REGULATIONS AND CURRICULUM GOVERNING

B.Sc. CARDIOVASCULAR TECHNOLOGY PROGRAM

Implemented in Academic year 2016-17

Revised in 2020

Amended upto 2025

Name of the Constituent Unit: Yenepoya School of Allied Health Sciences



YENEPOYA
(DEEMED TO BE UNIVERSITY)

Deralakatte, Mangalore, Karnataka.

NOTIFICATIONS FROM THE UNIVERSITY

Sl. No.	ACM with date	Decisions/Approvals
1.	21st ACM/ 31.07.2015	Starting of B.Sc. Course in Cardiac care tech during 2016-17
2.	30th ACM/ 20.10.2017	Change in nomenclature of B.Sc. Cardiac care technology to cardiovascular technology
3.	38th ACM/ 27.04.2020	All the Undergraduate programs offered by the Faculty of Allied and Healthcare Professionals approved for the Credit Based Semester System from the Academic year 2020-21.
4.	44th ACM/ 05.10.2021	Proposal for Introduction of Choice Based Credit System in all the Undergraduate programs offered by the Yenepoya Institute of Allied Health Sciences from the academic year 2021-22.
5.	49th ACM/ 13.12.2022	Curriculum of B.Sc. –M.Sc. Integrated UG –PG programme with NEP regulations have approved for the implementation from the Academic Year 2022-23.
6.	51st ACM/ 16.05.2023	Introduction of New National Credit Framework (NCRF) for all undergraduate programme under the faculty of Allied & Healthcare Professions from the academic year 2023-24.
7.	61st ACM/ 13.02.2025	The amendment in the syllabus of the course “Pathology & Microbiology II” of the B.Sc. Technology Program was Approved.
8.	64th ACM/ 14.08.2025	Implementing Ability Enhancement Course “English and Communication” in all B.Sc. Technology Programs under the Faculty of Allied & Healthcare Professions was approved.

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1. Preamble

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

B.Sc. in Cardiovascular technology (B.Sc. CVT) is a 4-year undergraduate program including internship offered by Yenepoya College of Allied and Health care professionals. This program is designed to provide board-based theoretical knowledge and up-to-date technical training that is relevant to current cardiac clinical practice. The areas in which training is provided include electrocardiography, treadmill stress testing, 24-hour ambulatory ECG monitoring, 24 hour blood pressure monitoring, Echocardiography and cardiac catheterization laboratory technology. The program includes theory classes, practical "hands on" training and periodic evaluations. Candidates successfully completing the program will be adequately equipped to independently provide technical assistance at any advanced cardiac centre

2. Definitions

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

2.2 **Semester system / Choice Based Credit System**: The semester system accelerates the teaching -learning process. The credit based semester system provides flexibility in designing curriculum at assigning credits based on the course content and hours of teaching. The choice- based credit system provides a cafeteria type approach in which the students can take courses of their choice, undergo additional courses and acquire

more than the required credits, and adopt an interdisciplinary approach to learning.

An academic year shall consist of two semesters;

Odd Semester 1st, 3rd, 5th& 7th	September/October to February/March
Even semester 2nd, 4th, 6th& 8th	March/April to August/September

2.3 Course: Usually referred to, as 'papers" is a component of a programme. The courses shall define learning objectives and learning outcomes. A course shall comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these. The courses can be of the following types i.e. Core, Ability Enhancement, Skill enhancement, value added courses, multidisciplinary electives and internship.

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

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

Credits asked for different types of courses: Each course may have only a lecture component or a lecture and tutorial component or a lecture and practicum component or a lecture, tutorial, and practicum component, or only practicum component. For example, a three-credit lecture course in a semester means three one-hour lectures per week with each one-hour lecture counted as one credit. In a semester of 15 weeks duration, a three-credit lecture course is equivalent to 45 hours of teaching.

One credit for tutorial work means one hour of engagement per week. In a semester of 15 weeks duration, a one-credit tutorial in a course is equivalent to 15 hours of engagement.

A one-credit course in practicum or lab work, community engagement and services, and fieldwork in a semester mean two-hour engagement per week. In a semester of 15 weeks duration, a one-credit practicum in a course is equivalent to 30 hours of engagement.

A one-credit of Seminar or Internship or Studio activities or Field practice/projects or Community engagement and service means two-hour engagements per week. Accordingly, in a semester of 15 weeks duration, one credit in these courses is equivalent to 30 hours of engagement.

A course can have a combination of lecture credits, tutorial credits, and practicum credits. For example, a 4–credit course with three credits assigned for lectures and one credit for practicum shall have three 1-hour lectures per week and one 2-hour duration field-based learning/project or lab work, or workshop activities . In a semester of 15 weeks duration, a 4-credit course is equivalent to 45 hours of lectures and 30 hours of practicum. Similarly, a 4 –credit course with 3-credits assigned for lectures and one credit for tutorial shall have three 1-hour lectures per

week and one 1-hour tutorial per week. In a semester of 15 weeks duration, a four-credit course is equivalent to 45 hours of lectures and 15 hours of tutorials.

Experiential learning credit is equal to 3-hour duration per week. For example, 1 credit for experiential learning will mean 45 hours of learning. The credits assigned to the course is indicated as L:T:P format. For example, for a 4credit course format could be: 4:0:0 or 1:2:1 or 3:1:0 or 0:0:4etc.

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

The following types of courses/activities constitute the programmes of study. Each of them will require a specific number of hours of teaching/guidance and laboratory/studio/workshop activities, field-based learning/projects, internships, and community engagement and service

a. **Lecture courses**: Courses involving lectures relating to a field or discipline by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.

b. **Tutorial courses:** Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning, work/vocation, or professional practice.

c. **Practicum or Laboratory work:** A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an expert or qualified individual in the field of learning, work/vocation or professional practice.

d. **Seminar**: A course requiring students to participate in structured discussion/conversation or debate focused on assigned tasks/readings, current or historical events, or shared experiences guided or led by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.

e. **Internship**: A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

f. **Studio activities**: Studio activities involve the engagement of students in creative or artistic activities. Every student is engaged in performing a creative activity to obtain a specific outcome. Studio-based activities involve visual- or aesthetic focused experiential work.

g. **Field practice/projects:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity.

h. **Community engagement and service:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

i. **Experiential learning activities**: Field project work / Day out learning activities etc are considered as experiential activities.

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

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

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

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

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

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

2.12 **Academic Bank Account:** means an individual account with the Academic Bank of Credits opened and operated by a student, to which all academic credits earned by the Student from course(s) of study are deposited, recognized, maintained, accumulated, transferred, validated or redeemed for the purposes of the award of degree/diploma/certificates etc. by an awarding institution.

2.13 **Academic Bank of Credits:** means the provision for innovative and interchangeable curricular structures to enable creative combinations of Courses or Programmes in Disciplines of study leading to Degree or Diploma or Post Graduate Diploma or Certificate of Study offering multiple entry and multiple exit facilities, while removing rigid curricular boundaries and creating new possibilities of life-long learning;

2.14 **Credit-accumulation:** Means the facility created by Academic

Bank of Credits in the Academic Bank Account opened by students in order to transfer and consolidate the credits earned by them by undergoing Courses;

2.15 **Credit-redemption:** Means the process of commuting the accrued credits in the Academic Bank Account of the students maintained in ABC for the purpose of fulfilling the credits requirements for the award of Degrees or Diplomas or Certificates or Course work for Ph.D. programme etc., by the registered degree-awarding Higher Educational Institutions;

2.16 **Credit-transfer:** Means the mechanism by which the Registered Higher Educational Institutions are able to receive or provide prescribed credits to individual Academic Bank Accounts in adherence to the University Grants Commission credit norms for the 'course/s' undertaken by students enrolled in any Registered Higher Education Institution within India.

2.17 Curriculum Components of the B.Sc. CVT Programme:

Courses in the programme may be of the following types:

a. Core Course
b. Skill Enhancement Course
c. Ability Enhancement Course
d. Value Added Course
e. Multidisciplinary Elective
f. Internship

a. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. This is the course which is the major disciple/subject having main focus and degree will be awarded in this discipline. This core course provides opportunity for our student to pursue in depth study of a particular subject or discipline hence, it is compulsorily studied by a student as a core requirement to complete the program of study in a said discipline. Every Core course shall be restricted to a minimum of 4 credits.

b. **Skill enhancement course:** SEC courses are aimed at imparting practical skills, hands- on training, competencies etc to enhance the skill based knowledge and thus the employability of the students.

c. **Ability Enhancement Courses (AEC):** These are the courses which aim to provide the students the competency in a modern Indian language(MIL) and in the English language with special emphasis on language and the communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic skills, that helps students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity. The courses will also emphasize the development and enhancement of skills such a communication, and the ability to participate/ conduct discussion and debate.

d. **Value Added Courses (VAC):** These are the courses relating to understanding India, environmental science/ education, Health and Wellness etc.

j. **Constitution of India:** The course aims at enabling the students at acquire and demonstrate the knowledge and understanding of contemporary India with its historical

perspective, the basic framework of the goals and policies of National development, and the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties

ii. Environmental Studies: The course aims to equip the students with the ability to apply the acquired knowledge, skills, attitudes, and values require to take appropriate actions for mitigating the effects of environmental degradation, climate change , and pollution, effective waste management, conservation of biological diversity, management of biological resources , forest and wild life conservation, and sustainable development and living.

iii. Human Rights & Gender equity: The Course emphasis understanding social justice issues and roles of human rights in promoting equitable society including international, national perspective, contemporary issues with this holistic coverage and relevance to today's world.

iv. Medical Ethics: The course deals with ethics involving fundamental and moral issues related to decision making while performing professional practice. It guides the students in systematic and rational way of working through dilemmas and to determine the best course of action in their field of practice.

e. **Multidisciplinary Electives (ME):** These courses are intended to broaden the intellectual experience and form part of liberal arts and science education. Students are not allowed to choose or repeat courses already undergone at the higher secondary level (Twelfth class). The courses relating to any of the broad discipline given below will come under this category.

i. **Natural and Physical Sciences:** Students can choose basic courses from disciplines such as natural science, for example, Biology, Botany , Zoology ,Biotechnology, Biochemistry, Chemistry, Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental sciences, etc.

ii. **Mathematics, Statistics and computer applications:** Courses under this category will facilitate the students to use and apply tools and techniques in their major and minor disciplines. The course may include training in programming software like python among others and application software like

STATA, SPSS, TALLY, etc. Basic courses under this category will be helpful; for science and social science in data analysis and the application of quantitative tools.

iii. **Library, Information, and Media Sciences :** Courses from this category will help the students to understand the recent developments in information and media science (journalism, Mass Media , and Communication)

iv. **Commerce and Management :** Courses include business management, accountancy, financial institutions, Fintech, etc.,

v. **Humanities and Social Sciences :** The courses relating to Social sciences, for example, Anthropology, Communication and Media, Economics, History, Linguistics, Political science, Psychology, Social work, Sociology , etc. will enable students to understand the individuals and their social behavior, society and nation. Students be introduced to survey methodology and available large – scale databases for India. The courses under humanities include for example, Archeology, History, Comparative Literature, Arts and Creative Expressions, Creative writing and literature, language(s), philosophy etc., and interdisciplinary courses relating to humanities. The list of courses that can include interdisciplinary subjects such as cognitive science, environmental science, gender studies, global environment and health, international relations, political economy and development , sustainable development, Women's and gender studies , etc. will be useful to understand society.

The Multidisciplinary elective offered by Yenepoya (Deemed to be)University includes:

i. **First Aid and Basic Life Support (BLS):** ThisCourse deals with training the students to be a first responder when there are medical or traumatic emergencies.

ii. **Yoga:** The coursedevelop a comprehensive understanding of yoga, including its history, various schools, practices, and their application in daily life, while also recognizing its potential for personal well-being, professional growth, and promoting positive health.

iii. **Vermitechnology:** This category of course will help students to gain skills in using worms toconvertdecomposingfoodwasteintonutrient-richfertilizer in simple, inexpensive and energyefficient way.

iv. **Positive Psychology:** The course will enable students to enrich themselves to thrive on the belief that people want to lead meaningful and fulfilling lives, cultivate what is best within them, and enhance their experiences of love, work, and play.

v. **National Service Scheme (NSS):**Students can choose NSS to understand the basic concept of NSS, to identify the needs and problems of the community in which they work and to gain skills in mobilizing community participation.

vi. **Lifestyle Management:** This course will help students to learn to achieve health goals through lifestyle and behavior adjustments by creating healthy habits as well as stress management.

vii. **Youth Red Cross:** The course deals withproviding knowledge on Youth Red Cross volunteer ship and Identifying the role of youth in humanitarian service. It also enables youth to promote national and international understanding by using international link of the movement.

viii. **Jeevan Kaushal:** University grant commission identified 4 modules on life skills (JeevanKaushal), the skills that required through our life.

JeevanKaushal courses such as Communication skills, Professional Skills, Leadership and Management skills and Universal Human Values which will help students in developing personal competencies that helps to deal with challenges of life effectively thereby realizing his/her infinite potential as a human being.

ix. **Self – learning courses:** In accordance with the UGC (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2021, New Delhi, dated 25th March 2021, and reference No.F.1-100/2016 (MOOCs/e-content), students are encouraged to augment their learning experience by opting for Massive Open Online Courses (MOOCs), Study Webs of Active Learning for Young Aspiring Minds (SWAYAM), and Coursera courses as part of the multidisciplinary elective.

Yenepoya(Deemed to be University) will adhere to UGC regulations governing MOOCs/SWAYAM/Coursera courses, incorporating amendments as communicated by UGC over time.To facilitate the seamless completion of chosen courses, the department will appoint a designated course coordinator. The coordinator will guide and support students throughout the duration of the selected online courses.

The evaluation process will adhere to predefined norms and parameters, which will be communicated in the course overview at the time of offering

In Coursera, the assessment are multifaceted and include quizzes or tests at the conclusion of each module, assignments or projects demonstrating the practical application of concepts, active participation in discussion forums, and peer-reviewed assessments. The culmination of each course involves final quizzes or capstone projects tailored to the course's content. Upon successful completion, students receive an online certificate, Yenepoya (Deemed to be University) will integrate the acquired credits into the student's official marks sheet.

In SWAYAM, Assessment will include formative continuous online assessments and end-of-course proctored exams, all of which are mandatory for successful completion by the student. Yenepoya (Deemed to be University) will integrate the marks or grade achieved by the student, conveyed by the Host Institution through the PI of the SWAYAM course, into the student's official marks sheet. These marks contribute to the final award of the degree conferred by the University.

f. Internship

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

3. Eligibility for admission:

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

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

4. Duration of the Programme:

The duration of the programme shall extend over 8 semesters (three academic years with one year internship) each semester comprising minimum of 15 weeks with the minimum of 90 actual working days of instruction in each semester. The successful completion of the

Undergraduate program, along with internship as applicable will lead to Bachelor's degree in Cardiovascular Technology (B.Sc. CVT).

5. Maximum Period for Completion of Programme:

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

6. Aim of the program

To equip the students with a comprehensive understanding of the human cardiovascular system, alongside the technical and clinical skills necessary for the diagnosis, management, and treatment of cardiovascular disorders. It also emphasizes the application of modern tools and techniques in cardiovascular care, ensuring students are proficient in diagnostic procedures such as ECG, TMT, and ECHO, as well as therapeutic interventions like catheter-based procedures. It aims to foster leadership, ethical responsibility, and effective communication within interdisciplinary healthcare teams, while preparing students to navigate the societal and legal aspects of patient care.

By the end of the program, students will be capable of making informed decisions, ensuring patient safety, and contributing to innovative solutions in cardiovascular healthcare.

7. Program outcomes

PO1:Apply knowledge of human cardiovascular system in the management of cardiovascular related disorders and to implement clinical and scientific activities related to the profession of cardiovascular technology(K,S)

PO2 :Identify and solve complex problems arising during cardiovascular care of the patients and to utilize modern tools and techniques in the arena of cardiovascular technology for patient compliance(K,S)

PO3: Act efficiently as a leader in various inter-disciplinary and multi-disciplinary health care communities and to apply the knowledge and skills to assess societal and legal issues related to cardiovascular care of the patients(K,S,C)

PO4: Understand the impact of the cardiovascular technology in societal and environmental contexts to provide innovative solutions(K,S)

Expected skill to be acquired by the end of the programme

PO5: Develop effective technical skills in the performance of diagnostic tests like ECG, TMT, ECHO, assist during TEE, Stress Echo and therapeutic catheter-based procedures.(K,S,A)

PO6: Ability to learn the indications, risks, and benefits of these procedures and to develop a comprehensive understanding of the role of these procedures in the management of patients with cardiovascular disease. (K,S)

PO7:Able to identify whether a procedure is appropriate for the patient referred, recognize risks and benefits of planned procedures, provide patients with necessary information to give a valid informed consent to the procedure, and follow patients following the procedure to ensure optimal management of any procedural complications.(A,K,C)

PO8: Gain knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care.(K,S)

PO9: Develop commitment to carrying out professional responsibilities and an adherence to ethical principles.(A,C)

PO10:Demonstrate interpersonal and communication skills that result in the effective exchange of information and teaming with patients, their families, and professional associates(C,A)

Program structure

	Broad category of course	Hours/Credits	Course (Title)
1.	**Discipline-Specific Courses**		
a)	Theory	**SEMESTER-I**	
		60 hours/4 credits	Human anatomy and Physiology-I
		60 hours/4 credits	Pathology and Microbiology-I
		60 hours/4 credits	Cardiac anatomy and Physiology
		60 hours/4 credits	Basic ECG
		60 hours/4 credits	Human anatomy and physiology- II
		SEMESTER-II	
		60 hours/4 credits	Pathology and Microbiology-II
		60 hours/4 credits	Advanced ECG &Holter monitoring
		60 hours/4 credits	Cardiac embryology
		60 hours/4 credits	Biochemistry
		SEMESTER-III	
		60 hours/4 credits	Systemic Pathology
		60 hours/4 credits	Applied microbiology
		60 hours/4 credits	Introduction to Pharmacology

		60 hours/4 credits	Congenital Heart disease-I
		60 hours/4 credits	Physics and Instrumentation
		SEMESTER-IV	
		60 hours/4 credits	Congenital Heart Diseases-II
		60 hours/4 credits	Clinical cardiology
		60 hours/4 credits	Cardiac stress test and Nuclear cardiology
		60 hours/4 credits	Basic cardiac Cath and hardwares
		SEMESTER-V	
		60 hours/4 credits	Valvular and aortic heart diseases
		60 hours/4 credits	Applied echocardiography
		60 hours/4 credits	Cardiac Cath and Intervention I
		SEMESTER-VI	
		60 hours/4 credits	Ischemic, myo- pericardial heart diseases and cardiac masses
		60 hours/4 credits	Advanced echocardiography
		60 hours/4 credits	Cardiac Cath and intervention –II
b)	Practical (SEC)*	-	-
c)	Clinical	**SEMESER-III**	

	(SEC)*		
		120hours/4credits	Clinical CVT-I
		SEMESER-IV	
		120hours/4credits	Clinical CVT -II
		SEMESER-V	
		120hours/4credits	Clinical CVT-III
		SEMESER-VI	
		120hours/4credits	Clinical CVT-IV
d)	Simulation-based (SEC)*	-	-
2.	**Curriculum Enrichment Courses**		
a)	Field Visit	-	-
b)	Community Posting	-	-
c)	Industry / Clinical Internship	**SEMESTER VII**	
		42 Hours/week / 20 Credits	Internship I
		SEMESTER VIII	
		42 Hours/week / 20 Credits	Internship II

d)	Research Project	-	-
3.	**Electives**		
a)	Discipline-Specific Electives	-	-
b)	Interdisciplinary Courses	45 Hours / 3 Credits per year (any one from the options)	Coursera/Swayam/NSS/Red cross
c)	Ability Enhancement Courses • *Soft skills development* • *Language and communication skill development* • *Analytical skill development*	**SEMESTER-I**	
		45hours/3 credits	English and communication-I
		45hours/3 credits	English and communication-II
		30hours/2 credits	Kannada

	• *Personality and professional development* • *Employability skill development*		
d)	Value Added Courses	**SEMESTER I**	
e)		30hours/2 credits	Constitution of India
f)		**SEMESTER IV**	
g)		30hours/2 credits	Environmental studies
h)		**SEMESTER V**	
i)		30hours/2 credits	Medical ethics
j)		**SEMESTER V**	
k)		30hours/2 credits	Human rights and Gender equity
l)		**SEMESTER VI**	
m)		30hours/2 credits	Biostatistics
	Total	**179 credits**	

9. Attendance

- Each course (theory, practical, clinical etc.) shall be treated as an independent unit for the purpose of attendance. Candidates having minimum 80% attendance in each of the Courses can only qualify to appear for the Semester End Examination. The Candidates with less than 80% of attendance shall be required to repeat that Course by attending the semester.
- There shall be no provision for condonation of shortage of attendance.
- The HOD/Programme Coordinator through the Dean of Faculties shall announce the names of the candidates who will not be eligible to take the Semester End-Examinations (SEE) in the various courses and send a copy of the same to the Controller of Examinations (COE) Office. Registrations of such candidates for those courses shall be treated as cancelled.

