

Internship/Apprenticeship course plan

The name of the course: **Physiology of Blood Circulation**

Attendance Days in Department: **Saturdays**

Program Duration (Course length): **1.2 theoretical units, 0.1 practical units**

Start and End Dates: **September 27 to December 20**

Department attendance hours: **8:00 AM to 10:00 AM**

Location of In-Person Sessions: **Faculty of Medicine**

Clinical trainers' information table

First Name	Last Name	Rank	Group	Mobile Number	Email
Behnaz	Mokhtari	Assistant Professor	Physiology	+989143826286	behnaz.sa.mokhtari@gmail.com

Main goal of the course:

In this course, students are expected to learn the concepts, principles, and physiological mechanisms related to the function of the circulatory system in each of the following areas and be able to identify them in both normal and altered physiological processes:

1. Basic physical concepts of the circulatory and pulmonary systems
2. Structure of blood vessels, their similarities and differences
3. The process of exchange of fluids and substances between blood and body cells
4. Structure and functions of the lymphatic system
5. Blood pressure, its influencing factors, and how it is regulated
6. Coronary circulation and its control mechanisms
7. Systemic and pulmonary circulations, their components, and differences
8. Relationships between blood pressure, blood flow, and vascular resistance in connection with Ohm's and Poiseuille's laws

9. Measurement of blood flow, difference between laminar and turbulent flow, and how to determine and distinguish them
10. Substances between plasma and interstitial fluid
11. Capillary filtration and factors affecting it related to Starling's law
12. Lymphatic system structure and functions
13. Blood pressure, mean arterial pressure, pulse pressure, and their influencing factors
14. Local control of blood flow in short-term and long-term
15. Neural and hormonal control of blood flow
16. Short-term and long-term regulation of blood pressure
17. Role of kidneys and renin-angiotensin system in long-term regulation of blood pressure
18. Hormonal control of blood pressure and their role in regulation
19. Changes in coronary blood flow with cardiac cycle variations
20. Neural and chemical regulation of coronary blood flow

Learning objectives:

Theoretical Unit Objectives

Learners, after completing this course, are expected to:

1. Describe the systemic and pulmonary circulatory circuits.
2. Explain the branches and vascular structure from the aorta to the vena cavae and state their differences.
3. Explain the interrelationships of vascular resistance, blood pressure, and blood flow using Ohm's law and Poiseuille's formula.
4. Describe types of blood flow in vascular beds and how to differentiate them.
5. Explain factors affecting blood viscosity and their impact on vascular resistance and blood flow in various vessels.
6. Define vascular compliance and explain differences between veins and arteries.
7. Explain delayed compliance mechanisms in vessels.
8. Calculate pulse pressure and mean arterial pressure and describe pulse pressure patterns in various diseases.
9. Describe methods of blood pressure measurement in humans.
10. Explain factors involved in venous return to the heart.
11. Describe capillary structure.
12. Explain capillary filtration.
13. Describe Starling's equilibrium in capillary exchanges.

14. List factors contributing to edema formation.
15. Define the lymphatic system and name its components.
16. List the functions of the lymphatic system.
17. Explain local control of blood flow in tissues.
18. Describe metabolic and myogenic mechanisms in vascular autoregulation.
19. Define reactive and active hyperemia.
20. Explain neural and hormonal control of blood flow.
21. List vasoconstrictors and vasodilators.
22. Name factors affecting blood pressure and explain their effects.
23. Describe the role of the vasomotor center and autonomic nervous system (sympathetic and parasympathetic) in regulating vessel diameter and blood pressure.
24. Explain the nervous system's role in rapid blood pressure regulation.
25. Describe baroreceptor-mediated blood pressure control.
26. Explain chemoreceptor-mediated blood pressure control.
27. Describe atrial and pulmonary arterial reflexes in blood pressure regulation.
28. Explain the central nervous system's response importance in blood pressure control.
29. Describe the effect of respiratory waves on blood pressure.
30. Describe components of the renin-angiotensin system and their role in blood pressure control.
31. Explain the kidney's role in long-term control of extracellular fluid volume and blood pressure.
32. Describe Frank-Starling mechanism's role in cardiac output control.
33. Explain factors affecting increase and decrease in cardiac pump strength.
34. Describe the nervous system's role in cardiac output control.
35. Sketch the cardiac output curve and the effects of various factors.
36. Define mean systemic circulatory filling pressure.
37. Draw the venous return curve and explain factors influencing it.
38. Write the venous return formula.
39. Overlay venous return (right atrial pressure) and cardiac output curves and explain the effects of blood volume infusion and sympathetic stimulation.
40. Describe the coronary vessel anatomy and physiology.
41. Compare the effect of cardiac activity on right and left ventricular coronary blood flow.
42. Explain factors influencing coronary circulation.
43. Describe chemical regulation of coronary blood flow.
44. Describe neural regulation of coronary blood flow.
45. Explain muscle blood flow during muscular contraction.
46. Describe regulation of skeletal muscle blood flow during activity.

