



A Multi Campus University with 'A' Grade Accreditation by NAAC

# AMRITA SCHOOL OF MEDICINE

## Centre for Allied Health Sciences

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## PROGRAM

# BSc Echocardiography Technology

(Revised with effect from 2014-2015 onwards)



A Super Speciality Tertiary Care Hospital Accredited by ISO 9001-2008, NABL & NABH

# Our Chancellor



## **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”**

## **Amrita Institute of Medical Sciences**

Since its inception, Amrita Institute of Medical Sciences (AIMS) in fifteen short years has grown from a 115 bed specialty hospital to a 1250 bed super-specialty tertiary care health centre with an attached medical school and hospital. On the 17th of May 1998, AIMS was inaugurated by the Prime Minister of India, Shri Atal Bihari Vajpayee, in the presence of Her Holiness, Sri Mata Amritanandamayi Devi. 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 9,00,000 sq. ft of built-up area spread over 100 acres of land supports a daily patient volume of approx 3000 outpatients and an average of 135 admissions. Annual patient turnover touches an incredible figure of over 9,00,000 outpatients and nearly 41,000 inpatients.

With extensive facilities comprising 28 modern operating theatres, 220 equipped intensive-care beds, a fully computerized and networked Hospital Information System (HIS), a fully digital radiology department, a 24/7 telemedicine service and a comprehensive well-equipped clinical laboratory, AIMS offers a total and comprehensive health solution comparable to the best hospitals in the world. AIMS features one of the most advanced hospital computer networks in India. The network supports more than hundreds computers and has computerized nearly every aspect of patient care including all patient information, lab testing and radiological imaging. The AIMS team comprises physicians, surgeons and other healthcare professionals of the highest calibre and experience. Our Hospital services are accredited by ISO 9001-2008 and National Accreditation Board for Hospitals & Healthcare Providers (NABH) and lab services by National Accreditation Board for Testing and Calibration Laboratories.

The educational institutions of Amrita Institute of Medical Sciences, which include the Amrita School of Medicine, the Amrita School of Dentistry, the Amrita College of Nursing, the Amrita School of Pharmacy and Amrita Centre for Allied Health Sciences are 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 Institute of Medical Sciences 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.

Based on evaluation of all our University campuses and programs by a peer review committee, the university has been accredited by the National Assessment and Accreditation Council (NAAC) with an 'A' grade. Amrita has also been ranked in the Ivy League of Indian Universities along with Indian Institute of Science, Bangalore, Tata Institute of Fundamental Research (TIFR), Mumbai etc. in a review of deemed universities by the Ministry of Human Resource Development (MHRD) of the Government of India. In a recent review of Deemed Universities by a high-power committee of reputed academicians, popularly known as the Tandon Committee, set up by the Ministry of Human Resources Development, Amrita Vishwa Vidyapeetham was placed in Category 1. In Tamil Nadu, besides Amrita, only the Chennai Mathematical Institute, a Deemed University, was given this recognition.

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# Part I

## Rules and Regulations

## Under Graduate Programmes (Bachelor of Sciences)

<b>I.1. Details of Under Graduate Courses :</b>			
<b>Sl. No.</b>	<b>Course</b>	<b>Duration</b>	<b>Conditions of Eligibility for admission to the course</b>
1	Medical Laboratory Technology (MLT)	4 years	Pass in plus Two with 50% marks with Physics, chemistry and Biology
2	Medical Radiologic Technology (MRT)	4 Years	First class in plus two with Mathematics, Physics, Chemistry, and Biology
3	Emergency Medical Technology	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
4	Anaesthesia Technology	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology
5	Respiratory Therapy (RT)	3 Years + one year Internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology
6	Dialysis Therapy	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology
7	Physician Assistant	3 years + one year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
8	Cardio Vascular Technology (CVT)	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
9	Echocardiography Technology	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
10	Cardiac Perfusion Technology (CPT)	3 Years + One year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
11	Diabetes Sciences	3 years + one year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
12	Optometry	3 Years + one year Internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.
13	Optometry (Lateral Entry )	2 Years + one year Internship	Pass in two year Diploma in Optometry
14	Bachelor of Audiology & Speech Language Pathology (BASLP)	3 years + one year internship	Pass in plus two with 50% marks in Physics, Chemistry and Biology.