10. Teaching - Learning methods course-wise

Teaching - Learning method	**Courses**
Experiential learning	Basic ECG Advanced ECG
Integrated/Inter-disciplinary learning	Cardiac anatomy and physiology Cardiac cath and intervention-I
Participatory learning	Clinical cardiology Cardiac stress test and nuclear cardiology
Problem-solving methodologies	Applied echocardiography

Teaching - Learning method	Courses
	Advanced echocardiography Cardiac catheterization and intervention-I
Self-directed learning	Applied echocardiography
Patient-centric and Evidence-based learning	Physics and instrumentation Congenital heart diseases I and II Cardiac catheterization and intervention-I and II Valvular and aortic heart diseases
The Humanities	Human Rights & Gender Equity
Project-based learning	Applied echocardiography Cardiac stress test and nuclear cardiology
Role-play	Clinical cardiology Cardiac stress test and nuclear cardiology
Team-work	Clinical cardiology Cardiac stress test and nuclear cardiology

Teaching - Learning method	Courses
Reflective writing	Basics in cardiac cath and hardwares Cardiac cath and intervention-II
Any other (Simulation based learning)	Physics and instrumentation Cardiac cath and intervention I Cardiac cath and intervention II

10. Scheme of Examination

- Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by Semester End University Examination (SEE) for each core, SEC, AEC & VAC. The evaluation of Multidisciplinary elective offered by Yenepoya (Deemed to be) University shall be done based on formative assessment.
- The components of CIA (Continuous Internal Assessment) may include sessional tests, Seminar, Assignment/ Social involvement and other activities as determined by the respective speciality.
- There shall be examinations at the end of each semester ordinarily during February/March for odd semesters and during August/September for even semesters.
- The SEE duration shall be 60 minutes for 25 marks paper and 120 minutes for 50 marks paper.
- The various Formative assessment method include Assignments, reports, quizzes, oral presentation, Think-Pair -Share, Chart preparation, brainstorming, reflective writing, concept mapping, peer/self-assessment, etc.

10.1 Examination structure:

The Examination structure shall vary depending on the course, however, broadly divided as follows:

Examination/Assessment	Core/SEC/AEC(English)	AEC(Hindi& Kannada) /VAC
Continuous Internal Assessment	50 Marks	25 Marks
Semester End Examination	50 Marks	25 Marks
Total	**100 Marks**	**50 Marks**

10.2 Multidisciplinary Elective

Multidisciplinary Elective will be assessed through Continuous and Comprehensive assessment throughout the Semester (50 Marks).

i. Evaluation and Certification of Online Courses:-

Evaluation will be based on predefined norms and parameters and announced in the overview of the Course at the time of offering the course. Formative continuous online assessments and end of course proctored exams shall be completed by the student.

The certificate obtained shall be submitted to the college office which will be communicated to the office of the Controller of Examinations of Yenepoya (Deemed to be University).

The Yenepoya (Deemed to be) University will give the equivalent credit weightage to the students for the credits earned through online learning courses through MOOCS/Coursera as per the credit plan of the program.

ii. Credit Mobility of Online Courses:

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

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

The elective course offered by the Yenepoya (Deemed to be University) shall be restricted to a maximum of 3 credits.

A candidate shall compulsorily complete total 9 Credits of Multidisciplinary courses

These courses shall be selected either from the Generic Electives offered by the Yenepoya (Deemed to be) university or from the SWAYAM/Coursera courses. A Candidate shall have freedom to choose the courses of once own choice and learn at their own pace but, require to complete minimum 3 credits before second semester, 6 credits before fourth semester and 9 credits before sixth semester end examination.

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

10.3 Parameters for CIA

Internal Assessment Components	**Core/SEC**	**AEC(English,Kannada) /VAC**
Internal Assessment tests	20	10
Assignment	10	05
Continuous and Comprehensive assessment	20	10
Total Marks	**50**	**25**

10.4 Assessment Methods:

1	Quiz	6	Role Play
2	Group Discussion	7	Peer to Peer Assessment
3	Open Book Exam	8	Mind Mapping
4	Think-Pair-Share	9	Minute paper
5	Presentations	10	Case Study

10.5 Question Paper Pattern for Core course (Internal Assessment & Semester End Examination)

	MAXIMUM MARKS = 50				**Duration**
Type of question	**Number of**	**To be**	**Marks for**	**Total**	

	questions	**Answered**	**each question**		120 minutes
LONG ESSAY TYPE	02	01	10	10	
SHORT ESSAY TYPE	07	05	04	20	
SHORT ANSWERS	12	10	02	20	
			Total	**50**	

	MAXIMUM MARKS = 50				**Duration**
PART A					
Type of question	**Number of questions**	**To be Answered**	**Marks for each question**	**Total**	120 Minutes
LONG ESSAY TYPE	02	01	10	10	
SHORT ESSAY TYPE	02	01	05	05	
SHORT ANSWERS	06	05	2	10	
PART B					
LONG ESSAY TYPE	02	01	10	10	
SHORT ESSAY	02	01	05	05	

TYPE					
SHORT ANSWERS	06	05	2	10	
			Total	**50**	

10.6 Question Paper Pattern for Ability Enhancement Compulsory (AEC) Course

	MAXIMUM MARKS = 25				**Duration**
Type of question	**Number of questions**	**To be Answered**	**Marks for each question**	**Total**	60 minutes
ESSAY	05	03	05	15	
SHORT ANSWERS	07	05	02	10	
			Total	**25**	

10.7 Question Paper Pattern for Value Added (VAC) Course

	SUBJECTS HAVING MAXIMUM MARKS = 25				**Duration**
Type of question	**Number of questions**	**To be Answered**	**Marks for each question**	**Total**	60
ESSAY	05	03	05	15	

SHORT ANSWERS	07	05	02	10	minutes
			Total	**25**	

Practical examination (SEC)

SI.NO	Components	Marks
1	Spotters	10
2	Case scenario/Stations	20
3	Viva Voce	20
Total Marks		50

PARTICULARS OF PRACTICAL, VIVA-VOCE

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

11. Eligibility to appear for University Examination

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

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

Evaluation of a course shall be done based on continuous internal assessment (CIA) mode followed by Semester End University Examination (SEE) for each core, SEC, AEC & VAC. The evaluation of Multidisciplinary elective offered by Yenepoya (Deemed to be) University shall be done based on formative assessment.

The components of CIA (Continuous Internal Assessment) may include sessional tests, Seminar, Assignment/ Social involvement and other activities as determined by the respective speciality.

The marks for CIA shall be 50% and SEE shall be 50%.

The minimum marks for CIA shall be 40% and SEE shall be 40% for a pass, but the minimum marks for pass per course shall be 50% CIA and SEE added together.

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

12. Criteria for passing

The marks for CIA shall be 50% and SEE shall be 50%.

The minimum marks for CIA shall be 40% and SEE shall be 40% for a pass, but the minimum marks for pass per course shall be 50% CIA and SEE added together.

A candidate shall be declared to have passed the UG programme if he/she secures at least CGPA of 5.0 (Course Alpha-Sign Grade P) in the aggregate of both Internal Continuous Assessment and Semester End Examination.

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

13. Grading and Classification

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

a. **Letter Grades and Grade Points:**

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

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

Letter Grade	Marks	Grade Point
O (Outstanding)	90-100	10
A+ (Excellent)	80-89	9
A (Very Good)	70-79	8
B+ (Good)	60-69	7
B(Above Average)	55-59	6
P (Pass)	50-55	5
F (Fail)/ RA (Reappear)	Below 50	0
Ab (Absent)		0

*The Marks with 0.5 shall be rounded up to the next whole number.

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

b. **The Semester Grade Point Average (SGPA)**

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

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

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

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

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

c. **Cumulative Grade Point Average (CGPA)**

The CGPA is calculated with the SGPA of all the VI semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VI semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s)

is/are passed. When the program(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

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

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

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

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

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

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

The SGPA & CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Cumulative Grade point (CGPA) & Letter grade

The results at the end of six semesters shall be classified on the basis of CGPA obtained and the corresponding overall letter grade.

The letter grade as described below shall be adopted:

Letter Grade	CGPA Range
O (Outstanding)	9.0-10.0
A+ (Excellent)	8.0-8.99
A (Very Good)	7.0-7.99
B+ (Good)	6.0-6.99
B(Above Average)	5.5-5.99
C (Average)	5.0-5.49

Note: The CGPA will be calculated only after the successful completion of all the six semesters.

14. Any other information (Progression Criteria, Re-entry after break of the study, Evaluation of Answer Scripts, Internship)

15.1 Progression Criteria

- The students are allowed to carry over any number of courses till sixth semester. But student is eligible to appear for the End semester exam of sixth semester if he/she has cleared all the Courses both Core, AEC, SEC & VAC of first, second, third & fourth semesters. If student has any pending course of first to fourthsemesters, he/she is not eligible to appear for the endsemester exam of the sixth semester. However, Fifth semester courses are allowed to club with sixth semester end examination. But, all the Core, AEC, SEC & VAC of first to fourth semester should be completed to be eligible for sixth semester End Semester Examination.
- Candidate should clear all Courses (Core, AEC, SEC, VAC & ME) of all the semester, to be eligible to start the one year of mandatory internship.

- A fail in any one Course will mean the candidate has to reappear for the exam in that Course only.
- A candidate who passes the semester examinations in parts is eligible for only CGPA and letter grade but not for award/medal from the University.

15.2 Re-Entry after Break of the study

- Candidates admitted to a program abstaining for more than 3 months must seek readmission into the appropriate semester.
- The candidate shall follow the syllabus in vogue (currently approved/is being followed) for the program.
- All re-admissions of candidates are subject to the approval of the University.

15.3 Evaluation of Answer Scripts

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

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

15.4 Internship

A candidate has to mandatorily complete 1 year (2 semesters) of internship. The total credit per semester is 20 and for two semesters it is 40.

- **Eligibility:**A candidate should have passed in all the courses (Core, AEC, VAC and Multidisciplinary Electives) amounting to 137 number of credits before entering in to internship.

- **Internship guidelines:**Each semester of Internship shall be minimum of 20 credits. The credits are calculated based on 1 credit = 3 to 5 hours of practical training. There shall be an exit exam at the end of the each semester at the college level.

Components of Exit Exam

SI.No.	Components	Marks
1	Spotters	30
2	Case scenario/Stations	30
3	Viva Voice	40
Total Marks		100

PARTICULARS OF PRACTICAL, VIVA-VOCE

- Practical examination will be aimed at examination of clinical skills and competence of the candidates for undertaking independent work as a Cardiovascular Technologist.
- Viva- Voce examination shall aim at assessing, i.e., depth of knowledge, logical reasoning, confidence &oral communication skills.
- OSCE/OSPE- shall have minimum of 3 stations.

SEMESTER-I

HUMAN ANATOMY AND PHYSIOLOGY

PART A- HUMAN ANATOMY

Course: Core

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

- **Course Outcomes:**

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

  CO1: To identify and locate each of the body systems to apply anatomical knowledge to perform minor technical procedural skills.

  CO2: To know the normal disposition of the structures in the body while clinically examining a patient and while conducting clinical procedures.

  CO3: To know the anatomical basis of disease and injury

  CO4: To discuss the interrelationship of systems in maintaining homeostasis.

  CO5: To describe the structure of each body system

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type Of Questions
Unit 1	4hrs	Introduction: Human body as a whole 1.1 Definition of anatomy and its divisions 1.2Terms of location, positions, and planes 1.3 Cell and its organelles. 1.4Epithelium: definition, classification, describe with examples, function. 1.5 Glands: classification, describe serous & mucous glands with examples. 1.6 Basic tissues: classification with examples 1.7Demonstration: Histology of types of epithelium. Histology of serous, mucous & mixed salivary gland.	√			10%	SE & SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type Of Questions
Unit 2	5hrs	Locomotion and support 2.1Bone: classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, inter-vertebral disc, fontanelles of fetal skull. 2.2 Joints: classification of joints with examples, synovial joint (in detail for radiology). 2.3Muscular system: classification of muscular tissue & histology, names of muscles of the body. 2.4 Demonstration: Bones & joints. Histology of compact bone (TS & LS). Demonstration of all muscles of the body. Histology of skeletal, smooth &cardiac muscle (TS & LS). Histology of the 3 types of cartilage. Demo of all bones showing parts, radiographs of normal.	√			15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type Of Questions
Unit 3	5hrs	Cardiovascular system 3.1Heart: size, location, chambers, exterior & interior, blood supply of heart 3.2 Systemic &pulmonary circulation, branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery, peripheral pulse, inferior vena cava, portal vein, Porto-systemic anastomosis, great saphenous vein, Dural venous sinuses. 3.3 Lymphatic system: cisterna chyli& thoracic duct, histology of lymphatic tissues, names of regional lymphatics, axillary and inguinal lymph nodes in brief. 3.4 Demonstration of heart and vessels in the body. Histology of large artery, medium sized artery & vein,	√			25%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type Of Questions
		large vein. Histology of lymph node, spleen, tonsil & thymus. Normal chest radiograph showing heart shadows.					
Unit 4	10hrs	Gastro-intestinal system 4.1 Parts of GIT, oral cavity, lip, tongue, dentition, pharynx, oesophagus, stomach, small and large intestine,liver,gall bladder, pancreas. 4.2 Tonsil, salivary glands extrahepatic biliary apparatus,Waldeyer's ring 4.3Demonstration of parts of gastro intestinal system. Normal radiographs of gastro intestinal system. Histology of gastro intestinal system.	√			30%	LE, SE, SA
Unit 5	4hrs	Respiratory system 5.1 Parts of RS, nose, nasal cavity, larynx, trachea, lungs, broncho-pulmonary segments, histology of	√			15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type Of Questions
		trachea, lung and pleura, names of paranasal air sinuses. 5.2 Demonstration of parts of respiratory System Normal radiographs of chest. - Histology of lung and trachea.					
Unit 6	2hrs	Embryology 6.1Spermatogenesis & oogenesis. Ovulation, fertilization. Fetal circulation. Placenta, Demonstration of models.		√		5%	SE, SA

- **LE**- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Recommended books:

1. PriyaRanganath, LeelavathyN,Basics in Human Anatomy for BSc Paramedical Courses,Revised and updated edition, The Health
2. Chaurasia BD. Human anatomy. CBS Publisher; 2004.
3. Vishram Singh, Textbook of Anatomy, Revised and updated edition, Elsevier
4. Waugh A, Grant A. , Ross &Wilson Anatomy and physiology in health and illness E-book. Elsevier Health Sciences; 2014 Jun 25.
5. Inderbir S. Textbook of human histology with color atlas. New Delhi: JaypeeBrothersMedical Publishers. 2006.

PART B- PHYSIOLOGY

- **Course Outcomes:**

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

CO1: To demonstrate the understanding of physiological structure of Renal system, endocrine system, Nervous system and special senses.

CO2: To broadly identify the clinical abnormalities of organs and its clinical physiological implications

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
Unit 1	2hrs	**General Physiology** 1.1 Introduction to physiology 1.2 Homeostasis: Definition, Positive feedback, negative feedback. PH 1.3 Body Fluid Compartments	√	√		15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
Unit 2	5hrs	**Muscle Nerve physiology** 2.1.1Introduction, Classification and structure of muscle, sarcomere 2.2Neuromuscular junction, Transmission across neuromuscular junction. 2.3 Excitation contraction coupling. Mechanism of muscle contraction, rigor mortis.	√	√		20%	LE, SE, SA
Unit 3	7hrs	**Blood** 3.1 Introduction: composition and function of blood. 3.2 Blood Cells: types, Normal Count 3.3 Red blood cells: function. Erythropoiesis: Definition, Stages,	√	√		25%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Factors affecting 3.4 Hemoglobin: Function, concentration Physiological variation of RBC Count and Hb 3.5 White blood cells: different types, functions, normal count, differential count 3.6 Platelets: origin, normal count, functions. 3.7 Hemostasis: definition, steps, clotting factors, mechanism of clotting, disorders of clotting 3.8 Blood groups: ABO system, Rh system: Rh factor, Rh incompatibility. 3.9 Blood grouping & typing, cross					

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		matching. 3.10 Blood transfusion: indication, universal donor and recipient concept. Selection criteria of a blood donor, transfusion reactions. 3.11 Anaemias: definition, Symptoms and signs (brief). 3.12 Blood indices: colour index, MCH, MCV, MCHC (def and Normal Values). 3.13 ESR and PCV: normal values, definition, determination (methods). 3.14Plasma proteins: types and concentration, functions of albumin, globulin, fibrinogen, prothrombin.					

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		3.15 Blood volume: normal value, determination of blood volume					
Unit 4	8hrs	**Cardiovascular system** 4.1 Heart: physiological anatomy, nerve supply. 4.2Properties of cardiac muscle PH 4.3Cardiac cycle: definition, systole, diastole, phases, JVP(brief) 4.4Cardiac output, stroke volume, EDV (only definitions). 4.5 Heart sounds, normal heart sounds, mechanism and features, areas of auscultation.	√	√		20%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		4.6 Blood pressure: definition, normal value, clinical measurement of blood pressure, hypotension, hypertension 4.7Heart rate: Physiological variations, regulation (brief), radial pulse 4.8Electrocardiogram (ECG): Definition, Normal ECG, Causes of ECG waves, Uses of ECG. 4.9Cardiac shock: Definition, Types (brief), Triple response.					
Unit 5	6hrs	**Respiratory system** 5.1Introduction: Functions of respiratory system, physiological anatomy of respiratory system, respiratory tract 5.2Respiratory organs:	√	√		20%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		lungs, alveoli, respiratory membrane 5.3Mechanism of breathing: Inspiration and Expiration, muscles involved, Mechanism. 5.4Surfactant: Composition, Function, 5.5Transport of oxygen: forms of transport, Oxygen Hemoglobin Curve. 5.6Lung volumes and capacities: Spirogram, Definitions and normal Volumes. 5.7Regulation of respiration: Nervous and chemical regulation, respiratory centre, Herring Breur reflexes. 5.8Hypoxia: Def, Classification, Description (in brief).					

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		5.9 Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea.(Definition Only)					

- **LE-** Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

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

PATHOLOGY &MICROBIOLOGY-I

Course: Core

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

PART A- PATHOLOGY

Course Outcome:

At the end of the course, the student should be able to:

CO1: Explain the blood cells structure, functions & its formation.

CO2: Enumerate the methods of estimating cell counts.

CO3: Demonstrate blood collection by various methods

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of questions
Unit 1	2 hrs	Introduction to Pathology		√		5%	SA
Unit 2	12 hrs	Hematology 2.1. Normal constituents of Blood, their structure and functions. 2.2. Collection of Blood samples. 2.3. Various anticoagulants used in hematology. 2.4. Hemoglobin estimation, different methods and normal values. 2.5. RBC count. 2.6. WBC count. 2.7. Platelet count.	√			35%	LE,SE, SA
Unit 3	10 hrs	Blood Bank 3.1. Introduction to blood banking. 3.2. Blood group system: ABO & Rh system.	√			30%	LE,SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of questions
		3.3. Methods of blood grouping: Forward & Reverse. 3.4. Donor selection criteria. 3.5. Collection and processing of blood for transfusion.					
Unit 4	6 hrs	Clinical Pathology 4.1. Collection, transport, preservation and processing of various clinical specimens. 4.1.1 Urine. 4.1.2 CSF. 4.1.3 Stool. 4.1.4 Sputum. 4.1.5 Body fluids. 4.1.6 Urine examination-collection and preservation, Physical, chemical and microscopicexamination for abnormal constituents.	√			30%	LE,SE, SA

- **LE-** Long Essay**, SE-** Short Essay**, SA-** Short Answer

- **Recommended Books**

1) Makroo RN. Blood Transfusion Reactions. In: Compendium of transfusion medicine.2nd ed. 2009;332-345
2) Dr.RamdasNayak ,text book of Hematology and Clinical pathogy.
3) Godkar PB, Godkar DP. Textbook of medical laboratory technology. Bhalani; 2003.

