and first aid for common emergencies
- Explain infection control

Recommended Books:

1. Hari S. Essentials of Management for Healthcare Professionals. Productivity Press; 2017 Dec 15.

Semester III

RADIOGRAPHIC PHOTOGRAPHY AND IMAGING PROCESSING

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- to structure a darkroom layout suitably to the department
- to express the uses of the radiographic film and dark room accessories

1) Photographic Principles

Radiographic film- construction and types Photographic effect and latent image formation Film density and log relative exposure Characteristic curve – its formation and features Film faults and Artifacts

2) Intensifying Screens

Luminescence- fluorescence and phosphorescence Construction and types of Intensifying Screens Resolving power of Intensifying Screens

Speed of intensifying screen film contact tests

Advantages and limitations of Intensifying Screens.

3) X-ray Cassette:

Construction of X-ray cassettes Types of cassettes

Mounting Intensifying Screens on cassettes Care and maintenance of cassettes

4) Dark Room – Planning &Construction

Planning for a small & large Hospital Location of Darkroom

Construction of Dark Room Ventilation Wall Protection

Entrance to Dark Room - Single Door, Double Door, Labyrinth and rotating

5) Dark Room Accessories

Dry bench

Hopper, Drawer, Cupboard Loading and unloading cassettes

Hangers, types of hangers and storage of hangers Wet bench

Cleanliness, control of dust, dark room sinks Hatches

Drier

Safe Lights- types and uses, factors affecting safelight performance, safelight Tests viewing room, Film dispensing

6) Film Processing

Photochemistry Developer

Rinsing Fixer

Washing and drying

Preparation of processing solutions Manual processing apparatus Effect of temperature in processing rapid processing

7) Automatic processor

Principle of working and features,

Thermal regulation and replenishment system

Care and maintenance

Advantages

Limitations

8) Computerized and Digital Radiography

Day Light Film handling

Computerized radiography-Principles, Processing, Equipments, Advantages, disadvantages

Digital Radiography - Principles, Processing, Equipments, advantages and disadvantages

9) The Radiographic Image:

The emergent beam related to densities on film contrast –objective and subjective Radiation contrast, film contrast and Radiographic contrast

Density Sharpness Unsharpness

10) Resolution:

Factors affecting resolution

Choice of Kilo Voltage

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

11) Reproduction of Radiographs:

Copying Radiographs

Magnification and Minification Radiography

12) Imaging Communication:

Hospital Information System, Radiology Information System PACS, DICOM

Course Outcome:

- to relate the different practices of processing methods of a film
- to determine the possible film artifacts by improper handling
- to define the principles behind the radiographic image formation

Recommended Books

1. D.N. Chesney & M.O Chesney: Radiographic Imaging (Cbs)I.C.R.P. : Protection Of The
2. Christensen, Curry & Dowdey : An Introduction Of Physics To Diagnostic Radiography
3. Stewart C. Bushong : Radiological Science for technologists

GENERAL PHARMACOLOGY

Course: Core

Credits: 04 **Number of hours: 60 hours**

Course objectives:

At the end of the program in Pharmacology the student is expected to:

- Know the basics of Pharmacology like, sources of drugs, routes of drug administration and general principles
- Describe the principles of pharmacokinetics and pharmaco dynamics
- To appreciate various adverse drug reactions
- To have a basic knowledge of drugs affecting various body systems

COURSE CONTENT:

Unit I: General Pharmacology **8 Hours**

- Introduction to Pharmacology
- Routes of drug Administration
- Absorption & Distribution
- Metabolism
- Excretion
- Pharmaco dynamics - Mechanism of drug action- receptors
- Factors modifying drug actions
- Adverse drug reactions

Unit II: Autonomic Nervous System drugs **6 Hours**

- Sympathomimetic
- Alpha blockers
- Beta-blockers

- Cholinomimetics
- Anticholinergics
- Skeletal muscle relaxants

Unit II: Central Nervous System **11 Hours**

- Opioid analgesics
- Non-opioid analgesics (Prostaglandins)
- NSAIDs
- Ethyl alcohol
- Sedative hypnotics
- Antiepileptic drugs
- Local anesthetics-1
- Local anesthetics-2
- General anesthetics- I
- G A – II (PAM)
- CNS stimulants

Unit IV: Cardio Vascular System Drugs **9 Hours**

- Diuretics
- Vasodilators (CCB's, Drugs acting on RAS)
- Antihypertensive
- Antianginal drugs
- Pharmacotherapy of shocks
- Cardiac glycosides
- Cardioplegic drugs
- Antiarrhythmic drugs
- Primary solutions