## **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, 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 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 co-workers and senior faculty, through training offered in the workplace, through



reading or other forms of self-study, using materials available through work, using materials 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 and annual scheme as per details mentioned under:

### **FIRST YEAR**

Commencement of classes	– August
First sessional exam	– November
Second sessional exam	– February
Model Exam (with practical)	– May - June
University exam (with practical)	– June - July
Annual Vacation	– After the University examination.

### **SECOND YEAR**

Commencement of classes	– August
First sessional exam	– November
Second sessional exam	– February
Model Exam (with practical)	– May - June
University exam (with practical)	– June - July
Annual Vacation	– After the University examination

### **THIRD YEAR**

Commencement of classes	– August
First sessional exam	– November
Second sessional exam	– February
Model Exam (with practical)	– May
University exam (with practical)	– June
Annual Vacation	– After the University examination.

### **INTERNSHIP**

Commencement of internship	– 01 August
Completion of internship	– 31 July

### **III. Examination Regulations :**

#### **III.1. Attendance :**

**80% of attendance (physical presence) is mandatory.** Medical leave or other types of sanctioned leaves will not be counted as physical presence. For those who possess a minimum of 75% attendance, deficiency up to 5% may be condoned on medical or other genuine grounds by the Principal at his sole discretion and as per the recommendation of the Heads of Departments concerned. Students are allowed such condonation only once for entire course of study. Condonation fee as decided by the Principal has to be paid. 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 :**

- 1. Regular periodic assessment shall be conducted throughout the course. At least two sessional examinations in theory and preferably two practical examinations should be conducted in each subject. The model examination should be of the same pattern of the University Examination. Average of the two examinations and the marks obtained in assignments / oral / viva / practicals also shall be taken to calculate the internal assessment.**
- 2. A candidate should secure a minimum of 35% marks in the internal assessment in each subject (separately in theory and practical) to be eligible to appear for the University examination.**
- 3. The internal assessment will be done by the department thrice during the course period in a gap of not more than three months and model exam will be the same pattern of university examination. The period for sessional examinations of academic year are as follows :**
  - First Sessional Exam : November**
  - Second Sessional Exam : February**
  - Model Exam : May /June**
4. 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.

5. 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.
6. Sessional examination as mentioned above will be conducted and secured by the students along with their attendance details shall be forwarded to the Principal (Result of the first sessional examination should reach before December 1<sup>st</sup> week of the academic year and result of the second sessional examination should reach to the Principal before March 1<sup>st</sup> week of the academic year)
7. Third sessional examinations (model exam) shall be held three to four weeks prior to the University Examination and the 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 35% and for the University Examination is 45%. However the student should score a total of 50% (adding the internal and external 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 re-appear 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.
- 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 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 35% 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. There will be **Re-Valuation** 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 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 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 all or 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 be permitted to continue the second and third year respectively of the course even if he/she has failed in the first or second year university examinations.

A candidate must have passed in all subjects 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.

## **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 35% for Internal Assessment.
- 45% in Theory & 35% in Oral / 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 / Oral + 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. Only a minimum of 40% is required to pass in 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 Ex-

amination. For the courses where the number of students are more than 15 only, rank will be calculated as under :

- Topmost score will be declared as First Rank.
- Second to the topmost will be declared as Second Rank.
- Third to the topmost will be declared as Third Rank.
- There will be no ranking if the candidate is less than 15.

## **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 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 extra ordinary circumstances where subject to the approval of the Principal the same 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.

### **V.2. Attendance and leave details during Internship :**

For 30 days of duty an intern will be eligible for casual leave and one weekly off. For all Under Graduate courses, the period of internship will be one year and so an intern is eligible for one casual leave and one weekly off in a month and total 12 days casual leave is permitted during internship for a student. For example if a student has taken more than 15 days leave in an emergency situation, then he/she is permitted 12 days as casual leave and the remaining 3 days she / he has to compensate by doing duty for 3 days after expiry of the original date.

