



# Cardiac Perfusion Diploma

2026



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

— In The Name of Allah —

# I. PREFACE

- The primary goal of this document was to enrich the training experience of postgraduate trainees by outlining the learning objectives and competencies necessary for them to become independent and competent future practitioners.
- This curriculum may contain sections outlining training regulations; however, such regulations must be sought from the “General Bylaws of Training in Postgraduate Programs” and “Executive Policies” published by the Saudi Commission for Health Specialties (SCFHS), which can be accessed online through the official SCFHS website. In case of discrepancies in the regulation statements, the one stated in the most updated bylaws and executive policies must be considered.
- As this curriculum is subject to periodic refinement, please refer to the electronic version posted online for the most updated edition at [www.scfhs.org.sa](http://www.scfhs.org.sa)

## II. CONTRIBUTORS

This curriculum was prepared by the Specialty's Curriculum Development Committee:

- Dr. Hajed M. Al-Otaibi
- Mr. Bander Zamzami
- Mrs. Budoor Alaujan
- Mr. Junaid Ahmed
- Mr. Yasser Aljehani

Reviewed and Approved by the Specialty's Scientific (Council of Health Rehabilitation) Members:

- Dr. Hajed M. Al-Otaibi
- Mr. Khalid Alebawi

Advisory Committee Members (Curriculum Review Committee members):

- Dr. Nouf Alrumaihi, MBBS, Msc.MedEd., PMP
- Dr. Mai Alajaji, Msc.MedEd, PhD

Approved by the Head of the Curricula Review Committee:

- Dr. Ali Alyhaya, MD, MME, FRCS



## III. COPYRIGHT STATEMENTS

All rights reserved. © 2026 Saudi Commission for Health Specialties. This material may not be reproduced, displayed, modified, distributed, or used in any manner without prior written permission from the Saudi Commission for Health Specialties, Riyadh, Saudi Arabia. Any changes to this document must be endorsed by the Specialty Scientific Council and approved by the Central Training Committee. Unless otherwise stated, this document shall be considered effective from the publication date of the updated electronic version of this curriculum on the commission's website.

We also acknowledge that the CanMEDS framework is a copyright of the Royal College of Physicians and Surgeons of Canada and that many of the competencies described have been acquired from their resources. Please refer to: Frank, J. R., Snell, L., Sherbino, J., & Boucher, A. (2015). CanMEDS 2015 Physician Competency Framework Series I. Ottawa: Royal College of Physicians and Surgeons of Canada.

Correspondence: Saudi Commission for Health Specialties P.O. Box: 94656  
Postal Code: 11614 Contact Center: 920019393

**E-mail:** [Curricula@scfhs.org.sa](mailto:Curricula@scfhs.org.sa)

**Website:** [www.scfhs.org.sa](http://www.scfhs.org.sa)

**ISBN:** 978-603-8408-88-9

# IV. TABLE OF CONTENTS

I. PREFACE	3
II. CONTRIBUTORS	4
III. COPYRIGHT STATEMENTS	5
IV. TABLE OF CONTENTS	6
V. INTRODUCTION	7
1. Context of Practice	7
2. Goals and Responsibilities of Curriculum	12
VI. ABBREVIATIONS USED IN THIS DOCUMENT	14
VII. PROGRAM ENTRY REQUIREMENTS	15
VIII. LEARNING AND COMPETENCIES:	16
1. Introduction to Competency-Based Education	16
IX. TEACHING METHODS:	27
1. Program-Specific Learning Activities:	27
2.1. Logbook	29
3. Universal Topics	30
4. General Learning Opportunities:	32
X. ASSESSMENT AND EVALUATION	33
1. Purpose of Assessment	33
2 Formative Assessment	34
2.2 Formative Assessment Tools	36
2.3 Promotion of the trainee:	43
3 Summative Assessment	44
XI. PROGRAM AND COURSE EVALUATION	51
Appendix A	52



# V. INTRODUCTION

## 1. Context of Practice

Perfusion involves the circulation of bodily fluids such as blood through the circulatory or lymphatic systems to the organs or tissues. Because the heart plays a crucial role in distributing fluids throughout the body, when a patient undergoes a cardiac procedure that disrupts normal cardiac function, a cardiac perfusionist intervenes to artificially regulate this process <sup>[1-3]</sup>.

### Historical Evolution:

**Early Concepts (Ancient Times to 19th Century):** The origins of perfusion can be traced back to ancient times, as evidenced by early practices such as bloodletting and wound care. However, the systematic study of perfusion commenced in the 17th and 18th centuries through the work of scientists such as William Harvey, who elucidated blood circulation in mammals <sup>[4]</sup>.

**Development of Experimental Techniques (19th Century):** In the 19th century, the study of perfusion began to evolve through pioneering scientists who laid the foundation for novel methodologies through revolutionary research on blood transfusions and bubble oxygenation. This included extracting organs for perfusion trials, wherein organs were removed from the body and perfused with blood or other fluids to examine their functions <sup>[5]</sup>.

**Introduction of Heart-Lung Machines (20th Century):** One of the significant milestones in perfusion technology was the development of heart-lung machines (HLM) in the early 20th century. John H. Gibbon Jr. is considered the founder of this groundbreaking machine in 1953 <sup>[6]</sup>. This invention has paved the way for advancements in cardiovascular surgery and the field of perfusion technology.

**Emergence of Surgical Assistants:** Despite the historical progression of perfusionists linked to the development of perfusion technology and the increasing complexity of medical procedures involving the management of blood circulation, surgical assistants have evolved to aid in various aspects of surgery. Nonetheless, perfusionists have usually been individuals who frequently receive on-the-job training, often from backgrounds such as laboratory technicians or nurses <sup>[7]</sup>.

**Introduction of Cardiopulmonary Bypass (20th Century):** The formal role of perfusionists began to take shape with the invention of cardiopulmonary bypass (CPB) technology to aid open-heart surgery (OHS) during the latter part of the 20th century. This revolution paved the way for additional developments such as extracorporeal circulatory support (ECS), mechanical circulatory support (MCS), and total artificial hearts (TAH). With the ability to bypass both the heart and lungs, surgeons can fix cardiac abnormalities, replace dysfunctional valves, and bypass occluded coronary arteries <sup>[8]</sup>.

**Establishment of Formal Training Programs (Late 20th Century):** With the increasing prevalence of OHS and advancements in perfusion technology, the demand for proficient perfusionists has increased. Specialized training programs tailored for perfusionists have emerged, providing extensive instructions on cardiovascular physiology, CPB procedures, equipment utilization, and patient management. Graduates of these programs often obtain a certification as a clinical perfusionist <sup>[9]</sup>.

### Current Practices and Responsibilities of Perfusionists:

In contemporary healthcare, perfusionists are highly trained professionals who hold a pivotal position in supporting a variety of medical interventions that require CPB, extracorporeal membrane oxygenation (ECMO), organ preservation, intra-aortic balloon pump (IABP), autologous blood salvage, and ventricular assist devices (VAD) <sup>[10]</sup>.



- 1- **Cardiopulmonary Bypass (CPB) during Cardiac Surgery:** Perfusionists supervise the operation of HLM during OHS to ensure the circulation of oxygenated blood throughout the body while the heart is temporarily suspended. They are responsible for monitoring and regulating various parameters, including blood flow rates, blood gas analysis, temperature management, anticoagulant efficiency, ultrafiltration, and myocardial preservation, to ensure patient safety and well-being during the procedure [11].
- 2- **Extracorporeal Membrane Oxygenation (ECMO) Support:** Perfusionists are involved in the management of patients requiring ECMO support, a treatment that offers temporary cardiac or respiratory aid to individuals with critical heart or lung dysfunctions. Perfusionists usually supervise the ECMO circuit, monitor patients' vital signs, and enact modifications to enhance oxygenation and circulation [12].
- 3- **Organ Preservation for Transplantation:** Perfusionists play a crucial role in preserving donor organs intended for transplantation. They use specialized perfusion devices to sustain the viability of organs outside the body, thereby ensuring optimal conditions for transplantation. Perfusionists diligently monitor organ function, oxygenation, and metabolic parameters to assess organ quality and appropriateness for transplantation.
- 4- **Intra-operative auto transfusion:** Perfusionists also handle Intra-operative auto transfusion, a (process wherein a patient's own blood is collected, processed, and reinfused during surgery to minimize the necessity for allogeneic blood transfusions).
- 5- **Mechanical Circulatory Support:** Perfusionists play a multifaceted role in mechanical circulatory support, which requires technical proficiency, analytical thinking, and dedication to patient well-being. Vital contributions to the effective execution and supervision of MCS treatments include left ventricular assist device (LVAD), right ventricular assist device (RVAD), and

TAH, which are engineered for long-term use in patients with heart failure, either as a bridge to heart transplantation or permanent treatment. Perfusionists also play a crucial role in the management of patients receiving IABP therapy, especially in preoperative and critical care settings, and ensure the safety and efficacy of the procedure <sup>[13]</sup>.

