CURRICULUM
B.Sc Echocardiography Technology
SPIRITUAL PRINCIPLES IN EDUCATION

“In the gurukulas of ancient rishis, when the master spoke it was love that spoke; and at the receiving end disciple absorbed of nothing but love. Because of their love for their Master, the disciples’ hearts were like a fertile field, ready to receive the knowledge imparted by the Master. Love given and love received. Love made them open to each other. True giving and receiving take place where love is present. Real listening and ‘sraddha’ is possible only where there is love, otherwise the listener will be closed. If you are closed you will be easily dominated by anger and resentment, and nothing can enter into you”.

“Satguru Mata Amritanandamayi Devi”
Introducing AIMS

India is the second most populous nation on earth. This means that India’s health problems are the world’s health problems. And by the numbers, these problems are staggering: 41 million cases of diabetes, nearly half the world’s blind population, and 60% of the world’s incidences of heart disease. But behind the numbers are human beings, and we believe that every human being has a right to high-quality healthcare.

Since opening its doors in 1998, AIMS, our 1,200 bed tertiary care hospital in Kochi, Kerala, has provided more than 4 billion rupees worth of charitable medical care; more than 3 million patients received completely free treatment. AIMS offers sophisticated and compassionate care in a serene and beautiful atmosphere, and is recognized as one of the premier hospitals in South Asia. Our commitment to serving the poor has attracted a dedicated team of highly qualified medical professionals from around the world.

The Amrita Institute of Medical Sciences is the adjunct to the term “New Universalism” coined by the World Health Organization. This massive healthcare infrastructure with over 3,330,000 sq. ft. of built-up area spread over 125 acres of land, supports a daily patient volume of about 3000 outpatients with 95 percent inpatient occupancy. Annual patient turnover touches an incredible figure of almost 800,000 outpatients and nearly 50,000 inpatients. There are 12 super specialty departments, 45 other departments, 4500 support staff and 670 faculty members.

With extensive facilities comprising 28 modern operating theatres, 230 equipped intensive-care beds, a fully computerized and networked Hospital Information System (HIS), a fully digital radiology department, 17 NABL accredited clinical laboratories and a 24/7 telemedicine service, AIMS offers a total and comprehensive healthcare solution comparable to the best hospitals in the world. The AIMS team comprises physicians, surgeons and other healthcare professionals of the highest caliber and experience.

AIMS features one of the most advanced hospital computer networks in India. The network supports more than 2000 computers and has computerized nearly every aspect of patient care including all patient information, lab testing and radiological imaging. A PET (Positron Emitting Tomography) CT scanner, the first of its kind in the state of Kerala and which is extremely useful for early detection of cancer, has been installed in AIMS and was inaugurated in July 2009 by Dr. A. P. J. Abdul Kalam, former President of India. The most recent addition is a 3 Tesla Silent MRI.

The educational institutions of Amrita Vishwa Vidya Peetham, has at its Health Sciences Campus in Kochi, the Amrita School of Medicine, the Amrita Centre for Nanosciences, the Amrita School of Dentistry, the Amrita College of Nursing, and the Amrita School of Pharmacy, committed to being centres of excellence providing value-based medical education, where the highest human qualities of compassion, dedication, purity and service are instilled in the youth. Amrita School of Ayurveda is located at Amritapuri, in the district of Kollam. Amrita University strives to help all students attain the competence and character to humbly serve humanity in accordance with the highest principles and standards of the healthcare profession.
## Table of Contents
### Part I – Rules and Regulations

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Contents</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Under Graduate Programs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Details of Under Graduate Courses</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2. Medium of Instruction</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3. Eligibility</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td>General Rules</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Duration of the course</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2. Discontinuation of Studies</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3. Educational Methodology</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>4. Academic Calendar</td>
<td>9</td>
</tr>
<tr>
<td>III</td>
<td>Examination Regulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Attendance</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>2. Internal Assessment</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3. University Examination</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>4. Eligibility to appear for University Examination</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>5. Valuation of Theory – Written Paper</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6. Supplementary Examination</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>7. Rules regarding Carryover subjects</td>
<td>12</td>
</tr>
<tr>
<td>IV</td>
<td>Criteria for Pass in University Examination – Regulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Eligibility criteria for pass in University Examinations</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>2. Evaluation and Grade</td>
<td>13</td>
</tr>
<tr>
<td>V</td>
<td>Internship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Eligibility for Internship – Regulations</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2. Attendance and leave details during Internship</td>
<td>14</td>
</tr>
<tr>
<td>VI</td>
<td>General considerations and Teaching / Learning Approach</td>
<td>14</td>
</tr>
<tr>
<td>VII</td>
<td>Project</td>
<td>14</td>
</tr>
<tr>
<td>VIII</td>
<td>Maintenance of Log book</td>
<td>14</td>
</tr>
</tbody>
</table>
# Table of Contents
## Part II – Syllabus

<table>
<thead>
<tr>
<th>SL No:</th>
<th>Contents</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction and Advancement of the program</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>Main Objective of the program</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>Course Structure</td>
<td>18</td>
</tr>
<tr>
<td><strong>First Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Anatomy – Paper I</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>Physiology – Paper II</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>Biochemistry – Paper III</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>Microbiology – Paper IV</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>Introduction to Computer Application (Section A) – Paper V</td>
<td>28</td>
</tr>
<tr>
<td>9</td>
<td>Quality Assurance &amp; Accreditation (Section B) – Paper V</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>English &amp; Soft Skills – Paper VI</td>
<td>32</td>
</tr>
<tr>
<td><strong>Second Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Pharmacology – Paper VII</td>
<td>33</td>
</tr>
<tr>
<td>12</td>
<td>Pathology – Paper VIII</td>
<td>35</td>
</tr>
<tr>
<td>13</td>
<td>Cardiac Anatomy &amp; Physiology – Paper IX</td>
<td>37</td>
</tr>
<tr>
<td>14</td>
<td>Cardiac Pathology &amp; Pharmacology – Paper X</td>
<td>38</td>
</tr>
<tr>
<td><strong>Third Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Echocardiography Technology - Clinical – Paper XI</td>
<td>39</td>
</tr>
<tr>
<td>16</td>
<td>Echocardiography Technology - Applied – Paper XII</td>
<td>41</td>
</tr>
<tr>
<td>17</td>
<td>Echocardiography Technology - Advanced – Paper XIII</td>
<td>42</td>
</tr>
<tr>
<td><strong>Fourth Year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Internship</td>
<td>43</td>
</tr>
<tr>
<td>19</td>
<td>Scheme of Examination</td>
<td>44</td>
</tr>
<tr>
<td>20</td>
<td>Pattern of Question Paper</td>
<td>45</td>
</tr>
</tbody>
</table>
Part I
Rules and Regulations
## Under Graduate Programmes (Bachelor of Sciences)

### I.1. Details of Under Graduate Courses:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Course</th>
<th>Duration</th>
<th>Conditions of Eligibility for admission to the course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Medical Laboratory Technology (MLT)</td>
<td>4 years</td>
<td>Pass in plus Two with 50% marks with Physics, chemistry and Biology</td>
</tr>
<tr>
<td>2</td>
<td>Medical Radiologic Technology (MRT)</td>
<td>4 Years</td>
<td>First class in plus two with Mathematics, Physics, Chemistry, and Biology</td>
</tr>
<tr>
<td>3</td>
<td>Emergency Medical Technology</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>4</td>
<td>Anaesthesia Technology</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>5</td>
<td>Respiratory Therapy (RT)</td>
<td>3 Years + One year Internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>6</td>
<td>Dialysis Therapy</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>7</td>
<td>Physician Assistant</td>
<td>3 years + one year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>8</td>
<td>Cardio Vascular Technology (CVT)</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>9</td>
<td>Echocardiography Technology</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>10</td>
<td>Cardiac Perfusion Technology (CPT)</td>
<td>3 Years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>11</td>
<td>Diabetes Sciences</td>
<td>3 years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>12</td>
<td>Optometry</td>
<td>3 Years + One year Internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>13</td>
<td>Bachelor of Audiology &amp; Speech Language Pathology (BASLP)</td>
<td>3 years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>14</td>
<td>Neuroelectro-physiology</td>
<td>3 years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>15</td>
<td>Operation Theatre Technology</td>
<td>3 years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
<tr>
<td>16</td>
<td>Intensive Care Technology</td>
<td>3 years + One year internship</td>
<td>Pass in plus two with 50% marks in Physics, Chemistry and Biology.</td>
</tr>
</tbody>
</table>
I.2. Medium of Instruction:
English shall be the medium of instruction for all subjects of study and for examinations.