Unit V: Blood **6 Hours**

- Anemia, erythropoietin
- Anticoagulants

- Anti-platelet drugs
- Fibrinolytics,
- Lipid lowering drugs
- Vit.D and calcium, folic acid, phosphate binders

Unit VI: Endocrines **1 Hour**

- Corticosteroids

Unit VII: Chemotherapy **9 Hours**

- General Principles of Chemotherapy
- Sulfonamides
- Penicillin's
- Cephalosporins
- Broad spectrum antibiotics
- Macrolides
- Aminoglycosides
- Chemotherapy of UTI
- Drug Therapy of Tuberculosis

Unit VIII: Miscellaneous topics **10 Hours**

- Antihistamines
- Antiemetics
- Drugs used in bronchial asthma-1
- Drugs used in bronchial asthma-2
- Cough
- Inhalational gases and emergency drugs
- I V fluids
- Metabolic and electrolyte imbalance
- Immuno suppressants
- Antiseptics and disinfectants

Course Outcomes:

At the end of the course, the students will be able to

- Define and describe the principles of pharmacology and pharmaco therapeutics
- Define absorption, distribution, metabolism and excretion of drugs
- Define, identify and describe the adverse drug reactions
- Define and describe the pharmacological actions and therapeutic uses of drugs affecting systems- autonomic nervous system, cardiovascular system, blood, endocrine etc.
- To have a basic knowledge of drugs used in the treatment of various infections
- To have a basic knowledge on miscellaneous drugs

Recommended Books:

- Uday Kumar P. Textbook of Pharmacology for Dental and Allied Sciences. Jaypee Brothers Publishers; 2008.

RADIOGRAPHIC POSITIONING – 1

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective:

- To annotate positioning landmarks and terminology
- To perform positioning without technical and manual errors
- to avoid repeat exposure

Course Content:

1) Principles of Radiography:

- Preparation of the Rooms and Instruments
- Positions of the Patient: Erect Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors.
- Use of accessories such as radiographic cones, grid and positioning aids.
- Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the patient.
- Brief introduction to anatomy before each positioning classes.

2) Upper limb:

- Routine projections for
    - Whole hand
    - Fingers
    - Wrist joint
    - Forearm
    - Elbow joint
    - Humerus.
- Supplementary projections
    - Scaphoid
    - Carpal tunnel

- Ball Catchers projections
- Head of the Radius
- Supracondylar fracture
- Olecranon process.

3) Shoulder Girdle and Thorax

- Routine projections for
    - The shoulder joint
    - Scapula
    - Acromio-clavicular joint
    - Clavicle, sternoclavicular joint
    - Sternum and ribs
- Supplementary projections for
    - The axial projection of Clavicle
    - Bicipital groove
    - Coracoid process

4) Lower limb:

- Routine projections for
    - The whole foot
    - Toes
    - Calcaneum
    - Ankle joint
    - Leg, knee- joint
    - Patella and femurs
- Supplementary projections for
    - Talo-Calcaneal joint
    - Forced projections for torn ligaments
    - Flat Feet
    - Club Feet
    - Intercondylar projections for loose bodies in the knee
    - Axial projection for Patella

5) Pelvic girdle and hipregion:

- Routine projections for
    - The whole pelvis,
    - Sacro-ileac joints,
    - Hip joint
    - Neck of femur.
- Supplementary projections for
    - The greater and lesser trochanters of Femur.
    - Frog leg projection,
    - Ischeum,
    - Symphysis Pubis,
    - Ileum,
    - Acetabulum
    - Congenital Dislocation of Hip
    - Arthrodesis.

Course Outcome:

- To be aware of routine and supplementary views for each anatomical region
- To apply special positioning skills for different pathological and physical conditions.
- To use essential aids to reduce radiation dose and to improve image quality

Reference Books:

1. Ra Swallow, E Naylor: Clarks Positioning In Radiography
2. Ross and Gailway: A Handbook of Radiography(Lewis)
3. Glenda J.Bryan: Diagnostic Radiography(Mosby)
4. Merill's Atlas of radiographic positioning and Radiological procedure

RADIATION PROTECTION

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- To identify the protective measures
- To be taken in the department
- To choose appropriate exposure factors

Course Content

Biological Effects of radiation

- Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell.
- Chromosomal aberration and its application for the biological dosimetry.
- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus
- Somatic effects and hereditary effects, stochastic and deterministic effects.
- Acute exposure and chronic exposure: factors affecting radio-sensitivity.
- Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

Radiation detection and Measurements

- Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers-proportional counters-G.M counters scintillation detectors-liquid semiconductor detectors-Gamma ray spectrometer.
- Measuring systems: Free air ionization chamber, thimble ion chamber, condenser chamber, standard dosimeters, film dosimeter & chemical dosimeter, thermoluminescent dosimeter & Pocket dosimeter.