**6- Research and Development:** Perfusionists actively engage in research projects focused on the advancement of perfusion technology, enhancement of perfusion strategies, and improvement of patient outcomes. They collaborate with interdisciplinary teams to design and execute research studies, collect data, and analyze results to contribute to the understanding of knowledge within the realm of perfusion.

**7- Quality Assurance and Safety:** Perfusionists adhere to strict quality assurance protocols and safety standards to maintain the integrity and sterility of perfusion equipment and supplies. They actively participate in quality improvement initiatives, safety evaluations, and ongoing professional development to sustain their expertise and skill in the field <sup>[14]</sup>.

### Current Situation in Saudi Arabia:

A study conducted in 2016 revealed that cardiovascular disease (CVD) was a leading cause of death among Saudi nationals, accounting for 45% of all mortalities in this group <sup>[15]</sup> while another proportion of population in the kingdom had high rates of valvular heart disease (VHD) and congenital heart disease (CHD). This high percentage underscores the significant health burden that CVD imposes on the Saudi population, which in turn emphasizes the importance of improving healthcare delivery.



The MOH declared that ECMO services would be available in the kingdom following the pandemic; additionally, they indicated that multiple institutes would be established exclusively for this purpose, as it has become a critical part and foundation to support terminally ill patients with refractory reversible hypoxic respiratory failure or refractory cardiogenic failure. Managing such patients requires an integrated medical team that also includes a perfusion specialist to adequately handle such major situations.

In addition, continuous research and improvements in perfusion technologies are expected to increase the standards of the field in the region. In recent years, in addition to cardiac surgery, perfusionists have played a key role in organ transplant surgeries involving CPB. Moreover, perfusionists have begun to focus on their expertise in specialized fields such as pediatric perfusion to address the distinct requirements of young patients undergoing cardiac procedures.

In conclusion, the future of perfusion technology in SA is expected to be bright, as the vital role of perfusionists in medical procedures continues to be in demand, owing to the growing need for complex procedures that require highly skilled perfusionists.

### Course Overview:

The Cardiac Perfusion diploma curriculum will provide specialized focus on surgical techniques related to the physiology and pathology of the heart and lungs. Additionally, trainees will learn about the latest perfusion technologies and equipment used in medical procedures. The program will also cover topics such as patient assessment, pharmacology, ethics in perfusion practice, and equipment used to maintain function during medical interventions. Overall, the goal of the program will be to prepare trainees for careers as proficient and skilled perfusionists in different healthcare settings.

## Foundational Concepts:

The curriculum aims to develop a comprehensive understanding of the fundamental concepts of perfusion, the cardiovascular system, blood flow dynamics, and the use of medical devices to support circulation during surgical procedures. Graduates of perfusion programs are trained to operate HLM and other specialized equipment to maintain the patient's physiological stability during cardiac surgery. They also learn the principles of oxygenation, ventilation, and circulation to provide optimal support for patients undergoing CPB.

## Technological Advancements:

Perfusion technology has advanced significantly in recent years, allowing for better monitoring and control of blood flow during surgeries and other medical procedures. The curriculum covers the latest developments in perfusion equipment and techniques including ECS, MCS, myocardial preservation, induction of hypothermia/hypothermia and TAH with the ability to bypass both the heart and lungs, membrane oxygenators, VAD, and ECMO systems. Graduates will master operating these devices safely and proficiently, ensuring the most optimum outcomes during surgical procedures.

## 2. Goals and Responsibilities of Curriculum

In this program, a proficient graduate undergoes precise training to effectively oversee and operate intricate apparatuses. The trainees will receive comprehensive training to become proficient in handling sophisticated medical equipment such as HLM, ECMO, anticoagulation analysis, online blood gas monitoring, hyperthermic intraperitoneal chemotherapy, autologous cell salvaging devices, IABP, and VAD.



Graduates will be tasked with optimal functionality to sustain patients. circulation and oxygen levels throughout the surgical procedure. They will also be entrusted with the vital responsibility of closely monitoring the patient's physiological indicators, regulating the blood flow rate within the machine, and skillfully managing potential complications that may arise.

Graduates are expected to be actively involved and resolute in achieving educational goals, engage in self-directed learning, problem solving, have a keenness to apply knowledge through reflective practice based on feedback and formative assessment, self-awareness, and exhibit readiness to seek assistance when necessary.

This curriculum also requires considerable dedication and collaboration from all committee members engaged in the diploma program. The strategic direction of the Saudi Commission for Health Specialties (SCFHS) employs a recognized competency framework of training governance to ensure the highest quality of training. The diploma program also emphasizes research and evidence-based practice in its curriculum. Furthermore, academic affairs within training centers and the regional supervisory training committee play a pivotal role in overseeing the implementation of training. The scientific committee of the diploma in the Cardiac Perfusion course is dedicated to regularly updating the curriculum content to align it with the highest standards of diploma education for all graduates.

## VI. ABBREVIATIONS USED IN THIS DOCUMENT

Congenital Heart Disease	CHD
Valvular Heart Disease	VHD
Coronary Artery Disease	CAD
Extracorporeal Membrane Oxygenation	ECMO
Ventricular Assist Devices	VAD
Heart-Lung Machine	HLM
Total Artificial Heart	TAH
Extracorporeal circulatory support	ECS
Cardiopulmonary Bypass	CPB
Mechanical Circulatory Support	MCS
Intra Aortic Balloon Pump	IABP
Left ventricular assist device	LVAD
Right ventricular assist device	RVAD
Open Heart Surgery	OHS
Ministry of Health	MOH
Saudi commission for Health Specialties	SCFHS
Saudi Arabia	SA



# VII. PROGRAM ENTRY REQUIREMENTS

**For the updated program entry requirement,** please refer to the executive policy of the SCFHS on admission and registration.

# VIII. LEARNING AND COMPETENCIES:

## 1. Introduction to Competency-Based Education

The Cardiovascular Perfusion Diploma curriculum is designed based on a competency-based education (CBE) framework. This approach focuses on attaining specific, measurable, and critical competencies that ensure perfusionists are fully equipped to meet the demands of their roles in the healthcare system. The competencies in this curriculum are divided into knowledge, skills, and attitudes, which are essential for effective performance in the cardiovascular perfusion field <sup>[16, 17, 18]</sup>.

The concepts associated with CBE are:

- a. **Competency:** Competency refers to a healthcare professional's observable ability; it encompasses knowledge, skills, values, and attitudes/professional behavior. It reflects the potential to perform efficiently in a given situation based on the standards of the profession, and involves the ability to practically apply these components in real-world settings. Professional roles (e.g., medical experts, health advocates, communicators, leaders, scholars, collaborators, and professionals) are used to define competency roles that make them malleable for learning and assessment.
- b. **Milestones:** Milestones represent stages of the developmental journey along the competency continuum. Throughout their learning journey, trainees from junior to senior levels assist in transitioning from novice/supervised to master/unsupervised. This should not undermine the role of supervisory/regulatory bodies toward the malpractice of



independent practitioners. Milestones are expected to enhance the learning process by pacing training/assessment to match the trainees' developmental levels (junior vs. senior).