I.3. Eligibility:
Generally Science Graduates with Physics, Chemistry, and Biology are eligible for admission to the Under Graduate Courses except in respect of certain specialties for which other qualification or subjects are specifically called for. Essential qualifications for eligibility are mentioned under clause I.1

II. General Rules:
Admissions to the courses will be governed by the conditions laid down by the University from time to time and as published in the Regulations for admissions each year.

II.1. Duration of the Course
Duration details are mentioned under clause No.I.1 of this booklet.

Duration of the course : 4 Years (3 years + 1 year Internship except for courses at serial number 1 and 2 in clause I.1)
Weeks available per year : 52 weeks
Vacation / holidays : 5 weeks (2 weeks vacation + 3 weeks calendar holidays)
Examination (including preparatory) : 6 weeks
Extra curricular activities : 2 weeks
Weeks available : 39 weeks
Hours per week : 40 hours
Hours available per academic year : 1560 (39 weeks x 40 hours)

Internship wherever specified are integral part of the course and needs to be done in Amrita Institute of Medical Sciences, Kochi itself.

II.2. Discontinuation of studies
Rules for discontinuation of studies during the course period will be those decided by the Chairman /Admissions, Amrita School of Medicine, and Published in the “Rules and Regulations” every year.

II.3. Educational Methodology
Learning occurs by attending didactic lectures, as part of regular work, from coworkers and senior faculty, through training offered in the workplace, through read-
ing or other forms of self-study, using materials available through work, using mate-
rials obtained through a professional association or union, using materials obtained
on students own initiative, during working hours at no cost to the student.

II.4. Academic Calendar

Course will follow an annual scheme as per details mentioned under:

FIRST YEAR

Commencement of classes – August 2019
First sessional exam – November 2019
Second sessional exam – February 2020
Model Exam (with practical) – May - June 2020 (one week study leave)
University exam (with practical) – June - July 2020 (10 days study leave)
Annual Vacation – 3 weeks after the University examination.

SECOND YEAR

Commencement of classes – August 2020
First sessional exam – January 2021
Model Exam (with practical) – May - June 2021 (one week study leave)
University exam (with practical) – June - July 2021 (10 days study leave)
Annual Vacation – 2 weeks after the University examination

THIRD YEAR

Commencement of classes – August 2021
First sessional exam – January 2022
Model Exam (with practical) – May 2022 (one week study leave)
University exam (with practical) – June 2022 (10 days study leave)
Annual Vacation – 1 week after the University examination.
Date of completion of third
academic year – 31st July 2022

INTERNSHIP

Commencement of internship – 01 August 2022
Completion of internship – 31 July 2023
III. Examination Regulations:

III.1. Attendance:

75% of attendance (physical presence) is mandatory. Medical leave or other types of sanctioned leaves will not be counted as physical presence. Attendance will be counted from the date of commencement of the session to the last day of the final examination in each subject.

III.2. Internal Assessment:

For the first year at least three sessional examinations in theory and preferably one practical examination should be conducted in each subject. The following second/third year shall have one sessional and one model examination.

- The period for sessional examinations of first academic year are as follows:
  
  First Sessional Exam : November
  Second Sessional Exam : February
  Model Exam : May /June

- The period for sessional examinations of second and third academic year are as follows:
  
  Sessional Exam : January
  Model Exam : May /June

- The last internal assessment examination will be the model examination which shall follow the pattern of the University Examination. Average of best of two examinations and the marks obtained in assignments/viva/practical also shall be taken to calculate the internal assessment.

- A candidate should secure a minimum of 50% marks in the internal assessment in each subject (separately in theory and practical) to be eligible to appear for the University examination.

- Each student should maintain a logbook and record the procedures they do and the work patterns they are undergoing. It shall be based on periodical assessment, evaluation of student assignment, preparation for seminar, clinical case presentation, assessment of candidate’s performance in the sessional examinations, routine clinical works, logbook and record keeping etc.

- Day to day assessment will be given importance during internal assessment, Weightage for internal assessment shall be 20% of the total marks in each subject.
• Pre-University examinations (model exam) shall be held three to four weeks prior to the University Examination. Final internal assessment report shall be made available to the Principal ten days prior to the commencement of the university examination.

III.3. University Examinations:

• University Examination shall be conducted at the end of every academic year. A candidate who satisfies the requirement of attendance and internal assessment marks, as stipulated by the University shall be eligible to appear for the University Examination.

• One academic year will be twelve months including the days of the University Examination. Year will be counted from the date of commencement of classes which will include the inauguration day.

• The minimum pass marks for internal assessment is 50% and for the University Examination is 50%. The student should score a total of 50% (adding the internal and external examination (University Examination)) to pass in each subject (separately for theory and practical).

• If a candidate fails in either theory or practical paper, he/she has to reappear for both the papers (theory and practical).

• Maximum number of attempts permitted for each paper is five (5) including the first attempt.

• The maximum period to complete the course shall not exceed 6 years from the date of enrollment for the course.

• All practical examinations will be conducted in the respective clinical areas.

• Number of candidates for practical examination should be maximum 12 to 15 per day.

• One internal and one external examiner will jointly conduct the theory evaluation and practical examination for each student during the final year.

III.4. Eligibility to appear university Examination:

A student who has secured 50% marks for Internal Assessment is qualified to appear for University Examination provided he/she satisfies percentage of attendance requirement as already mentioned at the III (1).

III.5. Valuation of Theory – Revaluation Papers:

1. Valuation work will be undertaken by the examiners in the premises of the Examination Control Division in the Health Sciences Campus.

2. Failed candidates will have the option of revaluation for all the University examinations. Fees for revaluation will be decided by the Principal from time to time.
3. Application for revaluation should be submitted within 5 days (or the time as decided by the Principal) from date of result of examination declared and it should be submitted to the office with payment of fees as decided by the Principal.

III.6. Supplementary Examinations:

Every main University examination will be followed by a supplementary examination which will normally be held within four to six months from the date of completion of the main examination.

As stipulated under clause No. III.2 under Internal Assessment, HOD will hold an internal examination three to four weeks prior to the date of the University Examination. Marks secured in the said examination or the ones secured in the internal examination held prior to the earlier University Examination whichever is more only will be taken for the purpose of internal assessment. HODs will send such details to the Principal at least ten days prior to the date of commencement of University examination.

Same attendance and internal marks of the main examination will be considered for the supplementary examination, unless the HOD furnishes fresh internal marks and attendance after conducting fresh examination.