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.

# Part II Syllabus

## **INTRODUCTION AND ADVANCEMENT**

Current management of various cardiac disorders includes complex diagnostic and therapeutic procedures, which involve use of various equipment, hard ware, 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 COURSE**

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.



### **Program Outcomes (PO)**

1. **PO1:** Fundamental knowledge on the subject.
2. **PO2:** Effective communication skills..
3. **PO3:** Knowledge in professional ethics
4. **PO4:** Leadership qualities and team work
5. **PO5:** Problem Analysis and solving skills
6. **PO6:** Basic knowledge on research methodology
7. **PO7:** Higher Technical skills and competences.
8. **PO8:** Higher study options in many fields.
9. **PO9:** Employability in various sectors.
10. **PO10:** Better employment opportunities.

### **Program Specific Outcomes (PSO)**

1. **PSO1:** Demonstrate knowledge and understanding of human gross anatomy, sectional anatomy, and normal and abnormal cardiovascular anatomy.
2. **PSO2:** Demonstrate knowledge and understanding of cardiovascular physiology, pathology, and pathophysiology.
3. **PSO3:** Become proficient in all aspects of adult echocardiography at an entry level position.
4. **PSO4:** To recognize the most common congenital heart defects.
5. **PSO5:** knowledge, clinical skills, values and behaviors to become competent cardiac sonographers.
6. **PSO6:** Communicate effectively with patients and their relatives.

### **Elective Course**

#### **BECT40**

#### **Value Based Education**

CO1: The attitude to be a good human being, with the curiosity to continue lifelong learning.

CO2: The conviction to do service to humanity - to put the interests of the individual patient as the foremost priority. Acquisition of values of gender sensitivity, environment & sustainability.

CO3: Acquisition of the "skills for life" in addition to the skills to live.

CO4: Acquisition of positive lifelong values including ethics and etiquette.

CO5: The "practical applications" of the right values

### **COURSE STRUCTURE**

#### **First year**

Theory classes and practicals of following subjects

Anatomy

Physiology

Biochemistry

Pharmacology

Microbiology

Pathology

Introduction to Computer Application  
Quality Assurance & Accreditation  
English

**Second year**

Theory class and posting in the clinical area  
Cardiac Anatomy and Cardiac Physiology  
Cardiac Pathology and Cardiac 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 –AHS11**  
**Section A: 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.

**Course Outcome:**

1. Knowledge of general anatomy and locomotion.
2. Knowledge of basic human anatomy and histology of CVS and Respiratory systems.
3. Knowledge of basic human anatomy and histology of CNS, GI, excretory and reproductive systems.
4. Knowledge of basic human anatomy and histology of endocrine system and special senses.

**1. The human body as a whole**

**1 hour**

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** **8 hours**

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:** **2 hours**

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

**3. Anatomy of nervous system** **6 hours**

Introduction and divisions of nervous system  
Central nervous system: Spinal cord, 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 cord

**4. Anatomy of Cardiovascular system**

**Gross anatomy & Structural features of the Heart and Great vessels:** **2 hours**  
**Heart**

Location, size, surface features, pericardium & valves  
Right Atrium :- structural features  
Venous area, Septum and atrial appendage  
Right Ventricle :- structural features, inflow & Out flow characteristics  
Left Atrium :- structural features, venous area, Septum and appendage  
Left ventricle :- structural features, inflow & out flow 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**

**2 hours**

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**

**1 hour**

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**

**1 hour**

Demonstrations of the parts and functions  
Normal x-rays

## **7. Anatomy of excretory system & Reproductive system**

**1 hour**

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:**

**2 hours**

Testis, Duct system, Prostate

Female Reproductive system:

Ovaries, duct system, accessory organs

### **Practicals**

**1 hour**

Demonstration of Kidneys, ureter, bladder

Histology of kidney

## **8. Anatomy of endocrine system**

**1 hour**

Name of all endocrine glands and their positions

Hormones and their functions

## **9. Histology**

**6 hours**

### **General Slides:**

Hyaline cartilage, Fibro cartilage, Elastic cartilage, T.S & L.S of bone, Blood vessels, Tonsils, Spleen, Thymus, Lymph node, Epithelial tissue, Skeletal and cardiac muscle, Peripheral nerve and optic nerve