- c. **Learning Domains:** The categories or dimensions of learning encompass the development of a learner's abilities and attributes. These domains are commonly divided into the following three key areas: K = Knowledge, S = Skills, and A = Attitude (also known as professional behavior).

## COMPETENCY FRAMEWORK:

### 1. MEDICAL EXPERT

Integrates all medical knowledge, skills, and attitudes to provide safe, high-quality, and patient-centered care during cardiopulmonary bypass and other perfusion-related procedures <sup>[19, 20]</sup>.

#### Objectives:

- To execute the setup and priming of the heart-lung machine for cardiopulmonary bypass without assistance, as consistently verified using Direct Observation of Procedural Skills (DOPS) assessments.
- To manage simulated CPB emergencies by promptly initiating correct protocols to stabilize the simulated patient, as successfully assessed in high-fidelity simulation scenarios.
- To interpret real-time patient parameters during CPB procedures, documenting all interventions and their physiological rationale to demonstrate clinical reasoning.

### 2. COMMUNICATOR

Facilitates effective clinical communication and relationships with patients, their families, and the healthcare team <sup>[19, 20]</sup>.

### **Objectives:**

- To deliver clear pre-operative explanations of the perfusion process to patients or their families, consistently using layman's terms, and confirm understanding as documented in clinical evaluations.
- To provide structured and timely updates to the surgical team at all key milestones during every CPB case, achieving satisfactory ratings on intra-operative evaluations.
- To lead postoperative team debriefs for complex cases, effectively summarizing the perfusion course and contributing to discussions regarding the clinical outcomes.

### **3. COLLABORATOR**

Work effectively within an interprofessional team to achieve optimal patient care <sup>[19, 20]</sup>.

### **Objectives:**

- To contribute perfusion-specific inputs to interprofessional team meetings for complex cases, as verified by supervising preceptors.
- To document collaborative decision making by consistently consulting other healthcare professionals when managing complex patient scenarios.
- To resolve simulated interprofessional conflicts using structured communication techniques as assessed in a standardized scenario.

### **4. LEADER**

Demonstrates leadership and management skills to enhance patient care and contributes to a positive and efficient working environment <sup>[19, 20]</sup>.

### **Objectives:**

- To direct a simulated perfusion team through a complex procedure, ensure all safety checks are completed, and roles are clearly defined.



- To propose evidence-based improvements for perfusion protocols or safety practices within the clinical site for review and potential implementation.
- To demonstrate efficient resource management by consistently minimizing blood product usage and circuit waste, as documented in the final portfolio.

## 5. HEALTH ADVOCATE

Uses expertise and influence to advance the health and well-being of individual patients, communities, and populations <sup>[19, 20]</sup>.

### Objectives:

- To implement a patient safety checklist for pre-CPB equipment inspection to ensure its consistent use in clinical practice.
- To participate in community health outreach events focused on cardiovascular disease prevention, and submit reflective reports on the experience.
- To create a quality improvement report proposing an evidence-based intervention to enhance patient outcomes.

## 6. SCHOLAR

Demonstrates a lifelong commitment to reflective learning, and the creation and application of new knowledge <sup>[19, 20]</sup>.

### Objectives:

- To design a complete research proposal on a perfusion science topic for formal approval from the research committee.
- To lead journal club sessions that critique recent peer-reviewed articles and facilitate discussions on their clinical implications.
- To submit a case report or literature review based on clinical encounters for publication.

## 7. PROFESSIONAL

Demonstrates commitment to society and the profession through ethical practice, high personal standards of behavior, and accountability<sup>[19, 20]</sup>.

### Objectives:

- To maintain a consistent record of satisfactory or higher ratings for all clinical evaluations of professional conduct, including punctuality, reliability, and confidentiality.
- To report any clinical errors or near misses through the proper institutional channel and participate in the subsequent analysis.
- To update a personal development plan with a faculty advisor at regular intervals and identify strengths and weaknesses across all competency roles.

### Program Duration:

The Cardiovascular Perfusion Diploma is a comprehensive two-year program.

### Program Rotations:

The program rotations are designed to equip trainees with the necessary skills and knowledge through clinical, practical, and didactic experiences across various settings and patient populations.

### Rotation Schedule for the Cardiovascular Perfusion Diploma

The Postgraduate Diploma in Cardiac Perfusion is structured into 13 blocks per academic year; each block spans 4 weeks. One block is reserved for an annual vacation, while the remaining 12 blocks are devoted to academic coursework, practical training, and clinical rotations.



## First Year

Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
Introduction to Cardiovascular Perfusion	2 block	Hospital	<p>To identify the roles and responsibilities of a cardiovascular perfusionist in a clinical setting.</p> <p>To describe basic perfusion principles and their application in clinical practice.</p>	Introduces foundational concepts and the role of perfusionists in the clinical setting.
Basic Cardiovascular Physiology	2 blocks	Hospital	<p>Mastering cardiovascular physiology.</p> <p>To develop a thorough understanding of the components of the cardiovascular system and articulate their basic functions.</p> <p>To analyze the physiological mechanisms that affect cardiac performance and systemic circulation.</p>	Deep dive into the mechanics and dynamics of the cardiovascular system, essential for effective perfusion management.
Equipment and Instrumentation Handling	1 block	Hospital	<p>Learning to handle perfusion equipment.</p> <p>To provide a comprehensive introduction to each perfusion equipment, detailing its specific functions, components, alarm systems, and troubleshooting methods, accompanied by appropriate manuals and training.</p>	Covers the operation, maintenance, and troubleshooting of perfusion-related equipment.

Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
Perfusion Techniques	2 blocks	Hospital	<p>Applying basic perfusion techniques.</p> <p>To demonstrate basic perfusion techniques and protocols used during surgical procedures.</p> <p>To apply perfusion management strategies to maintain physiological stability during surgeries.</p>	Practical introduction to standard perfusion techniques used during surgeries
Clinical Rotations in Adult Cardiac Surgery	1 block	Hospital	<p>Gaining clinical experience in adult cardiac surgery.</p> <p>To participate in adult cardiac surgeries, applying perfusion techniques under supervision.</p> <p>To evaluate and respond to clinical situations during cardiac procedures effectively.</p>	Hands-on clinical rotation focusing on perfusion practices during adult cardiac surgeries.
Research Methodologies	1 block	University	<p>Developing research skills specific to perfusion.</p> <p>To design basic research projects related to cardiovascular perfusion.</p> <p>To apply statistical methods to analyze research data in perfusion studies.</p>	Teaches basic research methods, statistics, and how to apply them in perfusion studies.
Advanced Monitoring Techniques	1 block	Hospital	<p>Implementing advanced monitoring during perfusion.</p>	Focuses on the use of advanced monitoring



Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
			<p>To implement advanced monitoring techniques to enhance patient safety and outcomes.</p> <p>To interpret data obtained using advanced monitoring systems to make informed clinical decisions.</p>	technologies to improve patient outcomes during surgery.
Pediatric Perfusion Techniques	1 block	Specialized Pediatric Center	<p>Mastering pediatric perfusion techniques.</p> <p>To apply specialized perfusion techniques for pediatric patients.</p> <p>To address the physiological differences in pediatric patients during perfusion procedures.</p>	Specialized training in the unique challenges and techniques of pediatric perfusion.
Emergency Perfusion Procedures	1 block	Hospital	<p>Conducting emergency perfusion procedures confidently.</p> <p>To execute emergency perfusion protocols.</p> <p>To assess and manage changes in patient status and/or perfusion machinery during emergencies.</p>	Prepares students for handling urgent and life-saving perfusion scenarios effectively.
Annual Leave	1 block			
Total	13 blocks			

