**WINTER– 2023 EXAMINATION**

**MODEL ANSWER - ONLY FOR THE USE OF RAC ASSESSORS**

**Subject Title: HUMAN ANATOMY & PHYSIOLOGY- THEORY** Subject Code: **20114**

**Important Instructions to examiners:**

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 1 | | **Answer any SIX of the following:** | **30M** |
| 1 | a | **Describe the structure and function of skin.**<br><br>**Marking Scheme: Description of Structure - 2M, Diagram - 1M (Any 4 labels), Functions- 2M (Any 4)**<br>**Answer:**<br>**Structure of skin**:<br>The skin is the largest organ of the body, accounting for about 15% of the total adult body weight. The skin is composed of three layers: the epidermis, the dermis, and subcutaneous tissue (hypodermis).<br>**A) Epidermis:**<br>It is the most superficial layer composed of stratified keratinized squamous epithelium, which varies in thickness in different parts of the body. It is thickest on the palms & soles. There are no blood vessels in the epidermis. There are several layers of cells in the epidermis which extends from the deepest germinative layer to the surface stratum corneum. The cells on the surface are flat non nucleated & dead cells & have protein keratin. The cells from the germinative layer undergo change as they come towards the surface.<br>a. **Stratum Basale:** It is composed of a single layer of cuboidal or columnar keratinocytes. Some cells that are stem cells undergo cell division to continually produce new keratinocytes. The nuclei in these layers are large.<br>b. **Stratum spinosum:** Keratinocytes are arranged in 8-10 layers. Cells in the more superficial layers become flattened. | **5M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
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c. **Stratum Granulosum:** This consists of 3 -5 layers of flattened cells. The nuclei and other organelles begin to degenerate as they move away from the dermal blood vessels.

d. **Stratum lucidum:** It is present only in the thick skin of areas such as the fingertips, palms & soles. It consists of 4-6 layers of flattened clear dead keratinocytes containing keratin.

e. **Stratum corneum:** It consists of 25-30 layers of flattened dead cells. The cells on the surface are flat non-nucleated, dead cells & have protein keratin. The cells continue to shed & be replaced by cells from deeper layers. It forms a protective layer.

B) **Dermis:**

It is tough and elastic. It is made up of connective tissue (the collagen and elastic fibres). Fibroblasts, macrophages, and masts cells are found in dermis. There are blood vessels, lymph vessels, sensory nerve ending, sweat glands, hair, arrector pili muscles & sebaceous glands in the dermis.

C) **Subcutaneous tissue:**

The deepest layer of skin is made of connective tissue and fat. Subcutaneous tissue is well-vascularized. The hypodermis produces fat cells (adipocytes), which store energy.