PART B- MICROBIOLOGY

- **Course Outcome:**

At the end of the course, the student should be able to:

CO1: The general criteria for microbial classification, Types of culture medias and methods.

CO2: Identify key concepts of immunology.

CO3: Implement the common sterilization and disinfection methods.

CO4: Outline and practice general biomedical waste management.

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 1	5Hrs	**Introduction** 1.1 Introduction & history of Microbiology 1.2 Classifications of microorganisms & structure of bacteria 1.3 Microscopy and types of	✓			**10%**	LE, SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		microscope					
Unit 2	3 Hrs	**Growth & Nutrition** 2.1 Nutrition, growth and multiplication of bacteria, Bacterial Growth Curve 2.2 Culture medias 2.3 Culture methods	✓			**10%**	LE, SE,SA
Unit 3	4 Hrs	**Sterilization & Disinfection** 3.1 Classification of Sterilization and Disinfection 3.2Sterilization:Differentmethods of sterilization, Principles and use of equipment's of sterilization- Hot Air oven &Autoclave in detail 3.3 Disinfection: Commonly used chemical disinfectants and their uses	✓			**30%**	LE, SE
Unit 4	9 Hrs	**Immunology** 4.1 Immunity-Classification and types	✓			**30%**	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		4.2 Antigen 4.3 Antibody 4.4 Antigen antibody reactions 4.5 Hypersensitivity reactions 4.6 Immunization schedule					
Unit 5	4 Hrs	**Infection** 5.1 Infection- Definition, types, sources and mode of transmission 5.2 Hospital acquired infections 5.3 Types of infectious diseases- outbreak, endemic, epidemic, pandemic	✓			10%	SE,SA
Unit 6		**Applied Microbiology** 6.1 Biomedical Waste Management: Principles & Practices 6.2 Standard precautions 6.3 Hand hygiene technique and body fluids spill management	✓			**10%**	SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		6.4 Needle stick injury management-1					

- **LE**- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Recommended Books:

1. Baveja CP. Textbook of microbiology. Arya Publications; 2005.
2. Ananthanarayan R. Ananthanarayan and Paniker's textbook of microbiology. Orient Blackswan; 2006.
3. Owen JA, Punt J, Stanford SA, Jones PP, KubyJ.Kuby immunology. Seventh edition, International edition. Basingstoke: Macmillan Higher Education; 2013

CARDIAC ANATOMY AND PHYSIOLOGY

Course: Core

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

- **Course Outcomes:**

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

  CO1: Understand the normal structure and functioning of the heart.

  CO2: Understand the cardiac hemodynamic.

CO3: Have a knowledge on the generation of normal heart sounds and their variations in different disease conditions

CO4: Understand the arterial and venous supply of the heart and body.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Questions
Unit-1	6	1.1 Medical Terminology		✓		10%	SE
		1.2 Systemic and pulmonary circulation	✓				LE,SE
Unit 2	6	Cardiac Cycle 2.1 Phases of systole 2.2 Phases of diastole 2.3 Event timings	✓			10%	LE,SE
Unit 3	6	**Cardiac anatomy** 3.1 Endocardium 3.2 Myocardium 3.3 Pericardium	✓			10%	LE,SE
Unit 4	9	**Valves and cardiac**	✓			15%	LE,SE

		chambers 4.1 Mitral valve **4.2** Tricuspid valve 4.3 Aortic valve 4.4 Pulmonary valve **Chamber identification** 4.5 Right atrium, right ventricle 4.6 left atrium ,left ventricle		✓			
			✓				
				✓			
Unit 5	6	**Conduction system of the heart** 5.1 SA node 5.2 AV node 5.3 Bundle of His 5.4 Bundle branches 5.5 Purkinje fibers	✓			10%	LE,SE,SA
Unit 6	4	**Normal Anatomical Variants** 6.1 Right heart Variants 6.2 Left heart Variants		✓		6%	SE,SA

Unit 7	14	**7.1 Arterial supply of the heart** **7.2 Coronary venous anatomy** **7.3 Aorta and its branches** **7.4 Peripheral circulations** **7.5 Vena cava and its branches**	✓			23%	SE,SA
Unit 8	9	**Miscellaneous** 8.1 Blood pressure 8.2 Introduction to heart sounds and murmurs 8.3 Cardiogenic Shock	✓			15	LE,SE

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. Chaurasia BD. BD Chaurasia's Human Anatomy. CBS Publishers & Distributors PVT Ltd.; 2010.
2. Sampath Madhyastha Manipal Manual of Anatomy for Allied Health Sciences,New Delhi :CBS publishers & distributors

BASIC ECG

Course: Core

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

Course Outcomes:

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

CO1:Have an idea on cardiac electrophysiology

CO2: Understand the technical basis of ECG recording

CO3: Gain theoretical knowledge on normal ECG variables.

CO4: Gain theoretical knowledge on the common abnormalities in ECG

CO5: Gain basic practical skill to interpret a given ECG

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit -1	6	**Conduction system of the heart** 1.1 SA node 1.2 AV node 1.3 Bundle of His 1.4 Bundle branches 1.5 Purkinje fibers	✓			10%	LE,SE
Unit 2	4	**Electrophysiology of the heart** 2.1 Intracellular potential 2.2 Electrical potential produced by normal cardiac muscle 2.3 Relative and Absolute refractory	✓			7%	SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		period					
Unit 3	13	**Conventional Electrocardiographic Leads** 3.1 Unipolar 3.2 Bipolar 3.3 Lead placement 3.4 Electrical axis 3.5 Rhythm 3.6 Heart rate	✓			23%	LE,SE
Unit 4	10	**Basic Electrocardiographic deflections** 4.1 Standardization 4.2 P wave 4.3 QRS genesis & morphology 4.4 ST segment 4.5 T wave & U wave 4.6 PR interval, PR segment 4.7 QTc interval 4.8 True dextrocardia and Technical dextrocardia	✓			11%	LE,SE,SA
Unit	3	**Chamber hypertrophy and**	✓			5%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
5		**enlargement** 5.1 Left ventricular hypertrophy –Volume/pressure overload 5.2 Right ventricular hypertrophy - Volume/pressure overload 5.3 Bi-ventricular hypertrophy 5.4 Left,right and bi-atrial enlargements					
Unit 6	8	Intra-ventricular conduction abnormalities 6.1 Bundle branch blocks 6.2 Fascicular block	✓			6%	SE,SA
		6.3 Bifascicular&Trifascicular block 6.4 AV blocks		✓			SE,SA
Unit 7	13	**Myocardial Infarction** 7.1Ischemia, injury, infarction 7.2ST-T changes 7.3changes in QRS complex	✓			20%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		7.4 localization of MI 7.5 Identification of culprit vessel 7.6 Right ventricular MI and 7.7 Atrial MI 7.8 MI associated with bundle branch blocks					
Unit 8	3	**Pericarditis** 8.1 ECG findings 8.2 Differentiating with MI	✓			5%	SE,SA

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

References Books:

1. Leo Schamroth ,.Introduction to electrocardiography, Wiley publisher 8th edition 2018
2. Marriott's Practical Electrocardiography, LWW publisher 12th Edition 2013
3. Mervin J Goldman . Principles of Clinical Eclectrocardiograpgy, 12th edition

ENGLISH AND COMMUNICATION – PART - 1

Course: AEC

Semester : 1

Credits: 3 **No of Hours: 45 Hours**

- **Course Outcomes:**

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

CO1: Acquire the LSRW (Listening, Speaking, Reading, and Writing) skills. Through Cambridge Interchange Fifth Edition, students will develop real world communication skills- enhancing fluency in speaking, listening, reading and writing – wile mastering grammar, expanding vocabulary and improving pronunciation with supportive digital tools.

CO2: Learn to appreciate Literature.

CO3: Be aware of social responsibilities.

CO4 : Enhance the analytical skill

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit I	10hrs	**UNIT 1: CAMBRIDGE: INTERCHANGE FIFTH EDITION** 1.1 Good Memories 1.2 Life in the City 1.3 Making Changes 1.4 Have you ever tried it? 1.5 Hit the Road. 1.6 Sure. I will do it. 1.7 What do you use this for? 1.8 Time to Celebrate.	√			23%	SA
Unit II	8hrs	**UNIT- II: PHONETICS** 2.1 Brief Introduction 2.2 Classification of Vowels, Diphthongs and Consonants 2.3 Pronouncing the words phonemically and transcribing them into	√			18%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		Phonetics 2.4 IPA					
Unit III	11hrs	**UNIT – III: Grammar and Written Communication** 3.1 Parts of Speech 3.2 Verb Tenses 3.3 Articles 3.4 Capitalization and Punctuation 3.5 E-mail Drafts 3.6 Formal Letters 3.7 Essay Writing	√			24%	SA
Unit IV	4hrs	**UNIT – IV : Prose** 4.1 Steev Jobs : Commencement Address 4.2 Mother Teresa's Award	√			9%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		Winning Speech					LE, SE
Unit V	6hrs	**UNIT – V: Poetry** 5.1 The Road Not Taken : Robert Frost 5.2 The Man with the Wooden Leg : Catherine Mansfield 5.3 Our Casuarina Tree : Toru Dutt	√			13%	LE, SE
Unit VI	6hrs	**UNIT – VI : Short Stories** 6.1Gift of the Magi : O' Henry 6.2Kabulivala : Rabindranath Tagore 6.3The Blue Umbrella : Ruskin Bond		√		13%	LE, SE

- **LE**- Long Essay**, SE**- Short Essay**, SA**- Short Answer

- **Recommended Books:**

1. Cambridge: Interchange Fifth Edition
2. Contemporary English Grammar Structures & Composition by David Green
3. English Grammar and Composition: Wren & Martin
4. English Grammar in Use by Raymond Murphy

CONSTITUTION OF INDIA

Course: VAC

Credits: 2 **No of Hours: 30 Hours**

- **Course Outcome:**

At the end of this course, students will gain knowledge on

CO1: This course is to keep the students abreast with the knowledge of the Constitution of India.

CO2: To make the students understand the importance of human rights as citizens of India.

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 1	5hrs	Indian Constitution • Meaning and Importance of Constitution • The Constituent Assembly • The Preamble • Salient Features of Constitution	√			**10%**	SE, SA
Unit 2	3hrs	Fundamental Rights and Directive Principles • Meaning and Differences between Fundamental Rights and Directive Principles • Fundamental Rights • Rights Information Act Meaning ,importance of RTI 2005	√			20%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 3	4hrs	Union Government • The President of India-Election ,Powers and Position • Prime Minister and Council of Ministers • Parliament – Loksabha ,Rajyasabha- Organisations and Powers	√			15%	LE, SE, SA
Unit 4	4hrs	State Government • The Governor • Chief Minister and Council of Ministers • State	√			10%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
		Legislature Vidhanasabha ,vidhanaParishad-Organisations and Powers					SE, SA
Unit 5	2hrs	Federalism in India • Meaning Federal and Unitary Features	√			10%	SE, SA
Unit 6	2hrs	The Judiciary • The Supreme Court-Organization ,Jurisdiction and Role • The High Court-Organization ,Jurisdiction and Role	√			10%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 7	2hrs	Electoral Process In India • Election Commission – Organization ,Functions	√			10%	SE, SA
Unit 8	2hrs	Local Governments • Rural and Urban- Organization ,Powers and Functions	√			5%	SE, SA
Unit 9	3hrs	Human Rights • Human Rights- Meaning • Universal Declaration of Human Rights • Remedies against Violation of Human Rights in India	√			5%	LE, SE, SA
Unit	3hrs	Special Constitutional	√			5%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
10		Provisions • Special Rights created in the constitution for: Dalits , Backwards ,Women and Children and the Religious and Linguistic Minorities. • Constitution and Sustainable Development in India • Minority Commission in India					SE, SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

- **Recommended Books**

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

- ParvathyAppaiah, Human Rights. DivyaDeepa Publication Mangalore; 2016
- RajRam. M, Constitution of India Himalaya Publication, New Delhi; 1999

SEMESTER-II

HUMAN ANATOMY & PHYSIOLOGY II

Course: Core

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

PART A- HUMAN ANATOMY

- **Course Outcomes:**

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

CO1. To identify and locate each of the body systems to apply anatomical knowledge to perform minor technical procedural skills.

CO2. To know the normal disposition of the structures in the body while clinically examining a patient and while conducting clinical procedures.

CO3. To know the anatomical basis of disease and injury

CO4. To discuss the interrelationship of systems in maintaining homeostasis.

CO5. To describe the structure of each body system

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	
Unit 1	5hrs	Urinary system 1.1 Kidney, ureter, urinary bladder, male and female urethra. 1.2 Demonstration of parts of urinary system. Histology of kidney, ureter, urinary bladder.	√			15%	LE, SE, SA
Unit 2	10hrs	Reproductive system 2.1Parts of male reproductive system, testis, vas deferens, epididymis, prostate 2.2 Parts of female reproductive system, uterus, fallopian tubes, ovary 2.3 Mammary gland: 2.4 Demonstration of section of male and female pelvis with organs in situ. Histology of male and female reproductive organs.	√			30%	LE, SE, SA
Unit 3	3hrs	Endocrine glands 3.1Endocrine glands: pituitary gland, thyroid gland, parathyroid gland, suprarenal gland 3.2 Demonstration of the glands. Histology of pituitary,		√		15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	
		thyroid, parathyroid, suprarenal glands.					
Unit 4	10hrs	Nervous system 4.1 Neuron, classification of nervous system, cerebrum,cerebellum,midbrain,pons, medullaoblongata,spinalcordwithspinalnerve,meninges, ventricles & cerebrospinal fluid, names of basal nuclei, blood supply of brain, cranial nerves. Sympathetic trunk& names of parasympathetic ganglia 4.2 Histology of peripheral nerve & optic nerve. Demonstration of all plexuses and nerves in the body. Demonstration of all parts of brain. Histology of cerebrum, cerebellum, spinal cord.	√			25%	LE, SE, SA
Unit 5	2hrs	Sensory organs 5.1 Skin: histology, appendages of skin. 5.2 Eye: parts of eye & lacrimal apparatus. Extra-ocular muscles & nerve supply. 5.3 Parts of ear: external, middle, and inner ear and contents. 5.4 Histology of thin and thick skin. Demonstration and histology of eyeball. Histology of cornea & retina.		√		15%	SE, SA

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

- **Recommended Books**

1. Chaurasia BD. BD Chaurasia's Human Anatomy. CBS Publishers & Distributors PVt Ltd.; 2010.
2. SampathMadhyastha, Manipal Manual of Anatomy for Allied Health Sciences,New Delhi: CBS publishers and distributors.

3. Waugh A, Grant A. Ross & Wilson Anatomy and physiology in health and illness E-book. Elsevier Health Sciences; 2014 Jun 25.
4. Dilly PN. Essentials of Human Embryology. Postgraduate Medical Journal. 1984 Jun;60(704):447.
5. Inderbir S. Textbook of human histology with color atlas. New Delhi: Jaypee Brothers Medical Publishers. 2006.
6. PriyaRanganath, Leelavathy N, Basics in Human Anatomy for BSc Paramedical Courses, Revised and updated edition, The Health

PART B- PHYSIOLOGY

- **Course Outcomes:**

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

CO1: To demonstrate the understanding of physiological structure of Renal system, endocrine system, Nervous system and special senses.

CO2: To broadly identify the clinical abnormalities of organs and its clinical physiological implications

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
Unit 1	5hrs	**Digestive System** 1.1 Introduction 1.2Physiological anatomy of gastro intestinal tract (All Structures in brief), functions of digestive system 1.3Functions of	√			15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Saliva 14Deglutition: definition, stages 1.5Stomach: functions 1.6Gastric secretion: composition, function, Phases of secretion 1.7Pancreas: Functions (exocrine), pancreatic juice: composition and regulation. Secretin and CCK-PZ 1.8Liver: Functions , Bile secretion, composition, function of bile; 1.9Bilirubin metabolism, types of bilirubin, Vandenberg reaction, Jaundice: types, significance. 1.10Gall bladder: Functions.					

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		1.11Small intestine: functions, digestion and absorption, movements. (brief) 1.12Large intestine: functions, defecation reflex					
Unit 2	5 hrs	**Renal system** 2.1 Introduction: Functions of kidneys, composition of urine, nephron, cortical and juxtamedullary nephrons (comparison), 2.2 Juxta Glomerular Apparatus: structure and function. 2.3 Mechanism of urine formation 2.4 GFR: Definition, Normal Values, factors effecting GFR, Measurement (Creatine, Inulin Clearance). Tubular reabsorption, TMG,	√	√		15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Tubular secretion (brief). 2.5Mechanism of urine concentration: Counter-current mechanisms, Role of ADH 2.6 Micturition, innervation of bladder, cystometrogram.					
Unit 3	2 hrs	**Skin and Body temperature** 3.1Structure and function of Skin 3.2 Body Temperature: physiological variation. 3.3 Regulatory mechanisms: Mechanisms Activated by Heat/Cold 3.4 Role of hypothalamus, and fever.	√	√		10%	SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
Unit 4	5 hrs	**Endocrine System** 4.1 Introduction: Definition, classification of endocrine glands & their hormones. 4.2 Hypothalamo-pitiutary Axis 4.3 Pituitary hormones: anterior and posterior pituitary hormones, Functions of Growth hormone, 4.4 Thyroid gland: Thyroid Hormones: physiological function, regulation of secretion, disorders: hypo and hyper secretion of hormone. 4.5Adrenal cortex: functions of Cortisol and Aldosterone 4.6 Adrenal medulla: functions of		√		15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Adrenalline and Noradrenalline . 4.7Pancreas (Endocrine): Hormones of pancreas. 4.8Insulin: functions, regulation of blood glucose level, Diabetes mellitus 4.9 Regulation of Calcium Metabolism: Hormones involved, actions of PTH, Calcitonin, Vit D3					
Unit 5	5 hrs	**Reproductive system** 5.1 Introduction, Function of reproductive system, Changes during puberty. 5.2 Male reproductive system: functions of testes Spermatogenesis:	√	√		15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Definition, site, stages, factors influencing, Endocrine functions of testes. 5.3 Androgens: testosterone functions. 5.4 Female reproductive system 5.5Menstrual cycle: Definition, changes, ovulation 5.6 Functions of progesterone and estrogen 5.7 Physiological changes during pregnancy, Lactation(brief), milk ejection reflex					
Unit 6	3 hrs	**Special senses** 6.1 Vision: Functions of different parts(brief) 6.2 Optic Pathway, Dark Adaptation,	√	√		15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Colour vision. 6.3Hearing: Function of Middle Ear, Functions of inner ear, mechanism of hearing (brief). 6.4Chemical Senses: Taste: types, receptor, Smell: physiology, receptors.					
Unit 7	7 hrs	**Nervous system** 7.1 Introduction: Parts of CNS and PNS, Functions of nervous system 7.2Neuron: definition ,structure 7.3 Nerve Fibre: classification, conduction of impulses continuous and saltatory. 7.4Synapse: Definition, structure, types, properties (brief). Receptors:	√	√		15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		definition, classification, properties (brief). 7.5Reflex : Definition, Reflex Arc, Examples. 7.6Spinal cord nerve tracts: Diagram and Functions: Lateral Spino Thalamic Tract, Dorsal Column, Pyramidal Tract. 7.7Spinal cord nerve tracts: Diagram and Functions: Lateral Spino Thalamic Tract, Dorsal Column, Pyramidal Tract. 7.8Cerebro Spinal Fluid (CSF): site of formation, circulation (brief), functions. 7.9Autonomic Nervous System:					

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Questions
		Sympathetic and parasympathetic distribution and functions (brief).					

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

- **Recommended Books**

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

PATHOLOGY & MICROBIOLOGY-II

Course: Core

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

PART A- PATHOLOGY

- **Course objectives:**

CO1: To study fundamental aspects of different groups of microorganisms and their importance.

