FACULTY OF MEDICINE, UNIVERSITY OF RUHUNA
SECOND EXAMINATION FOR MEDICAL DEGREES
PHYSIOLOGY PAPER II – Structured Essay

Answer all five questions
Answer in the given space **Index Number:……** **Time: Three hours**
Use diagrams where necessary **August 2026**
No additional papers will be given

1.

1.1. Partial pressure of oxygen in the inspired air decreases from 160 mmHg to 100 mmHg when it reaches alveoli. Explain the physiological basis for this. (20 Marks)

1.2.

1.2.1. Draw the oxygen haemoglobin dissociation curve of a healthy person at rest at sea level. (15 Marks)

1.2.2. In the same graph mark P_{O_2} at

A. P_{50} (with value)
B. veins (with value)
C. aorta (with value) (15 Marks)

1.3 Briefly describe the changes that occur in the pulmonary circulation during exercise. (15 Marks)

1.4 Explain the mechanisms that facilitate increased unloading of oxygen from haemoglobin at tissue level during exercise. (20 Marks)

1.5 List the modes of carbon dioxide transport in blood. (15 Marks)

2.

2.1 The large intestine has several important functions. Bacteria in the large intestine play a vital physiological role in human health.

2.1.1 Briefly describe the absorptive and secretory functions of the large intestine. (10 Marks)

2.1.2 Briefly describe the intestinal movement seen only in the large intestine. (10 Marks)

2.1.3 Briefly describe the role of gut bacteria in the process of digestion. (10 Marks)

2.1.4 State two common causes for alteration of gut bacterial flora in the large intestine. (10 Marks)

2.2 Diuresis would result from excess water intake as well as from diuretics.

2.2.1 List four different classes of diuretics based on their mechanism of action. (10 Marks)

2.2.2 Describe the mechanism of action of the diuretic that acts on the Loop of Henle. (20 Marks)

2.2.3 List two side effects of the diuretic mentioned in 2.2.2. (10 Marks)

2.2.4 Describe the physiological mechanism of diuresis following ingestion of large volume of water. (20 Marks)

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3. A 28-year-old woman presents with progressive weight gain and fatigue. She also complains of menstrual irregularities. Examination reveals thin extremities with central obesity, a rounded face, and fat accumulation over the upper back of the chest. The abdominal skin shows prominent reddish-purple striae. Her blood pressure is 160/100 mmHg. Capillary blood glucose level is 350 mg/dL. Cushing syndrome is suspected.

3.1 State the underlying hormonal abnormality of this patient? (10 Marks)

3.2 Explain the physiological basis of following clinical features seen in her.

3.2.1 Blood pressure reading of 160/100 mmHg (15 Marks)

3.2.2 Thin extremities (10 Marks)

3.2.3 Blood glucose level of 350 mg/dL (15 Marks)

3.3 What is the test done to confirm Cushing syndrome? (5 Marks)

3.4 Explain the physiological basis of performing the above mentioned test to confirm the diagnosis instead of the random hormone level. (15 Marks)

After treating the condition, her menstrual cycles became regular.

3.5 Describe the hormonal changes that occur during the follicular phase of menstrual cycle.(20 Marks)

3.6 List 2 methods of detecting ovulation. (10 Marks)

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4. A 20-year-old woman presents with vomiting and diarrhoea for 3 days. Her urine output is low. On admission, she has cold peripheries, oxygen saturation 94%, pulse rate 110 bpm, blood pressure 80/50 mmHg. She is immediately started on fluid resuscitation.

4.1. Calculate her mean arterial pressure (MAP). (10 Marks)

4.2 Using flow charts explain the reasons for the following clinical features in this patient.

4.2.1 Low blood pressure. (10 Marks)

4.2.2 Tachycardia (15 Marks)

4.2.3 Reduced urine output (15 Marks)

4.2.4 Cold peripheries (10 Marks)

4.3 Draw a graph to illustrate the Frank–Starling curves of this patient before the onset of the illness (A) and on admission (B). (15 Marks)

4.4 This patient's arterial blood gas (ABG) shows a saturation of 99%. State a possible reason for the discrepancy in saturation compared to pulse oximeter reading mentioned above? (10 Marks)

After her acute condition settles, she is started on oral rehydration solution (ORS).

4.5 List three constituents of ORS along with their functions. (15 Marks)

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5 A 60-year-old patient who is a vegetarian presents with tiredness and shortness of breath on exertion. His conjunctivae are pale. His full blood count (FBC) shows macrocytic anaemia.

5.1 List two important evidence in FBC that suggest macrocytic anaemia (10 Marks)

5.2 Briefly explain how being a vegetarian could lead to macrocytic anaemia (20 Marks)

5.3 Mention two abnormalities that would be observed in this patient's blood picture (10 Marks)

5.4 What abnormality would you observe in his bone marrow? (05 Marks)

5.5 Briefly explain the reason for the shortness of breath on exertion in this patient (20 Marks)

5.6 What is the reason for pallor in anaemia? (10 Marks)

5.7 Name two gastrointestinal conditions that can cause macrocytic anaemia. Briefly explain how each condition leads to macrocytic anaemia (20 Marks)

Condition	Reason for macrocytic anaemia

5.8 This patient needs a blood transfusion. List two investigations that should be performed to identify suitable blood for transfusion (10 Marks)