- Radiation survey meters: wide range survey meter –zone monitor-contamination monitor-their principle-function and uses.
- Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement.

Radiation protection

- Radiation protection of self and patient.
- Principles of radiation protection, time - distance and shielding, shielding, calculation and radiation survey.
- ALARA- personnel dosimeters (TLD and film batches).
- Occupational exposure.

Radiation Hazard evaluation and control

- Philosophy of Radiation protection, effects of time, Distance & Shielding.
- Calculation of Work load, weekly calculated dose to radiation worker & General public
- Good work practice in Diagnostic Radiology.
- Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material

Course Outcome:

- To outline the biological effects of radiation
- To determine the primary and secondary barriers of radiation
- To implement radiation surveys effectively

Recommended Books

- Christensen, Curry & Dowdey : An Introduction Of Physics To Diagnostic Radiography

CLINICAL RADIOLOGY -1

Practical hours: 120 hours

- To annotate, positioning landmarks and terminology in X-ray
- To perform positioning without technical and manual errors to avoid repeat exposure
- To be aware of routine and supplementary views for each anatomical region
- To apply special positioning skills for different pathological and physical conditions.
- To use essential aids to reduce radiation dose and to improve image quality
- To identify the protective measures to be taken in the department
- To determine the primary and secondary barriers of radiation

KANNADA

Course: AECC

Credits: 02 **Number of hours: 60 hours**

Course Objectives

- Enable students to learn alphabet, words and simple sentences in Kannada.
- Enable students to enhance speaking and writing communicative skills in Kannada and learn technical words related to medical science

COURSE CONTENT:

Unit I: Kannada Letters (vowels, Consonant)

Unit II: Words, Phrases, formation of sentences, Letter Writing, Essay Writing. Treatment related Kannada words (from English to Kannada)

Unit III:

- Possible communication in kannada between Patients and Doctors.
- Advising sentences to the possible questions of patients.
- Some important sentences which enable to communicate with doctors and colleagues.

Course Outcome

- Allied health science students will be able to attend health issues of native Kannada speaking patients more effectively.
- They can also act as a bridge between doctors and patients.

Recommended Books

- Kannada Vyakarana – (8th ,9th and 10th Karnataka government text books)
- HSK, Vyavarahika Kannada

Semester IV

RADIOLOGICAL POSITIONING-2

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- To annotate positioning landmarks and terminology
- To perform positioning without technical and manual errors to avoid repeat exposure

Course Content

Syllabus

Vertebral Column:

- 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 inter vertebral foramina
    - Posterior arch of atlas
    - Flexion and extension of cervical spine
    - Scoliosis and Kyphosis
    - Sacro Ileac Joint

Chest:

- Routine projections and Supplementary projections for
    - Thoracic inlet
    - soft tissue Neck,
    - Decubitus,
    - Apicograms
    - paediatric cases

Abdomen

- KUB
- Erect abdomen and Decubitus projection
- Supplementary projections for acute abdomen.

Mammography

- Routine views Supplementary views Magnification view

Skull

- Routine projections for cranium and facial bones.
- Supplementary projections for
    - Trauma
    - Towne's method
    - Sellaturcica
    - Optic foramina
    - Jugular foramina
    - Temporal bones
    - Mastoids
    - Petrous bone
    - Zygomatic arches
    - Orbits, maxillae

- Nasal bones
- Mandible
- Temporomandibular joints.

Nasal Sinuses

- Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.

Dental Radiography

- Routine projections of all teeth - Intra Oral and Extra Oral Projections.
- Supplementary projections, Occlusals and Bitewings, Orthopantomography.