Students who have not passed / cleared any subjects in the first University examination will be permitted to attend the second year classes and also eligible to appear for second year university examination along with first year supplementary examination. However, he / she can appear for the third (final) year university examination, only if he / she clear all the subjects in the first as well as in the second year examinations.

Students of supplementary batches are expected to prepare themselves for the University Examinations. No extra coaching is expected to be provided by the Institution. In case at any time the Institution has to provide extra coaching, students will be required to pay fees as fixed by the Principal for the said coaching.

III.7. Rules regarding carryover subjects:

A candidate will not be permitted to continue the second and third year respectively of the course if he/she has failed in more than 3 subjects in the first or second year university examinations.

A candidate must have passed in all subjects of all the three years to become eligible to undergo compulsory internship of one year. For the candidates who have not passed all the subjects the duration of the third year shall be extended until they become eligible to undergo compulsory internship subject of course to the conditions mentioned under III.3.v &vi of these Rules.
IV. Criteria for Pass in University Examination - Regulations:

IV.1. Eligibility criteria for pass in University Examination:

In each of the subjects, a candidate must obtain 50% in aggregate for a pass and the details are as follows:

- A separate minimum of 50% for Internal Assessment.
- 50% in Theory & 50% in Viva.
- A separate minimum of 50% in aggregate for Practicals / Clinics (University Examinations).
- Overall 50% is the minimum pass in subject aggregate (University Theory + Viva + Practicals + Internal Assessment).

IV.2. Evaluation and Grade:

1. Minimum mark for pass shall be 50% in each of the theory and practical papers separately (including internal assessment) in all subjects except English.
2. A candidate who passes the examination in all subjects with an aggregate of 50% marks and above but less than 65% shall be declared to have passed the examination in the second class.
3. A candidate who passes the examination in all subjects in the first attempt obtaining not less than 65% of the aggregate marks for all the three years shall be declared to have passed the examination with First Class.
4. A candidate who secures an aggregate of 75% or above marks is awarded distinction. A candidate who secures not less than 75% marks in any subject will be deemed to have passed the subject with distinction in that subject provided he / she passes the whole examination in the first attempt.
5. A candidate who takes more than one attempt in any subject and pass subsequently shall be ranked only in pass class.
6. A Candidate passing the entire course is placed in Second class / First class / Distinction based on the cumulative percentage of the aggregate marks of all the subjects in the I, II and III (Final) university examinations
7. Rank in the examination: - Aggregate marks of all three year regular examinations will be considered for awarding rank for the B.Sc Graduate Examination.

V. Internship:

V.1. Eligibility for Internship - Regulations:

Wherever internship is a part of the curriculum, students will have to do the internship in Amrita Institute of Medical Sciences, Kochi itself. A candidate must have passed in all subjects to become eligible to undergo compulsory internship of one year or a period fixed in the curriculum.
Internship has to be done continuously for a period provided in the syllabus except in extraordinary circumstances where subject to the approval of the Principal may be done in not more than two parts with an interruption not exceeding six months. In any case Internship shall be completed within 18 months from the date of acquiring eligibility to do the internship.

The students will be posted in Amrita Institute of Medical Sciences, Kochi and Amrita Institute of Medical Sciences, Faridabad, if necessary, during final year and internship period.

V.2. Attendance and leave details during Internship:

For 30 days of duty an intern will be eligible for casual leave and weekly off. A Student will become eligible to receive his/her degree only after completion of internship to the complete satisfaction of the Principal.

VI. General considerations and teaching / learning approach:

There must be enough opportunities to be provided for self learning. The methods and techniques that would ensure this must become a part of teaching-learning process.

Proper records of the work should be maintained which will form the basis for the students assessment and should be available to any agency who is required to do statutory inspection of the school of the course.

VII. Project:

Each student should submit a project in consultation with HOD and guidance under Project Guide, 3 months prior to their final year university exam. The student will be eligible to appear for the final year examination only after submission of the project.

VIII. Maintenance of Log Book

- Every graduate student shall maintain a record of skills he/she has acquired during the training period certified by the various Heads of Departments/Program Coordinator under whom he/she has undergone training.
- In addition, the Head of the Department shall involve their graduate students in Seminars, Journal Club, Group Discussions and participation in Clinical, Clinical-Pathological meetings.
- The Head of the Departments/Program coordinator shall scrutinize the log-book in every month.
- At the end of the course, the student should summarize the contents and get the log book certified by the Head of the Department.

The log book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.
Part II
Syllabus
INTRODUCTION AND ADVANCEMENT OF THE PROGRAM

Current management of various cardiac disorders includes complex diagnostic and therapeutic procedures, which involve use of various equipment, hardware, tools, machines, and pharmacological agents. Handling of these equipment as well as their regular maintenance requires advanced and focused knowledge of the scientific principles on which the tests and equipments function. Proper training is mandatory for imparting hands-on skill in using these equipments correctly and safely. Correct interpretation of images obtained by these techniques needs scientific knowledge and clinical correlation. The personnel who carry out these responsibilities also must have adequate knowledge of the structure and function of the human body, especially the cardiovascular system. Optimal delivery of cardiovascular health care is based on the safe use of the equipments and devices. This necessitates development of a cadre consisting of science graduates, who obtain focused, relevant knowledge in this specific area of cardiovascular echocardiography technology through didactic theoretic learning as well as supervised practical hands-on training.

MAIN OBJECTIVES OF THE PROGRAM

The Amrita School of Medicine offers a comprehensive program designed to provide an in-depth clinical experience that will enable the students to produce accurate, high-quality echocardiographic images. Students acquire the knowledge needed to make the distinction between normal cardiac anatomy and cardiac pathology. In addition, the program emphasizes an understanding of basic cardiology and ancillary cardiovascular diagnostic procedures. The program communicates the importance of becoming credentialed in the profession of echocardiography and to utilize diagnostic techniques, sound judgment and good decision making to provide patient services.

Goals

1. Demonstrate knowledge and understanding of human gross anatomy, sectional anatomy, and normal and abnormal cardiovascular anatomy.
2. Demonstrate knowledge and understanding of cardiovascular physiology, pathology, and pathophysiology.
3. Become proficient in all aspects of adult echocardiography at an entry level position.
4. Be able to recognize the most common congenital heart defects.
5. Integrated didactic clinical and classroom training.
6. The program in Echocardiography provides students with the knowledge, clinical skills, values and behaviors to become competent cardiac sonographers.
7. Demonstrate the ability to work effectively in teams.
8. Demonstrate an ability to provide basic patient care and comfort.
9. Employ professional judgment, discretion and ethics.
COURSE STRUCTURE

First year

Theory classes and practicals of following subjects

- Anatomy
- Physiology
- Biochemistry
- Microbiology
- Introduction to Computer Application
- Quality Assurance & Accreditation
- English & Soft Skills

Second year

Theory class and posting in the clinical area

- Pharmacology
- Pathology
- Cardiac Anatomy and Physiology
- Cardiac Pathology and Pharmacology

Third year

Theory class and posting in the clinical area

- Echocardiography Technology - Clinical
- Echocardiography Technology - Applied
- Echocardiography Technology - Advanced

Fourth Year

Fourth year is internship in the clinical area
FIRST YEAR

During the first year the students will have didactic lecture in the medical college from 10 am to 4 pm.

**Internal Assessment**

Three sessional examinations will be conducted in this year. Average marks of these sessional examinations will be counted as internal marks.

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**Paper I – ANATOMY**

**COURSE OBJECTIVE:**
An outline of anatomy with special emphasis on applied aspects is provided to the students for better understanding of the technical and diagnostic procedure.