## Second Year

Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
Advanced Perfusion Techniques	3 block	Hospital	<p>Developing proficiency in complex perfusion techniques</p> <p>To employ the most current and advanced perfusion techniques to enhance the standards of practice.</p>	<p>Focuses on advanced methods and innovations in perfusion technology, including handling complex cases</p>
Management of Cardiopulmonary Bypass	2 blocks	Hospital	<p>Managing cardiopulmonary bypass setups and operations.</p> <p>To manage cardiopulmonary bypass setups, including equipment preparation and operation.</p> <p>To make critical decisions to modify bypass circuit and/or techniques based on the patient's history, parameters, procedure and the surgeon's preferences.</p>	<p>Teaches management and decision-making during cardiopulmonary bypass, emphasizing patient safety and technique efficiency.</p>
Miniaturized Circuits for Cardiopulmonary Bypass	2 block	Hospital	<p>Utilizing miniaturized circuits effectively.</p> <p>To learn the advantage of miniaturized cardiopulmonary bypass circuits and how to apply it.</p> <p>To evaluate the benefits and limitations of miniaturized circuits in clinical practice.</p>	<p>Provides hands-on experience with newer, smaller bypass circuits that reduce complications and improve outcomes.</p>



Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
Clinical Decision Making	1 block	Hospital	<p>Enhancing clinical judgment and decision-making skills.</p> <p>To enhance problem-solving and decision-making skills in real-time clinical settings.</p> <p>To apply clinical reasoning to develop effective perfusion management strategies.</p>	Focuses on critical thinking and problem-solving in real-time clinical environments.
Ventricular Assist Devices	1 block	Hospital	<p>Mastering the use of ventricular assist devices.</p> <p>To learn the indications and contraindications of ventricular assist devices.</p> <p>To install and manage ventricular assist devices for patients with heart failure.</p> <p>To monitor and adjust ventricular assist device settings to meet patient-specific needs.</p>	Covers the selection, implementation, and management of ventricular assist devices in patients with advanced heart failure.
Extracorporeal Membrane Oxygenation (ECMO)	1 block	Hospital	<p>Operating and managing ECMO systems.</p> <p>To operate ECMO systems with a focus on safety and efficiency.</p> <p>To troubleshoot ECMO systems during emergencies.</p>	Focuses on the setup, operation, and troubleshooting of ECMO systems, critical for patient support in cardiac and respiratory failure.

Rotation Name	Duration (Blocks)	Setting	Competencies and Objectives	Descriptions
Heart Transplantation Perfusion	1 block	Hospital	<p>Performing perfusion for heart transplantation surgeries.</p> <p>To perform specialized perfusion techniques during heart transplantation surgeries.</p> <p>To collaborate with surgical teams to ensure optimal patient care during transplantation.</p>	Provides training on the specific needs and challenges of perfusion during heart transplantation procedures.
Research in Perfusion Technology	1 block	University	<p>Conducting research in perfusion technologies.</p> <p>To conduct independent research projects to innovate or improve perfusion technologies.</p> <p>To critically review existing literature and studies to guide perfusion practice and research.</p>	Encourages the development of research skills related to improving and innovating perfusion technologies.
Annual Leave	1 block			
Total	13 blocks			



## IX. TEACHING METHODS:

The teaching process in postgraduate cardiac perfusion diploma training programs is mainly based on the principles of adult learning theory. The trainees are expected to be aware of the importance of learning and play active roles in the content and process of their own learning. The training programs implement the adult learning concept in each feature of the activities, where trainees are responsible for their own learning requirements. Formal training time includes the following three teaching activities:

1. Program-Specific Learning Activities
2. Universal topics
3. General Learning Opportunity

### 1. Program-Specific Learning Activities:

Program-specific activities are educational activities are specifically designed and intended to teach trainees during their training. Trainees are required to attend these activities, and noncompliance can result in disciplinary actions. It is advisable to link the attendance and participation in these activities with formative assessment tools (see the formative assessment section below). Program administration should support these activities by providing protected time for trainees to attend these activities and allowing them to participate.

Year	Module	Duration	Outlines
<b>Modules of first year training</b>	Orientation	1 week	<ul style="list-style-type: none"> <li>• General hospital orientation Program</li> <li>• General departmental orientation</li> <li>• Policies and procedures</li> <li>• Hospital mandatory training courses</li> <li>• infection control</li> <li>• BLS and ACLS</li> </ul>
	Module 1: Cardiopulmonary anatomy and physiology	8 weeks	See program rotation for more details
	Module 2: Cardiopulmonary pathophysiology	8 weeks	
	Module 3: Perfusion and hemodynamics	16 weeks	
	Module 4: Cardiac Pharmacology	8 weeks	
<b>Modules of second year training</b>	Module 5: Diagnostic test analysis	8 weeks	See program rotation for more details
	Module 6: ECMO and other related technology	16 weeks	
	Module 7: Research in cardiac perfusion	8 weeks	
	Module 8: Pediatric cardiac perfusion	8 weeks	

The trainees are meant to feel the importance of learning and playing active roles in the content and learning processes. Formal training time includes the following two formal teaching activities:

## 1.1. Program Academic Half-Day Activity:

At least 2 hours of formal training per week (commonly referred to as the academic half-day). Formal teaching time is a pre-arranged event involving an assigned tutor, time slots, and venue. Formal teaching time does not encompass activities such as bedside teaching or clinic postings. The academic half-day covers the core specialty topics determined and approved by the specialty's scientific council, aligned with specialty-defined competencies and teaching methods. The core specialty topics ensure that important clinical problems of the specialty are taught adequately. It is recommended that lectures be conducted using an interactive case-based discussion format. Each core topic's learning objectives must be clearly defined, and it is preferable to use pre-learning materials. Educators should ensure that each topic discussion is stratified into the three categories of the learning domain: knowledge, skill, and attitude.

The recommended sessions of "academic half days" typically comprise the following: Theoretical lectures and a case discussion based on cardiovascular perfusion topics. This academic half day should be an interactive session in which both the cardiovascular perfusion faculty and trainees present interesting cases and cardiovascular perfusion findings.

## 2.1. Logbook

The trainee is expected to fulfill the following requirements within the logbook:

### 2.1.1 Setting/conducting and maintaining:

- ❖ A minimum of 150 Adult cardiopulmonary bypasses.
- ❖ A minimum of 50 Pediatric cardiopulmonary bypass.
- ❖ A minimum of 50 minimal invasive procedure.
- ❖ A minimum of 20 complex perfusion procedures.

- ❖ A minimum of 50 ECMO
- ❖ A minimum of 10 pediatric ECMO.

2.1.2 Interpret a minimum of 100 ECG.

### 3. Universal Topics

Universal topics are educational activities developed by the SCFHS and intended for all specialties. Priority is given to topics related to these qualities:

- High value
- Interdisciplinary and integrated
- Require expertise that might be beyond the availability of the local training sites.

Universal topics have been developed by the SCFHS and are available through e-learning via personalized access for each trainee (to access online modules). Each universal topic has a self-assessment at the end of the module. As indicated in the “executive policies of formative assessment and annual promotion,” universal topics are a mandatory component of the criteria for the annual promotion of trainees from their current level of training to the subsequent level, particularly at residency level. Universal topics are usually distributed throughout the training period. The table below shows the universal topics and years required for completion.



Example table for Universal Topics distributed over the training years:

Training Year	Modules		Topics name	
	Number	Name	Number	Name
First year	Module-1	Medical fundamentals	Topic-2	Hospital acquired infection
			Topic-3	Antibiotic stewardship
			Topic-5	Safe drug prescribing
	Module-3	Diabetes and Metabolic Disorders	Topic-10	Diabetic Emergencies
			Topic-12	Obesity
	Module-4	Medical and Surgical Emergencies	Topic-14	Acute chest pain
			Topic-15	Acute breathlessness
			Topic-16	Altered sensorium
			Topic-17	Hypotension
			Topic-18	Hypertension
Topic-21			Abnormal ECG	
Second year	Module-5	Acute care	Topic-22	Pre-Operative Assessment
			Topic-24	Acute and Chronic Pain Management
			Topic-26	Management of Electrolyte Imbalances
	Module-7	Ethics and Healthcare	Topic-31	Occupational Hazards of Healthcare Workers
			Topic-32	Evidence-based Approach to Smoking Cessation

Training Year	Modules		Topics name	
	Number	Name	Number	Name
			Topic-33	Patient Advocacy
			Topic-34	Organ Transplantation
			Topic-35	Autonomy and Treatment Refusal
			Topic-36	Death and Dying

## 4. General Learning Opportunities:

Formal training time should be supplemented by other practice-based learning (PBL) such as:

### 4.1 Journal Club:

A journal club is an educational tool aimed at enhancing the knowledge of certain related topics and keeping trainees updated on new trends and evidence-based practices. This will also promote their research skills by encouraging them to critique and appraise current research findings. Journal clubs should be conducted at least once a month.

