



**All India Institute of Medical Sciences, Kalyani**  
**First Professional MBBS Examination, August 2024**

**Time: 3 Hrs.**

**Physiology (Paper-II)**

**Marks: 100**

**INSTRUCTIONS:**

- Answer all questions.
- Illustrate your answers with well labelled diagram wherever necessary.
- Answer each section in a separate answer book.

**SECTION – A (50 MARKS)**

(Renal physiology, Endocrinology, Reproductive physiology)

1. A 35-year-old female presented with a 3-month history of significant weight loss (6.4 kg), increased appetite, palpitations, and heat intolerance. She also reported experiencing tremors, anxiety, and irregular menstrual cycles. Physical examination revealed a diffusely enlarged thyroid gland and mild exophthalmos. (1+5+2+2=10)
  - a. What is the probable diagnosis for this patient?
  - b. Describe the steps of synthesis of the hormone involved in this condition.
  - c. Explain why exophthalmos occurs in this condition.
  - d. Explain the physiological basis of treatment of this condition.
2. Define glomerular filtration rate (GFR). Mention the normal physiological value. Enumerate the important physiological factors affecting GFR. (2+1+2)
3. A 42-year-old man presents to the endocrinology clinic with complaints of gradual changes in his facial features over the past 5 years. He reports that his shoe size has increased, and he's had to buy larger hats and gloves. He also mentions experiencing frequent headaches, joint pain, and excessive sweating. On physical examination, the patient has prominent supraorbital ridges, an enlarged nose, and a protruding jaw. His hands and feet appear larger than average. Biochemical test showed an increase in fasting blood sugar. (2+3)
  - a. What is the most probable diagnosis for this patient?
  - b. Explain why there is an increase in blood sugar level in this condition?
4. Explain the pathophysiology of (2.5+2.5)
  - a. Albuminuria in glomerular disease
  - b. Bitemporal hemianopia in pituitary tumour
5. Draw a labelled diagram of neural innervations of the urinary bladder. Describe the micturition reflex with the help of a flow chart. (2+3)
6. Explain the physiological reasons behind (2.5+2.5)
  - a. Poor wound healing in Cushing's syndrome
  - b. Hyperpigmentation in Addison's disease
7. Describe the indicators of ovulation. (5)

8. Name the hormones involved in calcium homeostasis. Describe the action of anyone. (2+3)
9. Describe countercurrent multiplication system and its role in modulating urine osmolality (5)

**SECTION – B (50 MARKS)**  
(Neurophysiology, Special senses and Yoga)

1. With a diagram describe the corticospinal tract. Name the extra pyramidal pathways and their function. (7+3)
2. Enumerate the differences between Upper motor neuron lesion and lower motor neuron lesion. (5)
3. Define muscle tone. Briefly describe the importance of alpha gamma coactivation in muscle tone. (2+3)
4. Explain the physiological basis of
- a. Olfactory adaptation (2.5)
  - b. Dissociated sensory loss in syringomyelia (2.5)
5. Describe the signal transduction pathway in photoreceptors. (5)
6. Define aphasia. Briefly describe the different types of aphasia (1+4)
7. With the help of diagram, explain the phenomenon of "lateral inhibition" and its physiological significance. (3+2)
8. Mention the salient features of various stages of sleep. With the help of flow chart trace the pathway of circadian regulation of sleep. (3+2)
9. With the help of flow diagram, explain the sequence of events during tympanic reflex of the middle ear to the loud sounds. List the advantages of this reflex. (3+2)



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## SECTION – A (50 MARKS)

(General Physiology, Blood, Nerve and Muscle, Gastrointestinal physiology and nutrition)