Skeletal Survey

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

Different Radiographic Techniques

- Theatre radiography
- Trauma radiography
- Ward radiography
- High kV technique
- Soft tissue radiography
- Macro and Micro radiography

Course Outcome:

- To annotate positioning landmarks and terminology
- To perform positioning without technical and manual errors to avoid repeat exposure
- To be aware of routine and supplementary views for each anatomical region
- To apply special positioning skills for different pathological and physical conditions.
- To use essential aids to reduce radiation dose and to improve image quality

Recommended Books

- Ra Swallow, E Naylor: Clarks Positioning In Radiography
- Rossand Gailway:A Handbook of Radiography(Lewis)
- Glenda J.Bryan: Diagnostic Radiography(Mosby)
- Meril's Atlas of radiographic positioning and Radiological procedure

RADIOLOGICAL PROCEDURE - 1

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- To distinguish indications and contra indications for procedure based on patient history
- To classify the contrast media based on solubility, physiology of excretion and the

Course Content

Syllabus Introduction:

General approach to Special Radiographic procedures

Responsibility of Radiology Technologist during radiological procedures. Preparation of patient for different procedures.

Room layout in interventional radiology and fluoroscopy.

Contrast Media :

Positive and Negative, Ionic & Non Ionic.

Adverse Reactions to contrast media and patient management. Emergency Equipments in the Radiology Department

Gastro Intestinal Tract:

Barium Swallow

Barium Meal - Single and Double Contrast Barium Meal Follow Through

Small Bowel Enema (Enteroclysis) Barium Enema - Gastrograffin Enema Loopogram

Biliary Tract:

Percutaneous Transhepatic Cholengiography Percutaneous Transhepatic Biliary Drainage

Endoscopic Retrograde Cholengiopancreatography

Course Outcome

- To have an idea of basic anatomy and related procedures to perform
- To position patients accurately for appropriate procedure
- To distinguish indications and contra indications for procedure based on patient history
- To classify the contrast media based on solubility, physiology of excretion and the procedure to be perform
- To assist radiologist by setting the equipment required for procedure

Recommended Books

- Chapman & Nakielny's Guide to Radiological Procedures
- Bhushan Lakhkar, Radiological Procedures

USG & Doppler

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- To outline the importance of ultrasound
- To categorize and choose transducers according to their use

Course Content

1. Basic principle and physics of ultrasound
2. Characteristics of ultrasound
3. Interaction of ultrasound with matter
4. Instrumentation and focusing
5. Piezoelectric effect
6. Transducers
7. Ultrasound display modes
8. Ultrasound controls
9. Ultrasound Artifacts
10. Biological effects of ultrasound and safety considerations
11. PNDT Act
12. Ultrasound protocol for different body parts
13. Quality assurance in ultrasound
14. Doppler – principle and physics
15. Doppler Instrumentation
16. Doppler – types, uses, advantages, disadvantages and comparison
17. Doppler artifacts
18. Vascular sonography
19. Patient preparation for Doppler studies

Course Outcome:

- To outline the importance of ultrasound
- To categorize and choose transducers according to their use
- To infer different protocols used for various anatomical regions To memorize physics beyond ultrasound imaging
- To define the advancements in ultrasound and doppler imaging

Recommended Books:

1. Curry and Dowdey, Christinsens physics of diagnostic radiology
2. Bushberg J.T, The Essential Physics of Medical Imaging.

CLINICAL RADIOLOGY-2

Practical Hours: 240 hours

- To distinguish indications and contra indications for procedure based on patient history
- To classify the contrast media based on solubility, physiology of excretion and the procedure to be perform
- To assist radiologist by setting the equipment required for procedure
- To be aware of routine and supplementary views for each anatomical region
- To apply special positioning skills for different pathological and physical conditions.
- To use essential aids to reduce radiation dose and to improve image quality

Semester V

RADIOLOGICAL PROCEDURES – 2

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- To distinguish indications and contra indications for procedure based on patient history
- To classify the contrast media based on solubility and physiology of excretion

Course Content

Genito Urinary system:

- Intravenousurography
- Retrograde pyelography
- Antegrade pyelography
- Cystography and micturating cystouresthrography
- Urethrography(ascending)
- Hysterosalpingography
- Fallopian tuberecanalization
- Sonosalpingography

Mammography:

- Basicviews
- specialviews
- BIRADS

Respiratory System:

Bronchography

other procedures:

- Sinography
- Fistulography
- Dacrocystography
- Sailography

Diagnostic image guided interventional procedures

- Biopsy
- FNAC (Fine needle aspirationcytology)
- Drainage procedures
- RFablation
- HIUF
- Lumbar Myelography
- Cervical Myelography

Course Outcome:

- To have an idea of basic anatomy and related procedures to perform
- To position patients accurately for appropriate procedure
- To distinguish indications and contra indications for procedure based on patient history
- To classify the contrast media based on solubility and physiology of excretion
- To assist radiologist by setting the equipment required for procedure