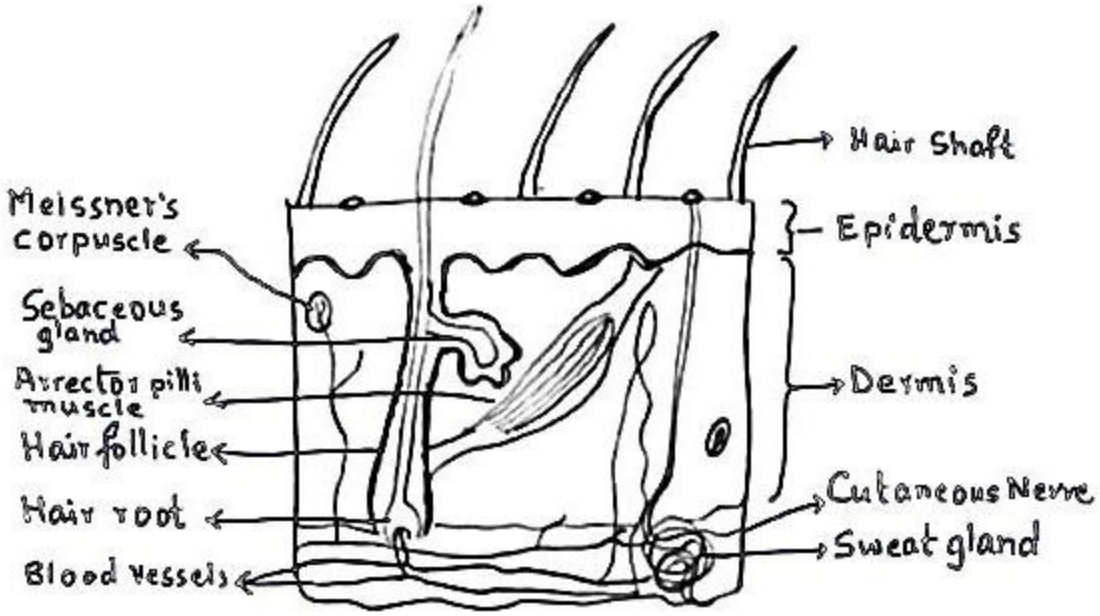


**Fig: Structure of Skin**

**Functions of skin:**

**A) Protection –** It forms the waterproof layer & protects the inner delicate structures. It acts as barrier against the invasion of the microbes, chemicals & dehydration. The melanin pigment protects against the harmful UV rays.

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | B) **Regulation of body temperature -** When the metabolic rate of the body increases, the body temperature increases & vice versa. To ensure constant body temperature, a balance between heat production & heat loss is maintained by the skin.<br>C) **Formation of vitamin D**. - 7-dehydrocholesterol is lipid-based substance present in the skin. UV light from the sun converts it to vitamin D.<br>D) **Sensation.** There are different sensations like touch, pain, pressure, etc. are felt due to the presence of sensory receptors in the skin.<br>E) **Absorption**- Some drugs & chemicals are absorbed through the skin.<br>F) **Excretion**- Skin is a minor excretory organ & excretes NaCl, urea & aromatic substances like garlic and other spices. | |
| **1** | **b** | **Explain how circulation of blood takes place through heart chambers with neat, labelled diagram of L.S. of human heart.**<br>**Marking Scheme: Explanation - 3M, L.S. of human heart - 2M**<br>**Answer:**<br>**Circulation of blood on right side of heart:**<br>• The superior vena cava and inferior vena cava receive deoxygenated blood from various parts of the body through different veins.<br>• This deoxygenated blood is poured into the right atrium of heart.<br>• The blood from right atrium enters the right ventricle through tricuspid valve, which prevents back flow of blood from ventricle into atrium.<br>• The deoxygenated blood from right ventricle is forced into pulmonary artery through pulmonary valve.<br>• The pulmonary arteries divide into two branches, each enters the right and left lungs.<br>• In the lungs, the red blood cells (RBCs) release carbon dioxide and absorb oxygen.<br>**Circulation of blood on left side of heart:**<br>• This oxygenated blood from the right and left lungs is collected by four pulmonary veins and poured into left atrium.<br>• From left atrium this blood enters into left ventricle through bicuspid valve which prevents back flow of blood into left atrium.<br>• This oxygenated blood from left ventricle is forced into the aorta through aortic valve which prevents back flow of blood into left ventricle. | **5M** |