1. **The human body as a whole**  
   Definition  
   Sub divisions of anatomy  
   Terms of location and positions  
   Fundamental planes, Vertebrate structure of man  
   Organization of body cells and tissues  

2. **Locomotion and Support**  
   The Skeletal System  
   Types of bones  
   Structure and growth of bones  
   Divisions of the skeleton  
   Appendicular skeleton, Axial skeleton  
   Name of all the bones and their parts  
   Joints: Classification, Types of movements with examples  
   **Muscles:** Structure, classification, muscles of abdominal wall, muscles of respiration, pelvic diaphragm, muscles of head and neck  

**Practicals:**  
Demonstrations of all bones:  
   Showing parts  
   Joints, X-rays of all normal bones and joints  
Muscles: Classification of muscle

3. **Anatomy of nervous system**  
   Introduction and divisions of nervous system  
   Central nervous system: Spinal chord, Anatomy, and functions, Reflex arc  
   **The Brain:**  
   Location, gross features, parts, functional areas  
   Hindbrain, Midbrain, fore brain
Coverings of brain and peripheral nervous system
Anatomy of cerebral blood supply & coverings
Spinal cord – gross features, extent, blood supply and coverings
Injuries to spinal cord and brain
Peripheral nervous system – organization & structure of a typical spinal nerve

Practicals: 1 hour
Demonstration of brain and spinal chord

4. Anatomy of Cardiovascular system
Gross anatomy & Structural features of the Heart and Great vessels:
Heart 2 hours
Location, size, surface features, pericardium & valves
Right Atrium - structural features
Venous area, Septum and atrial appendage
Right Ventricle - structural features, inflow & Outflow characteristics
Left Atrium - structural features, venous area, Septum and appendage
Left ventricle - structural features, inflow & Outflow characteristics
Valves - valve apparatus, location
Structure & functions of each valve
Blood Supply of heart - coronary arteries, cardiac cycle
Innervations - sympathetic and parasympathetic sensory
Pulmonary circuit - names of the arteries and veins & positions
Lymphatic drainage of the Heart

Great Vessels 2 hours
Structure of blood vessels and its organization
Aorta
Pulmonary artery & pulmonary vein
General plan of systemic circulation
Pulmonary circulation

PRACTICALS 2 hours
Demonstration to illustrate normal angiograms
Demonstration of surface features & interior of the heart
Demonstration of aorta and its branches
Histology of cardiac muscles and artery

5. Anatomy of the Respiratory system 4 hours
Organs of Respiratory System:
Conducting portion, respiratory portion
(Nose – nasal cavity, paranasal air sinuses
Larynx, trachea, bronchial tree
Muscles of Respiration
Cross structure and the interior features of nose & nasal cavity
Para nasal air sinuses
Cross structure and interior features of the pharynx and larynx
Cross structures and interior features of the trachea and bronchial tree
Gross structure, histology, position and coverings of the lungs
Pulmonary circulation – pulmonary arteries pulmonary veins & bronchial arteries
Nerve supply to the respiratory system

Practicals
Demonstration of the parts and function
Demonstration of the different parts of the respiratory system with special emphasis
On lungs
Histology of lungs

6. Anatomy of the Digestive system
Components of the digestive system
Alimentary tube
Mouth, tongue, tooth
Salivary gland, liver, biliary apparatus and its secretion, pancreas and pancreatic secretion, movements of intestine defecation, GI hormones, malabsorption and

Practicals
Demonstrations of the parts and functions
Normal x-rays

7. Anatomy of excretory system & Reproductive system
Organization of the renal system
Kidneys: location, gross features, structure, blood supply and nerve supply
Excretory ducts, ureters, urinary bladder, urethra location gross features and structure

Male reproductive system:
Testis, Duct system, Prostate

Female Reproductive system:
Ovaries, duct system, accessory organs

Practicals
Demonstration of Kidneys, ureter, bladder
Histology of kidney

8. Anatomy of endocrine system
Name of all endocrine glands and their positions
Hormones and their functions

9. Histology

General Slides:

**Systemic Slides**

1. G.I.T
2. Lung-Trachea
3. Kidney, Ureter, Urinary bladder
4. Endocrine- Adrenal, pancreas, pituitary, thyroid and parathyroid
5. Uterus, Ovary, testis

**Reference books:**

- **Human Anatomy- Regional and Applied Volume**
  B.D Chaurasia

- **Clinical Anatomy For Medical Students**
  Richard S.Snell

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**Paper II – PHYSIOLOGY**

1. **INTRODUCTION TO PHYSIOLOGY AND GENERAL PHYSIOLOGY-1 hr**

2. **MUSCLE and NERVE - 3 hrs**
   - Neurons and glial cells - Structure, function, Types, electrical property, degeneration and regeneration.
   - Muscle- Structure & Functions of skeletal muscle & smooth muscle
   - Neuromuscular transmission – Functional anatomy, Transmission & Clinical importance.

3. **HAEMATOLOGY - 9 hrs**
   - Fluid compartments, Composition & functions of blood, Plasma protein – names, functions.
   - Leucocytes - Morphology, Types, Properties & Functions, variations in count.
   - Thrombocytes- Morphology, Count, Function, Variations.
   - Blood groups and its importance, Blood transfusion.
   - Tissue fluid and Lymph
   - Immunity.

4. **CARDIOVASCULAR SYSTEM - 10 hrs**
   - Organisation of CVS, Properties of Cardiac Muscle, Origin and spread of cardiac impulse
   - Cardiac Cycle – Electrical (ECG)and mechanical events,
   - Cardiac output, Measurement, (Fick’s Principle) regulation
   - Blood pressure, measurement & variation, determinants, regulation, Shock.
• Regional circulation. (Salient features only)-coronary, Pulmonary, Cerebral, Cutaneous

5. RESPIRATORY SYSTEM - 8 hrs
• Introduction. Functional anatomy, Mechanics of ventilation, Pressure changes, volume changes, Surfactant, Compliance, Airway resistance.
• Alveolar ventilation, Dead space, Ventilation perfusion ratio and its significance,
• Spirogram
• Diffusion of gases, O₂ transport, CO₂ transport.
• Regulation of respiration – Voluntary, Neural, Chemical.
• Abnormalities of respiration Hypoxia, Cyanosis, Dyspnea, Asphyxia, High altitude,
• Dysbarism.

6. DIGESTIVE SYSTEM - 7 hrs
• Functional anatomy of GI tract,
• Secretions - Salivary secretion & its regulation, Gastric secretion and its regulation,
• Peptic ulcer, Pancreatic secretion and its regulation, Functions of liver. Bile – storage and functions. Intestinal juice
• Movements - Mastication, Deglutition, Movements of stomach, Small intestine, Large intestine. vomiting, Defecation.
• GI Hormones,
• Digestion & Absorption of carbohydrates, Proteins, Fat & vitamins

7. Excretion - 7 hrs
• Functional anatomy of kidney, Structure and function of kidney and nephron
• Renal blood flow, Glomerular filtration rate, Definition, Measurement and factors
• affecting Tubular functions – Reabsorption, Secretion, Acidification, concentration and abnormalities.
• Micturition – Bladder innervation, Micturition reflex.
• Functions of skin

8. ENDOCRINIOLOGY - 6 hrs
a) Introduction to endocrinology (Different glands, hormones)
b) Pituitary gland (Anterial and posterior glands, actions and applied aspects.
c) Thyroid gland (Actions and applied aspects)
d) Calcium homeostasis (Parathyroid, Vitamin D, Calcitonin, actions and applied aspects)
e) Pancreas (Endocrine part – insulin, glucagon – actions and applied aspects
f) Adrenal cortex and medulla (Actions and applied aspects)

9. REPRODUCTIVE SYSTEM - 3 hrs
• Male Reproductive System- Different parts, spermatogenesis, hormones
• Female reproductive system – Different parts, Sexual cycles – Menstrual cycles – Ovarian, endometrium
• Lactation, Pregnancy & Contraception (Basics only)

10. CENTRAL NERVOUS SYSTEM (Basics only) - 10 hrs
a) Organization of Nervous system.
b) Synapse, Properties & Function  
c) Reflexes, Reflex action, Property ,Function.  
d) Sensory system – Receptor, Ascending sensory pathway (basics only), Thalamus, sensory cortex  
e) Motor System – Spinal control of Motor activity, Motor areas in Cerebral Cortex,  
f) Pyramidal & extra pyramidal tracts (basics only),  
g) Basal ganglia & Cerebellum.  
h) Hypothalamus  
i) Autonomous nervous system  
j) Cerebro spinal fluid- formation and functions.