1. A 45-year-old woman presented with progressive muscle weakness, initially affecting her ocular muscles, leading to ptosis and diplopia. Over the past six months, she experienced increasing difficulty in chewing, swallowing and speaking, along with generalized fatigue. Physical examination revealed weakness in the proximal limb muscles and fatigability upon repetitive movements. Her symptoms worsened with activity and improved with rest.
  - a. What is the probable diagnosis of the above condition? (1)
  - b. Enumerate some important clinical feature of this condition. (1)
  - c. Briefly describe the pathophysiology of the above condition. (4)
  - d. Enumerate important tests to identify the condition. (2)
  - e. Briefly describe the treatment options of the condition. (2)(3+2)
2. Describe apoptosis. Write any two examples of apoptosis.
3. A 3-year-old male child was brought to a paediatrician with a complaint of bleeding from the nose, mouth, urinary tract, alimentary tract and skin after a trivial injury. Sometimes, swelling of the joints, along with pain and fever, was also noticed. The bleeding was not profuse, but it was persistent. A careful history revealed a similar bleeding tendency in male relatives. Investigations revealed that the coagulation time was prolonged. The bleeding time, prothrombin time and platelet count were normal. (1+2+2)
  - a. What is the most likely diagnosis?
  - b. Why females are not usually affected by this bleeding disorder?
  - c. Write the treatment of this disorder with the physiological basis.
4. Briefly describe the physiological importance of sodium-potassium pump along with a labelled diagram. (3+2)
5. Briefly describe the following (2.5+2.5)
  - a. Endplate potential
  - b. Facilitated Diffusion
6. Describe the physiological compensatory mechanism that could be involved with severe water loss (E.g. vomiting or diarrhoea). Mention the basis of oral rehydration in restoring water and salt balance. (2.5+2.5)
7. With the help diagram, describe the propagation of an action potential. Contrast this event in myelinated and unmyelinated axons. (3+2)
8. Explain why (2.5+2.5)
  - a. Consuming whole milk or a fatty snack before the ingestion of alcohol decreases the rate of intoxication.
  - b. Neonatal jaundice
9. What are dietary fibres? Describe various importance of dietary fibres. (2+3)

### SECTION – B (50 MARKS)

(Respiratory physiology, cardiovascular physiology, environmental physiology)

1. Mr. X is a 56-year-old obese man with the history of smoking and alcohol intake for the past 20 years. He casually attended a health check-up camp and during his examination of BP Dr. Y found out that Mr. X had the BP of 160/110 mm Hg. Dr. Y advised Mr. X to check his BP at home daily for a week and return to doctor's office. During his home recording also, the BP averaged at 160/100 mm Hg. Dr. Y concludes that Mr. X has high blood pressure or Hypertension. If not controlled, hypertension can lead to heart failure, stroke and other complications. Dr. Y advised Mr. X to start exercise and diet management with less salt intake. Dr. Y also prescribed a combination of medicines which is an ACE inhibitor with calcium channel blocker. At a later visit, doctor also added a diuretic for the management of hypertension.
    - a. Define and classify hypertension. (1+2)
    - b. What is the rationale for decreasing salt intake in management of hypertension? (2)
    - c. Define and classify diuretics. (1+2)
    - d. What is the role of ACE inhibitor in the management of hypertension? (2)
  2. A 68-year-old man with a history of hypertension and type 2 diabetes presented to the emergency department with a sudden onset of shortness of breath, orthopnea and swelling in his legs. He gives a history of weakness and exercise intolerance. Physical examination revealed elevated jugular venous pressure, bilateral lung crackles and pitting oedema in the lower extremities. An echocardiogram showed an ejection fraction of 30 %.
    - a. What is the probable diagnosis? (1+2+2)
    - b. Briefly explain the reason of elevated jugular venous pressure in the condition.
    - c. Briefly write about the salient treatment options in this condition.
  3. Write a note on the ventilation-perfusion ratio. Explain why tuberculosis occurs more commonly in the apex of the lung? (2+3)
  4. Describe the mechanisms of temperature regulation in a cold environment. (5)
  5. Illustrate the left ventricular pressure-volume changes during one cardiac cycle using a neat diagram. (2)  
Label the below-mentioned events in the graph (1+1+1)
    - a. EDV and ESV
    - b. Opening and closing of aortic valve
    - c. Opening and closing of mitral valve
  6. Describe the role of surfactant in respiratory physiology. Add a note on Laplace law. (3+2)
  7. Explain the pathophysiology of high altitude pulmonary edema. (5)
  8. With the help of flow diagram, describe the mechanism by which central chemoreceptors regulate the respiration. (5)
  9. Explain the physiological basis of the dysbarism. (5)
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