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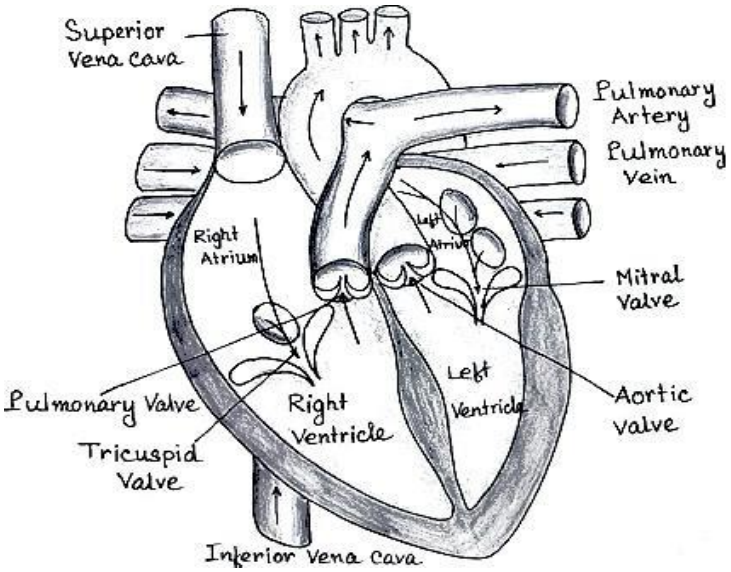
| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | |  **Fig. L.S. of human heart.** | |
| **1** | **c** | **Define Blood. Write classification and functions of Leucocytes.**<br>**Marking Scheme: Definition - 1M, Classification - 2M, Functions - 2M (Any 4 - 0.5M each)**<br>**Answer:**<br>**Definition:**<br>Blood is a fluid connective tissue circulated in the body and consists of blood cells, suspended in intercellular fluid called plasma.<br>**OR**<br>Blood is the liquid connective tissue flowing in a closed system of blood vessels.<br>**Leukocytes are also called white blood cell (WBCs) and classified into 2 groups:**<br>**1) Granulocytes** **2) Agranulocytes**<br>1. Eosinophils 1. Monocytes<br>2. Basophils 2. Lymphocytes<br>3. Neutrophils<br>**Functions of Leukocytes: -**<br>• **Neutrophils**: Phagocytosis (destruction of bacteria) & also remove cell debris.<br>• **Eosinophils**: Phagocytize antigen-antibody complex, parasitic invasion; overcomes effects of histamine involved in inflammation during allergic reactions. | **5M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | • **Basophils**: -Liberate heparin, histamine & serotonin at inflammation site in allergic reactions, that intensify overall inflammatory response.<br>• **Lymphocytes**: T cells control immune system response and directly attack infected and tumour cells. B cells develop into plasma cells which secret antibodies to invade viruses, bacteria.<br>• **Monocytes**: Phagocytosis. Monocytes use plasma membrane to engulf and break down dead cells or harmful foreign particles and bacteria. | |
| **1** | **d** | **Give the functions of Liver.**<br>**Marking Scheme: Functions of liver - 5M (Any ten - 0.5 M each)**<br>**Answer:**<br>**Functions of liver:**<br>1. **Carbohydrate metabolism (Glycogenic function)** - The hepatic cells by the action of enzymes convert glucose into glycogen and it is then stored in the liver.<br>2. **Metabolism of fat** - Whenever energy is needed, the saturated stored fat is converted to a form in which it can be used to provide energy.<br>3. **Protein metabolism (Formation of urea)** - Hepatic cell by the action of the enzyme cause deamination of amino acid, i.e. amine group is set free which forms urea.<br>4. **Metabolism of drugs & noxious substances**: Ethanol and most drugs.<br>5. Formation of plasma protein & blood clotting factors.<br>6. Formation of heparin, a natural anticoagulant in the blood.<br>7. Formation of RBCs in foetal life.<br>8. Destruction of RBCs forming bile pigments and iron.<br>9. **Storage**: i) Glycogen ii) Fat soluble vitamins iii) Iron and copper iv) Vitamin B12.<br>10. **Maintenance of body temperature (Heat production)–** As several chemical reactions occur in the liver, heat is generated which is helpful in maintaining body temperature.<br>11. **Secretion of bile**<br>12. **Synthesis of vitamin A from carotene**<br>13. **Excretion of toxic substance** -The toxic substances entering the body through alimentary canal are destroyed in liver.<br>14. **Inactivation of hormones**: Insulin, glucagon, cortisol, aldosterone, thyroid and sex hormones. | **5M** |
| **1** | **e** | **Explain mechanism of urine formation. Write any five functions of kidney.**<br>**Marking Scheme: Mechanism of urine formation - 2.5M, Functions - 2.5M. (Any five Functions – 0.5M each)**<br>**Answer:**<br>**Mechanism of urine formation:** | **5M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|

There are three processes in the mechanism of urine formation which takes place in the nephron in kidneys.

1) **Glomerular filtration / Ultra filtration -**

Filtration takes place through the semi permeable walls of the glomerulus & glomerular capsule or Bowman's capsule. Water and small molecules pass through it. The afferent renal artery brings blood to the glomerulus and the efferent artery carries the blood away from it. As the diameter of afferent artery is more than the efferent artery, a hydrostatic pressure is generated in the glomerulus (55 mm Hg). This pressure is opposed by osmotic (30 mmHg) and filtrate hydrostatic pressure in capsule (15 mmHg). The net filtration pressure is 55-(30+15) = 10 mmHg. All constituents of blood are filtered except blood cells and plasma proteins. The GFR i.e. Glomerular Filtration Rate is about 125 ml per min. i.e. 180 Liters of dilute filtrate is formed in each day, by the 2 kidneys.