11. SPECIAL SENSES (Basics only) - 4 hrs

- Audition
- Vision

Revision and evaluation session – 4-5 hours

Reference books:

Essentials of Medical Physiology  
Anil Baran Singha Mahapatra

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Paper III – BIOCHEMISTRY

I. CELL STRUCTURE & FUNCTIONS 1hr

- Mitochondria
- Endoplasmic reticulum, Lysosomes
- Fluid mosaic model for membrane structure

II. DIGESTION AND ABSORPTION OF NUTRIENTS 2hrs

- Digestion of carbohydrates
- Fats
- Enzymes in digestion of proteins

III. ENZYMES 1hr

- Normal serum range and diagnostic importance of serum AST, ALP,ALT,CK,GGT and AMYLASE.

IV. PROTEINS 1hr

- Essential amino acids
- Plasma proteins
- Immunoglobulins

V. CARBOHYDRATES 2hr
- Diabetes mellitus - symptoms and complications
- Glucose tolerance test
- Action of insulin and glucagon on carbohydrate metabolism

**VI VITAMINS** 2hrs
- Deficiency manifestations of Vitamin A, C, D, E, K
- Vit B Complex

**VII MINERALS** 1hr
1. Factors maintaining serum calcium level and important functions of calcium
2. Importance of trace elements

**VIII HEMOGLOBIN** 1hr
- Hemoglobin metabolism

**IX LIVER FUNCTION TESTS** 1hr
- Jaundice and types of jaundice
- Enzymes in liver disease

**X RENAL FUNCTION TESTS** 1hr
- Serum Creatinine

**XI SPECIALIZED LABORATORY INVESTIGATIONS** 1hr
Principle and applications of
- Radioimmunoassay (RIA)
- ELISA
- Colorimetry

**XII LIPIDS** 1hr
- Essential fatty acids (EFA)
- Poly unsaturated fatty acids (PUFA)
- Phospholipids

**XIII METABOLISM** 1hr
- TCA cycle (steps only)

**XIV MAINTENANCE OF HOMEOSTASIS** 1hr
- Plasma buffers
- Renal mechanisms in pH regulation
- Anion gap
- Metabolic acidosis,

**XV NUCLEIC ACIDS** 1hr
- DNA and RNA
- Purine and pyrimidine bases,

**XVI CANCER** 1hr
• Chemical and physical carcinogens
• Tumor markers.

Reference books:

**The Text Book of Biochemistry**
Dr. D.M.Vasudevan, Sreekumari.S

**Text Book of Biochemistry**
T.N.Pattabhiraman

**Essentials of Biochemistry**
U.Sathyarayanan

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Paper IV – : MICROBIOLOGY

Introduction to medical microbiology - 1 hr
Morphology and physiology of bacteria - 1 hr
Sterilization and disinfection - 2 hrs
Normal Microbial flora of the human body - 1 hr
Infection - 2 hrs
Antibiotics - 1 hr
Hospital infections and prevention - 2 hrs
Immunity - 1 hr
Antigen, Antibody, Antigen-antibody reactions - 1 hr
Immune response - 1 hr
Hypersensitivity - 1 hr
Immunoprophylaxis - 1 hr
Tuberculosis - 1 hr
Typhoid - 1 hr
Virus infections - 1 hr
HIV/AIDS - 1 hr
Hepatitis viruses - 1 hr
Medical Mycology - 1 hr
Medical Parasitology - 1 hr
Malaria - 1 hr
Urinary Tract Infections - 1 hr
Respiratory Tract Infections - 1 hr
Gastrointestinal Infections - 1 hr
Sexually Transmitted Disease - 1 hr
Infections of the nervous system - 1 hr

**Practical Demonstrations**
Gram Staining - ½ hr
Acid Fast Staining - ½ hr
Antibiotic Susceptibility Testing - ½ hr
CSSD Visit - ½ hr

Theory Class Hours - 28 hrs
Practical Demonstration hours - 2 hrs
**Total hours** - 30 hrs

**Referrence books:**

- **Text Book of Medical Parasitology**
  C.K. Jayaram Panicker

- **Text Book of Microbiology**
  Anand Narayan

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**Paper V – Section A: INTRODUCTION TO COMPUTER APPLICATION**

**Course Description:** This course is designed for students to develop basic understanding of use of computer and its applications in Clinical Departments

<table>
<thead>
<tr>
<th>Unit</th>
<th>Time (hours)</th>
<th>Learning Objective</th>
<th>Content</th>
<th>Teaching Learning activities</th>
<th>Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>10</td>
<td>Identify &amp; define various concepts used in computer Identify application of computer</td>
<td>Introduction * Concepts of computers * Hardware and Software * Trends and Technology * Application of Computers</td>
<td>* Lecture cum discussion * Explain using charts * Panel discussion</td>
<td>* Short answer questions * Objective Type</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>Describe and use of Disk Operating System (DOS) Demonstrate skill in the use of MS Office</td>
<td>Introduction to Disk Operating System * DOS * Windows (all version) * MS Word * MS Excel with Pictorial Presentation * MS - Access * MS-Power Point</td>
<td>* Lecture * Discussion * Demonstration * Practice session</td>
<td>* Short answers * Objective Type * Practical Exam and Viva voice</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>Demonstrate skill in using multimedia Identify features of computer aided teaching and testing</td>
<td>* Multimedia : types &amp; uses * Computer aided teaching &amp; testing</td>
<td>* Lecture * Discussion * Demonstration</td>
<td>* Short answers * Objective Type * Practical Exam and Viva voice</td>
</tr>
</tbody>
</table>
Paper V – Section B: QUALITY ASSURANCE AND ACCREDITATION

Course Objectives:

Modernization and its brand conscious make an organization thrive towards perfection in the comparative world of business. The underlying factor that allows an organization to stand the test of time is quality. The students are given the working knowledge of the subject.