### 4.2 Continuous professional development (CPD) activities relevant to the specialty (conferences and workshops)

CPD involves lifelong learning. Trainees will have the opportunity to update their knowledge, sharpen their skills, and/or refresh existing information by attending conferences, symposiums, workshops, scientific meetings, or short courses on relevant topics.

# X. ASSESSMENT AND EVALUATION

## 1. Purpose of Assessment

Assessment plays a vital role in the success of postgraduate training. Assessment guides trainees and trainers to achieve defined standards, learning outcomes, and competencies. Moreover, assessment provides feedback to learners and faculty regarding curriculum development and implementation, teaching methods, and quality of the learning environment. A reliable and valid assessment is essential for assessing curriculum alignment with respect to its objectives, learning methods, and assessment tools. Finally, the assessment assures patients and the public that health professionals are safe and competent in practice <sup>[21, 22, 23]</sup>.

Assessment can serve the following purposes:

- 1.1. **Assessment of learning:** Trainers use information from trainees' performances to inform their learning for improvement. This enables educators to use information about trainees' knowledge, understanding, and skills to provide feedback about learning and how to improve.
- 1.2. **Assessment as learning** involves trainees in the learning process while enabling them to monitor their own progress. Trainees use self-assessment and educator feedback to reflect on their progress. It develops and supports the trainees' metacognitive skills. Assessment as learning is crucial for helping residents/fellows become lifelong learners.

1.3. **Assessment of learning** is used to demonstrate the achievement of trainees' learning. This is a graded assessment that usually counts towards the trainees' end-of-training degree.

1.4. **Feedback and evaluation**, as assessment outcomes, represent quality metrics that can improve the learning experience.

For organizational purposes, assessments are classified into two main categories: formative and summative.

## 2 Formative Assessment

### 2.1 General Principles

Formative assessment should be integrated into curriculum design, grounded in best practices and evidence-based approaches, and aligned with the stated competencies and appropriate tools.

#### **Purpose of formative assessment:**

Formative assessment aims to actively support trainees' growth by guiding learning, verifying progression, and ensuring that they acquire competencies essential for high-quality professional practice across all health disciplines. It also aims to:

- Enhance learning by offering trainees opportunities to practice, receive immediate feedback, measure their performance, and identify areas for further development and improvement.
- Drive learning and optimize the training process by clarifying expectations for trainee and motivating them to actively pursue suitable training and experiences.
- Provide robust, comprehensive evidence that trainees are progressing toward meeting curriculum standards throughout the training program.
- Ensure trainees are acquiring the required competencies across all domains of good healthcare practice.



- Verify that trainees possess the essential foundational knowledge, skills, and professional attitudes needed for their specialty.
- Confirm that trainees are advancing appropriately in their performance relative to their stage of training.

Trainees, as adult learners, should actively seek out feedback and use it to develop their performance throughout their journey from “novice” to “mastery” levels of competence. Formative assessment (also referred to as continuous or ongoing assessment) is a component of assessment deliberately distributed across academic years to provide trainees with timely, meaningful, and actionable feedback that drives learning and improvement.

A specified time should be allocated for trainees to meet with their program director or equivalent, to review performance reports and logs (e.g., ITER, logbook, workplace-based assessment tools). Trainees are expected to take ownership of their development through self-directed learning. The input from the overall formative assessment tools is integrated at the end of the year to inform decisions about whether individual trainees will advance to the next level of training. The formative assessment instruments will be periodically reviewed and updated as needed to ensure alignment with SCFHS guidelines and standards.

In line with the best practices in health profession education, formative assessment will have the following features tailored to the targeted competencies:

- a. Multisource: Select all appropriate tools, including relevant workplace-based assessments, according to competency, training level, and rotation.
- b. Comprehensive: covers all learning domains (i.e., knowledge, skills, and attitude (professional behavior)).
- c. Relevant: focus on workplace-based observations for performance in authentic practice settings.

- d. Milestone-oriented competency: reflecting the trainee's expected competencies that matched their developmental levels.

## 2.2 Formative Assessment Tools

### 2.2.1 Work-based assessment:

Work-based assessment (WBA) is sometimes used interchangeably with workplace-based assessment (WPBA) is a direct observational assessment of a trainee in a real work environment. It has also recently been referred to as a supervised learning event (SLE).

WBA is one of the most recognized and widely utilized approaches for enhancing learning through formative assessment and feedback.

Many WBA tools assess a range of competencies, including communication and consultation skills, clinical decision-making and reasoning, and management of patients in contexts where diagnostic uncertainty, resource constraints, and public health considerations may exist. Moreover, WBA tools facilitate the assessment of more complex domains such as professionalism, procedural skills, and ethical and legal aspects inherent to clinical practice, which may not be adequately evaluated using traditional assessment methods.

### 2.2.2 Educational Activity (Non-WBA assessment)

Educational Activities (EA) are part of the trainees' training program, which involves teaching and learning activities to acquire specialty competencies. Examples of contributions to educational activities can be, but are not limited to, presenting in journal clubs, lectures, morbidity and mortality rounds, grand rounds, and research and scholarly activities.



All formative assessment tools used for formative assessment purposes **MUST** abide by the **Scoring Categories and Scaling Definitions in the SCFHS policies.**

Doesn't Meet Expectation	Borderline	Meets Expectation	Exceeds Expectation
(<50%)	(50-69.99%)	(>70- 89.99%)	(>90%)

Achieving the optimal training outcome requires the candidate to complete all mandatory formative assessment tools (see Tables A and B).

Table A. Formative assessment tools – D1

Level	Assessment Tool	Domain(s)	Description (what it is / what it assesses)	Frequency / Timing
D1	<b>Academic Activities (Educational Activities/EA)</b>	Knowledge / Professionalism	Participation in structured educational activities (academic half-day, lectures, seminars, journal club presentations, M&M/rounds, case presentations). Used to document engagement and progress and to guide feedback.	<b>Weekly</b> academic half-day (≥2 hours/week) + other scheduled activities across the year. Attendance monitored continuously.
D1	<b>CBD (Case-Based Discussion)</b>	Knowledge / Clinical reasoning	Structured discussion of a case managed/participated in by the trainee to assess clinical reasoning, application of knowledge, decision-making, and reflective practice; documented feedback on a CBD form.	<b>Minimum 6 CBDs per academic year</b> Recommended distributed across rotations.
D1	<b>DOPS (Direct Observation of Procedural Skills)</b>	Skills / Patient safety	Workplace-based direct observation of a defined perfusion-related procedure (e.g., setup/priming, anticoagulation management tasks, monitoring tasks, troubleshooting), focusing on technical steps, safety, and professional performance; includes immediate feedback.	<b>Minimum 3 per rotation</b> during clinical rotations