2) **Selective reabsorption –**

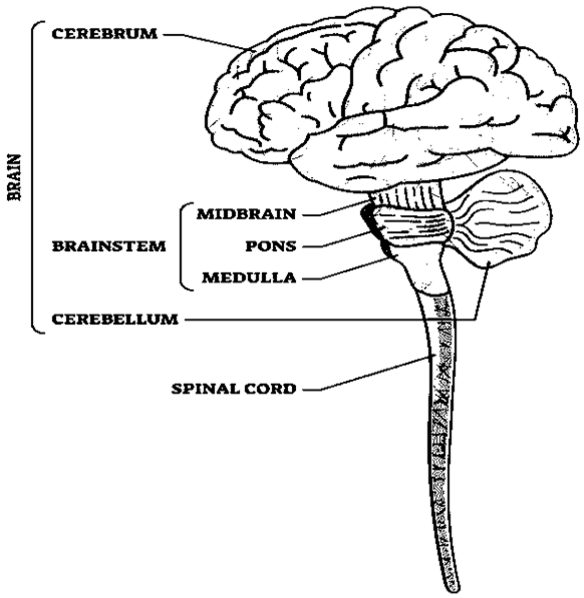
This is the process by which composition and volume of filtrate are changed during its passage through the tubule. The constituents required by the body are reabsorbed. Components like glucose, vitamins, amino acids get completely reabsorbed into the blood. These are called high threshold substances. Low threshold substances like urea, uric acid is absorbed slightly. Some substances like creatinine are not reabsorbed at all.

3) **Tubular secretion –**

Substances not required & the foreign material which have not got cleared during filtration due to short time, are secreted into the distal convoluted tubule & excreted in the urine. Tubular secretion of Hydrogen ions is important for maintaining pH. H ions are secreted in combination with bicarbonate as carbonic acid, with ammonia as ammonium chloride & with hydrogen phosphate as dihydrogen phosphate.

**Functions of kidney:**

1) Formation of urine.
2) Regulate the osmotic pressure of the body fluids.
3) Regulate the concentrations of numerous ions in blood plasma, including $Na^+$, $K^+$, $Ca^{2+}$, $Mg^{2+}$, $Cl^-$, bicarbonate ($HCO3^-$), phosphate, and sulphate.
4) Removes metabolic waste products from the blood & excrete them in urine.
5) Regulate the volume of the ECF by controlling Na+ and water excretion.
6) Remove many chemicals and drugs from the blood and excrete them in urine.
7) Hormone secretion – Renin, Erythropoietin
8) Degrade several polypeptide hormones, including insulin, glucagon, and parathyroid hormone.

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | 9) It helps to regulate arterial blood pressure by adjusting $Na^+$ excretion and producing various substances (e.g., renin) that can affect blood pressure.<br>10) Play an essential role in acid–base balance. Maintain pH of body fluids. | |
| 1 | f | **Sketch and label central nervous system and explain various functions of medulla oblongata.**<br>**Marking Scheme: - Labelled diagram - 2M, Functions of medulla oblongata - 3M (Any three - 1M each)**<br>**Answer:**<br>  <br><br>**Diagram: Central Nervous system**<br>**Functions of medulla oblongata: -**<br>The vital centres consisting of group of cells associated with autonomic reflex activity lie in Medulla oblongata. They are,<br>• **Cardiac centre –**<br>The cardiac centre controls the rate and force of cardiac contraction and blood pressure.<br>• **Respiratory centre –**<br>The respiratory centre controls the rate and depth of respiration. Nerve impulses pass to the phrenic and intercostal muscles which stimulate the contraction of diaphragm and intercostal muscles, thus initiating inspiration.<br>• **Vasomotor centre –**<br>This controls the diameter of blood vessels especially small arteries and arterioles.<br>• **Reflex centre –**<br>When irritating substance are present in stomach or respiratory tract, nerve impulse passes on to the medulla oblongata stimulating the reflex centre which initiate reflex actions like vomiting, sneezing, and coughing. | **5M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 1 | g | **Classify bones. Differentiate between male and female pelvis.** | 5M |

**Marking Scheme: Classification – 2.5 M (0.5 M each class), Differences – 2.5 M (0.5 for each difference)**

**Answer:**

**Depending upon shape and size bones are classified as,**

1) **Long bones:**

These consist of an elongated shaft with two extremities. The shaft consists of a cylindrical compact bone and extremities are formed by a thin outer shell of compact tissue with an interior network of spongy or cancellous bone containing red bone marrow. e.g. femur, tibia, fibula.