CO2: To compute medically important infective organisms and their diagnosis.

CO3: To enumerate the common infections of bacteria, virus, parasite and fungi.

CO4: To understand fundamental analytical principles and process used in histopathology

➢ **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 1	12 hrs	Histopathology 1.1 Introduction to histopathology 1.2. Grossing technique 1.3. Tissue processing (Fixation, Dehydration, Clearing & Impregnation) 1.4. Embedding technique 1.5. Section cutting 1.6. H&E staining	√			30%	LE,SE, SA
Unit 2	6 hrs	Cytology 2.1. Introduction to cytology. 2.2 FNAC 2.3. PAP stain.	√			25%	SE, SA
Unit 3	12 hrs	General Pathology 3.1. Cell injury: Agents causing cell injury, cellular adaptations (hypertrophy, atrophy, hyperplasia, metaplasia) reversible	√			45%	LE,SE, SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of questions
		and irreversible injury. 3.2. Inflammation: Cardinal signs of inflammation, acute and chronic inflammation. Laboratory tests in inflammation. 3.3. Hemodynamic Edema & shock Thromboembolism & Infarction. 3.4. Neoplasia: Definition of neoplasm, differences between benign and malignant tumors, Carcinogenesis. 3.5. Genetic disorders: Introduction to genetic disease and classification of geneticdisorder.					

➢ **Recommended Books:**

1. Histopathology techniques and its management –by Dr.Ramdas Nayak
2. RamnikSood ,Text book of Medical Laboratory Technology 6th Edition, Vol 1 & 2

PART B- MICROBIOLOGY

➢ **Course Outcomes:**

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

CO1: To outline fundamentals aspects of microbiology including origin, evolution of microorganisms, different groups of microorganisms and their importance, microscopy principles and applications, morphology, and structure.

CO2: To explain microbiological media, isolation, cultivation and enumeration methods of microorganisms, microbial growth characteristics, maintenance, and preservation of microbial cultures

CO3: To develop knowledge on basic immunological concepts.

CO4: To develop knowledge on basic immunological concepts.

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 1	**11Hrs**	**Systematic Bacteriology** **1.1** Overview of common bacterial infections & bacterial virulence factors and Antimicrobial sensitivity test **1.2** Morphology, pathogenesis and laboratory diagnosis of medically important	✓			**30%**	**LE, SE,SA**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		bacteria (Staphylococcus aureus & MRSA, Pneumococcus. Enterobacteriaceae- Salmonella (Enteric fever), E. coli, Vibrio cholerae, Mycobacterium tuberculosis **1.1** Biochemical reactions and identification of bacteria.					
Unit 2	**8Hrs**	**Virology** 2.1 Nutrition, growth and multiplication of bacteria, Bacterial Growth Curve 2.2 Morphology, pathogenesis and laboratory diagnosis of (HIV-1, Hepatitis viruses- Hepatitis B & Hepatitis C virus, Rabies-1, Arbo viruses- Dengue virus	✓			**30%**	**LE, SE,SA**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 3	**4 Hrs**	**Mycology** 3.1 Introduction to Mycology-1 3.2 Morphology, pathogenesis and laboratory diagnosis of (Dermatophytes, Candida, Cryptococcus)	✓			**20%**	**LE, SE,SA**
Unit 4	**7Hrs**	**Parasitology** 4.1 Introduction to Parasitology. 4.2 Morphology, Life cycle, pathogenesis and laboratory diagnosis of (E.histolytica, Plasmodium, Ascaris, T.solium, T.saginata, Ancylostoma)	✓			**20%**	**LE, SE,SA**

❖ **LE**- Long Essay**, SE**- Short Essay**, SA-** Short Answer

Recommended Books:

1. Baveja CP. Textbook of microbiology. Arya Publications; 2005.

Ananthanarayan R. Ananthanarayan and Paniker's textbook of microbiology. Orient Blackswan; 2006.

ADVANCED ECG& HOLTER MONITORING

Course: Core

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

- **Course Outcomes:**

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

  CO1:Gain knowledge in Diagnosis of an arrhythmia

  CO2:Understand the origin and mechanism associated with arrhythmias

  CO3:Correlate ECG findings to a reach a clinical interpretation.

  CO4:Gain knowledge and to enable the diagnostic skill in interpretation of any given ECG.

  CO5:Evaluate cardiac related symptoms by Holter monitoring and analyzing.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit-1	4	**Genesis of cardiac arrhythmias** 1.1 Automaticity 1.2 Triggered activity 1.3 Re-entry mechanism	✓			6%	SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 2	4	**Sinus nodal disturbances and arrhythmias** 2.1 Sinus arrhythmias 2.2 Sick sinus syndrome				6%	
Unit 3	13	**Atrial arrhythmias** 3.1 Atrial ectopics 3.2 Atrial tachycardia/ PJAT/Low atrial tachycardia 3.3 Atrial fibrillation 3.4 Atrial flutter	✓			21%	LE,SE,SA
Unit 4	10	**Av junctional arrhythmias** 4.1 Junctional ectopics 4.2 Junctional tachycardia 4.3 AVNRT 4.4 AVRT 4.5 Anti- dromic/ortho- dromic conduction in AVRT 4.6 WPW syndrome 4.7 LGL syndrome	✓			10%	LE,SE,SA
Unit 5	4	Approach to Narrow complex tachycardia				6%	LE,SE,SA
Unit	11	**Ventricular arrhythmias**	✓			18%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
6		6.1 Ventricular ectopics 6.2 Ventricular tachycardia 6.3 Ventricular fibrillation 6.4 Torsades de pointes 6.5 Approach to Broad complex tachycardia 6.6 SVT v/s VT					
Unit 7	9	**ECG in miscellaneous conditions** 7.1 Cardiomyopathies 7.2 Myocarditis 7.3 Pulmonary thromboembolism	✓			15%	LE,SE,SA
		7.4 ECG in Electrolyte imbalances 7.5 Brugada syndrome 7.6 Pacemaker rhythm		✓			
Unit 8	5	8.1 Ambulatory ECG recording (HOLTER) 8.2 Signal averaged ECG	✓			8%	SE,SA

- **LE**- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Recommended Books:

1. Leo Schamroth,. Introduction to electrocardiography, Wiley publisher 8th edition 2018
2. Marriott's Practical Electrocardiography, LWW publisher 12th Edition 2013
3. Mervin J Goldman. Principles of Clinical Electro cardiograph, 12th edition

CARDIAC EMBRYOLOGY

Course: Core

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

- **Course Outcomes:**

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

  CO1:Understand developmental facts of cardiovascular system and fetal circulation

  CO2:Describe the embryological development of structures of the heart

  CO3:Identify regions of the fetal heart

  CO4:Understand the developmental changes relate to definitive cardiac structure and abnormalities

  CO5:Relate fetal heart structures to adult counterparts

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit-1	12	**Early development of embryo** 1.1 Mitosis	✓			20%	LE,SE
		1.2 Meiosis	✓				LE,SE
		1.3 Oogenesis	✓				LE,SE
		1.4 Spermatogenesis	✓				LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		1.5 Fertilization	✓				LE,SE
		1.6 Placenta		✓			SE,SA
Unit 2	10	**Development of the heart** 2.1 Heart tube formation 3.5 Cardiac Looping 3.6 Development of sinus venous	✓			10%	LE,SE
Unit 3	6	Atrial formation, absorption of pulmonary veins into left atrium 3.1 Right atrium 3.2 Left atrium 3.3 Absorption of Pulmonary veins into left atrium 3.4 Inter atrial septum formation	✓			10%	LE,SE,SA
Unit 4	5	Formation of cardiac valves	✓			8%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		4.1 Atrioventricular Valves 4.2 Semilunar Valves					
Unit 5	8	Ventricular formation 5.1 Right Ventricle 5.2 Left Ventricle 5.3 Interventricular septal formation	✓			8%	LE,SE
Unit 6	10	Formation of great arteries and great cardiac veins 6.1 Fate of truncus arteriosus 6.2 Pharyngeal arch arteries 6.3 Fate of cardinal veins 6.4 Fate of vitelline veins 6.5 Umbilical veins 6.6 Ductus venosus 6.7 Superior vena cava 6.8 Inferior vena cava	✓			20%	LE,SE
Unit 7	6	7.1 Formation of pericardium 7.2 Formation of coronary arteries		✓			LE,SE,SA
Unit	3	Fetal Circulation	✓			8%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
8							

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. InderBir Singh. Human Embryology. Jaypeebrothers medical publishers. 10th Edition

BIOCHEMISTRY

Course: Core

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

- **Course Outcomes:**

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

CO1: Have knowledge and understanding of procedures of specimen collection,reagent preparationof specimens, performing biochemical tests, interpreting results, and managing biomedical waste effectively.

CO2: Understand the basic procedures in specimen collection, reagent preparation, and testing in a clinical laboratory

CO3: Demonstrate the knowledge of properties of biomolecules and their function.

CO4: Have knowledge of the importance of nutrition in health and diseases.

COURSE CONTENT:

Unit	Hrs	Content	Know	Know	Desirable to Know	Weightage	Types Of Questions
Unit 1	5hrs	**Introduction to Biochemistry and Clinical Laboratory** **1.1Specimen collection:** Pre analytical, variables, collection of blood, Urine, CSF, and other body fluids, anticoagulants and preservatives **1.2 Dilutions:** Dilution of solutions (Preparation of 0.1 N NaCl from 1 N NaCl), Preparation of percent solutions, Preparing working standard from stock standard, Specimen dilutions, Serial dilutions, and Reagent dilution **1.3 Special investigations:** Normal values, methods, and interpretation of biochemical parameters. Preparation of patients for special investigations, and interfering substances **1.4 Quality control:** Definition, types, IQAS and EQAS, Calculation of mean, standard deviation and	✓ ✓ ✓ ✓	✓		15%	LE, SA, SE

Unit	Hrs	Content	Know	Know	Desirable to Know	Weightage	Types Of Questions
		percentage of coefficient variation **1.5 Safety measures, Conventional and SI units** **1.6 Bio Medical waste management**					
Unit 2	10hrs	**Carbohydrate and Lipid chemistry** **2.1** Introduction, Definition, Properties of carbohydrates, Classification with suitable examples. **2.1.1** Biomedical importance of carbohydrates. **2.2** Introduction, Definition, Functions, and Classification of Lipids. Definition and Classification of fatty acids, Essential fatty acids with examples.	✓ ✓ ✓			25%	LE, SE,
Unit 3	5hrs	**Protein chemistry and Plasma Proteins** **3.1** Introduction, Definition, and Classification of amino acids with	✓ ✓ ✓			15%	LE, SE, SA

Unit	Hrs	Content	Know	Know	Desirable to Know	Weightage	Types Of Questions
		examples. **3.1.1** Peptides: definition & biologically important peptides with examples **3.1.2** Introduction, Definition, and Classification of Proteins with examples **3.1.3** Functions of amino acids and Proteins **3.2** Introduction, types, functions, and biological reference range of plasma proteins **3.2.1** Immunoglobulins	✓ ✓ ✓				
Unit 4	5hrs	**Enzymes** **4.1** Introduction, Definition, classification with suitable examples, Active site of enzyme, Factors influencing enzyme activity, **4.1.1** Definition of Cofactor, Coenzyme, And isoenzymes with examples.	✓ ✓			10%	LE,SE,SA

Unit	Hrs	Content	Know	Know	Desirable to Know	Weightage	Types Of Questions
Unit 5	10hrs	**Vitamins and Minerals** **5.1** Introduction, Definition, classification, Fat soluble and water-soluble vitamins: Sources, RDA, Biological functions and deficiency disorders. **5.2** Introduction, Definition and classification of macro and micro minerals with examples **5.2.1** Calcium, Phosphorous, iron, Sodium, Potassium: Sources, RDA, Reference ranges, Functions and Disorders of deficiency and excess	✓ ✓ ✓			20%	LE,SE
Unit 6	10hrs	**Nutrition** **6.1** Calorific values of carbohydrates, proteins, and fats **6.2** Nutritional importance of Carbohydrates, lipids, proteins, and Essential amino acids **6.3**SDA: Definition, values for major macronutrients, Significance of SDA **6.4** Basal metabolic rate (BMR): Definition, Reference range of BMR in men and women, Factors affecting BMR	✓ ✓ ✓ ✓			15%	LE.SA,SE

Unit	Hrs	Content	Know	Know	Desirable to Know	Weightage	Types Of Questions
		6.5 Dietary fibers: Definition, functions, importance and their daily requirements Balanced diet **6.6** Essential fatty acids: Definition, functions and deficiency manifestations **6.7** Define the classes of protein-energy malnutrition: marasmus and kwashiorkor.	✓				

Recommended Books

1) Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for medical students. Jaypee Brothers Medical Publishers; 2019 Sep 30.
2) Satyanarayana U and U Chakrapani. 2013. Biochemistry (version 4th ed). 4th ed. New Delhi: Elsevier Health Sciences APAC.

ENGLISH AND COMMUNICATION – PART - II

Course: AEC

Semester : 1I

Credits: 3 **No of Hours: 45 Hours**

- **Course Outcomes:**

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

CO1: Acquire the LSRW (Listening, Speaking, Reading, and Writing) skills. Through Cambridge Interchange Fifth Edition, students will develop real world communication skills- enhancing fluency in speaking, listening, reading and writing – wile mastering grammar, expanding vocabulary and improving pronunciation with supportive digital tools.

CO2: Learn to appreciate Literature.

CO3: Be aware of social responsibilities.

CO4 : Enhance the analytical skill

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 1	13hrs	**UNIT – I: CAMBRIDGE INTERCHANGES FIFTH EDITION** 1.1 Only Time Will Tell 1.2 I Like Working with People 1.3 It's Really Worth Seeing 1.4 It's a Long Story 1.5 That's Entertainment 1.6 Now I Get it 1.7 I wouldn't have done that 1.8 Making Excuses	√			29%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 2	3hrs	**UNIT – II: Phonetics – IPA Transcription**	√			7%	SA
Unit 3	13hrs	**UNIT – III: Grammar and Written Communication** 3.1 Reported Speech 3.2 Modals 3.3 Clauses 3.4 Gerunds 3.5 Active and Passive Voice 3.6 Synonyms and Antonyms 3.7 News Report Writing 3.8 Speech Writing 3.9 Dialogue Writing	√			29%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
Unit 4	4hrs	**UNIT – IV: PROSE** 4.1 Chicago Address by Swami Vivekananda 4.2 I have a Dream : Martin Luther King	√			9%	LE, SE
Unit 5	6hrs	**UNIT – V: Poetry** 5.1 Still I Rise : Maya Angelou 5.2 BThe Raven : Edgar Allen Poe 5.3 Break, Break, Break : Alfred Lord Tennyson	√			13%	LE, SE
Unit 6	6hrs	**UNIT – VI : Short Stories** 6.1 The Luncheon : William Somerset Maugham 6.2 The Power of Prayer : APJ Abdul Kalam 6.3 The Necklace : Guy De		√		13%	LE, SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types Of Questions
		Maupassant					

- **LE**- Long Essay**, SE**- Short Essay**, SA**- Short Answer

- **Recommended Books:**

5. Cambridge: Interchange Fifth Edition
6. Contemporary English Grammar Structures & Composition by David Green
7. English Grammar and Composition: Wren & Martin
8. English Grammar in Use by Raymond Murphy

KANNADA

Course: AEC

Credits: 02 **Number of hours: 30hours**

Course Objectives

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

COURSE CONTENT:

Unit I: Kannada Letters (vowels, Consonant)

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

Unit III:

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

Course Outcome

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

Recommended Books

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

SEMESTER III

SYSTEMIC PATHOLOGY

Course: Core

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

- **Course Outcomes:**

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

CO1: To be able to define the medical terms, define and classify disease and understand the concepts of the disease.

CO2: To be able to describe the causes and mechanism of common disease that occur during the routine work and also changes seen in different individual and various organs and fluids

CO3: To be able to enumerate various laboratory tests on various organs and serous cavities. Example : body fluids

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 1	20 hours	**Cardiovascular system** **1.1 Atherosclerosis:** Definition, risk factors, pathogenesis, morphology and complications **1.2Ischemic Heart Disease:** Myocardial infarction- definition, pathogenesis, pathogensis, morphology and complications **1.3 Hypertension:** Benign and malignant hypertension: pathogenesis, pathology and complications **1.4Anuerysms –** Definition, classification, pathology and complications **1.5 Heart Failure- Right** and left heart failure: causes, pathophysiology and morphology **1.6 Valvular**Heart Disease- causes, pathology and complication. complications of arterial valves 1.7 **Rheumatic heart disease and infectious endocarditi**s –definition, etiopathogenesis, morphologyandcomplications. 1.8 **Congenital Heart disease**- types and atrial septal defect: aneurysm – types and morphology, cardiomyopathies in brief 1.9 **Pericardial effusion** – causes, effects and diagnosis . Cardiomyopathy – definition , types, causes and significance , Infective endocarditis myocarditis	✓			40%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 2	10 hours	**Hematology:** **2.1 Anemia:** definition, morphological types and diagnosis of anemia, brief concept about hemolyticanemia and polycythaemia **2.2 Leukocyte disorder:** briefly leukemia, leukocytosis, agranulocytosis etc **2.3 Bleeding disorder**: definition, classification, causes and effect of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders	✓			13%	LE, SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 3	15 hours	**Respiratory System** 3.1Atelectasis- types, Adult respiratory distress syndrome-causes, pathogenesis and morphology 3.2 Pulmonary edema – classification, causes and morphology 3.3Chronic obstructive pulmonary disease - Chronic bronchitis, emphysema, asthma, bronchiectasis: Definition, etiopathogenesis and morphology 3.4 Restrictive pulmonary diseases- Definition, categories, pathogenesis and morphology 3.5Pneumoconiosis-types, asbestosis, coal workers pneumoconiosis- etiopathogenesis and morphology 3.6 Pleural effusion –causes, effects and diagnosis 3.7Pulmonary embolism, infarction, pulmonary hypertension-Definition, etiopathogenesis and morphology	✓			26%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 4	15 hours	**Renal system** **4.1** Clinical manifestation of renal disease. Briefky causes, mechanism, effects and laboratory diagnosis of ARF & CRF. Briefly glomerulonephritis and pyelonephritis **4.2** End stage Renal Disease – definition, causes, effects and role of dialysis and renal transplantation and its management **4.3** Briefly concept about obstructive uropathy	✓			21%	LE, SE, SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1) Dr.RamadasNayak, Text book of Pathology for Allied Health Sciences.
2) Comprehensive clinical Nephrology-6th edition- John feehaly

APPLIED MICROBIOLOGY

Course type: Core

Credits: 4 **Duration: 60 hours**

- **Course Outcomes:**

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

CO 1: To understand health care associated infections and antimicrobial resistance

CO:2 To acquire knowledge of the principles of sterilization and disinfection in hospital.