Level	Assessment Tool	Domain(s)	Description (what it is / what it assesses)	Frequency / Timing
D1	Mini-CEX (Mini Clinical Evaluation Exercise)	Skills / Communication / Professionalism	Brief observed encounter in the clinical environment (e.g., team communication at key CPB milestones, handover, perfusion plan discussion) assessing clinical skills, communication, professionalism; includes immediate feedback.	1–2 per rotation.
D1	Logbook / Portfolio	Skills / Breadth of exposure	Longitudinal documentation of exposure and competence development (cases, procedures, ECMO runs), aligned with required minimum numbers (e.g., adult/pediatric CPB, ECMO). Used for monitoring progression and feedback meetings.	Daily/ongoing entry as procedures occur; <b>mentor sign-off within 1 week;</b> <b>monthly review</b> with mentor/PD; submitted end of rotations and end of training
D1	Research / QI project (progressive milestones)	Scholar role / Skills	Supervised scholarly activity assessing ability to ask a question, apply scientific method, use evidence, and contribute to patient care improvement. In formative phase, emphasis is on proposal development, ethics (if applicable), data plan, and interim progress.	<b>Longitudinal across D1–D2</b> with documented milestones (proposal, progress update). Presentation/defense occurs at program end (summative decision).
D1	ITER (In-Training Evaluation Report)	Attitude / Overall performance	End-of-rotation evaluation aligned with SCFHS criteria assessing professionalism, teamwork, communication, reliability, and achievement of rotation objectives; informs feedback and learning plan.	<b>End of each rotation</b>



Level	Assessment Tool	Domain(s)	Description (what it is / what it assesses)	Frequency / Timing
D1	360-Degree Feedback (MSF)	Attitude / Teamwork	Multi-source feedback from consultants/surgeons, perfusion supervisors, OR team, ICU staff, and peers to assess professional behavior and collaboration.	annually or once per year
D1	EYPTn't (End-of-Year Promotion Exam)	Knowledge (and decision-making)	Year-end examination to <b>guide learning and readiness</b> for the next stage (D2). Used to identify knowledge gaps and shape individualized learning plans.	Annually at end of D1
D1	OSCE/OSPE (formative)	Skills / Communication / Safety	Structured stations assessing core perfusion competencies (e.g., circuit checks, parameter interpretation, emergency response steps, communication scenarios) in a controlled environment; formative feedback provided to target gaps before senior training.	Annually at end of D1

**DOPS:** Direct observation of procedural skills; **Mini-CEX:** Mini-Clinical Evaluation exercise; **CbD:** Case-based Discussion; **MCQs:** Multiple-choice Question Exam; **EYPT-Local:** End of year promotion exam; **SOE:** Structured Oral Exam; **OSCE:** Objective Structured Clinical Examination; **ITER:** In-Training Evaluation Report; **PT:** Progress Test; **CAPs:** Critically appraised paper; **COT:** Consultation observation tool; **CAT:** Critically appraised topic

- All formative and work-based assessments (WBA) should be performed following the SCHFS definitions and methodologies; not complying with these requirements will subject trainees to disciplinary actions according to the SCFHS bylaws.

Table B. Formative assessment tools — D2

Level	Assessment Tool	Domain(s)	Description	Frequency / Timing
D2	Academic Activities (EA)	Knowledge / Professionalism	As in D1.	Weekly academic half-day + scheduled activities.
D2	CBD	Knowledge / Reasoning	As in D1, but expected higher complexity and more independent justification.	Minimum 6/year (or program-defined).
D2	DOPS	Skills / Safety	As in D1, with higher expectations (less prompting, more independence).	Minimum 3/rotation.
D2	Mini-CEX	Skills / Communication	As in D1.	Program-defined (recommended 1–2/rotation).
D2	Logbook / Portfolio	Skills / Breadth	As in D1; ensures achievement of required case numbers and competencies.	Daily entries; weekly sign-off; monthly review; end-of-rotation submission.
D2	Research / QI project (completion readiness)	Scholar	Tracks completion and readiness for final presentation/defense.	Longitudinal; final product due end of D2 (summative outcome).
D2	ITER	Attitude / Overall	As in D1.	End of each rotation.
D2	360-Degree Feedback	Attitude	As in D1.	Program-defined (commonly annually / end of D2).

**DOPS:** Direct observation of procedural skills; **Mini-CEX:** Mini-Clinical Evaluation exercise; **CbD:** Case-based Discussion; **MCQs:** Multiple-choice Question Exam; **EYPT-Local:** End of year promotion exam; **SOE:** Structured Oral Exam; **OSCE:** Objective Structured Clinical Examination; **ITER:** In-Training Evaluation Report; **PT:** Progress Test; **CAPs:** Critically appraised paper; **COT:** Consultation observation tool; **CAT:** Critically appraised topic

- All formative and work-based assessments (WBA) should be performed following the SCHFS definitions and methodologies, and not complying with these requirements will subject trainees to disciplinary actions according to the SCFHS bylaws.

### **Clinical Performance during Clinical Rotations**

The trainee competency is measured by means of a daily electronic clinical evaluation. The daily clinical evaluation form is designed to address the cognitive, affective, psychomotor, and interpersonal learning domains of the program. The trainee must send the form to the clinical instructor, who completes the evaluation, and then reviews it with the trainee, immediately following each case. The trainees are responsible for completing the top portion of the evaluation form and providing it to the instructor at the beginning of their clinical experience. The trainees are required to submit their daily evaluations from the previous week, as specified in the course instructions. Trainees on rotations were required to electronically submit their evaluations to the program. If the evaluations show consistency in areas of a trainee's performance that require special attention, this will be addressed through increased instruction and practice. Additional simulation sessions, facilitated and supervised by the Program Director, may be required. The trainees are evaluated by their clinical instructors at the end of the rotation as well, as outlined in the syllabus of each clinical course.

The evaluation scale is as follows:

1. Dependent: > 90% of the time, the student almost **REQUIRES** direction, guidance, monitoring, and support, while 10% of the time, the student **EXHIBITS** assertiveness, efficiency, focus, and eagerness to learn.
2. Novice: 75% of the time the student **REQUIRES** direction, guidance, monitoring, and support, while 25% of the time, the student **EXHIBITS** assertiveness, efficiency, focus, and eagerness to learn.

3. Assisted: 50% of the time the student REQUIRES direction, guidance, monitoring, and support, while 50% of the time, the student EXHIBITS assertiveness, efficiency, focus, and eagerness to learn.
4. Supervised: 25% of the time the student REQUIRES direction, guidance, monitoring, and support, while 75% of the time, the student EXHIBITS assertiveness, efficiency, focus, and eagerness to learn.
5. Self-Directed: <10% of the time, the student REQUIRES direction, guidance, monitoring, and support, while >90% of the time, the student EXHIBITS assertiveness, efficiency, focus, and eagerness to learn.

### Methods of Evaluation of Clinical Course Performance

A final grade of 75% or higher is required to receive a passing score.

1. Competency Checklist a. Prior to pumping their first case, a student must have completed their clinical competency checklist.
2. Case Evaluations a. Submitted weekly.
3. End of Rotation Evaluations
4. Professionalism
  - a. The student communicates effectively, respectfully, and appropriately to the surgical team.
  - b. The student demonstrates a professional attitude: prompt, punctual, reliable, and dependable. The student should assume an appropriate workload, accept requests, and complete assignments.
  - c. The student is motivated to provide the “best patient care.”
  - d. The student disposes of the circuit properly without increased exposure to blood. The student leaves their workspace clean and ready for the next colleague.
  - e. The student communicates any significant factors affecting the patient’s hemodynamic status to their clinical instructor.



- f. The student is required to respect, value, and protect confidentiality in relation to patient care.
- 5. Rotation Writeups: a. Work-Up Forms; b. Weekly Progress Reports; c. Submission of Work-Up Forms. Weekly Progress Reports will be due weekly, as specified in the course syllabus.
- 6. Case Log
  - a. Daily submission of the information required for the case log
  - b. Case Log is found on the program website.
  - c. Conference Log (submitted at the end of semester)
- 7. Monthly Timesheets (submitted monthly to the Program Director (no later than the 5th of each month). They must be signed by clinical instructors.

## 2.3 Promotion of the trainee:

Trainee promotion from one level to the next will be determined in accordance with the SCFHS regulations and the applicable bylaws. This is generally based on the successful completion of the curriculum's required assessments, educational activities, evaluation forms, and specialty-specific requirements as well as satisfactory overall performance and fulfillment of any remediation or action plans, if applicable. Furthermore, noncompliance with these requirements may result in disciplinary actions under the SCFHS regulations, which could include repeating the entire academic year or a portion thereof.