2) **Short bones:**

These are roughly box like bones having no shaft but consist of smaller masses of spongy bones covered by a thin layer of compact bone. E.g. Wrist, Carpal and tarsal bones.

3) **Flat bones:**

In this type, a thin layer of cancellous bone is sandwiched in between two layers of compact bones. E.g. sternum, Scapula, bones of the skull.

4) **Irregular bones:**

These bones cannot place in any of the above categories and their shape is not fixed. E.g. vertebrae and most bones of face.

5) **Sesamoid bones:**

These are small bones which are developed in the tendons around certain joints. E.g. Patella bone.

**Differentiate between male and female pelvis: -**

| S. N. | Female pelvis | Male pelvis |
|---|---|---|
| 1 | Bones are lighter & thin | Bones are heavier & thick |
| 2 | Cavity is shallow & oval | Cavity is deep & funnel shaped |
| 3 | Sacrum is more concave anteriorly, making true pelvis broader. | Sacrum is less concave, making true pelvis narrower at the outlet. |
| 4 | The angle made at the symphysis pubis is wider. | The angle of pubic arch is narrower. |
| 5 | Acetabulum faces more lateral | Acetabulum faces anteriorly |

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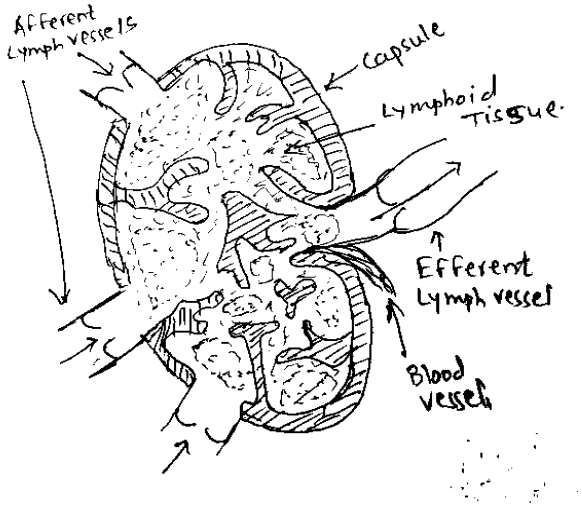
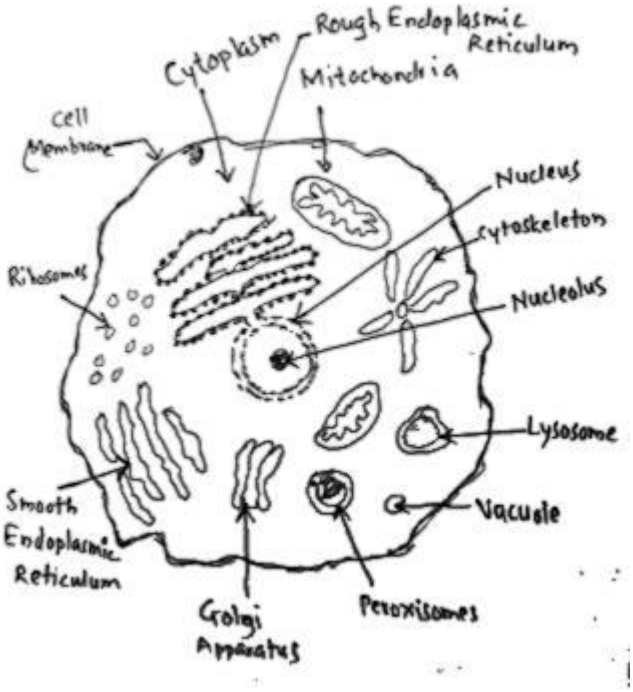
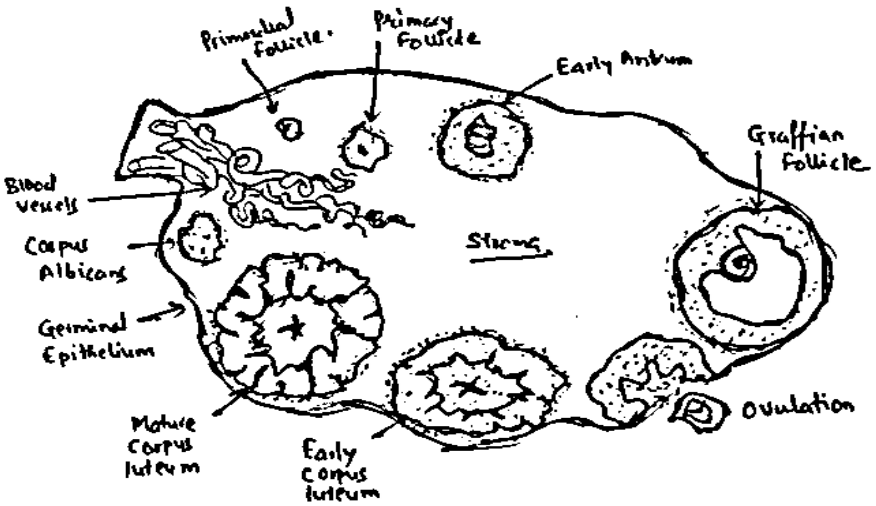
| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 2 | | **Answer any TEN of the following:** | **30 M** |
| 2 | a | **Give the composition and functions of saliva.**<br>**Marking Scheme:**<br>Composition of saliva – 1M; functions of saliva – 2M (0.5M for each function)<br>**Answer:**<br>**Composition –**<br>• **Water**- 99.5%<br>• **Solutes**- 0.5% - includes.<br>**Organic compounds** - albumin, globulin, mucus, urea, bacteriolytic enzymes, uric acid, lysosomes, digestive enzymes, salivary amylase.<br>**Ions** – $Na^+$, $K^+$, $Cl^-$, $HCO_3$, $PO_4^{3-}$, Calcium, Magnesium, Hydrogen, Iodine, Iron<br>**Proteome:** glycoproteins to peptides<br>**OR**<br>**Composition**<br>• Water<br>• Mineral salts<br>• Enzyme- Salivary amylase (Ptyalin)<br>• Mucus<br>• Lysozyme<br>• Immunoglobulin<br>• Blood clotting factors<br>**Function –**<br>• Cleaning - Saliva helps in cleaning mouth & teeth which prevents growth of bacteria.<br>• Moistening & Lubricating - Saliva lubricates, moistens soft part of mouth, keeping it pliable (flexible) for speech.<br>• Excretion – Various organic substances like urea and inorganic substances like mercury, lead and several drugs like metronidazole are excreted in saliva.<br>• Salivary amylase acts on starch, reduces them to disaccharides.<br>• Lubrication of food.<br>• Non-specific defence mechanism (lysosome's & immunoglobulin).<br>• Sense of Taste by lubrication of food. | **3M** |
| 2 | b | **What are the functions of lymphatic system? Draw a well labelled diagram of 'Lymph node'.**<br>**Marking Scheme: Functions - 1M (0.5M for each function); Labelled Diagram: 2M**<br>**Answer:**<br>**Functions of lymphatic system**<br>1. Lymph node protects the body against infections by filtering and destroying bacteria. | **3M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | 2. Lymph nodes are the sites where lymphocytes are produced.<br>3. Lymphatics drain excess fluid from tissues back to circulation.<br>4. Lymphatics carries waste products from tissues to blood.<br><br>**Diagram of Lymph Node –**<br><br>  <br> | |