Course Content:
Introduction to quality - 2 hrs
Definition, Concept, Benefits - 2 hrs
Function - 2 hrs
Design - 2 hrs
Formulation - 2 hrs
Standardization - 2 hrs
Implementation - 2 hrs
Factors affecting quality - 2 hrs
Need for quality - 2 hrs
Quality cycle - 2 hrs
Quality objectives - 2 hrs
Quality policy - 2 hrs
Quality measurable - 2 hrs
Quality Control, Quality Standards, Q C Tools - 6 hrs
Quality Documents, QC Records, Kaizen techniques - 2 hrs
Such as Market-in, TQC, Q C Circles, - 2 hrs
Detailed Course Plan

Unit- I
Introduction to quality –Definition, concept, Benefits-Functions-Design- Formulation- Standardization

Unit-II
Implementation –Factors affecting quality –Need for Quality Cycle –Quality objectives- Quality policy

Unit-III

Unit-IV
ISO- Quality management system- Quality manual-Quality procedure- Quality records- Quality audit

Unit- V
Corrective and preventive action –SQC (Statistical Quality Control technique)
Cost effectiveness- Cost of quality system- Benefit in total cost –Cost
Measuring system- TOM- concept, awareness, aspects training

Reference Text:
1. Dale H Bester field. Carol Bester field, Glen H Bester field, Mary Bester field –Scare, Total Quality Management .Wesley Logman (Singapore)Pte.Ltd. Indian Branch, 482F.I.E, Patparganj, Delhi 110092, India
**Paper VI: ENGLISH**

**Course Description**: The course is designed to enable students to enhance their ability to comprehend spoken and written English (and use English) required for effective communication in their professional work. Students will practice their skills in verbal and written.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Time (Hours)</th>
<th>Learning Objective</th>
<th>Content</th>
<th>Teaching Learning activities</th>
<th>Assessment Methods</th>
</tr>
</thead>
</table>
| I    | 10           | Speak and write grammatically correct English | * Review of grammar  
  * Remedial study of grammar  
  * Building vocabulary  
  * Phonetics  
  * Public speaking  
  * Demonstrate use of dictionary  
  * Class Room conversation  
  * Exercise on use of grammar  
  * Practice in public speaking  | * Demonstrate use of dictionary  
  * Class Room conversation  
  * Exercise on use of grammar  
  * Practice in public speaking  | * Objective type  
  * Fill in the blanks  
  * Para Phrasing |
| II   | 10           | Develop ability to read, understand and express meaning fully, the prescribed text | * Read and comprehend prescribed course books  
  Exercise on :  
  * Reading  
  * Summarizing  
  * Comprehension  | * Short answers  
  * Essay Type |
| III  | 8            | Develop writing skills | * Various forms of Composition  
  * Letter writing  
  * Note taking  
  * Precise writing  
  * Anecdotal records  
  * Diary writing  
  * Reports on health Problems etc.  
  * Resume / CV  
  Exercise on writing :  
  * Letter  
  * Note  
  * Precise  
  * Diary  
  * Anecdote  
  * Health problems  
  * Story writing  
  * Resume / CV  
  * Essay Writing  
  * Discussion on written reports / documents  | * Assessment of the skills based on the checklist |
| IV  | 6   | Develop skill in spoken English | Spoken English  
* Oral report  
* Discussion  
* Debate  
* Telephone conversation | Exercise on:  
* Debating  
* Participating in Seminar, panel, Symposium  
* Teleonic Conversation | * Assessment of the skills based on the check list |
|-----|-----|---------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| V   | 2   | Develop skill in listening comprehension | Listening Comprehension  
* Media, audio, video, Speeches etc. | Exercise on:  
* Listening to audio, video, tapes and identify the key points | * Assessment of the skills based on the check list |
| VI  | 4   | Develop skill in Grammer | Grammer  
* Transformation of Sentences  
* Correction of sentence  
* Vocabulary Building  
* Composition  
* Essay writing - on topics of every day life | Exercise on:  
* Voice  
* The Sentence  
* Parts of Speech  
* Direct and Indirect Speech  
* Affirmative and Negative  
* Change the Question Tag  
* Correction of Syllabus  
* Idioms  
* Letter writing – Personal, Official matters connection with daily life | * Assessment of the skills based on the check list |

**Soft Skills**

1. Introduction to Soft Skills
   - What are Soft Skills?
   - Why is Soft Skills necessary in the modern age?
   - Significance of Soft Skills in the medical profession.
Topics to be covered in the Soft Skills training program.

2. Interpersonal Skill
   - What is an Interpersonal Skill?
   - What is the significance of having a good Interpersonal Skill in a medical profession?
   - How can we develop our Interpersonal Skills through Empathic listening and building trust?

3. Communication Skill
   - The process of communication
   - Barriers to communication
   - Verbal communication and Non-verbal communication
   - Role of perception in communication

4. Time Management
   - Value of time, setting goals/planning and prioritization.
   - Check the time killing habits
   - Procrastination
   - Tools of time management – Time Management Matrix as explained by Dr. Stephen R Covey

5. Goal Setting
   - Concept of goal setting
   - Personal values and Personal goals
   - Six areas of goal setting
   - The process of goal setting: SMART goals
   - How to set SMART goals

6. Stress Management
   - What are the causes of stress and different types of stressors
   - Identifying the stressors in an individual
   - Process of stress
   - What are the effective ways of managing stress?

7. Emotional Intelligence
   - The concept of Emotional Intelligence
   - The components of Emotional Intelligence
   - The different models of Emotional Intelligence
   - Emotional Intelligence for leadership.
8. **Listening skill**
   - The concept of listening and its significance in the communication process
   - Why listening skill is important in the medical profession
   - Different types of listening
   - How to become an effective listener

9. **Being Proactive**
   - The concept of being proactive
   - The Importance of being proactive in life
   - The stimulus – response model of being proactive – Dr. Stephen R Covey
   - Circle of concern and Circle of Influence – Dr. Stephen R Covey
   - Developing the Proactive language in life

10. **Presentation Skill**
    - The process of presentation skill
    - Adult learning principles
    - Preparation and planning for presentation
    - How to effectively deliver a presentation
    - Effective use of voice and body language
    - Effective use of visual aids,
    - Do’s and Don’ts of presentation

11. **Group discussion**
    - The significance of a group discussion round in an interview – Different skills of an individual that are tested in a group discussion.
    - Do’s and Don’ts in a group discussion.

12. **Interview Skills**
    - What is the purpose of Job Interview?
    - What are the different types of Job Interview?
    - Do’s and Don’ts of an Interview
    - Effective Resume preparation
    - Dressing and Grooming for an Interview
    - Self Introduction
    - Extempore practice
SECOND YEAR

During the second year the students will be posted in the clinical area (Cardiology department) from 9 am to 6 pm including one hour didactic lecture from 2 pm to 3 pm.

Internal Assessment

One sessional exam and one model examination will be conducted in this year. Average marks of these two examinations will be counted as internal marks along with performance in the clinical posting.

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Paper VII – PHARMACOLOGY

- General Pharmacology – 4 hours
- Evaluation of drugs in man, drug prescribing and drug interactions – 3 hours
- Sedatives, hypnotics and pharmacotherapy of insomnia – 1 hour
- Drugs effective in convulsive disorders – 1 hour
- Opioid analgesics – 1 hour
- Analgesic – antipyretics and non-steroidal anti-inflammatory drugs – 1 hour
- Psychopharmacology – 1 hour
- Drug therapy of parkinsonism and other degenerative disorders of the brain – 1 hour
- Local anesthetics – 1 hour
- Adrenergic and adrenergic blocking drugs – 1 hour
- Histamine and anti histamic drugs – 1 hour
- Pharmacotherapy of cough – 1 hour
- Pharmacotherapy of bronchial asthma and rhinitis – 1 hour
- Digitalis and pharmacotherapy of cardiac failure – 1 hour
- Vasodilator drugs and pharmacotherapy of angina pectoris – 1 hour
- Pharmacotherapy of hypertension – 1 hour
- Drugs and blood coagulation – 1 hour
- Drugs effective in iron deficiency and other related anemias – 1 hour
- Diuretics – 1 hour
- Emetics, drug therapy of vomiting, vertigo and diarrhea – 1 hour
- Pharmacotherapy of constipation – 1 hour
- Pharmacotherapy of peptic ulcer – 1 hour
- Sulfonamides, Trimethoprim, cortimoxazole, nitrofurans and quinolones – 1 hour
- Penicillins and antibiotics effective mainly against gram positive organisms – 1 hour
- Aminoglycosides and other antibiotics effective mainly against gram negative organisms – 1 hour
• Antibiotics effective against both gram positive and gram negative organisms – 1 hour
• General principles of chemotherapy of infections – 1 hour
• Chemotherapy of urinary tract infections – 1 hour
• Antiseptics, disinfectants and insecticides – 1 hour
• Thyroid and antithyroid drugs – 1 hour
• Insulin and antidiabetic drugs – 1 hour
• Adrenal cortical steroids – 1 hour
• Vitamins and antioxidants – 1 hour
• Drugs, pregnancy and the newborn – 1 hour