47. Compare sympathetic nervous system effects on skeletal muscle vessels at rest and during activity.
48. Explain the importance of increased cardiac output and arterial pressure during muscle activity on muscle blood flow.
49. Describe the physiology of shock causes.
50. List stages of shock development.
51. Explain types of circulatory shock.
52. Describe cardiovascular system changes following circulatory shock.
53. State the physiological basis of shock therapy.
54. Explain circulatory arrest.

Practical Unit – Blood Pressure Measurement

Learners, after completing this course, are expected to:

1. Define systolic, diastolic, pulse, and mean arterial pressure.
2. List factors affecting blood pressure.
3. Explain the principles of blood pressure measurement.
4. Become familiar with necessary equipment for blood pressure measurement.
5. Describe blood pressure measurement methods (palpatory and auscultatory).
6. Measure blood pressure of a volunteer using both palpatory and auscultatory methods.
7. Explain conditions required for accurate blood pressure measurement.
8. Describe heart sounds and their origins.
9. Identify auscultatory valve areas.
10. Perform auscultation of heart sounds on a volunteer.

Teaching Methods

Objective/Setting	Morning Report	Educational Rounds	Outpatient clinics	Clinical Skills Center (Skill lab)	Other
Students will learn the concepts, principles, and physiological mechanisms related to the function of the circulatory system, including the systemic and pulmonary circuits, vascular structures,					Lecture Sessions

blood flow dynamics, blood pressure regulation, coronary circulation, and neural and hormonal control mechanisms. They will understand how these factors interact in both normal and altered physiological states and apply this knowledge to clinical contexts.					
Laboratory Practical sessions focus on hands-on skills such as measuring systolic and diastolic blood pressure, pulse pressure, and mean arterial pressure using palpatory and auscultatory methods. Students will also learn to identify heart sounds, valve auscultation points, and perform practical assessments related to cardiovascular physiology.					Laboratory Practical

Student Evaluation Methods and rubric

1. The theoretical exam will be conducted as a written MCQ (multiple-choice questions) worth 17 points, and the practical exam will be worth 2 points.
2. A score of 1 point will be given for regular class attendance, active participation in discussions, and completion of optional assignments.

Topic	Logbook	DOPS	Written Exam	OSCE	Other	The weight of the total score
		*	*		Class Activity	
Total		2	17		1	20

Minimum Passing Grade: 10

The maximum number of excused absences permitted for this course unit, subject to the trainer(s)'s approval:

According to the total educational hours of this course (based on approved educational regulations), the student is not allowed to be absent from any session. Only in cases of justified absence, the student is permitted to be absent for up to four seventeenths of the total hours.

Educational References:

The latest editions for recommended physiology books are:

1. Guyton and Hall Medical Physiology: Latest edition 2024 (13th Edition)
2. Ganong Review of Medical Physiology: Latest edition 27th Edition, 2021
3. Berne & Levy Physiology: Latest edition 8th Edition, 2024, translated by Dr. Seyed Ali Haeri Rouhani and others, published by Andisheh Rafie

For practical lessons:

1. Practical Physiology book authored by faculty members of the Physiology Department, available in the Physiology Department laboratories.

Supplementary Learning References:

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Learning Opportunities

The Weekly Journal Club in the Physiology Department is held on Tuesdays from 12:30 to 14:00.

Contact Information:

- Trainer(s): (Phone, Email)

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- Course Coordinator: (Phone, Email)

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- Educational staff of the department: (Phone, Email)

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Signature of Course Director:



Dr. Behnaz Mokhtari

Signature of Department Chair:

دکتر رضا بدل زاده
مدیر گروه آموزشی فیزیولوژی



Signature of the head of Educational Development Office (EDO):