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
Unit 1	**30 Hrs**	**Healthcareassociatedinfectionsa ndantimicrobialresistance** **1.1 Infection &Multidrug resistant organisms** 1.1.1 Definitions of various types of infections, Source of infection, modes of transmission, Drug resistant pathogens- methicillin resistant Staphylococcus aureus 1.1.2 Clostridium defile, Vancomycin resistant enterococci **1.2 Hospital acquired infections** 1.2.1 Definitions, criteria for diagnosis in brief and causative agents – catheterrelatedbloodstreaminfections,ventilatorassociatedpneumonia,surgicalsite infections **1.3 Microbiology of urinary tract infections**	✓	✓		**50%**	**LE,SE,SA**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		1.3.3Definition, Causative agents, Transmission, Predisposing factors, Pathogenesis, Lab diagnosis in detail significant bacteriuria, catheter related urinary tract infections	✓				
		1.4 Healthcare personnel in hospital set up 1.4.1 Disease communicable to hospital personnel and preventive measures tocombat the spread of these infections by monitoring and control- tuberculosis, HIV, hepatitisB, hepatitis C, salmonella	✓				
		1.4.2 Respiratory route (varicella-zoster, respiratory syncitial virus etc),Blood borne transmission (cytomegalovirus, Ebola virus etc), orofaecal route (hepatitis Aetc),direct contact	✓				
		1.5 Microbiological surveillance 1.5.1 Definitions, Methods& sampling techniques					

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		1.6 Opportunistic infections 1.6.1 In brief- opportunistic pathogens seen in Immunocompromised patients- Candida, Cryptococcus. 1.6.2 Parasites, viruses&bacteriaas opportunisticpathogens **1.7 Disinfection of wards, OT andlaboratory** 1.7.1 Disinfection of instruments used in patient careclassification, differentmethods, advantages anddisadvantages of thevarious methods. Disinfection of the patient care unit. Infection control measures for ICU's **1.8 Collection of specimen forsterility testing** 1.8.1 Collection of specimenfrom outpatient units, inpatient units, minoroperation theatre and majoroperation theatre forsterility testing Airsampling culture plates,interpretation of colonyforming units based on airflow rate and sampling time	✓	✓ ✓			

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		1.9 Methods employed for sterilitytesting & Interpretation ofresults of sterility testing. 1.9.1 Rooms: gaseoussterilization, Equipments:classification of theinstruments andappropriate methods ofsterilization. Centralsupply department: thefour areas and thefloor plan forinstrument cleaning,high-level disinfectingand sterilizing areas.Interpretation ofsterility ofhemodialysiswater/distilled water/de ionized water,based on growth of colonies in BHI Agarto be reported as XCFU/ unit					
Unit 2	**30 Hrs**	**2.1 Immunity** 2.1.1 Definition, Classification of methods, Principles of Dry heat, Moist heat, Autoclaving in detail- Preparation of materials for Autoclaving: packing of different types ofmaterials,loading, holding timeand unloading. 2.1.2 Hot Air Oven	✓	✓			

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		2.2 Disinfection, antiseptics 2.2.1 Disinfection of instruments used in patient care: classification, different methods, advantages and disadvantages of the various methods. Disinfection of the patient care unit. Infection control measures for ICU's. 2.2.2 Disinfectant efficacy testing **2.3 Sterilization – applied aspects** 2.3.1 Rooms: gaseous sterilization, Equipments: classification of the instruments and appropriate methods of sterilization. Central supply department: the zoning and the floor plan for instrument cleaning, High-level disinfecting and sterilizing critical areas. 2.3.2 Quality control in CSSD **2.4 Principles of autoclaving &quality control of sterilization. Infection &**	✓ ✓ ✓	✓		**50%**	**LE,SE,SA**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of Question
		and Multidrug resistantorganisms 2.4.1 Principles of autoclaving & and quality control ofsterilization. Definition, Classification of methods,Principles of Dry heat, moist heat 2.4.2 In detail autoclaving Preparation of materialsfor autoclaving: packing of different types ofmaterials, loading, holding time and unloading. Dryheat/Moist heat: Temperature recordingcharts interpretation, Color change indicatorsinterpretation 2.4.3 Definitions, criteria for diagnosis in brief and causative agents – catheter related blood streaminfections, ventilator associated pneumonia, surgical site infections **2.5 Bacteriological analysis of water** 2.5.1 Different sampling techniques forpotablewater,ROwater,dialysate. 2.5.2 Endotoxin testing		✓			

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1)Baveja CP. Textbook of microbiology. Arya Publications; 2005.

2)Ananthanarayan R. Ananthanarayan and Paniker's textbook of microbiology. Orient Blackswan; 2006.

GENERAL PHARMACOLOGY

Course type: Core

Credits: 04 **Duration: 60 hours**

- **Course Outcomes:**

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

CO1. Know the basics of Pharmacology like, sources of drugs, routes of drug Administration and general principles

CO2. Describe the principles of pharmacokinetics and pharmacodynamics

CO3. To appreciate various adverse drug reactions

CO4. To have a basic knowledge of drugs affecting various body systems

- **Course Content:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of Questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of Questions
Unit 1	8hrs	General Pharmacology 1.1 Introduction to Pharmacology 1.2 Routes of drug Administration 1.3Absorption & Distribution Metabolism Excretion 1.4 Pharmacodynamics - Mechanism of drug action- receptors 1.5 Factors modifying drug actions 1.6 Adverse drug reactions	√			15%	LE, SE, SA
Unit 2	6hrs	Autonomic Nervous System drugs 2.1 Sympathomimetics 2.2 Alpha blockers 2.3 Beta-blockers 2.4 Cholinomimetics 2.5 Anticholinergics 2.6 Skeletal muscle relaxants	√			15%	LE, SE, SA
Unit	11hrs	Central Nervous System	√			20%	LE, SE,

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of Questions
3		3.1 Opioid analgesics 3.2 Non-opioid analgesics (Prostaglandins) 3.3 NSAIDs 3.4 Ethyl alcohol 3.5 Sedative hypnotics 3.6 Antiepileptic drugs 3.7 Local anesthetics-1 3.8 Local anesthetics-2 3.9 General anesthetics- I 3.10 G A – II (PAM) 3.11 CNS stimulants					SA
Unit 4	9hrs	Cardio Vascular System Drugs 4.1 Diuretics 4.2 Vasodilators (CCB's, Drugs acting on RAS) 4.3 Antihypertensives 4.4 Antianginal drugs 4.5 Pharmacotherapy of shocks 4.6 Cardiac glycosides 4.7 Cardioplegic drugs 4.8 Antiarrhythmic drugs 4.9 Primary solutions	√			15%	LE, SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of Questions
Unit 5	6hrs	Blood 5.1 Anaemia, erythropoietin 5.2 Anticoagulants 5.3 Anti platelet drugs 5.4 Fibrinolytics, 5.5 Lipid lowering drugs 5.6 Vit.D and calcium, folic acid, phosphate binders			√	5%	SE, SA
Unit 6	1hrs	Endocrines 6.1 Corticosteroids			√	5%	SE, SA
Unit 7	9 hrs	Chemotherapy 7.1 General Principles of Chemotherapy 7.2 Sulfonamides 7.3 Penicillins 7.4 Cephalosporins 7.5 Broad spectrum antibiotics 7.6 Macrolides 7.7 Aminoglycosides 7.8 Chemotherapy of UTI 7.9 Drug Therapy of Tuberculosis	√			15%	LE, SE, SA
Unit	1.1 hrs	Miscellaneous topics		√		10%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of Questions
8		8.1 Antihistamines 8.2 Antiemetics 8.3 Drugs used in bronchial asthma 8.4 Drugs used in bronchial asthma-2 8.5 Cough 8.6 Inhalational gases and emergency drugs 8.7 I V fluids 8.8 Metabolic and electrolyte imbalance 8.9 Immunosuppressants 8.10 Antiseptics and disinfectants					

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. ShanBhag T V, Shenoy S&NayakV.Pharmacology For Nurses, Elesever; 3rd edition.2023.
2. Udaykumar P. Textbook of Pharmacology for Dental and Allied Sciences. Jaypee Brothers Publishers; 4th edition. 2017.

CONGENITAL HEART DISEASES I

Course: Core

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

- **Course Outcomes:**

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

  CO1: Gain knowledge in depth of various acyanotic congenital heart diseases

  CO2: Understand the morphology and classifications of acyanotic congenital heart diseases.

  CO3: Understand the hemodynamics of each acyanotic congenital heart disease in details

  CO4: Understand and develop theoretical and practical skills in cardiac catheterization, Interventional and surgical Management.

COURS CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit-1	5	**Segmental approach to Congenital heart diseases** Congenital Heart Diseases 1.1 Introduction 1.2 Classification	✓			8%	SE,SA
Unit 2	8	**Atrial Septal Defect** 2.1 Definition & Morphology	✓			13%	SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		2.2 Prevalence & Classification 2.3 Pathology 2.4 Pathophysiology 2.5 Clinical findings 2.6 ECG findings & X-Ray Findings 2.7 Echo Findings 2.8 Cardiac Cath 2.9 Associated Anomalies 2.10 Management					
Unit 3	8	**Ventricular Septal Defect** 3.1 Definition & Morphology 4.2 Prevalence & Classification 3.2 Pathology 3.3 Pathophysiology 3.4 Clinical findings 3.5 ECG findings & X-Ray Findings 3.6 Echo Findings 3.7 Cardiac Cath 3.8 Associated Anomalies 3.9 Management	✓			13%	LE,SE,SA
Unit 4	12	**Patent Ductus Arteriosus and AP Window**	✓			20%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		4.1 Definition & morphology 4.2 Prevalence & classification 4.3 Pathology 4.4 Pathophysiology 4.5 Clinical findings 4.6 ECG & X-ray findings 4.7 Echo findings 4.8 Cardiac Cath 4.9 Associated Lesions 4.10 Management					
Unit 5	7	**AV canal defect** **5.1** Definition & morphology **5.2** Prevalence & classification **5.3** Pathology **5.4** Pathophysiology **5.5** Clinical findings **5.6** ECG & X-ray findings **5.7** Echo findings **5.8** Cardiac Cath **5.9** Associated Lesions **5.10** Management	✓			11%	LE,SE,SA
Unit 6	**5**	**PAPVC**	✓			8%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		6.1 Definition & Morphology 6.2 Prevalence & Classification 6.3Pathology Pathophysiology 6.3 Clinical findings 6.4 ECG findings & X-Ray Findings 6.5 Echo Findings 6.6 Cardiac Cath and Associated Anomalies 6.7 Management					
Unit 7	10	**Co- arctation of aorta and Interrupted Aortic arch anomalies** 7.1 Definition & morphology 7.2 Prevalence & classification 7.3 pathology 7.4 Pathophysiology 7.5 clinical findings 7.6 ECG findings & X ray findings 7.7 Echo findings 7.8 Cath 7.9 Associated Anomalies	✓			16%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		7.10 Management					
Unit 8	5	**Cor- triatriatum and Cor-triatriatum Dexter** 8.1 Definition & morphology 8.2 Prevalence & Classification 8.3 Pathophysiology 8.4 Clinical findings 8.5 ECG findings 8.6 Echo findings 8.7 Management	✓			8%	LE,SE,SA

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Reference books:

1. Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in 2014
2. J K Perloff. Congenital Heart Disease in Adults. Sonders 3rd Edition
3. Moss and Adams. Heart Disease in Infants & children's 9th edition

PHYSICS AND INSTRUMENTATION

Course: Core

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

- **Course Outcomes:**

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

  CO1:Understand basic concepts of ultrasound physics and its applications to patient care.

  CO2:Gain knowledge on technical aspects of an echo machine.

  CO3:Gain theoretical and practical knowledge on common source of errors and how to overcome it

  CO4:Understand the application of 2D and Doppler principles in image acquisition.

  CO4:Understand core concepts of Hemodynamic using Doppler calculations.

  CO5:Gain theoretical and practical skill in image acquisition techniques using various control knobs.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit-1	6	**Physical Properties of Ultrasound** 1.1 Introduction 1.2 Physical principles 1.3 Frequency 1.4 Velocity 1.5 Wavelength 1.6 Amplitude 1.7 Power 1.8 intensity	✓			10%	LE,SE
Unit 2	6	**Interaction between ultrasound and tissue** 2.1 Attenuation 2.2 Acoustic Impedance 2.3 Reflection and refraction 2.4 Specular and scattered echoes	✓			10%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 3	6	Transducers 3.1 Definition 3.2 Piezoelectric Effect 3.3 Components 3.4 Classification and selection of transducers and clinical applications 3.5 Manipulation of US beam 3.6 Near field and Far field	✓			11%	LE,SE
Unit 4	9	**Resolution** 4.1 Display options 4.2 A mode 4.3 B mode 4.4 M mode 4.5 2D	✓			15%	LE,SE
		Basic Pulse Echo system, Pulse generation 2D Image Optimization		✓			SA
Unit 5	15	5.1 Knobology		✓		25%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		5.2 2D cardiac chamber examination 5.3 Harmonic imaging 5.31 Definition 5.3.2 Tissue Harmonic Imaging 5.3.3 Fundamental Harmonic Imaging					
Unit 6	8	**Doppler Echocardiography** 6.1 Principle	✓			13%	LE,SE,SA
		6.2 Doppler formats: Pulsed wave Doppler and continuous wave Doppler, Aliasing	✓				
		6.3 Clinical applications of Doppler echocardiography	✓				
		6.4 Color flow imaging	✓				

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		6.5 Billiard ball effect, Coianda Effect, Venturieffect ,		✓			
		6.6 Doppler artifacts		✓			
Unit 7	6	**Hemodynamic assessment by Doppler** 7.1 Blood flow pattern – Laminar, non laminar 7.2 Stroke volume/Cardiac output 7.3 Bernoulli's Principle 7.4 Continuity equation 7.5 PISA 7.6 Pressure half time	✓			11%	LE,SE
Unit 8	4	Biological Effects of ultrasound 8.1Introduction 8.2Mechanical Index		✓		6%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		and Thermal Index					

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Reference books:

1. Harvey Feigenbaum. Feigenbaum's Echocardiography,Wolters Kluwer India .6th Edition ,2010
2. Jae K OH Tajik. Echo Manual 3rd Edition, 2006
3. Catherine M Otto, Textbook of clinical Echocardiography, Elsevier, 6th Edition 2018
4. Arthur Weyman,Principles and practices of Echocardiography,Lippincottwilliams and wilkins,

CLINICAL CVT-I

Course: SEC

Credits: 4 **No of Hours: 120 Hours**

- **Course Outcomes:**

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

  CO1:Perform and interpret various ECG abnormalities

  CO2:Perform and interpret ambulatory ECG monitoring

  CO3:Diagnose various congenital heart diseases using segmental approach of echocardiography

  CO4: Understand basic concepts of ultrasound physics and its applications to patient care.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit 1	40hrs	Electrocardiography: To perform and interpret the following ECG abnormalities: 1.1 Atrial arrhythmias 1.2 Ventricular arrhythmias 1.3 Approach to narrow and broad complex tachycardia 1.4 Sick sinus syndrome 1.5 Pacemaker rhythms 1.6 Cardiomyopathies 1.7 Myocarditis 1.8 Pulmonary thromboembolism 1.9 Electrolyte imbalance 1.10 Brugada syndrome	✓			33%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit 2	20hrs	Ambulatory ECG recording (Holter monitoring) 2.1 Indications 2.2 Lead system 2.3 Analysis and interpretation	✓			16%
Unit 3	40hrs	Congenital heart diseases 3.1 Approach to various congenital heart diseases by echocardiography 3.2 Cardiac malposition 3.3 Atrial septal defect 3.4 Ventricular septal defects 3.5 Patent ductus arteriosus 3.6 AV canal defect 3.7 Partial anomalous pulmonary venous	✓			34%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		connection 3.8 AP window 3.9 Co- arctation of aorta 3.10 Aortic arch anomalies 3.11 Cor-triatriatum 3.12 Congenital isolated aortic and pulmonary stenosis				
Unit 4	20hrs	Physics and instrumentation 4.1 Basic concepts of Ultrasound physics 4.2 Technical aspects of Echo machines 4.3 Display options 4.4 2-D cardiac chamber examination 4.5 Various types of transducers	✓			17%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		4.6 Doppler echocardiography				

Recommended Books:

1. Leo Schamroth ,Introduction to electrocardiography, Wiley publisher 8th edition 2018
2. Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in 2014
3. Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010

SEMESTER IV

CONGENITAL HEART DISEASE II

Course: Core

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

Course outcomes:

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

CO1: Gain knowledge in depth of various Cyanotic congenital heart diseases.

CO2: Understand the morphology and classifications of Cyanotic congenital heart diseases

CO3: Understand the hemodynamics of each Cyanotic congenital heart disease in detail.

CO4: Understand relevant screening and/or diagnostic tests appropriate for cardiovascular risk stratification.

CO5: Develop theoretical and practical skills to how to approach Cyanotic congenital heart diseases by echocardiography.

CO6: Understand and develop theoretical and practical skills in cardiac catheterization, Interventional and surgical Management

COURSE CONTENT:

Unit	Hrs	Content	Know	Good to Know	Desirable to Know	Weightage	Type of questions

Unit 1	3hrs	**Cyanotic Congenital Heart Diseases** 1.1 Introduction 1.2 Classification	✓			6%	SE,SA
Unit 2	13hrs	**Tetralogy of Fallot and basics of Palliative Shunts** 2.1 Definition & Morphology 2.2 Prevalence & Components 2.3 Pathology 2.4 Pathophysiology 2.5 Clinical findings 2.6 ECG findings & X-Ray Findings 2.7 Echo Findings 2.8 Cardiac Cath 2.9 Associated Anomalies 2.10 Management 2.11 Pulmonary Atresia 2.12 Pulmonary atresia with intact ventricular septum	✓			10%	LE,SE,SA
Unit 3	5hrs	**Tricuspid Atresia** 3.1 Definition and Morphology 3.2 Prevalence & Components 3.3 Pathology 3.4 Pathophysiology 3.5 Clinical findings	✓			**8**%	

		3.6 ECG findings & X-Ray Findings 3.7 Echo Findings 3.8 Cardiac Cath 3.9 Associated Anomalies 3.10 Management					LE,SE,SA
Unit 4	4hrs	**Ebstein's anomaly** 4.1 Definition and Morphology 4.2 Prevalence & Classification 4.3 Pathology 4.4 Pathophysiology 4.5 Clinical findings 4.6 ECG findings & X-Ray Findings 4.7 Echo Findings 4.8 Cardiac Cath 4.9 Associated Anomalies 4.10 Management	✓			**6**%	LE,SE,SA
Unit 5	14hrs	**Trans position of Great Arteries and Congenitally corrected TGA** 5.1 Definition & Morphology 5.2 Prevalence & Classification 5.3 Pathology 5.4 Pathophysiology 5.5 Clinical findings	✓			**23**%	

		5.6 ECG findings & X-Ray Findings 5.7 Echo Findings 5.8 Cardiac Cath 5.9 Associated Anomalies 5.10 Management **Truncus arteriosus** 5.11 Definition & Morphology 5.12 Prevalence & Classification 5.13 Pathophysiology 5.14 Clinical findings 5.15 ECG findings & X-Ray Findings 5.16 Echo findings 5.17 Cath findings 5.18 Management					LE,SE,SA
Unit 6	5hrs	**Double Outlet Right Ventricle** 6.1 Definition &Morphology 6.2 Prevalence & Classification 6.3 Pathophysiology 6.4 Clinical findings 6.5 ECG findings & X-Ray Findings 6.6 Echo Findings 6.7 Cardiac Cath 6.8 Management	✓			**8**%	LE,SE,SA

Unit 7	5hrs	TAPVC 7.1 Definition & Morphology 7.2 Prevalence & Classification 7.3 Pathology 7.4 Pathophysiology 7.5 Clinical findings 7.6 ECG findings & X-Ray Findings 7.7 Echo Findings 7.8 Cardiac Cath 7.9 Associated Anomalies 7.10 Management	✓			**8**%	LE,SE,SA
Unit 8	11hrs	**Miscellaneous Congenital Heart Diseases** 8.1 RSOV 8.2 Coronary anomalies 8.3 AV fistulas – Coronary, Pulmonary 8.4 Common Atrium 8.5 DCRV 8.6 Single Ventricle 8.7 HLHS		✓		**18**%	SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1.Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in 2014

2.J K Perloff. Congenital Heart Disease in Adults. Sonders 3rd Edition

3.Moss and Adams. Heart Disease in Infants & children's 9th edition

CLINICAL CARDIOLOGY

Course: Core

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

Course outcomes:

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

CO1: Gain knowledge on the clinical examination of cardiac diseases.

CO2: Understand various cardiac and non cardiac causes of symptoms associated with cardiac diseases.

CO3: Provide proper diagnosis and care for patients with cardiac diseases.

CO4: Understand the grade of severity of cardiovascular diseases based on symptoms.