| **2** | **c** | **Why is pancreas called exo-endocrine gland?**<br>**Marking Scheme: Each point – 0.5M Any six points – 3M**<br>**Answer:**<br>1. Exocrine glands secrete their substances through ducts onto your body's surfaces.<br>2. Endocrine glands secrete their substances directly into your bloodstream.<br>3. Pancreas is functionally divided into exocrine & endocrine part.<br>4. *Exocrine* part of pancreas pours its secretion into duodenum and Endocrine part pours its secretion into bloodstream.<br>5. *Exocrine* portion of pancreas is made up of pancreatic cells, arranged in clusters (c/a acini) and secret digestive juices into the duodenum.<br>6. Endocrine part is made up of islets of Langerhans, which secretes their secretions directly into the blood.<br>7. Since pancreas secretes both digestive juices and hormones and has exocrine and endocrine parts, it is known as an exo- endocrine gland. | **3M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 2 | d | **Draw a neat, labelled sketch of human cell.**<br>**Marking Scheme: Diagram – 1.5M; Labell: 1.5M (Correct label; minimum 6 label)**<br>**Answer:**<br>  <br> | 3M |
| 2 | e | **Give the composition and functions of CSF.**<br>**Marking Scheme: Composition – 1M; Functions – 2M (0.5M for each)**<br>**Answer:**<br>**Composition:**<br>• Clear colourless liquid mainly containing Water (99.13%) and Solid (0.87%).<br>• Solid consist of organic substances and inorganic substances.<br>  • **Organic substances**: Proteins, Amino acids, Glucose, Cholesterol, Lactic acid, Urea, Uric acid, Creatinine.<br>  • **Inorganic substances**: Cations like $Na^{+}$, $K^{+}$, $Ca^{++}$, $Mg^{++}$, Anions like $Cl^{-}$, $HCO3^{-}$, Phosphate, Sulfate etc.<br>• Other: Lymphocytes<br>OR<br>**Composition**<br>• Water<br>• Mineral salts<br>• Glucose<br>• Plasma proteins - small amounts of albumin & globulin | 3M |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | • Creatinine in small amount<br>• Urea<br>• Few leucocytes<br>**Functions:**<br>• Provides support, protects the delicate structure of brain, spinal cord.<br>• As shock absorber cushion to brain & spinal cord.<br>• Maintain uniform pressure around brain & spinal cord.<br>• Provides chemical protection to brain & spinal cord.<br>• Provides nutrients and carries away metabolic waste. | |
| 2 | f | **Enlist different types of blood cells with their normal values.**<br>**Marking Scheme: Types of blood cells – 1.5M (Each-0.5M); Normal Value – 1.5M (0.5M for each value)**<br>**Answer:** ***(Any values from standard reference book will be considered)***<br>• Erythrocytes (RBC) = Men – 4.0 to 5.9 million per microliter (mcL),<br>Women – 3.8 to 5.2 million per microliter (mcL)<br>• Leukocytes (WBC) = 4500 to 11000 cells/ µL<br>(Neutrophils - 40-60%, Lymphocytes - 20-40%, Monocyte - 2-8%, Eosinophil - 1-4%, Basophil - up to 1%)<br>• Thrombocytes (Platelets) = 150,000 to 450,000 platelets/ µL | **3M** |
| 2 | g | **Explain the structure and functions of ovary.**<br>**Marking Scheme: Explanation of structure - 1M; Diagram with label- 1M; Functions:1M (0.5M for each function)**<br>**Answer:**<br>**Structure of ovary:**<br>• One ovary lies on each side of uterus.<br>• Ovary is in close connection with *fimbriae* of *infundibulum*.<br>• It is made up of in *germinal epithelium, tunica albuginea, stroma, ovarian follicles, Graafian follicle* & *Corpus luteum.*<br>• The *Graafian follicle* is the mature follicle filled with fluid and is ready for rupture and release of secondary oocytes.<br>• Remnants of Graafian follicle after release of secondary oocytes is called *Corpus luteum*, it produces progesterone, estrogens, relaxin, and inhibin. | **3M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | **Diagram of Ovary:**<br>  <br><br>**Functions of ovary:**<br>• To produce and store ovum/egg.<br>• To produce hormones that control the menstrual cycle and pregnancy.<br>• To produce the ovum and secrete female sex hormones like oestrogen and progesterone.<br>• Fertilization of ovum.<br>• Ovaries carries genetic material. | |