### *2.4 Final In-training Evaluation Report (FITER)*

The FITER is the comprehensive final evaluation required at the end of training to determine a trainee's readiness for independent practice. Its format and content are governed by the SCFHS regulations and may evolve over time. Submission of the FITER is part of the process for certification eligibility in accordance with the SCFHS requirements.

## 3 Summative Assessment

### 3.1 General Principles

*Summative* assessment is the component of assessment primarily designed to make informed decisions regarding trainees' competence and readiness to progress or enter independent practice. Unlike formative assessment, it does not principally aim to provide constructive feedback but rather to judge whether the required standards have been met. For more details, please refer to the general bylaws and Executive Policy of Assessment (available online at [www.scfhs.org](http://www.scfhs.org)).

To be eligible to sit for final examinations, trainees are issued a "Certification of Training Completion" upon successful completion of all training rotations, in accordance with the SCFHS regulations.

### 3.2 Certification of Training-Completion

Certification of Training Completion and eligibility for final examinations are governed by SCFHS regulations and policies. Trainees must fulfill all the requirements outlined by the SCFHS and their training program, including the successful completion of rotations, assessments, and any additional mandated components (please refer to [www.scfhs.org](http://www.scfhs.org)). This certification is issued and approved by the supervisory committee or its equivalent, according to the SCFHS policies.

### 3.3 First Part Examination

This is a written exam that enables trainees to progress from "junior" to "senior" level of training. For further details on the first part of the examination, please refer to the General Bylaws of Training in Postgraduate Programs and General Assessment Bylaws (available online: [www.scfhs.org](http://www.scfhs.org)).



### 3.4 Final Specialty Examinations

The final specialty examination serves as a summative assessment component that grants trainee specialty certifications. It comprises the following two elements:

- a) Final written examination: to be eligible to sit for this exam, trainees must have obtained a “Certification of Training-Completion.”
- b) Final clinical/practical examination: Eligibility to sit for this exam requires successful completion of the final written examination.

Table A of Summative Assessment (After completion of D2)

Learning Domain	Summative Tool	Description	Format / Quantity	Timing
Knowledge	<b>Final Written Examination (MCQ)</b>	High-stakes exam assessing core and advanced perfusion knowledge and applied clinical decision-making aligned to curriculum outcomes and patient safety. Standard setting applied per SCFHS/executive assessment policy.	<b>100 SBA-MCQs</b>	<b>After completion of D2 (end-of-program)</b>
Skills	<b>OSCE</b>	High-stakes performance exam using standardized stations to assess procedural/technical skills, data interpretation, emergency response, and communication in a controlled environment.	<b>16 stations</b>	<b>After completion of D2 (end-of-program)</b>
Skills	<b>SOE (Structured Oral Examination)</b>	Structured oral exam assessing clinical reasoning, judgement, and ability to justify perfusion plans and respond to complications; scored using structured rubrics.	Structured oral cases/questions (per blueprint and rubrics)	<b>After completion of D2 (as scheduled)</b>

Learning Domain	Summative Tool	Description	Format / Quantity	Timing
Attitude	<b>FITER</b>	Final comprehensive in-training evaluation confirming readiness for independent practice, based on aggregated evidence (ITERS, WBAs, logbook completion, professionalism).	Pass/Fail per SCFHS	<b>At program completion</b> (after D2)

After the trainee has completed D2 (end-of-program decision-making). **DOPS:** Direct observation of procedural skills; **Mini-CEX:** Mini-Clinical Evaluation exercise; **CbD:** Case-based Discussion; **MCQs:** Multiple-choice Question Exam; **EYPT-Local:** End of year promotion exam; **SOE:** Structured Oral Exam; **OSCE:** Objective Structured Clinical Examination; **ITER:** In-Training Evaluation Report; **PT:** Progress Test; **CAPs:** Critically appraised paper; **COT:** Consultation observation tool; **CAT:** Critically appraised topic

- All formative and work-based assessments (WBA) should be performed following the SCHFS definitions and methodologies; not complying with these requirements will subject trainees to disciplinary actions according to the SCFHS bylaws.

The following tables present the blueprints for: (A) content blueprint by domain, (B) cognitive blueprint by level, (C) OSCE station distribution according to station type, (D) OSCE station blueprint, and (E) global marking elements:

## Blueprint — Final Written Exam (100 MCQs)

### A. Content blueprint (according to domain)

Domain	Topics	Weight %	MCQs (n=100)
1. Foundations	Cardiopulmonary anatomy & physiology; pathophysiology; perfusion & hemodynamics	15%	15
2. CPB setup & conduct	HLM setup/priming; conduct of CPB; oxygenation/ventilation principles; temperature management; ultrafiltration; myocardial preservation	20%	20
3. Anticoagulation & hemostasis	Anticoagulation monitoring/efficacy; ACT principles; heparin/protamine concepts; bleeding/thrombosis risk	10%	10
4. Monitoring & interpretation	Advanced monitoring; online blood gas monitoring; ECG interpretation principles (program requirement); data-driven adjustments	15%	15
5. Emergencies & troubleshooting	Emergency perfusion procedures; CPB emergencies; circuit/pump/oxygenator alarms; safety protocols	15%	15
6. ECMO	Indications/principles; circuit management; troubleshooting emergencies	10%	10
7. Pediatric perfusion	Pediatric perfusion techniques; pediatric physiology differences; safety considerations	10%	10
8. Professional practice & systems	Ethics in perfusion practice; communication/teamwork principles; QA/safety; documentation	5%	5
<b>Total</b>		<b>100%</b>	<b>100</b>

## B. Cognitive blueprint (according to level)

Cognitive level	Description	Target %	MCQs (n=100)
Recall/Understanding	definitions, normal ranges, principles, equipment components	30%	30
Application	apply to clinical scenarios, choose actions/adjustments	50%	50
Analysis/Judgement	interpret trends, prioritize emergencies, patient safety decisions	20%	20
<b>Total</b>		<b>100%</b>	<b>100</b>

## Blueprint — OSCE (16 stations)

### C. OSCE station distribution (according to station type)

Station type	Competency focus	Weight %	Stations (n=16)
1. Equipment & safety checks	pre-CPB checklist, circuit inspection, alarms, infection control/safety	25%	4
2. CPB conduct (scenarios)	manage flows/pressures/temperature/UF; communicate milestones	25%	4
3. Monitoring & interpretation	ABG/online monitoring interpretation; ECG interpretation; hemodynamic reasoning	25%	4
4. Emergencies & troubleshooting	simulated CPB emergency recognition + immediate actions	12.5%	2
5. ECMO / MCS	ECMO setup/management troubleshooting; MCS concepts (IABP/VAD)	12.5%	2
<b>Total</b>		<b>100%</b>	<b>16</b>



## D. OSCE station blueprint

### Equipment & Safety (4 stations)

1. Pre-CPB machine & circuit safety check (checklist, alarms, documentation)
2. Priming and de-airing / air management safety (risk control and steps)
3. Anticoagulation preparation & safety verification (ACT plan, monitoring readiness)
4. Infection control + safe handling/disposal of circuit (exposure prevention and workspace readiness)

### CPB Conduct (4 stations)

5. **Initiation of CPB and stabilization** (flows, pressures, communication)
6. **Temperature management strategy** (hypothermia/rewarming safety and targets)
7. **Ultrafiltration / fluid** management during CPB (indications and adjustments)
8. **Weaning from CPB** and handover summary (structured communication and key parameters).

### Monitoring & Interpretation (4 stations)

9. **ABG interpretation during CPB** (oxygenation/ventilation correction plan)
10. **Online monitoring trend interpretation** (perfusion adequacy, interventions with rationale)
11. **ECG interpretation station** (abnormal ECG recognition relevant to the perioperative setting)
12. **Hemodynamic scenario: low venous return/low reservoir level** (diagnosis + corrective actions).