Recommended Books

- Chapman & Nakielny's Guide to Radiological Procedures
- Bhushan Lakhkar, Radiological Procedures

NUCLEAR MEDICINE & INTERVENTIONAL RADIOLOGY

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- to have knowledge of proper handling of radioactive sources
- to know how the radiation will be detected by radiation detection devices
- to have an idea on vascular anatomy

Course Content

Nuclear medicine:

1. History

2. Isotopes and Radionuclides
   - Production of Radionuclides
   - Transport of Radionuclides

3. Radio Activity
   - Radio Active transformations
   - Specific Activity

4. Radiopharmaceuticals
   - coldkits
   - Preparation
   - Precautions while handling, storage and transportation

5. Gamma Camera instrumentation
    - Collimator- classification and types

6. Single Photon Emission Computed Tomography(SPECT)

7. Positron Emission Tomography(PET)

8. Advanced techniques in NM
    - SPECT-CT
    - PET-CT
    - PET-MRI

9. Safety Considerations & Radiation Dose in Nuclear Medicine

10. Room layout in nuclear medicine

11. waste management in nuclear medicine

12. Radiation signages and placards used in nuclear medicine department

Interventional Radiography:

1. Basic angiography andDSA:
    - History , technique, patient care
    - Percutaneous catherisation, catheterization sites, Asepsis
    - Guidewire, catheters, pressure injectors, accessories
    - Use of digital subtraction- single plane and bi-plane all forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure.
2. Central Nervous System:
    - Myelography

- Cerebral studies
- Ventriculography

3. Arthrography:
    - Shoulder
    - Hip
    - Knee
    - Elbow

4. Angiography:
    - Carotid Angiography (4 Vessel angiography)
    - Thoracic and Arch Aortography
    - Selective studies: Renal, SMA, Coeliacaxis
    - Vertebral angiography
    - Femoral arteriography
    - Angiocardiography

5. Venography:
    - Peripheral venography
    - Cerebral venography
    - Inferior and superior venocavography
    - Relevant visceral phlebography

6. Cardiac catheterization procedures:
    - PTCA
    - BMV
    - CAG
    - Pacemaker
    - Electrophysiology

7. embolizing agents, embolization procedures : UAE,TACE

Course Outcome:

- to have an idea on uses and hazards of radioactive materials
- to have knowledge of proper handling of radioactive sources
- to know how the radiation will be detected by radiation detection devices
- to have an idea on vascular anatomy
- to distinguish the types of catheters and their uses

Recommended Books

- Gopal B.Saha, Fundamentals of Nuclear Pharmacy
- Bushberg J.T.,The Essential Physics of Medical Imaging,

PATIENT CARE IN MEDICAL IMAGING

Course: Core

Credits: 4 Credits **No of hours: 60 Hours**

Course Objective

- Know precautions to handle emergency patients of different pathology
- To be able to perform basic and advanced life support to the patient in case of emergency Importance of consent form and documentation

Course Content

1. Professional attitude of the technologist to patients and other members of the staff
2. Management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients
3. First aid: wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation
4. Use of suction apparatus
5. Drug reactions; prophylactic measures
6. Fractures; splints, bandaging; dressing, foreign bodies; poisons.
7. Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections HIV, Hepatitis B, C, and MRSA etc.
8. Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs; setting of trays and trolleys in the medical imaging department
9. Drugs in the department: Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti depressive, anti-hypertensive etc.
10. Emergency crash carts
11. Basic and Advanced life support

Course Outcome:

- Know precautions to handle emergency patients of different pathology
- To be able to perform basic and advanced life support to the patient in case of emergency Importance of consent form and documentation
- To know the emergency drugs used in the department
- To prepare sterile environment and equipments to perform procedure

Recommended Books

- Bushberg J.T.The Essential Physics of Medical Imaging
- Curry and Dowdey, Christinsens physics of diagnostic radiology

CLINICAL RADIOLOGY-3

Practical hours: 270 Hours

- To have an idea on uses and hazards of radioactive materials
- To have knowledge of proper handling of radioactive resources
- To have an idea of basic anatomy and related procedures to perform
- To position patients accurately for appropriate procedure
- To distinguish indications and contra indications for procedure based on patient history

SEMESTER VI

BASIC AND ADVANCED INSTRUMENTATION OF COMPUTED TOMOGRAPHY

Course: Core

Credits: 6 Credits

Course Objective

- Understand the working principle of computed tomography
- To have an idea of components of CT and its relation in image formation Complete knowledge about the protocols done in CT