Reference books:

Essentials of Medical Pharmacology
Tripathi

Basics and Clinical Pharmacology
Katzung

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Paper VIII – PATHOLOGY

1. Introduction to Pathology
3 hrs
- Histopathology- Methods and techniques
- Cytology-FNAC,Exfoliative advantages and limitations of cytology
- Hematology-Sample collection.
- Immunohistochemistry,Immunofluorescence, Electron microscopy, Flow cytometry

2. Cell injury & adaptations
1 hr
- Etiology
- Reversible & - Irreversible cell injury
- Necrosis & Apoptosis
- Gangrene - Dry - Wet
- Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Dysplasia.
  Fatty change

3. Inflammation & Repair
2hrs
- What is inflammation
- Signs of inflammation, Acute and chronic inflammation, Types of inflammation, Giant cells, Macrophages, Ulcer, abscess, Acute inflammation, Systemic effects of acute inflammation
- Factors affecting healing- Complications of healing

4. Hemodynamic Disorders 2 hrs
- Definition of edema and causes of edema
- Exudate and transudate
Shock – Definition and types of shock
Thrombosis
Emboli- Definition and types of emboli , Pulmonary thromboembolism

5. Neoplasia 2 hrs
- Definition
- Difference between benign and malignant cells, Nomenclature of tumors
- Routes of metastasis of tumours, Staging of tumour, Etiology of cancers - Diagnosis of cancer, including tumour markers

6. CVS 1hr
- Definition of Ischaemia, Infarction, Aneurysm
- Rheumatic heart disease, Infective endocarditis, Atherosclerosis
- Myocardial infarction, Hypertension and pericardial effusion

7. Respiratory system 1hr
- Tuberculosis, Pleural effusion, Pneumonia, COPD and tumours

8. GIT 1hr
- Peptic ulcer, Carcinoma of oesophagus, Stomach & Colon,
- Inflammatory bowel disease (UC & Crohns)

9. Liver and GB 1h
- Hepatitis, Cirrhosis, Tumours of liver
- Cholecystitis and GB calculi

10. Renal 1hr
- Glomerulonephritis & Pyelonephritis
- Renal calculi -Nephrotic syndrome, Renal tumors, Polycystic renal diseases-

11. MGS 1hr
- Cryptorchidism, Orchitis, epididymitis, Prostatic hyperplasia
  - Carcinoma penis, Testicular tumors

12. FGS & Breast 1hr
Ovarian tumours, - Fibroid - Carcinoma cervix- Carcinoma endometrium pap smear
Fibroadenoma breast, Carcinoma Breast-Predisposing factors & TNM

13. CNS 1hr
- Meningitis & encephalitis.- Alzheimer’s disease, Tumours - Meningioma, Gliomas, Metastasis
CSF collection, indication and contraindication, tests performed, cytocentrifu
gue

14. Skin & soft tissue 1hr
Skin- SCC, Melanoma, BCC inflammatory lesions lipoma,

15. Bone 1hr
Osteoporosis, Osteomyelitis, Rickets , Osteomalacia
  Tumours – Osteosarcoma, Osteoclastoma, Ewings sarcoma & Arthritis

16. Endocrine 1hr
Organs, Pituitary, Adrenal brief; Thyroid – Goitre thyroiditis and tumours
  Diabetes and its complications

17. Anaemias 1hr
- Types of anaemia
18. **WBC disorders**  Non neoplastic and neoplastic  

19. **Lymphoreticular system**- Lymphadenitis, Lymphomas  

20. **Platelet and coagulation abnormalities**- Primary & Secondary Hemostasis  

21. **Clinical Pathology I**  
   Blood collection, anticoagulants used, vacuettes and their color code, complete hemogram and the various parameters, Bone marrow - Indication of BM study & collection procedure, PT, APTT sample collection  

22. **Clinical Pathology II**  
   Urine analysis – Physical, Chemical, microscopic, Dipstick parameters  

23. **Transfusion Medicine**  
   Blood grouping, cross matching, Screening of donor, Precautions to take when you start blood transfusion, Monitoring during transfusion, Transfusion reactions, Blood components  

**Internal assessment**  
**Exam - 1 ½ hrs**  

**Lab visit:**  
- Histopathology lab - 1 hr  
- Hematology lab & blood bank - 1 hr  
- Cytology lab - 1 hr  

**Total Hours:** 29 hrs lecture + 3 hrs exam + 3 hrs lab visit = 35 hrs  

**Reference Books:**  
*Basic Pathology: An introduction to the mechanisms of disease*  
Sunil R Lakhani, Susan A Dilly, Caroline J Filayson  

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Cardiac Anatomy
Anatomy of Heart:
- Surface anatomy,
- Gross anatomy, cardiac chambers, septa, valves,
- Pericardium

Arteries, Veins, Lymphatics
1. Aorta and branches
2. Venous drainage
3. Pulmonary vessels and circulation
4. Coronary circulation and coronary venous drainage

Conduction System of Heart

Cardiac Physiology

- Normal Cardiac Cycle
- Pulse
- Heart rate
- Blood pressure
- Cardiac output
- Heart Sounds, Murmurs
- Measurement of Blood Pressure: Technique: Sphygmomanometer
- ECG and Cardiac Cycle
- Chambers: Pressures, Wave Forms
- Arterial, Venous Pressures and Wave Forms
- Oxygen Saturations: Physiology of Oxygen Transport
- Blood Gases – Technique and Various parameters
- Flow, pressure and resistance
- Cardiac Cycle, Circulation, Tissue Perfusion – Unified Concept

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Paper X: CARDIAC PATHOLOGY AND PHARMACOLOGY

Cardiac Pathology

- Coronary artery disease and myocardial infarction
- Rheumatic Fever
- Valvular Heart Disease
  - Mitral stenosis
  - Mitral regurgitation
  - Aortic stenosis
  - Aortic regurgitation
  - Tricuspid valve disease
  - Combined valve diseases
- Pericardial, Myocardial Diseases including End myocardial Diseases
- Hypertension
- Pulmonary Hypertension
- Congenital Heart Disease:
  - Acyanotic
  - Cyanotic
- Shunts
  - Left to Right Shunts
  - Right to Left Shunts
- Heart Failure
- Invasive Monitoring, CVP, Intra Arterial BP, PA Wedge Pressure, Cardiac Output

Applied Pharmacology

- Modes / routes of Drug Administration (Rationale)
- Intra Venous Fluids: Crystalloids, Colloids
- Common Cardiac Drugs – PART-I: Digoxin, Diuretics, Vasodilators, Nitrates
- Common Cardiac Drugs – PART-II: Beta Blockers, Calcium Blockers, ACE inhibitor
- Common Cardiac Drugs – PART-III: Antiarrhythmic drugs, Positive inotropic drugs
- Drugs for Cardiac Resuscitation
- Drugs for all Cardiac and Medical Emergencies
- Contrast Media
- Heparin, Protamine
- Anaphylaxis, Drug reactions, Drug interaction (Basics)

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THIRD YEAR

During the third year the students will be posted in the clinical area from 8 am to 6 pm including one hour didactic lecture.