COURSE CONTENT

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit1	2	**History taking** 1.1 NYHA functional class	✓			3%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 2	13	**Physical Examination – I (Symptoms)** Chest pain 2.1 Etiology 2.2 Cardiovascular causes 2.3 Non-Cardiac causes 2.4 Duration, Radiation, Location, Character 2.5 Chronic stable angina 2.6 Unstable angina 2.7 Palpitation: Cardiac and Non-Cardiac – Etiology, Evaluatio	✓			21%	LE,SE,SA
		2.8 Fatigue – Etiology, Evaluation		✓			
		2.9 Syncope: Cardiac and Non-cardiac – causes, Etiology, Evaluation, Unknown cause	✓				

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		2.10 Dyspnea: Cardiac and non-cardiac – causes, Etiology, Pathogenesis,Paroxysmal nocturnal dyspnea,Orthopnea,Tachy pnea	✓				

Unit 3	8	Physical Examination II (Signs) 3.1 Hoarseness of voice – Etiology, Evaluation		✓		13%	LE,SE,SA
		3.2 Hemoptysis – Etiology, Evaluation	✓				
		3.3 Cyanosis -Definition, Evaluation,Types: Peripheral cyanosis, Central cyanosis, Mixed cyanosis, Differential cyanosis	✓				
		3.4 Squatting		✓			

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		3.5 Pedal Edema – Etiology, Evaluation, Cardiac and non cardiac causes		✓			
Unit 4	8	**Arterial pulse** 4.1 Definition, Genesis 4.2 Pulse wave pattern 4.3 Examination of arterial pulse 4.4 Regularly irregular pulse and Irregularly irregular pulse 4.5 Abnormalities in pulse volume; Pulsusmagnus/pulsustardus / bounding pulse 4.6 Abnormalities in character: Parvus et tardus, collapsing/ water hammer pulse, pulse alternans, dicrotic pulse, bisferience pulse, pulsusparadoxus, pulsusbigeminy, apex	✓			13%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		pulse deficit					
Unit 5	4	Jugular venous pulse Waves of JVP in normal and abnormal – conditions	✓			6%	LE,SE
Unit 6	8	**Heart sounds and Heart murmers** 6.1 Normal heart sounds 6.2 Heart murmurs in various disease –conditions	✓			13%	LE,SE
Unit 7	9	**Chest X-ray** 7.1 Approach to chest x-ray 7.2 Pulmonary arterial flow and venous flow 7.3 Cardiac chamber enlargement 7.4 Chest X-ray in heart disease	✓			15%	LE,SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 8	8	Medicines Relevant to CVT 8.1 Hypertension 8.2 DM 8.3 CKD 8.4 Diabetes mellitus	✓			13%	SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1. Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier,9 January 2018
2. Hurst's The Heart manual of cardiology ,13nth edition Graw - hill education/medical ,16 November 2012
3. 3. Moss and Adams. Heart Disease in Infants & children 9th edition
4. B N VijayaRaghavaRao, Clinical examination in cardiology, Second edition,Elsevier.21 march 2017
5. R alagappan, Manual of Practical Medicine,6th edition, Jaypee brothers, Jan 2018

CARDIAC STRESS TESTS & NUCLEAR CARDIOLOGY

Course: Core

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

Course outcomes:

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

CO1: Understand the various cardiac stress tests and nuclear tests usedin diagnostic cardiology.

CO2: Gain practical knowledge in performing various cardiac stress test andnuclear tests.

CO3: Understand the importance of myocardial viability in patients who requirecardiac revascularization.

CO4: Gain theoretical and practical knowledge in cardiac monitoring andmanaging cardiac arrest in emergency situations.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 1	6	**Stress Echo -Methodologyy, indications and contraindications of:** 1.1 Treadmill Test 1.2 Bicycle Ergometry 1.3 Dobutamine Stress Echo 1.4 Dipyridamole and Adenosine	✓			10%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 2	13	**Exercise testing procedures** **Indications and contraindications** 2.1 Course preparation 2.2 ECG Recording 2.3 Equipment &protocol **Interpretation of Exercise Stress Test** 2.4 Categorization of Wall motion &its response to stress&Localization of Coronary artery lesions 2.5 Hemodynamic Response: BP, HR during exercise&ST-T changes Mason Likar modification	✓			21%	LE,SE
Unit 3	8	**Applications of Stress Echocardiography** 3.1 Stress echo after myocardial infarction, revascularization 3.2 Stress echo in Valvular Heart Disease 3.3 Diastolic Stress echocardiography	✓			13%	LE,SE,SA
Unit 4	8	**Contrast Echocardiography** 4.1 Contrast Agents	✓			13%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
		4.2 Clinical use of contrast echo 4.3 Detection methods: Machine settings, low mechanical index, Doppler imaging 4.4 Contrast Artifacts					LE,SE
Unit 5	6	**Nuclear Cardiology** :PET& SPECT Scan – Basic Knowledge		✓		10%	SE,SA
Unit 6	5	Cardiac Monitoring		✓		8%	SE,SA
Unit 7	4	Cardiac Arrest :Definition, causes	✓			6%	SE,SA
Unit 8	10	BLS ACLS		✓		16%	

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. Brain Griffin, Manual of cardiovascular medicine, 9th edition

BASICS IN CARDIAC CATH & HARD WARES

Course: Core

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

Course outcomes:

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

CO 1: At the end of the course student would gain knowledge & understand about

CO 2: Various Hardware and instruments used in cardiac catheterization laboratory.

CO 3: X ray production and importance of radiation safety in Cath lab.

CO 4: Practical knowledge in providing the Hardware during various procedures in Cath lab.

CO 5: Emergency medications used in Cath lab and the importance of maintaining Cath lab sterility.

COURSE CONTENTS:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type of questions
Unit 1	6	**X-ray theory** 1.1 Electric and electromagnetic energy 1.1 Electromagnetic radiation 1.2 Quantum theory and X-ray photons	✓			10%	LE,SE,SA

		1.3 X-ray tube 1.4 X-ray production 1.5 Characteristic of radiation 1.6 Radiation dose and exposure, Safety and protocols					
Unit 2	9	**Introduction to Cardiac Cath procedures** 2.1 Guidelines for diagnostic Cath 2.2 premedication, anesthesia and sedation 2.3 Contrast media 2.3.Contrast nephropathy anaphylactic reaction Medical asepsis 2.4 maintaining sterility 2.5 personnel protective equipment	✓			15%	LE,SE,SA
Unit 3	8	**Coronary vascular system** 3.1Coronary artery 3.2 Coronary Angio –views	✓			13%	LE,SE,SA

		3.3 Coronary anomalies-ALCAPA **Coronary Angiogram** 3.4 Indications and contraindications 3.5 Procedure 3.6 Materials used, type and amount of dye used 3.7 coronary angio views used, interpretation 3.8 Complications					
Unit 4	8	**Coronary Angioplasty** 4.1 Primary PCI 4.2 Indications &Contraindications 4.3 Procedure, materials used, type and amount of dye used 4.4 Coronary angio views used, Interpretation 4.5 Complications 4.6 Thrombus suction devices 4.7 SVD, DVD, MVD	✓			13%	LE,SE,SA

		4.8 Complex lesions, bifurcation, LMCA, calcific, CTO					
Unit 5	4	**Hardwares** 5.1 Diagnostic hardware 5.2 Introducer set 5.3 Diagnostic catheter 5.4 Wires and accessories 5.5 Interventional hardware 5.5.1 Guiding catheters 5.5.2 Guide wires	✓			6%	LE,SE,SA
Unit 6	6	**6.1 Coronary balloons** 6.1.1 Compliant and noncompliant balloons 6.1.2 Cutting balloon catheter 6.1.3 Drug balloons **6.2 Coronary stents** 6.2.1 Materials 6.2.2 structure 6.2.3 covered stents 6.3.4 balloons Stent system -	✓			10%	LE,SE,SA

		bare metal stent, drug eluting stent					
Unit 7	9	**Left Heart Catheterization** 7.1 Introduction and History 7.2 Indications and Contraindications, Complications 7.3 Procedure, Materials used, Catheter position 7.4 Oximetry Study – Step up and step down at various levels 7.5 Left Ventricular angiogram 7.5.1 Indications, Equipment, Complications 7.5.2 Normal LV Angiogram 7.5.3 Calculation of LV function 7.5.4 Severity assessment of MR, AR and in VSD	✓			15%	LE,SE,SA
Unit 8	10	**Right Heart Catheterization** 8.1 Introduction and History 8.2 Indications and	✓			16%	

		Contraindications 8.3 Procedure, Materials Used, Catheters – balloon tipped catheters 8.4 Measurement of hemodynamic variables 8.4.1 Oxygen Content 8.4.2 Oxygen Consumption 8.5 Cardiac Output measurement 8.5.1 Fick Method 8.5.2 Thermo dilution Method 8.5.3 Die dilution Method 8.6 Detection, Localization and Quantification of Intracardiac Shunts 8.6.1 Indicator Dilution Method 8.6.2 Contrast Angiography 8.6.3 Oximetry Study 8.7 Quantitative assessment of shunts					LE,SE,SA

		8.7.1 Flow ratio (Qp/Qs Calculation, Qep, Qes calculations) 8.7.2 Shunt flow (Qp-Qs Calculation) 8.7.3Step UP and Step Down at various levels 8.8 Vascular resistance-SVR,PVR Calculation 8. 9 Pressure measurements 8.9.1 Errors and corrective measures in pressure measurement 8.9.2 Right heart pressure waveforms: RAP, RVP, PAP, PCWP 8.9.3 Left heart pressure waveforms: LAP, LVP, Aortic pressure 8.9.4 Pressure measurements in various valvular and congenital heart disease					

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Reference books:

1. William Grossman and Baims Cardiac Catherization, Angiography & Intervention, 8Th edition Wolters Kluwer ,
2. Eric J Topol, Textbook of Interventional Cardiology, Elseveir , 8th edition
3. Morton J Kern. The Catheterization Handbook 6th edition Elsevier 2015
4. Spencer B King, Interventional Cardiology 2nd edition

Clinical CVT-II

Course: Core

Credits: 04 **Number of hours: 120 hours**

Course outcomes:

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

CO1: Diagnose various complex congenital heart diseases

CO2: Diagnose various chest X ray abnormalities

CO3: Understand basic concepts of cardiac catheterization

CO4: Understandindications,contraindications,procedure and interpretation of various stress tests

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(DEEMED TO BE UNIVERSITY)

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit-1	40hrs	**Diagnosis of complex congenital heart diseases** 60hours 1.1 Tetralogy of fallot 1.2 Pulmonary atresia 1.3 Tricuspid atresia 1.4 Ebstein's anomaly 1.5 Transposition of great arteries 1.6 Double outlet RV 1.7 Truncus arteriosus 1.8 Total anomalous pulmonary venous connections 1.9 Admixture physiology 1.10 Miscellaneous congenital heart diseases	✓			33%
Unit 2	20hrs	Unit 2: Diagnosis of chest X ray 60hours 2.1 Approach to chest x ray 2.2 Cardiac chamber enlargements 2.3 Chest x ray in various cardiac	✓			16%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		abnormalities				
Unit 3	40hrs	Basic concepts of cardiac catheterization 3.1 Basic concepts on X ray 3.2 Coronary vascular system 3.3 Hardwares 3.4 Coronary balloons, Guidewires and stents 3.5 Coronary angiogram 3.6 Coronary angioplasty 3.7 Basic knowledge on left and right heart catheterization 3.8 Pressure measurements	✓			34%
Unit 4	20hrs	Exercise stress tests 4.1 Indications and contraindications 4.2 Different types of exercise stress tests	✓			17%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		4.3 Interpretation 4.4 Basic knowledge on BLS and ACLS				

Recommended Books

1. William Grossman and Baims Cardiac Catherization, Angiography & Intervention, 8Th edition Wolters Kluwer ,
2. Eric J Topol, Textbook of Interventional Cardiology, Elseveir , 8th edition
3. Brain Griffin, Manual of cardiovascular medicine, 9th edition
4. Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier,9 January 2018
5. B N VijayaRaghavaRao, Clinical examination in cardiology, Second edition,Elsevier.21 march 2017
6. Myung K Park. Park's Pediatric Cardiology for practitioners. Elsevier India published in 2014

ENVIRONMENTAL STUDIES

Course: VAC

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

Course Outcome:

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

CO1: Student will be able to learn about environment, factors affecting it, environmental ethics and its protection.

CO2: Student will be able to describe a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, political, health and safety, manufacturability and sustainability

CO3: Student will be able to critically analyze technical subject matter (Written/ oral) for scientific merit apply learnt environmental knowledge and understanding to solve technical or research problems in new contexts

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
Unit 1	2 hrs	Multidisciplinary nature of Environmental Studies • Multidisciplinary nature of Environmental Studies Environment definition, Components of environment, Scope of environmental studies. Four spheres of earth (Hydrosphere, Atmosphere, Lithosphere and Biosphere) • Concept of sustainability and sustainable development (Brundtland Commission), pillars of sustainability; Sustainable Development Goals (SDGs). • International Agreements: Montreal protocol, Kyoto protocol, Convention on Biological Diversity (CBD)	✓			**5%**	SE, SA
Unit 2	6 hrs	Ecosystems • What is an ecosystem? Ecological units. Structure of an ecosystem; biotic and	✓			10%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		abiotic components, and function of an ecosystem; energy flow in the ecosystem; biogeochemical cycle, biological interactions, food chains, food webs, ecological pyramids and ecological succession. • Types of ecosystems: a. Terrestrial • Forest ecosystem – tropical evergreen, tropical deciduous, temperate evergreen, temperate deciduous and Taiga/Boreal • Grassland ecosystem – Savannas and Temperate grasslands (Steppes, Pampas, Prairies, Veldt and Downs. • Desert ecosystem – hot and dry, semi-					

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		arid, coastal and cold. Plant and animal adaptations. b. Aquatic ecosystems – Marine, Freshwater (lentic and lotic) and Estuarine; Pond as an ecosystem. • Ecosystem services					
Unit 3	7 hrs	Natural Resources • Classification of natural resources - Renewable and Non-renewable resources • Forest resources: Uses (timber, medicinal, food, economic importance, prevent soil erosion, control floods, religious and cultural practices) and overexploitation (Deforestation, timber extraction, mining, construction of dams). • Water resources: Uses (domestic, agricultural, industrial, electricity and	✓			15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		transport) and over utilization of surface and ground water (drying of wells, lakes and ponds, extraction of groundwater, decrease in water table, deterioration of water quality and land subsidence). Floods, Drought, dams – benefits and problems, conflicts over water (state and international) • Land resources: Land as a resource; Land degradation, earthquake, landslides, soil erosion and desertification. • Energy resources: Renewable and non-renewable energy sources, growing energy needs, use of alternate energy sources, case studies (Kochi – first solar powered airport, Tamilnadu – windmills, Gujarat – tidal energy) • Conservation of forest,					

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		water, land and energy resources.					
Unit 4	7 hrs	Biodiversity and its conservation • Introduction; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Global biodiversity hotspots • India as a mega-biodiversity nation; Endangered and endemic species of India • Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. • Ecosystem and biodiversity services: ecological, economic, social, ethical, aesthetic and informational	✓			15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		value. • Human wildlife conflicts in Indian – People and wildlife					
Unit 5	8 hrs	Environmental Pollution Definition • Cause, effects and control measures/management of: - a. Air pollution b. Water pollution c. Soil pollution d. Light pollution e. Noise pollution f. Thermal pollution g. Radiation pollution • Pollution case studies (London smog, Bhopal gas tragedy, Beijing/Delhi air pollution, Eutrophication, Minamata disease, Exxon Valdez oil spill, Love canal tragedy, Chernobyl disaster) • Climate change, Greenhouse effect, Global warming, Acid rain, Ozone layer depletion.	✓			15%	SE, SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Question type
		• Solid waste management: control measures of urban and industrial wastes. • Carbon footprint – How to calculate carbon footprint and ways to reduce your carbon footprint. • Human Population growth – impacts on environment • Environmental movements: Chipko movement, Bishnois of Rajasthan, Silent Valley, Narmada bachaoandolan					

SE- Short Essay, SA- Short Answer

Recommended Books

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., &Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.

6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. &Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press

SEMESTER V

VALVULAR AND AORTIC HEART DISEASES

Course: Core

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

Course outcomes:

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

CO1:Gain knowledge in-depth of various Valvular and aortic heart diseases

CO2:Understand the etiology, morphology and classifications of Valvular and aortic heart diseases.

CO3:Understand the hemodynamics and Pathophysiology of each Valvular and aortic heart diseases in detail.

CO4:Develop theoretical and practical skills to how to approach Valvularandaortic heart diseases by echocardiography.

CO5:Understand and develop theoretical and practical skills in cardiac catheterization, Interventional and surgical management.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of Questions

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of Questions
Unit 1	4hrs	**Rheumatic Fever** 1.1 Prevalence 1.2 Causes 1.3 Pathology 1.4 History 1.5 Major manifestations 1.6 Minor manifestations 1.7 Differential diagnosis	✓			6%	LE,SE,SA
Unit 2	11hrs	**Mitral stenosis and regurgitation** 2.1 Causes 2.2 Pathology 2.3 Pathophysiology 2.4 Clinical findings 2.5 ECG findings 2.6 X-Ray Findings 2.7 Echo Findings 2.8 Treatment 2.9 Echo Findings 2.10 Treatment	✓			18%	LE,SE,SA
Unit 3	13hrs	**Aortic valve disease and low flow low gradient AS** 3.1 Causes	✓			21%	

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of Questions
		3.2 Pathology 3.3 Pathophysiology 3.4 Clinical findings 3.5 ECG findings 3.6 X-Ray Findings 3.7 Echo Findings 3.8 Treatment					LE,SE,SA
Unit 4	5hrs	**Pulmonary valve diseases** 4.1 Causes 4.2 Pathology 4.3 Pathophysiology 4.4 Clinical findings 4.5 ECG findings 4.6 X-Ray Findings 4.7 Echo Findings 4.8 Treatment		✓		8%	
Unit 5	8hrs	**Tricuspid valve diseases** 5.1 Causes 5.2 Pathology 5.3 Pathophysiology 5.4 Clinical findings 5.5 ECG findings 5.6 X-Ray Findings	✓			13%	

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of Questions
		5.7 Echo Findings 5.8 Treatment					SE,SA
Unit 6	3hrs	**Infective Endocarditis** 6.1 Definition & Pathology 6.2 Clinical findings 6.3 Diagnosis – modified duke's criteria, ECG, X-ray, Echo 6.4 Treatment	✓			5%	SE,SA
Unit 7	8hrs	**7.1 ACC/AHA guidelines for Valvular surgery** 7.2 **Prosthetic Valves** 7.2.1 Types: mechanical/ bioprosthetic 7.2.2 Indications 7.2.3 Evaluation of prosthetic valve function: clinically/ echocardiographically 7.2.4 Prosthetic valve	✓			13%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Type of Questions
		dysfunction:Stuck valve, pannus, dehiscence etc					
Unit 8	8hrs	Diseases of Aorta 8.1 Aortic Atherosclerosis	✓			12%	LE,SE,SA
		8.2 Aortic aneurysms		✓			
		8.3 Aortic dissection	✓				
		8.4 Sinus of Valsalva Aneurysm	✓				
		8.5 Aortic Trauma		✓			

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

- Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11th edition,Elsevier,9 January 2018
- Brain Griffin, Manual of Cardiovascular medicine, 9th edition

APPLIED ECHOCARDIOGRAPHY

Course: Core

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

Course outcomes:

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

- Develop an understanding of the multi-disciplinary applications of echocardiography in structural heart disease interventions and its role as a vital procedural adjunct.
- Description and understanding of cardiologic problems almost always involves the echocardiographic findings.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit-1	11 hrs	**Transthoracic Echo Views** 1.1 dult Echo : Transducer selection, Probe Position 1.2 ifferent views 1.3 mage Optimization 1.4 ediatric Echo: .Transducer selection, Probe Position ,Different views & Image Optimization Chamber Quantification 1.2 V: Systolic function assessment, diastolic function assessment 1.3 A function assessment 1.4 ight heart functional assessment	✓			18%	LE,SE,SA
Unit 2	12 hrs	**Echo in Stenotic lesions and Regurgitant Lesions** 2.1 MS,MR	✓			20%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		2.2 AS,AR 2.3 TS,TR 2.4 PS,PR					LE,SE,SA
Unit 3	4hrs	Echo in Pulmonary Artery Hypertension and Infective Endocarditis	✓			6%	SE,SA
Unit 4	8hrs	**Echo in congenital heart disease** 4.1 Pre tricuspid shunts 4.2 Post tricuspid shunts 4.3 Increases pulmonary blood flow 4.4 Decreased pulmonary blood flow 4.5 Pulmonary venous anomalies straddling/ overriding	✓			13%	SE,SA
Unit 5	4hrs	**Echo in Ischemic Heart Diseases** 5.1 MI – Acute & Chronic 5.2 Detection of wall motion abnormalities 5.3 Segmental analysis – 2D Echo 5.4 Global LV Function 5.5 Doppler evaluation of Systolic and diastolic function 5.6 Complications of MI	✓			6%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
							LE,SE,SA
Unit 6	8hrs	**Echo in Cardiomyopathies** 6.1 DCM 6.2 RCM 6.3 HCM – obstructive / Non-obstructive 6.4 LV non compaction 6.5 ARVD	✓			13%	LE,SE,SA
Unit 7	4hrs	Echo in cardiac masses and tumors	✓			6%	SE,SA
Unit 8	9hrs	**Echo in pericardial aortic diseases** 8.1 Pericardial effusion / Tamponade 8.2 Constrictive Pericarditis 8.3 Restrictive vs constrictive physiology 8.4 Aortic dissection 8.5 Ruptured Sinus of Valsalva 8.6 Annuloaortic Ectasia	✓			15%	SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1. Harvey Feigenbaum. Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010
2. Jae K OH Tajik. Echo Manual 3rd Edition, 2006
3. Catherine M Otto, Textbook of clinical Echocardiography , Elsevier, 6th Edition 2018
4. Arthur Weyman, Principles and practices of Echocardiography, Lippincott williams and wilkins