Course Content

Unit I

1. Introduction and history
2. CT principle
3. CT generations
4. CT Instrumentation
5. CT detectors
6. Axial & Helical CT – Slip ring technology

Unit II

7. Data acquisition
8. Image pre-processing/reconstruction techniques
9. Algorithms for image reconstruction
10. Image display
11. Image post-processing techniques
12. C Tartifacts
13. Image quality

Unit III

14. CTD osimetry
15. Dose optimization techniques in CT
16. Basic concepts of 3DCT
17. HRCT , Isotropic imaging

Unit IV

18. CT contrast media and administration
19. CT imaging protocols
20. CT pediatric protocols

Unit V

21. Safety consideration
22. Documentation in CT
23. Role of Medical Imaging technologist in CT scan procedures
24. Quality assurance in CT

Course Outcome:

- Understand the working principle of computed tomography
- To have an idea of components of CT and its relation in image formation Complete knowledge about the protocols done in CT
- Must know post processing techniques and related cross sectional anatomy
- To have knowledge about the tools and parameters to be used for specific procedure

Recommended Books.

1. Christensen, Curry & Dowdey : An Introduction Of Physics To Diagnostic Radiography
2. Computed Tomography for Technologists A Comprehensive Text Lois E. Romans · 2018
3. The Essential Physics of Medical Imaging, Bushberg J.T.

BASIC AND ADVANCED INSTRUMENTATION OF MAGNETIC RESONANCE IMAGING

Course: Core

Credits: 6 Credits

Course Objective

- To understand the working principle of MRI
- To have knowledge about the things restricted in MRI to carry Proper handling of the equipment and RF coils

Course Content

Unit I

1. Introduction to MRI
2. Basic principle
3. Image weighting and contrast in MRI
4. Instrumentation of MRI
   - Magnets- classification, types, advantages, disadvantages
   - Gradient & Body Coils
   - R Fcoils
   - Shimcoils
   - Ramping
   - Cryogen
   - RF shielding
   - Computer

Unit II

Encoding and Image formation

- Encoding

- K-Space

Parameters and Trade-offs MRI Pulse sequences

- Spin Echo pulse sequence
- Gradient Echo pulse sequence Fast imaging sequences

Unit III

Vascular Imaging

- Digital Subtraction MRA
- MR-Angiogram
- MR-Venogram

Unit IV

MRI Artifacts and their compensation MRI contrast agents

- T1 contrast agent
- T2 contrast agent

Unit V

Advanced MRI techniques

- DWI &DTI
- Perfusion
- Spectroscopy
- Functional MRI
- Interventional MRI

Unit VI

MRI safety

Documentation

Quality assurance in MRI

Course Outcome:

- To understand the working principle of MRI
- To have knowledge about the things restricted in MRI to carry Proper handling of the equipment and RF coils
- Distinguish the different zones in MRI To perform scans with ideal sequences

Recommended Books.

1. Christensen, Curry & Dowdey : An Introduction Of Physics To Diagnostic Radiography
2. Bushberg J.T.The Essential Physics of Medical Imaging
3. Catherine Westbrook, Carolyn KautRoth, MRI in Practice

CLINICAL RADIOLOGY- 4

- To understand the working principle of MRI
- Proper handling of the equipment and RFcoils
- Distinguish the different zones in MRI
- To perform scans with ideal sequences
- To have an idea of components of CT and its relation in image formation
- Complete knowledge about the protocols done in CT
- Must know post processing techniques and related cross sectional anatomy

Semester VI & Semester VII(Internship)

Duration

- The internship will span1year
- This will include 8 hours of practice a day, totaling to 1500 hours for1year.
- The internship time period provides the students the opportunity to continue to develop confidence and increased skill in simulation and treatment delivery.
- Students will demonstrate clinical competence in beginning and intermediate procedures. Students will observe the advanced and specialized treatment procedures.
- The student will complete the clinical training by practicing all the skills learned in classroom and clinical postings.
- The students are expected to work for minimum 6 hours per day and this may be more depending on the need and the health care setting.

Competency statements

- Maintains patient confidence and protects hospital operations by keeping information confidential.
- Demonstrates discipline by maintaining safe and clean working environment and by complying with procedures, rules and regulations.
- Be able to understand and learn the preparation, operation and maintenance MRI,CT and other advanced modalities
- **Clinical duty in various modalities**
    - Conventional X-Ray
    - Mobile X-Ray
    - Computerized Radiography
    - CT scan
    - MRI scan
    - C-Arm