| **2** | **h** | **Define and give normal values of**<br>**i. Vital capacity**<br>**ii. Tidal volume**<br>**iii. Residual volume**<br>**Marking Scheme: Definition with normal value - 1 M each**<br>**Answer:**<br>**i. Vital capacity –**<br>It is the maximum amount of air which can expel from the lungs after a maximum inhalation (Effort). It is equal to the sum of inspiratory reserve volume, tidal volume, and expiratory reserve volume.<br>**Normal value**- 3-5 liters<br>**ii. Tidal volume –**<br>Amount of air inspired and expired during normal quiet breathing is volume of one breath.<br>**Normal value**- 500 ml<br>**iii. Residual volume-**<br>After normal expiration a considerable amount of air remains in lungs (even after expiratory reserve volume is expelled) and this volume of air called as residual volume.<br>**Normal value**- 1 to 1.2 liters | **3M** |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 2 | i | **Define hormones. Explain the role of hormones secreted by Adenohypophysis.**<br>**Marking Scheme: Definition – 1M; Any four Roles / Functions: 2M**<br>**Answer:**<br>**Hormones**<br>These are chemical substances secreted by endocrine or ductless glands.<br>**OR**<br>A hormone is a chemical message transmitted in the blood that is secreted by an endocrine gland.<br>**Role of hormones by Adenohypophysis OR Anterior Pituitary gland**<br>• Growth hormone – Responsible for overall growth of body and body parts.<br>• Adrenocorticotropic hormone (ACTH) – Responsible for secretion of glucocorticoids, by the adrenal cortex.<br>• Melanocyte stimulating hormone (MSH) - causes darkening of skin.<br>• Thyroid stimulating hormone (TSH) - secret thyroxine (T4) and triiodothyronine (T3)<br>• Follicle stimulating hormone (FSH) and luteinizing hormone (LH) which play important roles in sexual functions.<br>• Prolactin causes development of breast & milk secretion. | 3M |
| 2 | j | **Define blood pressure. Explain all factors that modify blood pressure.**<br>**Marking Scheme:**<br>Definition – 1M; Factor: 0.5M each (Consider any four factors for 2M)<br>**Answer:**<br>**Blood Pressure:**<br>The hydrostatic pressure exerted by blood on the walls of blood vessels is called blood pressure. It is the result of cardiac output and peripheral resistance.<br>OR<br>It is the lateral pressure produced by the blood on the walls of blood vessels.<br>**Factors**<br>• **Peripheral vascular resistance (Systemic vascular resistance, SVR)** - Blood pressure is most inversely proportional to viscosity of blood. PVR also depends upon viscosity of blood, total length, and average radius of blood vessels. Blood viscosity depends upon RBC to plasma volume ratio.<br>• **Cardiac output – (5 – 6 L/min)** - Amount of blood ejected per minute by both ventricles.<br>• **Baroreceptors**– Baroreceptors are found on some large systemic arteries' walls. Nerve's mechanism for arterial pressure control is Baro-receptors reflex. These are stimulated when stretched. As blood pressure increases Baro-receptors are stretched and | 3M |