CARDIAC CATH AND INTERVENTION I

Course: Core

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

Course outcomes:

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

CO 1: Perform procedural technique, emergency care in cath lab

CO 2: Assist diagnostic and intervention procedures

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Nice to Know	Weightage	Types of questions
Unit 1	11 hrs	**Basic concept of pacemaker** 1.1 Introduction overview	✓			18%	LE,SE,SA

		1.2 Pacemaker circuits,mode 1.3 Pacing leads 1.4 Electrical aspects of pacing 1.5 Powersource,connection 1.6 PG circuits **Temporary Pacemakers** 1.7 Indication 1.8 Components 1.9 Procedures 1.10 Pacing Methods 1.11 Lead Testing 1.12 Trouble Shootings 1.13 Complications					

Unit 2	10 hrs	**Permanent Pacemakers** 2.1 Introduction 2.2 Cardiac Hemodynamics 2.3 Basic components 2.4 classifications (NBG code) 2.5 indications 2.6 lead thresholds 2.7 Pacemaker problems 2.7.1 Acute and chronic complications 2.7.2 Malfunctioning 2.7.3 Pre-operative patients	✓			16%	LE,SE,SA
Unit 3	7 hrs	**Cardiac resynchronization therapy** 3.1 Indications & Contraindications 3.2Patient selection, Materials Used 3.3Procedure, Cath Views 3.4 Prognosis, post procedural programming and follow up assessment	✓			11%	LE,SE,SA

Unit 4	7 hrs	**Implantable cardioverter Defibrillators** 4.1 Introduction 4.2 Sudden cardiac death 4.3 Indications and Contraindications 4.4 System components and functions 4.5 Implantation and testing procedures 4.6 Devise programming for arrhythmia recognition 4.7 Device therapy 4.8 Magnet function 4.9 Management and follow-up 4.10 Surveillance	✓			11%	LE,SE,SA
Unit 5	6 hrs	**Vascular access** 5.1 Umbilical approach 5.2 Femoral approach 5.3 Subclavian approach 5.4 Radial approach	✓			10%	LE,SE,SA

		5.5 Internal jugular approach					
Unit 6	6 hrs	**Interventional Complications** 6.1 Procedure related complications 6.1.1 Dissection 6.1.2 Rupture 6.1.3 Slow flow, no flow 6.1.4 Puncture site complication 6.2 Pericardiocentesis 6.3 Covered stent 6.4 Material related Complication 6.4.1Catheter break 6.4.2 Catheter kink	✓			10%	LE,SE,SA
Unit 7	8hrs	**IVC Filter** 7.1 Indications & Contraindications	✓			13%	LE,SE,SA

		7.2Procedure 7.3Complications **FFR (Fractional flow reserve)** 7.3 Instrumentation 7.4 Equipment 7.5 Working principle 7.6 Achieving Hyperemia state 7.7 Interpretation 7.8 Pitfalls					
Unit 8	5 hrs	**Cardiac Pharmacology** 8.1 Inotropic agents 8.2 Beta blockers 8.3 Calcium channel blockers 8.4 Bronchodilators 8.5 Diuretics 8.6 Narcotics 8.7 Thrombolytics 8.8 Nitrates 8.9 Vasodilators 8.10 Antiplatelets 8.11 Steroids	✓			9%	SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1. William Grossman and Baims Cardiac Catherization, Angiography & Intervention, 8Th edition Wolters Kluwer,
2. Eric J Topol, Textbook of Interventional Cardiology, Elsevier, 8th edition
3. Morton J Kern . The Catheterization Handbook 6th edition Elsevier 2015
4. Spencer B King, Interventional Cardiology 2nd edition

Clinical CVT –III

Course: Core

Credits: 04 **Number of hours: 120 hours**

Course outcomes:

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

CO1: Quantify chambers and assess cardiac function by echocardiography

CO2:understand the applications of echocardiography in various structural heart disease interventions

CO3:Assist various diagnostic and therapeutic interventions in cath lab

- **Course Content:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit-1	40	Chamber quantification and function assessment by echocardiography	✓			33%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit 2	40	To know the applications of echocardiography in various structural heart disease interventions 2.1 Valvular lesions 2.2 Pulmonary artery hypertension 2.3 Congenital heart diseases 2.4 Infective endocarditis 2.5 Ischemic heart diseases 2.6 Cardiomyopathies 2.7 Cardiac masses and tumors 2.8 Pericardial diseases 2.9 Aortic diseases 2.10 Prosthetic valves assessment	✓			34%

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit 3	40	Cardiac Cath and intervention I 3.1 Basics of Pacemaker functioning 3.2 Temporary pacemakers 3.3 Permanent pacemakers 3.4 CRT 3.5 ICD 3.6 Interventional complications 3.7 IVUS 3.8 IVC filter 3.9 FFR	✓			33%

Recommended Books:

1.Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier, 9 January 2018

2.Hurst's The Heart manual of cardiology ,13nth edition Graw - hill education/medical ,16 November 2012

3. Moss and Adams. Heart Disease in Infants & children 9th edition

4.B N VijayaRaghava Rao, Clinical examination in cardiology, Second edition,Elsevier.21 march 2017

5.R alagappan, Manual of Practical Medicine, 6th edition, Jaypee brothers, Jan 2018

MEDICAL ETHICS

Course: VAC

Credits: 2 **No of Hours: 30 Hours**

- **Course Outcomes:**

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

CO1: Increasing the awareness and knowledge of students of the valuedimensions of interactions with the patients, colleagues, relations andpublic.

CO2: Fostering the development of skills of analysis, decision making and judgment.

CO3: Making the students aware of the need to respect the rights of the patient.

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 1	3hr	Introduction to ethics What is ethics, what are values and norms, freedom and personal responsibility?	□			15%	SA, SE

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 2	4hrs	Definition of medical ethics Major principles of medic ethics.	√			20%	LE, SA

Unit 3	4hrs	Perspective of medical ethics The Hippocratic oath, The pof Helsinki, The WHO Declaration of Geneva, International code of Medical Ethics (1993), Medical Council of India Code of Ethics (2002).	√			15%	LE, SA, SE
Unit 4	4hrs	Ethics of the individual Truth and confidentiality, the concept of disease, health and healing, theRighttohealth.	√			15%	SE
Unit 5	3hrs	The ethics of human life Prenatal sex	√			15%	SA, SE

		determination.					
Unit 6	4hrs	The family and society in medical ethics Euthanasia, cancer and terminal care.		√		10%	LE, SA
Unit 7	4hrs	Death and dying Use of life-support systems, the right to die with dignity, suicide–the Ethical outlook.		√		05%	LE, SA, SE
Unit 8	4hrs	Professional Ethics Contract and confidentiality, malpractice and negligence.		√		05%	SA, SE

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. Tsai DF. The WMA medical ethics manual. Journal of Medical Ethics. 2006 Mar 1;32(3):163
2. Loewy EE, Loewy RS. Textbook of healthcare ethics. Springer Science & Business Media; 2004 Jun 29.

HUMAN RIGHTS AND GENDER EQUITY

Course: VAC

Credits: 2 **No of Hours: 30 Hours**

- **Course Outcome:**

  At the end of this course, students will gain knowledge on,

  CO1: Basic Knowledge of Human Rights and its function and authorities in society and industry women's status, issues and gender equity.

- **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
Unit 1	5hrs	Human Rights 1.1 Human Rights –Meaning 1.2 Universal declaration of Human Rights	√			20 %	SE, SA
Unit 2	5hrs	Human Rights Advocacy 2.1 Global Advocacy of Human Rights; Amnesty International and Other Organisations 2.2 People's Union for Civil Liberty (PUCL) 2.3 Human Rights Commission in India 2.4 Minority Commission in India 2.5 Remedies Against Violation of Human Rights in India	√			25%	SE, SA
Unit 3	5hrs	Gender Equity Key Concepts- 3.1 Sex and Gender 3.2 Masculinity and Femininity 3.3 Patriarchy, Matriarchy	√			20%	SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Type Of Questions
		3.4 Gender roles and Attributes,Gender Division of Labour 3.5 Gender Bias 3.6 Gender Stereotypes 3.7 Need for Gender Sensitization					
Unit 4	5hrs	Women's Status in India Important indicators-Sex Ratio, Education, Health, Nutrition, Maternal and Infant Mortality, Work Participation Rate, And Political Participation.	√			15%	SE, SA
Unit 5	5hrs	Contemporary Women's Issues 5.1 Discrimination Against Girl Child 5.2 Violence Against Women 5.3 Problems of health and nutrition 5.4 Women's Education and Gender Bias in Education 5.5 Trafficking in women 5.6 Globalization and Impact on Women	√			15%	SE, SA
Unit 6	5hrs	State Initiatives for Gender Equity 6.1 Constitutional Rights of Women 6.2 Laws Pertaining to Women 6.3 The National and State Commissions for Women		√		05%	SE

LE- Long Essay**, SE**- Short Essay**, SA**- Short Answer

Recommended Books:

1. Parvathy Appaiah, Human Rights, Gender Equity and Environmental Studies, Shivam Books publishers, 2012.
2. Parvathy Appaiah, Human Rights, Gender Equity and Environmental Studies, Jai BharathPrakashan publishers, 2016.
3. Parvathy Appaiah, Human Rights, Gender Equity and Environmental Studies, Jai BharathPrakashan publishers, 2018-19.
4. NirmalChiranjivi: Human Rights in India,New Delhi,OUP,2001.

SEMESTER VI

ISCHEMIC, MYO-PERICARDIAL HEART DIASEASES AND CARDIAC MASSES

Course: Core

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

Course outcomes:

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

CO1: Provide knowledge with a systematic approach to evaluate patients withdifferent heart diseases like Ischemic, Myo - Pericardial heart diseases and Cardiac Masses.

CO2: Acquire knowledge on physiologic principles, Structural and functional abnormalities which govern the function of the heart.

CO3: Understand different etiologies, clinical presentations and types associatedwith disease states including Ischemic, Myo - Pericardial heart diseases and Cardiac Masses.

CO4: Develop theoretical and practical skills to how to approach Ischemic,Myo - Pericardial heart diseases and Cardiac Masses by echocardiography.

CO5: Understand and develop theoretical and practical skills in CardiacCatheterization, Interventional and surgical management of underlyingPathologies.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit-1	12	**Acute Coronary Syndrome** 1.1 Definition 1.2 STEMI 1.3 NSTEMI 1.4 Etiology 1.5 Pathophysiology of ACS - Ischemic Cascade 1.6 Clinical Presentation - Unstable Angina, Chronic Stable Angina 1.7 Diagnosis – ECG, Cardiac biomarkers, ECHO, Cath Management **Old Myocardial Infarction** 1.8 Definition 1.9 Pathophysiology 1.10 Clinical Presentation 1.11 Diagnosis – ECG, ECHO 1.12 Management	✓			20%	LE,SE,SA
Unit 2	4	2.1 Detection and Quantitation of Wall Motion Abnormalities	✓			6%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		2.2 ECHO – Transthoracic and Stress Echo 2.3 Role of other modalities					SE,SA
Unit 3	13	**Complications of Myocardial Infarction** 3.1 Pericardial Effusion 3.2 Infarct Expansion / Acute remodeling 3.3 Free wall rupture 3.4 Ventricular Thrombus 3.5 Right Ventricular Infarction 3.6 Acute MR 3.7 VSR 3.8 Cardiogenic Shock **Chronic Complications** 3.9 Left Ventricular Aneurysm 3.10 Left Ventricular Pseudoaneurysm 3.11 Chronic Remodelling 3.12 Mural Thrombus 3.13 MR	✓			21%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		3.14 Chronic Ischemic Dysfunction					
Unit 4	5	**Dilated cardiomyopathy** 4.1 Etiologies – idiopathic, familial DCM 4.2 Clinical findings 4.3 Pathophysiology 4.4 ECG, XRAY, ECHO, Cath findings 4.5 Management & Prognosis	✓			9%	LE,SE,SA
Unit 5	5	**Hypertrophic cardiomyopathy** 5.1 Definition, Genetic basis 5.2 Anatomical Variants 5.3 Physiological Variants : Obstructive vs non obstructive 5.4 Pathophysiology 5.5 Clinical findings 5.6 ECG, XRAY, ECHO findings		✓		9%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		5.7 Differential Diagnosis 5.8 Predictors of sudden cardiac death inHCM 5.9 Management & Prognosis					LE,SE,SA
Unit 6	5	**Restrictive cardiomyopathy** 7.1 Definition 7.2 Classification &Etiology 7.3 Pathophysiology 7.4 Clinical features 7.5 Diagnosis : ECG, ECHO & other modalities 7.6 Infiltrative Cardiomyopathy 7.7 Cardiac Amyloidosis 7.8 Endomyocardial fibrosis 7.9 Sarcoidosis 9 Storage disorders: Pompe's disease, Fabry's disease		✓		8%	LE,SE,SA
Unit 7	4	**Other variants in Cardiomyopathy**	✓			6%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		7.1 Peripartum Cardiomyopathy 7.2 LV non compaction 7.3 Arrythmogenic RV dysplasia 7.4 Takostubo Cardiomyopathy					SE,SA
Unit 8	5	**Cardiac tumors and masses** 8.1 Definition 8.2 Primary Cardiac Tumors 8.3 Metastatic cardiac Tumors 8.4 Clinical features 8.5 Diagnosis: ECG, ECHO & other modalities 8.6 Differential Diagnosis	✓			8%	SE,SA
Unit 9	7	**Pericardial disease** 9.1 Pericardial effusion/ tamponade 9.2 Constrictive Pericarditis 9.3 Absent Pericardium	✓			11%	

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
							LE,SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books

1. Harvey Feigenbaum. Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010
2. Jae K OH Tajik. Echo Manual 3rd Edition, 2006
3. Catherine M Otto, Textbook of clinical Echocardiography , Elsevier, 6th Edition 2018
4. Arthur Weyman,Principles and practices of Echocardiography,Lippincottwilliams and wilkins

ADVANCED ECHOCARDIOGRAPHY

Course: Core

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

Course outcomes:

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

CO1: Understand basic concepts of ultrasound physics of advancedtechniques in echocardiography.

CO2: Develop an understanding of the multi-disciplinary applications of advanced techniques in clinical practice over conventional 2D imaging and its role as a vital procedural adjunct.

CO3: Acquire theoretical and practical knowledge of advantages andlimitations of each technique in clinical applications.

CO4: To understand its role in qualitative and quantitative assessments ofvarious heart diseases according to evidence-based guidelines.

CO5: Understand the utility and prerequisite of each technique in various areas including catheter based interventional techniques and duringcardiac surgeries in diagnosis making.

COURSE CONTENT:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit-1	8hrs	**TEE** **1.1** Introduction **1.2** Indications, Contra indications, Complications **1.3** Equipments used **1.4** TEE Probe – Types, Manipulation and orientation options **1.5** Examination technique; Patient preparation, Probe insertion, Technical problems **1.6** TEE Views and Interpretation	✓			14%	LE,SE,SA
Unit 2	6hrs	**Contrast echocardiography** 2.1 Introduction 2.2 Indications Contraindications 2.3 Ultrasound Contrast Agents 2.4 Applications of Contrast Echo – Shunt lesions, Stress Echo, Myocardial contrast 2.5 Machine settings	✓			11%	LE,SE,SA
Unit 3	7hrs	**Tissue Doppler imaging(TDI)** **3.1** Tissue annular velocities **3.2** Myocardial strain & Strain rate **3.3** Tissue dyssynchrony imaging	✓			11%	LE,SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 4	11 hrs	**Advanced echocardiographic imaging modalities** Speckle tracking echocardiography 4.1 AFI 4.2 Strain and strain rate 4.3 LV torsion **3D Echocardiography** 4.4 Introduction 4.5 Indications, Advantages & Limitations 4.6 3D Echo Transducers and Physics 4.7 Views and Interpretation	✓			18%	SE,SA
Unit 5	7hrs	**Cardiac Dyssynchrony** 5.1 Definition & etiology 5.2 Pathophysiology 5.3 Assessment of intra ventricular/ interventricular/ atrioventricular dyssynchrony by echocardiography	✓			11%	LE,SE,SA
Unit 6	5hrs	**Myocardial perfusion imaging**		✓		8%	SE,SA
Unit 7	10 hrs	**Newer types of ultrasound scanners** **7.1** Portable **7.2** Laptop **7.3** Handheld **7.4** Palmheld		✓		10%	SE,SA

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
		7.5 Point of care echoes **Storage and retrieval of echo images**					
Unit 8	6hrs	**Intracardiac Echocardiography** **8.1** Instrumentation & Technique **8.2** Applications & Limitations	✓			11%	SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

Recommended Books:

1. Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010
2. Jae K OH Tajik. Echo Manual 3rd Edition, 2006
3. Catherine M Otto, Textbook of clinical Echocardiography , Elsevier, 6th Edition 2018
4. Arthur Weyman, Principles and practices of Echocardiography, Lippincott williams and wilkins

CARDIAC CATH AND INTERVENTION II

Course: Core

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

Course outcomes:

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

CO 1: Gain knowledge in depth of indications and timings of interventional procedures for various heart diseases.

CO 2: Understand in detail about equipment, materials, sequential approach for various procedures in cathlab.

CO 3: Develop assisting interventionalist during each procedure independently.

CO 4: Develop practical skill in how to manage situations during emergencies in cathlab.

CO 5: Enumerate the measures to be taken before, after and during the procedures.

CO 6: Illustrate the role of ECG, echocardiography, hemodynamic assessment during and after the interventional procedures of various diseases.