### **Systemic Slides**

**5 hours**

4. G.I.T

5. Lung-Trachea

6. Kidney, Ureter, Urinary bladder

7. Endocrine- Adrenal,pancreas,pituitary,thyroid and parathyroid

8. 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 I – Section B: PHYSIOLOGY**

### **Course outcome:**

- 1.** CO1: Knowledge of general physiology, nerve-muscle physiology and haematology.
- 2.** CO2: Knowledge of basic human physiology with respect to CVS, Respiratory system and GI system.
- 3.** CO3: Knowledge of basic human physiology of excretion and CNS.

4. CO4: Knowledge of basic human physiology of special senses and endocrine system.

**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.
- Erythrocyte - Morphology, Count, Function, Erythropoiesis, Factors affecting erythropoiesis, Structure of Haemoglobin, Erythrocyte Sedimentation rate, Anaemia, Polycythemia, Fate of RBC, Jaundice.
- Leucocytes - Morphology, Types, Properties & Functions, variations in count.
- Thrombocytes- Morphology, Count, Function, Variations.
- Hemostasis. Coagulation and its disorders.
- 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, O<sub>2</sub> transport, CO<sub>2</sub> 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. ENDOCRINOLOGY - 6 hrs**

- Introduction to endocrinology (Different glands, hormones)
- Pituitary gland ( Anterior and posterior glands, actions and applied aspects.
- Thyroid gland (Actions and applied aspects)
- Calcium homeostasis (Parathyroid, Vitamin D, Calcitonin, actions and applied aspects
- Pancreas (Endocrine part – insulin, glucagon – actions and applied aspects
- 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**

- Organization of Nervous system.
- Synapse, Properties & Function
- Reflexes, Reflex action, Property ,Function.
- Sensory system – Receptor, Ascending sensory pathway (basics only), Thalamus, sensory cortex
- Motor System – Spinal control of Motor activity, Motor areas in Cerebral Cortex,
- Pyramidal & extra pyramidal tracts (basics only),
- Basal ganglia & Cerebellum.
- Hypothalamus
- Autonomous nervous system
- 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 II – AHS12** **Section A: BIOCHEMISTRY**

**Course outcome:**

1. CO1: Knowledge of biochemistry of cell structure, functions, digestion, enzymes and proteins.
2. CO2: Knowledge of biochemistry of carbohydrates, minerals and vitamins.
3. CO3: Knowledge of biochemistry of liver and renal function tests, specialized laboratory investigations and lipids.
4. CO4: Knowledge of biochemistry of metabolism, homeostasis, nucleic acids and cancer.

**I. CELL STRUCTURE & FUNCTIONS****1hr**

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

**II. DIGESTION AND ABSORPTION OF NUTRIENTS****2hrs**

1. Digestion of carbohydrates
2. Fats
3. 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**

- Factors maintaining serum calcium level and important functions of calcium
- Importance of trace elements

**VIII HEMOGLOBIN****1hr**

- 1 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.Sathyannarayanan

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**Paper II – Section B: PHARMACOLOGY**

**Course outcome:**

1. CO1: Basic knowledge in pharmacology.
2. CO2: Detailed systemic pharmacology.
3. CO3: Detailed knowledge of drugs and groups of drugs.

**Course**

- 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 – 1hour
- 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, cotrimoxazole, nitrofurans and quinolones – 1 hour
- Penicillins and antibiotics effective mainly against gram positive organisms – 1 hour
- Amonoglycosides 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 III – AHS 13**  
**Section A: MICROBIOLOGY**

**Course Outcome:**

1. CO1: To understand the morphological characters of bacteria.
2. CO2: To master the preparation of smear, fixation and staining of bacterial smears and its quality control methods
3. CO3: Learn to use microscope, autoclave, hot air oven, water bath, steamer, filters
4. CO4: To differentiate between innate and adaptive immunity, and explain the main defence lines as well as biological barrier to the infections.
5. CO5: Employ antigen-antibody interaction to conduct different immunological and serological tests in the laboratory

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
<b>Practical Demonstrations</b>	
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
<b>Total hours</b>	<b>- 30 hrs</b>

**Reference books:**

**Text Book of Medical Paracytology**

C.K.Jayaram Panicker

**Text Book of Microbiology**

Anand Narayan

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**Paper III – Section B: PATHOLOGY**

**Course Outcome:**

1. CO1: Knowledge of general and systemic pathology.
2. CO2: Knowledge of pathology of neoplasms.
3. CO3: Knowledge of basics of community health.