### Emergencies & Troubleshooting (2 stations)

13. **Oxygenator failure / gas exchange deterioration** (immediate safety actions and team update)

14. **Air detection alarm / suspected air embolism** (stop, isolate, manage, and communicate)

ECMO / MCS (2 stations)

15. **ECMO circuit troubleshooting** (poor oxygenation/flow issues and safety priorities)

16. **MCS scenario (IABP/VAD basics)** (indications/contraindications and monitoring priorities)

**E. Global marking elements (apply across stations)**

- Patient safety and risk control
- Correct technical sequence / procedural accuracy
- Situational awareness and escalation
- Closed-loop communication with team
- Professionalism and documentation quality



# XI. PROGRAM AND COURSE EVALUATION

The SCFHS applies various measures to evaluate the implementation of this curriculum. The training outcomes of this program follow the quality assurance framework endorsed by the Central Training Committee of the SCFHS. Trainee assessment (both formative and summative) results are analyzed and mapped to the curriculum content. The other indicators that will be incorporated are:

- Report of the annual trainees' satisfaction survey.
- Reports from trainees' evaluation of faculty members.
- Reports from trainees' evaluation of rotations.
- Reports from the annual survey of program directors.
- Data available from program accreditations.
- Reports from direct field communications with trainees and trainers.

Goal-Based Evaluation: the achievement of intended milestones will be evaluated at the end of each stage to assess the progress of curriculum delivery, and any deficiencies will be addressed in the following stage, utilizing the time devoted to trainee-selected topics and professional sessions.

In addition to subject-matter opinions and best practices from benchmarked international programs, the SCFHS will apply a robust method to ensure that this curriculum will utilize all data available during revision of this curriculum in the future.

## Appendix A

### Log Book:

1. Record and document all academic activities (e.g., procedures, lectures, journal clubs, meetings, training courses, workshops, symposia, and case presentations) undertaken during the training program.
2. Assist the trainee in identifying his/her deficiencies in specific areas
3. Assist the program director/evaluator in documenting the contribution and evaluation of trainees
4. Provide the evaluator with guidance about appropriate and fair assessment of trainees
5. Provide the program director with guidance regarding deficiencies in training

### Guidelines for trainee:

1. Trainees are required to maintain log books during the entire training period
2. Log book entries concerning recorded activities should be completed on the day the activities are conducted.
3. All entries must be signed by a mentor within one week
4. Trainees must discuss their training progress, as indicated in the logbook, with mentors and/or program directors every month.
5. Trainees should submit their completed logbooks to the program director at the end of the rotations and training for subsequent submission to the Scientific Council.
6. If the log book is not signed by the program director, the trainee will be ineligible for the end-of-training certification and final examinations.



## Procedures Logbook

Date	MRN	Age/Gender	Procedure Name	Supervising Consultant	Comments

Trainee Name: ..... Signature: .....

### References:

1. Gravlee GP, Davis RF, Kurusz M, Utley JR. *Cardiopulmonary bypass: principles and practice*. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2015.
2. Kirali K, Coselli JS, Kalangos A. *Cardiopulmonary bypass: advances in extracorporeal life support*. 1st ed. Cham: Springer; 2022. <https://doi.org/10.1007/978-3-030-94163-7>
3. O Ciardha N, Royds K. A clinical perfusion scientist: the job and the role in ECMO during the COVID-19 pandemic. *Physiological Society*. Available from: <https://www.physoc.org/magazine-articles/a-clinical-perfusion-scientist/>
4. Sainath P, Ladeeda V, Jessica L. Perfusionists: the camouflaged healthcare professionals. *Cureus*. 2023;15(9):e44363. <https://doi.org/10.7759/cureus.44363>

5. Boettcher W, Merkle F, Weitkemper HH. History of extracorporeal circulation: the conceptual and developmental period. *J Extra Corpor Technol.* 2003;35(3):172–83.
6. Hessel EA 2nd. History of cardiopulmonary bypass (CPB). *Best Pract Res Clin Anaesthesiol.* 2015;29(2):99–111. <https://doi.org/10.1016/j.bpa.2015.04.006>
7. Merkle F. From pump technicians to qualified health personnel—the evolution of the perfusionist profession. *Interact Cardiovasc Thorac Surg.* 2010;10(4):496–7. <https://doi.org/10.1510/icvts.2010.235085>
8. van Beekum CJ, Vilz TO, Glowka TR, von Websky MW, Kalff JC, Manekeller S. Normothermic machine perfusion (NMP) of the liver: current status and future perspectives. *Ann Transplant.* 2021;26:e931664. <https://doi.org/10.12659/AOT.931664>
9. Paules BR. The development of a perfusion educational program. *J Extra Corpor Technol.* 1987;19:216–20.
10. Roush RE, Beall AC Jr, Nathanson JM, Beall MM. Trends in the training of cardiopulmonary perfusionists. *J Extra Corpor Technol.* 1984;16:116–20.
11. Ghoneima AS, Sousa da Silva RX, Gosteli MA, Barlow AD, Kron P. Outcomes of kidney perfusion techniques in transplantation from deceased donors: a systematic review and meta-analysis. *J Clin Med.* 2023;12(12):3871. <https://doi.org/10.3390/jcm12123871>
12. Butt SP, Razzaq N, Saleem Y, Ashiq F, et al. Extracorporeal circulation and venous hemodynamics: a literature review on physiological foundations to clinical applications. Available from: <https://maplespub.com/article/extracorporeal-circulation-and-venous-hemodynamics-a-literature-review-on-physiological-foundations-to-clinical-applications>



13. Peberdy MA, Gluck JA, Ornato JP, et al. Cardiopulmonary resuscitation in adults and children with mechanical circulatory support. *Circulation*. 2017;135:e111–e121. <https://doi.org/10.1161/CIR.0000000000000504>
14. American Society of Extracorporeal Technology. Standards and guidelines for perfusion practice. 2023. Available from: [https://www.amsect.org/Portals/0/AmSECT\\_Perfusion\\_S%26G\\_2023%20Ratified%20021023.pdf](https://www.amsect.org/Portals/0/AmSECT_Perfusion_S%26G_2023%20Ratified%20021023.pdf)
15. Tash AA, Al-Bawardy RF. Cardiovascular disease in Saudi Arabia: facts and the way forward. *J Saudi Heart Assoc*. 2023;35(2):101–108. <https://doi.org/10.1016/j.jsha.2023.02.002>
16. Frank JR, Snell L, Cate OT, Holmboe ES, Carraccio C, Swing SR, et al. Competency-based medical education: theory to practice. *Med Teach*. 2010;32(8):638–45. <https://doi.org/10.3109/0142159X.2010.501190>
17. World Federation for Medical Education. WFME global standards for quality improvement: postgraduate medical education. Revised ed. 2015. Available from: <https://formacionenradiologia.files.wordpress.com/2018/09/wfme-2015-global-standards-for-postgraduate-medical-education.pdf>
18. World Federation for Medical Education. WFME global standards for quality improvement: postgraduate medical education. 3rd ed. 2023. Available from: [https://wfme.org/wp-content/uploads/2023/03/WFME-STANDARDS-FOR-POSTGRADUATE-MEDICAL-EDUCATION\\_2023.pdf](https://wfme.org/wp-content/uploads/2023/03/WFME-STANDARDS-FOR-POSTGRADUATE-MEDICAL-EDUCATION_2023.pdf)
19. Royal College of Physicians and Surgeons of Canada. Competency-based medical education. 2015. Available from: <https://www.royalcollege.ca>
20. Frank JR, Snell L, Sherbino J, editors. *CanMEDS 2015 physician competency framework*. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.
21. Norcini J, Anderson MB, Bollela V, Burch V, Costa MJ, Duvivier R, et al. 2018 consensus framework for good assessment. *Med Teach*. 2018;40(11):1102–9. <https://doi.org/10.1080/0142159X.2018.1500016>

22. General Medical Council. Designing and maintaining postgraduate assessment programmes. 2019. Available from: <https://www.gmc-uk.org>
23. Royal College of Paediatrics and Child Health. RCPCH progress: paediatric curriculum for excellence assessment strategy. Version 1.2. 2019.
24. Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.