Internal Assessment

One sessional exam and one model examination will be conducted in this year. Average marks of these two examinations will be counted as internal marks along with performance in the clinical posting.

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**Paper XI: ECHOCARDIOGRAPHY TECHNOLOGY – CLINICAL**

**Electrocardiography**

- Basics and Principle
- Electrode / Lead Placements
- Normal ECG: Wave Form
- Normal ECG: Intervals
- ECG Machines: Functions, Frequency Response, Recording

**Speed, Sensitivity, Standardization, Stylus Lag (Heat Stylus)**

- ECG and Chamber Hypertrophy
- ECG and Arrhythmia
- ECG in Myocardial Infraction, Myocardial Ischemia
- ECG in Miscellaneous Conditions: Metabolic, electrolyte changes
- ECG for Technician: Summary

**Exercise ECG**

- Equipments / Types of Exercise ECG
- Indication / Contradiction
- Lead Placement – Rationale, Limitation
- Monitoring during Ex. ECG: Clinical / ECG / Parameters
- Exercise ECG Protocol: Indications / Advantage and Disadvantage
- Exercise Physiology
- Exercise ECG: Preparation of Patient / Equipment / Defibrillators,

**Emergency Drugs**

- Exercise ECG: Detection of Various Arrhythmias, Ischemia, and

Plan of action
• Exercise ECG:
  • Endpoints: Recognition and Action
  • Post Exercise ECG: Observation, Instructions

Echocardiography

• Principle of Echocardiography
• Transducers
• Anatomical Planes for Viewing in Echocardiography
• Normal M-Mode Echo Study: Anatomy / Function: Measurements
• Normal 2D Echo Study: Anatomy / Function: Measurements.
• Echo for Cardiac Function- systolic and diastolic
• Echo in Heart Disease: Acquired
• Echo in Heart Disease: Congenital
• Contrast Echocardiography: Technique and Indications
• Transesophageal echocardiography
• Echo Cardiography: Technician’s Role:
  ◦ Disposables
  ◦ Archiving
  ◦ Record Keeping
  ◦ Stock-Indents, Stock Maintenance, Stock Verification

Principle of Doppler

Measurement of Flows and Gradients
  • Assessment of gradients, shunts, valve areas, cardiac output
  • Assessment of valve regurgitations

Utility of Doppler in Assessment of Cardiac Disease
  • Tissue Doppler
Stress Echocardiography: Protocols, 2D Echo Views, Analysis

Trans-esophageal Echo
  • Indication / Contraindication
  • Patient Preparation
  • Transducer: Maintenance, Sterilization, Handling etc.
  • Monitoring
  • Emergency Drugs
  • Utility
Intra Vascular Ultrasound, Intracoronary Doppler wire

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**Paper XII: ECHOCARDIOGRAPHY TECHNOLOGY – APPLIED**

**Echocardiographic Techniques**

- Contrast echocardiography for LV opacification
- Flow propagation velocity
- Tissue Doppler: Pulsed tissue Doppler, Tissue velocity imaging (TVI)
- Trans esophageal echocardiography
- Assessment of valve disease, myocardial and pericardial diseases
- Prosthetic valve assessment
- Cardiac tumors
- Pulmonary artery hypertension
- Evaluation of congenital acyanotic and cyanotic heart disease
- Utilization of echo echocardiography in cathlab and operation theaters.
- Peripheral Doppler Electrocardiogram Basic principle
- Interpretation of normal ECG
- Abnormal ECGs, Arrhythmias, Bundle branch blocks, Myocardial infarction
- Exercise testing: Basic principles and instrumentation
- Protocol selection
- Indication and contra indication for the study
- Patient Preparation for the TMT
- Patient monitoring during the exercise
- Post exercise echocardiography
- Principles of pharmacologic stress testing, indications, contraindications
- Patient Preparation for pharmacologic stress testing
- Patient monitoring during pharmacologic stress testing: symptoms, rhythm, BP, pulse oximetry, ECG
- Indications to stop stress testing
- Early detection and avoidance of complications during pharmacologic stress testing
- Interpretation of results, use of TDI, contrast for pharmacologic stress testing
- TEE set up, indications, contraindications, preparation, probe care, probe sterilization, premedication, technique of probe insertion, image acquisition and interpretation
- Technique of IV cannulation and injection using sterile techniques
- Use of suction apparatus
- Use of infusion pumps
• Pulse oximeter
• TEE probe cleaning, sterilization
• Defibrillation
• Basics of pacemakers, AICDs and CRT

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Paper XIII: ECHOCARDIOGRAPHY TECHNOLOGY – ADVANCED

Advanced Echocardiographic Techniques

• Strain and strain rate
• 2 D speckle tracking
• 3D speckle tracking
• 3D echocardiography: anatomical diagnosis, Volume analysis, segmental volume analysis for dyssynchrony, 3D color for assessment of regurgitation assessment
• IV contrast for myocardial viability assessment
• Dobutamine stress echo with and without IV contrast.
• Transesophageal echocardiography for assessment of ASDs for device closure, mitral valve assessment for repair, left atrial clot, prosthetic valve function, evaluation of endocarditis, PFO

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FOURTH YEAR

Internship

Description:

One-year compulsory internship in various clinical areas in Amrita Institute of Medical Sciences during which the students get to hone their skills and knowledge acquired in the three years of rigorous study. During this period their work is very similar to what is expected from them after the completion of their training. The training ensures their readiness to approach a patient in any setting.

Eligibility:

Student who has successfully completed his/her theory and practical in the first three years of the programme.

Duration:

One year (compulsory Internship) at Amrita Institute of Medical Sciences.
### SCHEME OF EXAMINATION

**B.Sc Echocardiography Technology Degree Examination**  
Distribution of Marks for each subject

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Subject Name</th>
<th>Theory</th>
<th>Subject Total</th>
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<td>University</td>
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<td><strong>FIRST YEAR</strong></td>
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Total Marks: 150 to 1700
PATTERN OF QUESTION PAPERS

Paper I to Paper IV and VII & VIII
The duration of each theory paper will be three hours; the paper will have only one section for a total of 70 marks.

Pattern of Question Paper
- Structured Essay (2 out of 3) - 30 marks (2 x 15 marks)
- Short Notes (5 out of 6) - 25 marks (5 x 5 marks)
- Short answer question (5 out of 7) - 15 marks (5 x 3 marks)

Total Marks - 70 marks

Paper V (English)
The duration of the paper will be three hours; the paper will have two sections (Section A & Section B) each carrying 50 marks and a total of 100 marks.

Pattern of Question Paper
- Structured Essay (2 out of 2) - 20 marks (2 x 10 marks)
- Short Notes (3 out of 4) - 15 marks (3 x 5 marks)
- Short answer question (5 out of 7) - 15 marks (5 x 3 marks)

Total Marks - 70 marks

Paper VI
The duration of Paper V will be two hours; the paper will have only one section for a total of 50 marks.

Pattern of Question Paper
- English Grammar - 20 marks
- English Writing - 30 marks

Total Marks - 50 marks

Paper IX to Paper XIII
The duration of each theory paper will be three hours; the paper will have only one section of 100 marks.

Pattern of Question Paper
- Structured Essay (2 out of 2) - 30 marks (2 x 15 marks)
- Short Answer Question (10 out of 12) - 70 marks (10 x 7 marks)

Total Marks - 100 marks

IMPORTANT TELEPHONE NUMBERS
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B.Sc Echocardiography Technology