**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
- Embolism- 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-

**Internal assessment Exam -1 ½ hrs**

**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, cytocentrifuge

**14. Skin & soft tissue** **1hr**

- Skin- SCC, Melanoma, BCC inflammatory lesions lipoma,

**15. Bone** **1hr**

Osteoporosis, Osteomyelitis, Rickets, Osteomalacia

Tumours – Osteosarcoma, Osteoclastoma, Ewing's sarcoma & Arthritis

**16. Endocrine** **1hr**

Organs, Pituitary, Adrenal brief; Thyroid – Goitre, thyroiditis and tumours

Diabetes and its complications

**17. Anaemias** - Types of anaemia **1hr**

**18. WBC disorders** Non neoplastic and neoplastic **1hr**

**19. Lymphoreticular system-** Lymphadenitis, Lymphomas **1hr**

**20. Platelet and coagulation abnormalities-** Primary & Secondary Hemostasis **2hrs**

**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 **1hr**

**22. Clinical Pathology II** –Urine analysis –Physical, Chemical, microscopic, Dipstick parameters **1hr**

**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. **1Hr**

**Internal assessment Exam -1 1/2 hrs**

**Lab visit: Histopathology lab-1hr**

**Hematology lab & blood bank: 1 hr**

**Cytology lab: 1hr**

**Total Hours: 29 hrs lecture + 3hrs 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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**Paper IV (AHS 14) – Section A: INTRODUCTION TO COMPUTER APPLICATION**

**Course outcome:**

1. CO1: basic under-standing of use of computer.
2. CO2: Applications of computer in clinical departments.
3. CO3: Deatiled knowledge on how to use hospital information system.

**Coure Description:** This course is designed for students to develop basic under-standing of used of computer and its applications in Clinical Departments

Unit	Time (hours)		Learning Objective	Content	Teaching Learning activities	Assessment Methods
	Th.	Pr.				
1	10	5	<b>Identify &amp; define various concepts used in computer Identify application of computer</b>	Introduction * Concepts of computers * Hardware and Software * Trends and Technology * Application of Computers	* Lecture cum discussion * Explain using charts * Panel discussion	* Short answer questins  * Objective Type
II	5	10	<b>Describe and use of Disk Operating System (DOS) Demonstrate skill in the use of MS Office</b>	Introduction to Disk Operating System * DOS * Windows (all version) * MS Word * MS Excel with Pictorial Presentation * MS - Access * MS-Power Point	* Lecture * Discussion * Demonstration * Practice session	* Short answers  * Objective Type * Practical Exam and Viva voice
III	10	5	<b>Demonstrate skill in using multimedia Identify features of computer aided teaching and testing</b>	* Multimedia : types & uses * Computer aided teaching & testing	* Lecture * Discussion * Demonstration	* Short answers * Objective Type * Practical Exam and Viva voice

IV	10	5	<b>Describe and use of the statistical packages</b>	* Statistical packages: Types and their features	* Lecture * Discussion * Demonstration * Practice Session	* Short answers * Objective Type * Practical Exam and Viva voice
V	5	5	<b>Describe the use of Hospital Management System</b>	* Hospital Management System : Types and uses * Electronic patient records	* Lecture * Discussion * Demonstration	* Short answers * Objective Type * Practical Exam and Viva voice

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### **Paper IV – Section B: QUALITY ASSURANCE AND ACCREDITATION**