COURSE CONTENTS:

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage	Types of questions
Unit 1	7hrs	**Valvuloplasties** **1.1** Indications, Procedure, Materials used, Complications of: 1.1.1 BMV 1.1.2 BAV 1.1.3 BPV 1.1.4 BTV	✓			10%	LE,SE,SA
Unit 2	14 hrs	**Cath and angiography in CHD** 2.1Indications, Procedure, Materials used, interventional procedures and complications of (Acyanotic): 2.1.1 ASD 2.1.2 VSD	✓			12%	LE,SE,SA

		2.1.3 PDA 2.2. Indications, Procedure, Materials used, Complications of (Cyanotic): 2.2.1 TOF 2.2.2 TGA 2.2.3 ECD					
Unit 3	7 hrs	**Cardiac assist devices** 3.1 Indications, Procedure, Materials used, Complications of: 3.1.1. IABP 3.1.2 Impella 3.1.3 ECMO	✓			11%	LE,SE,SA
Unit 4	8 hrs	**Introduction to EP study** 4.1 Indications & Contraindications Patient selection, Materials Used Procedure, Cath Views 4.2 Prognosis, Post procedural programming and follow up assessment 4.3 Radio Frequency Ablation	✓			12%	LE,SE,SA

Unit 5	5 hrs	**Cardiac Cath and intervention in HOCM** 5.1 Indications & Contraindications 5.2 Procedure, Materials Used, Complications 5.3 Brocken brough phenomena 5.4 PTSMA	✓			8%	LE,SE,SA
Unit 6	4 hrs	**Recent advances in Interventional Cardiology** 6.1 TAVI 6.1.1. Indications & Contraindications 6.1.2 Procedure, materials used, Cath views 6.1.3. Valves used 6.1.4. Complications 6.1.5. Role of Echo in TAVI	✓			8%	LE,SE,SA
Unit 7	2 hrs	**Mitra Clip** 7.1. Indications & Contraindications, Complications 7.2. Procedure, materials used, Cath views 7.3. Role of Echo in Mitra clip	✓			4%	LE,SE,SA

Unit 8	8 hrs	**Advanced Techniques** 8.1 Intravascular lithotripsy 8.1.1 Indications & Contraindications, Complications 8.1.2. Procedure, materials used, Cath views 8.2 IVUS 8.2.1 Instrumentation 8.2.2 Equipment 8.2.3 Working principle 8.2.4 Plaque distribution imaging 8.2.5 Interpretation 8.2.6 Advantages & disadvantages 8.3Rotablation 8.3.1 Instrumentation 8.3.2 Equipment 8.3.3 Indications & Contraindications 8.3.4 Complications	✓			4%	SE,SA
Unit 9	5hrs	**Peripheral intervention** 9.1 Indications & Contraindications 9.2 Procedure, Materials Used, Complications 9.3 Renal stenting 9.4 Carotid stenting peripheral vascular stenting 9.5 EPD				8%	LE,SE,SA

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

References:

1. William Grossman and Baims Cardiac Catherization, Angiography &Intervention , 8Th edition Wolters Kluwer ,
2. Eric J Topol, Textbook of Interventional Cardiology, Elseveir , 8th edition
3. Morton J Kern . The Catheterization Handbook 6th edition Elsevier 2015
4. Spencer B King , Interventional Cardiology 2nd edition

Clinical CVT-IV

Course: Core

Credits: 4 **No of Hours: 120hours**

Course Outcomes:

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

CO1: Perform advanced techniques of echocardiography

CO2: Detect and quantify wall motion abnormalities by using echocardiography

CO3: Asssist various Cath lab procedures

- **Course Content:**

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
Unit-1	40	Advanced techniques in echocardiography 1.1 Trans esophageal echocardiography	✓			33%
		1.2 Contrast echocardiography	✓			
		1.3 Tissue Doppler imaging	✓			

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		1.4 Speckle tracking echocardiography	✓			
		1.5 3D echocardiography		✓		
		1.6 Cardiac dys synchrony	✓			
		1.7 Newer types of ultrasound scanners	✓			
		1.8 Basic knowledge on myocardial perfusion scan		✓		
		1.9 Intracardiac echocardiography		✓		
Unit 2	40	Detection and quantification of wall motion abnormalities 2.1 ECHO-Transthoracic and stress echo	✓			33%
		2.2 Role of other modalities		✓		
		2.3 Complications of Myocardial infarction	✓			
Unit 3	40	Cardiac Cath and intervention II 3.1 Procedures for VHD	✓			34%
		3.1a BMV	✓			
		3.1b BAV	✓			
		3.1c BPV, BTV	✓			

Unit	Hrs	Content	Must Know	Good to Know	Desirable to Know	Weightage
		3.2 Cath and angiography in CHD	✓			
		3.3 Cardiac assist devices		✓		
		3.4 Recent advances in interventional cardiology	✓			
		3.5 Introduction to EP study	✓			

Recommended Books:

1.Feigenbaum's Echocardiography, Wolters Kluwer India .6th Edition ,2010

2.William Grossman and Baims Cardiac Catherization, Angiography & Intervention , 8Th edition Wolters Kluwer ,

3.Eric J Topol, Textbook of Interventional Cardiology, Elseveir , 8th edition

4.Catherine M Otto, Textbook of clinical Echocardiography , Elsevier, 6th Edition 2018

5.Braunwald's Heart Disease, A Textbook of cardiovascular medicine,11nth edition, Elsevier, 9 January 2018

BIOSTATISTICS

Course: VAC

Credits: 2 **No of Hours: 30 Hours**

- **Course Outcomes:**

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

CO 1: Understand the concepts of Statistics in the field of Health Professionals.

➢ **COURSE CONTENT:**

Unit	Hrs	Content	Must Know	Good to Know	Nice to Know	Weightage	Types of Question
Unit 1	3 hours	**Introduction** 1.1 Meaning, definition of statistics. 1.2 Importance of the study of statistics. 1.3 Branches of statistics. 1.4 Statistics and health science including nursing. 1.5 Parameters and estimates. 1.6 Descriptive and inferential statistics. 1.7 Variables and their types. 1.8 Measurement scales		√		15%	SA, SE
Unit 2	3 hours	**Tabulation of Data** 2.1 Raw data, the array, frequency distribution 2.2 Basic principles of graphical representation 2.3 Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, ogive. 2.4 Normal probability	√			15%	SA, SE

Unit	Hrs	Content	Must Know	Good to Know	Nice to Know	Weightage	Types of Question
		curve.					
Unit 3	4 hours	**Measure of Central Tendency** 3.1 Need for measures of central tendency 3.2 Definition and calculation of mean - ungrouped and grouped 3.3 Meaning, interpretation and calculation of median ungrouped and grouped 3.4 Meaning and calculation of mode. 3.5 Comparison of the mean, and mode.	√			15%	LE, SE
Unit4	6 hours	**Measure of Variability** 4.1 Need for measure of dispersion. The range, the average deviation. 4.2 The variance and standard deviation. 4.3 Calculation of	√			15%	LE, SE

Unit	Hrs	Content	Must Know	Good to Know	Nice to Know	Weightage	Types of Question
		variance and standard deviation ungrouped and grouped. 4.4 Properties and uses of variance					
Unit 5	6 hours	**Probability and Standard Distributions** 5.1 Meaning of probability of standard distribution. 5.2 The Binominal distribution. 5.3 The normal distribution. 5.4 Divergence from normality - skewness, kurtosis.	√			15%	SA, SE
Unit 6	5 hours	**Sampling Techniques** 6.1 Need for sampling - Criteria for good samples. 6.2 Various sampling designs. 6.3 Procedures of sampling and sampling designs errors.	√			15%	LE, SA, SE

Unit	Hrs	Content	Must Know	Good to Know	e to Know	Weightage	Types of Question
		6.4 Sampling variation. 6.5 Tests of significance.					
Unit 7	3 hours	**Health Indicator** 7.1 Importance of health Indicator. 7.2 Indicators of population, morbidity, mortality, health services. 7.3 Calculation of rates and rations of health.		√		10%	SA, SE

LE- Long Essay**, SE-** Short Essay**, SA-** Short Answer

- **Recommended Books:**

1. K S Negi, Biostatistics, Third Edition, AITBS Publishers, India, 2020.

2. K VisveswaraRao, Biostatistics a Manual of Statistical Methods for Use in Health Nutrition and Anthropology. 2 nd Edition, JAYPEE, 2009.

INTERNSHIP (SEMESTER VII &VIII)

ELIGIBILTY:

A candidate should have passed in all the courses (Core, AECC and Electives) amounting to 137 number of credits before entering in to internship.

DURATION:

A candidate has to mandatorily complete 1 year (2 semesters) of internship. The total credit per

semester is 20 and for two semesters it is 40

OBJECTIVES: 1. Be able to perform and diagnose ECG's , stress tests and Holter monitoring

2. Be able to assess Ischemic, Myo-Pericardial Heart Disease And Cardiac Masses based on clinical evaluation & Cardiac Non-invasive diagnostic modalities , mainly Transthoracic Echocardiography

3. Be able to understand the various diagnostic and therapeutic modalities based on the patient's historyand examination findings.

4. Be able to understand & assess Advanced Echocardiographic modalities including Contrast Echo,Dobutamine stress echo & Strain Echocardiography

5. Be able to have knowledge and skills for detection of various Congenital & Acquired heart diseaseusing Cardiac Ultrasound

6. Be able to operate, maintain equipment & Assist physicians with Cardiac catheterization proceduresincluding implanting of pacemakers.

CLINICAL ROTATION AREAS AND DURATION (Mandatory) :

Areas/Unit	**Minimum duration**
BASEMENT ECG	2 months
OPD ECG	2 months
TMT	2 months
ECHO 1	2 months
ECHO 2	2 months
CATH	2 months

Learning outcomes

Sl .No	**Learning outcome**	**Knowledge**	**Application/Evaluation**

1.	Develop in depth knowledge on cardiac electrophysiology & to perform electrocardiogram	To gain theoretical knowledge on the normal ECG variables & abnormalities in ECG	To perform & gain basic practical skill to interpret a given ECG
2.	Develop an understanding of the multi-disciplinary applications of echocardiography in structural heart disease interventions and its role as a vital procedural adjunct.	-Knowledge on morphology, classifications &hemodynamic of cyanotic &acyanotic congenital heart diseases , valvular& other acquired heart diseases	To perform standard diagnostic Echocardiography and report it
3.	Gain knowledge in depth of indications and to build the ability to assist independently for the interventional procedures	Knowledge on normal Coronary artery /venous circulation and its anomalies	To perform standard Coronary angiographic views and assist during other Interventional Cath lab procedures
4.	Perform relevant screening and / or diagnostic tests appropriate for cardiovascular risk stratification	Determines tests and procedures appropriate to the patient's condition and abilities, with cardiologists	Formulates an examination plan based on the patient history

1. The duration of the internship shall be a minimum of one year or 2 semesters (8 hours of practice a day, totaling to 36 credits).

2. The Interns shall be entitled for 12 day total leave on any account during the entire period of Internship and no other leave shall be permissible.

3. The candidate is expected to work for minimum 8 hours per day and this may be more depending on the need and the healthcare setting.

4. If the period of leave exceeds the sanctioned limit, Internship is liable to be extended at the discretion of the authority. In case of Emergency any additional leave asked for shall be discretion of the authority and will be doubled.

5. The attendance of all the interns shall be marked/monitored by the respective Clinical coordinator and concerned HOD, by maintaining the intern's attendance register. All the interns are directed to mark their attendance, by putting their full initials (specimen signature to be given to the Clinical coordinator).

6. Interns shall observe duties as per the roaster devised by the department, and no change in duty shall be permissible without the permission of clinical coordinators Interns shall be courteous, polite, respectful and sympathetic towards the patients, their accompanying attenders, hospital staff and their colleagues.

7. Intern shall maintain decorum and commitment and discipline of the profession and show keen interest in patient care.

8. The interns will be entrusted with clinical responsibilities under supervision of the senior Technician/Technologist and are expected to discharge the duties assigned to them sincerely & effectively.

9. Aprons/scrubs & ID is mandatory while reporting to the Hospital and always carry the required articles needed for examination of the patients. A fine of Rs.500/- will be charged from the interns not using white coat/scrubs and identification card during their duty in the Hospital.

10. Scrubs should be worn inside the campus only. If found outside, a fine of Rs 500/- will be charged.

11. The performance shall be assessed based on the assessment sheet provided in the Log Book.

12. Maintains safe and clean working environment by complying with procedures, rules, and regulations.

13. Provides continuous of care by developing and implementing patient-management plans.

14. Each semester of Internship shall be minimum of 18 credits. The credits are calculated based on 1 credit = 3 to 5hours of practical training. There shall be an exit exam at the end of the each semester.

ANNEXURES

List of Annexures:

1. ANNEXURE – I: Question Paper Layout for Internal Assessment of Theory Examination (Core)
2. ANNEXURE – II: Question Paper Layout for Internal Assessment of Theory Examination (AEC & VAC)
3. ANNEXURE – III: Logbook Format
4. ANNEXURE – IV: Seminar assessment scoring template
5. ANNEXURE V: Objective Structured Practical Examination (OSPE)
6. ANNEXURE – VI: Internship Assessment and Evaluation Format
7. ANNEXURE – VII: Assignment assessment rubric

ANNEXURE – I

Model Question Paper for theory of Internal assessment & Semester end Examination

I Semester B.Sc. Cardiovascular technology

Time: 2 Hours Max. Marks: 50 Marks

SUBJECT NAME:

Q.P Code:

Your answer shall be specific to question asked.

Draw neat and labeled diagrams wherever necessary.

LONG ESSAY (Answer any One) **(1x10=10Marks)**

1.

2.

SHORT ESSAY (Answer any Five) **(5x4=20Marks)**

3.

4.

5.

6.

7.

8.

9.

SHORT ANSWERS (Answer any Ten) **(10x2=20Marks)**

10.

11.

12.

13.

14.

15

16.

17.

18.

19.

20.

21.

ANNEXURE – II

Model Question Paper of theory for Internal assessment and Semester end Examination of AEC & VAC

I Semester B.Sc. Cardiovascular Technology

Time: 2 Hours **Max. Marks: 25 Mark**

Subject name

Q.P Code:

Your answer shall be specific to question asked.

Draw neat and labeled diagrams wherever necessary.

LONG ESSAY (Answer any Three) (3x5=15Marks)

1.

2.

3.

4.

5.

SHORT ANSWERS (Answer any Five) **(5x2=10Marks)**

6.

7.

8.

9.

10.

11.

12

ANNEXURE – III:Logbook format

Area of Posting:
Date:

Patient Name: Age: Hospital Number:

History:

Symptoms:

Clinical Examination:

HR: BP: Pulse: JVP:

CVS: S1S2: Murmur: RS:

Investigation:

ECG:

Chest X Ray:

Indication for Test:

Observation:

Final Impression:

Coordinators signature

ANNEXURE IV: Seminar assessment scoring template

B.Sc. Cardiovscular technology

Name of the Student **Registration No :**

Class:

Rubric for Case Presentation		
Assessment Criteria	**Meets Expectations**	**Below Expectations**
Score	**2**	**1**
Organization & Style		
Content & Knowledge		
Presentation skills		
Analysis		
Q & A Session		
Total Score (Max Score – 10)		

Assessment done by:

Assessor Signature :

ANNEXURE V: Objective Structured Practical Examination (OSPE)

B.Sc. Cardiovascular Technology

TEST: Segmental approach to echocardiography

Objectives:

1. To learn about the stepwise approach to perform echocardiography

Skills tested

- Recall
- Psychomotor skills

Materials Required:

1. Simulation lab
2. Echo workstation
3. Mannequin
4. Probe
5. Probe Gel

Max Marks: 20

Time: 10 Min

Check List for the observer: **Roll Numbers**

Steps	**Marks**					
Ask the name, check the ECG and reference sheet, ask for any cardiac history and symptoms	1					
Apply gel to the probe	1					
Ask the patient to lie in lateral decubitus position	1					
Parasternal long axis view, probe and indicator position	2					
Parasternal short axis view at 4 level, probe and indicator position	2					
Apical 4 chamber view, probe and indicator position	2					

Apical 2 chamber view, probe and indicator position	2					
Apical 3 chamber view, probe and indicator position	2					
Apical 5 chamber view, probe and indicator position	2					
Subcoastal 4 chamber view, probe and indicator position	2					
Suprasternal view, probe and indicator position	2					
Give the tissue paper	1					
Total Marks	**20**					

Instructions: Mark ☑ for the correct procedure step and Mark ☒ for the incorrect procedure step

Signature of the observer

ANNEXURE – VI: Internship Assessment and Evaluation Format

CLINICAL EVALUATION:

Quality and Quantity of Work:

Quality and Quantity of work	Poor (1)	Good (2)	Very Good (3)	Excellent (4)	Remarks
1.To what extent has the quality of intern's work matched the responsibilities given?					
2.How thorough and complete has the intern's work been?					
3. How successful has the intern been in meeting the requirements with respect to the amount of work within the time allocated?					
4.Define in quantity (list) work done: 1. 2. 3. 4.					

Knowledge of work and working abilities evaluation:

Knowledge of work and working abilities	Poor (1)	Good (2)	Very Good (3)	Excellent (4)	Remarks
1. To what extent does the intern demonstrate capability of using scientific facts and skills as a basis for his performance?					
2. To what extent does the intern demonstrate a desire to learn more than just routine aspects of the prescribed work?					
3. To what extent does the intern adjust to new work methods and conditions?					
4. How effective has the intern been in planning and organizing his work?					
5. How effectively does the Inter communicate in speech and writing					
6. To what extent does the intern accept the maximum responsibilities for his work and volunteer for new assignments?					
7. How effective has the intern been in establishing a working relationship?					
8. To what extent is the intern receptive to new ideas and information?					

General Performance:

General Performance	Poor (1)	Good (2)	Very Good (3)	Excellent (4)	Remarks
1.To what extent has the intern been punctual and complied with the working hours of the institution?					
2.How effective has the intern been in following departmental policies and procedures?					
3.How effective were the intern's attitudes towards other members of the health care team?					

Clinical Evaluation

The total points acquired will be calculated for the 15 components and the points acquired out of 60 marks will be normalised to 50 marks for grading.

Case Presentation

Slide preparation and explanation skill	5 marks
Respiratory care Management	10 marks
Reasoning skills/new updates	10 marks
Total Marks	25 marks

Log Book

- Documentation of one clinical case per day and to be verified by the respective clinical incharge.

- Submission of log book to be done fortnightly and verified by the coordinator.

RUBRICS FOR CLINICAL EVALUATION:

Skills	Marks
Clinical Evaluation	50 marks
Case Presentation	25 marks
Log Book	25 marks
Total Marks	100 marks

ANNEXURE VII: Rubric for Assignment

Guidelines:

- Each student has to submit two assignments in each of the core courses.
- The assignment topics need to be displayed on the **Yengage portal** by the 4th week of instruction of the semester (Dates specified in the Semester Planner)
- The assignment topic should be in correspondence with the topics covered in the syllabus.
- The students have to submit the assignments on the Yengage portal on or before the date of submission. (Dates specified in the Semester Planner). After which, the assignments cannot be uploaded.
- The faculty needs to evaluate the assignment based on the evaluation rubric
- The assignment marks have to be displayed on the Yengage portal within 15 days of submission (Dates specified in the Semester Planner)

Assignment Rules and Regulations (PG Students)

- The assignment should not exceed 3,000 words (excluding title page and references).
- The assignment needs to be written using A4-sized white sheets or notebook for future reference.
- Assignments must be neat, well-organized, and free from typographical errors.
- Evaluation will be based on the assignment rubric considering content quality, analysis, structure, and presentation.
- Basic structure to be followed are as follows:
    - **Introduction** (10% of the assignment): This is where you introduce the topic and briefly explain the purpose of the assignment.
    - **Discussion** (80% of the assignment): This section is divided into a number of paragraphs. A paragraph usually starts with a topic sentence stating the main idea, followed by supporting evidence and examples.

- **Conclusion** (10% of the assignment): this section briefly restates your main argument, evaluate your ideas and summarise your conclusions. Don't introduce any new information in this section.

Report Evaluation

Name of the student: _____

Program: _____

Course: _____

Assignment Topic: _____

Date of submission: _____

Faculty In charge: _____

Sl. No.	Assessment criteria	Marks Allotted	Marks Awarded
1	Title/Cover page	--	
2	Table of contents	--	
3	Organization of assignment	02	
4	Level of Content	03	
5	Pictures/diagrams/illustrations	03	
6	Grammar and mechanics	01	
7	Bibliography	01	
	Total points	10	

Criteria	Excellent	Good	Satisfactory	Needs Improvement
Organization	Clear, logical flow; well-structured introduction, body, conclusion **(2 points)**	Mostly clear structure with minor lapses **(1.5 points)**	Somewhat organized but hard to follow **(1 points)**	Disorganized, difficult to follow **(0.5 points)**
Level of content	Information is accurate, thorough, and relevant **(3 points)**	Mostly accurate with some irrelevant details **(2 points)**	Some inaccuracies or missing key points **(1.5 points)**	Many inaccuracies, lacking key points **(1 point)**
Diagrams / Pictures / Illustrations	Diagrams or illustrations are neat, accurate, well-labeled, and add value to understanding. **(3 points)**	Diagrams are mostly clear but may lack some labels or neatness. **(2 points)**	Diagrams are present but do not clearly explain the content. **(1.5 points)**	No relevant diagrams or pictures included, or they are poorly done. **(1 points)**
Grammar & Mechanics	Writing is clear and error-free. Proper sentence structure, punctuation, and spelling used throughout. **(1 point)**	Few minor errors that do not affect understanding. **(0.5 points)**		Many grammar and spelling mistakes make it hard to understand. **(0 points)**
Bibliography / References	All sources are properly listed and formatted correctly. Reliable and relevant references are used. **(1 point)**		Few references included; some may not be reliable. **(0.5 points)**	No bibliography or sources listed. **(0 points)**