#### **Course outcome:**

1. CO4: Introduction and basic concept of quality.
2. CO5: Standardization and Implementation

#### **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, Kazen techniques	- 2 hrs



Such as Market-in, TOC, Q C Circles,	- 2 hrs
Suggestion scheme, TPM, Kanban,	- 2 hrs
JIT, Zero defect programme	- 2 hrs
ISO	- 4 hrs
Quality management system Quality manual	- 4 hrs
Quality procedures	- 4 hrs
Quality records	- 4 hrs
Quality audit	- 4 hrs
Correlative and preventive action	- 2 hrs
SQC (Statistical Quality Control techniques)	- 2 hrs
Cost effectiveness	- 2 hrs
Cost of quality system	- 2 hrs
Benefit in total cost	- 4 hrs
Cost measuring system	- 4 hrs
TQM- Concept, awareness, aspects train	- 4 hrs
Total	- <b>80hrs</b>

### 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

Quality measurable –Quality Control Quality Standards. Q C Tools –NABH, NABL, JCI~Quality Documents, QC Records. Kazen Technique such as Market-in, TQC .Q C Circles –Suggestion scheme. TPM, Kanban –JIT, Zero defect programmes

#### 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
2. K.Shridhara bhat, Total Quality management .Himalaya Publishing Hollse. "Ramdoot" Dr Bhalerao Mag. Girgaon, Mumbai-400004

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## Paper V (AHS 15): ENGLISH

**Course Description :** The course is designed to enable students to enhance 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.

### **Course Outcome**

1. CO1: Develop their intellectual, personal and professional abilities.
2. CO2: Acquire basic language skills (listening, speaking, reading and writing) in order to communication with speakers of English language
3. CO3: Acquire the linguistic competence necessarily required in various life situations

Unit	Time (Hours)	Learning Objective	Content	Teaching Learning activities	Assessment Methods
1.	<b>10</b>	<b>Speak and write grammatically correct English</b>	<ul style="list-style-type: none"> <li>* Review of grammar</li> <li>* Remedial study of grammar</li> <li>* Building vocabulary</li> <li>* Phonetics</li> <li>* Public speaking</li> </ul>	<ul style="list-style-type: none"> <li>* Demonstrate use of dictionary</li> <li>* Class Room conversation</li> <li>* Exercise on use of grammar</li> <li>* Practice in public speaking</li> </ul>	<ul style="list-style-type: none"> <li>* Objective type</li> <li>* Fill in the blanks</li> <li>* Para Phrasing</li> </ul>
II	<b>10</b>	<b>Develop ability to read, understand and express meaning fully, the prescribed text</b>	<ul style="list-style-type: none"> <li>* Read and comprehend prescribed course books</li> </ul>	Exercise on : <ul style="list-style-type: none"> <li>* Reading</li> <li>* Summarizing</li> <li>* Comprehension</li> </ul>	<ul style="list-style-type: none"> <li>* Short answers</li> <li>* Essay Type</li> </ul>
III	<b>8</b>	<b>Develop writing skills</b>	<ul style="list-style-type: none"> <li>* Various forms of Composition</li> <li>* Letter writing</li> <li>* Note taking</li> <li>* Precise writing</li> <li>* Anecdotal records</li> <li>* Diary writing</li> <li>* Reports on health Problems etc.</li> <li>* Resume / CV</li> </ul>	Exercise on writing : <ul style="list-style-type: none"> <li>* Letter</li> <li>* Note</li> <li>* Precise</li> <li>* Diary</li> <li>* Anecdote</li> <li>* Health problems</li> <li>* Story writing</li> <li>* Resume / CV</li> <li>* Essay Writing</li> <li>* Discussion on written reports / documents</li> </ul>	<ul style="list-style-type: none"> <li>* Assessment of the skills based on the check list</li> </ul>

IV	6	<b>Develop skill in spoken English</b>	Spoken English * Oral report * Discussion * Debate * Telephone conversation	Exercise on : * Debating * Participating in Seminar, panel, Symposium * Telephonic Conversation	* Assessment of the skills based on the check list
V	2	<b>Develop skill in listening comprehension</b>	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	<b>Develop skill in Grammar</b>	Grammar * 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

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## 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

Three sessional examinations will be conducted in this year. Average marks of these sessional examinations will be counted as internal marks along with performance in the clinical posting.

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### **Paper VI: CARDIAC ANATOMY & CARDIAC PHYSIOLOGY**

#### **Course outcome:**

1. CO1: Detailed knowledge in cardiac anatomy.
2. CO2: Detailed knowledge in conduction system of heart.
3. CO3: Detailed knowledge in cardiac physiology

#### **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 VII: CARDIAC PATHOLOGY AND PHARMACOLOGY**

### **COURSE Outcome:**

1. CO1: Detailed knowledge in cardiac pathology
2. CO2: Detailed knowledge in cardiac monitoring.
3. CO3: Detailed knowledge in cardiac 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**

Three sessional examinations will be conducted in this year. Average marks of these sessional examinations will be counted as internal marks along with performance in the clinical posting.

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### **Paper VIII: ECHOCARDIOGRAPHY TECHNOLOGY – CLINICAL BECT31**

#### **Course outcome:**

1. CO1: Detailed knowledge in ECG.
2. CO2: Detailed knowledge in Exercise ECG.
3. CO3: Detailed knowledge in echocardiography.
4. CO4: Detailed knowledge in principle of doppler

#### **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
- ECG in Pediatric age group
- ECG – 12 Lead and other formats

### **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
- Echo in pediatric age group.
- 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 IX: ECHOCARDIOGRAPHY TECHNOLOGY – APPLIED BECT32**

### **Course Outcome:**

1. CO1: Detailed knowledge in echocardiographic techniques
2. CO2: Patient preparation and patient monitoring in various procedures.
3. CO3: Interpretation of results of various tests.

### **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 – Precautions during Tread Mill Test
- 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 – what to do
- 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 & the precautions to be taken
- Basics of pacemakers,AICDs and CRT

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## **Paper X: ECHOCARDIOGRAPHY TECHNOLOGY – ADVANCED BECT33**

### **Course outcome:**

1. CO1: Detailed. Knowledge in advanced echocardiographic techniques.
2. CO2: Knowledge in 3D echocardiography.
3. CO3: Knowledge in dobutamine stress echo.
4. CO4: Knowledge in transesophageal echo.
5. CO5: Recent advances

### **Advanced Echocardiographic Techniques**

- Strain and strain rate
- 2 D speckle tracking
- 3D speckle tracking

- 3 D 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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## **SCHEME OF EXAMINATION**

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

Paper Code	Subject Name	Theory				Paper Total	Aggregate
		University	Internal	Oral	Subject Total		
<b>FIRST YEAR</b>							
I	Section A - Anatomy	50	10	15	75	150	1500
	Section B - Physiology	50	10	15	75		
II	Section A - Biochemistry	50	10	15	75	150	
	Section B - Pharmacology	50	10	15	75		
III	Section A - Microbiology	50	10	15	75	150	
	Section B - Pathology	50	10	15	75		
IV	Section A – Introduction to Computer Application	50	-	-	50	100	
	Section B - Quality Assurance and Accreditation	50	-	-	50		
V	English	50	-	-	50	50	
<b>SECOND YEAR</b>							
VI	Cardiac Anatomy & Cardiac Physiology	100	20	30	150	150	
VII	Cardiac Pathology & Pharmacology	100	20	30	150	150	
<b>THIRD YEAR</b>							
VIII	Echocardiography Technology - Clinical	100	20	30	150	150	
IX	Echocardiography Technology - Applied	100	20	30	150	150	
X	Echocardiography Technolo-	100	20	30	150	150	

	gy - Advanced						
XI	Practical +Viva (100+50)	-	-	-	-	150	

## **PATTERN OF QUESTION PAPERS**

### **1. Paper I to Paper IV**

The duration of each theory 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)
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Total Marks	- 50 marks

### **2. Paper V**

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
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Total Marks	- 50 marks

### **3. Paper VI to Paper X**

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 (4 out of 4)	- 40 marks (4 x 10 marks)
Short Notes (6 out of 8)	- 30 marks (6 x 5 marks)
Short answer question (10 out of 12)	- 30 marks (10 x 3 marks)
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Total Marks	- 100 marks

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### **IMPORTANT TELEPHONE NUMBERS**

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