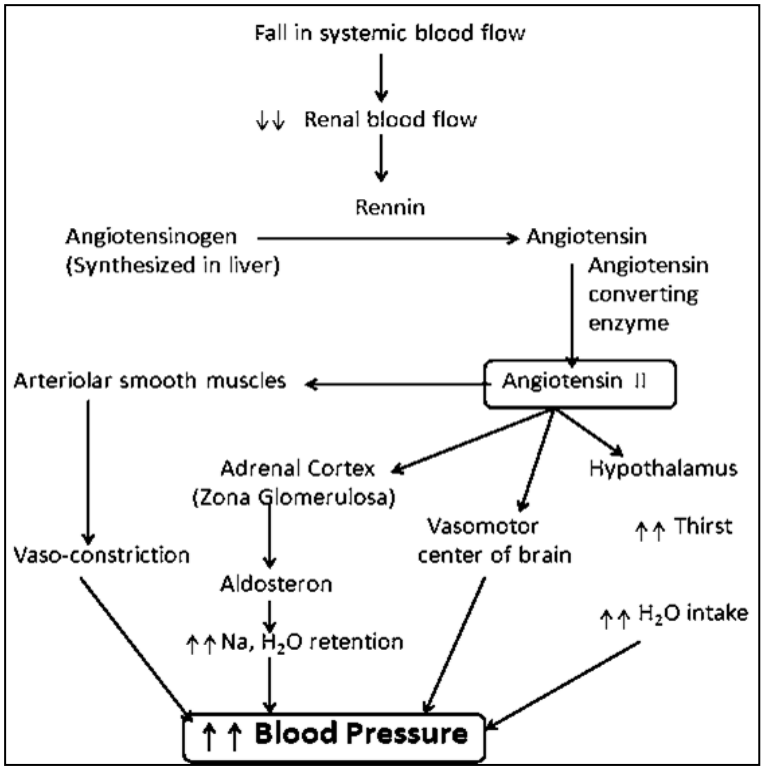
| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|

the rate of impulse transmission drastically decreases. This results in vasodilation of veins and arterioles.

- **Chemo-receptors**- Chemoreceptors are associated with baroreceptors. These are in close contact with arterial blood. If there is full blood pressure these receptors sends signals to vasomotor centers and excite to elevate arterial pressure back to normal.
- **Rennin Angiotensin System**- *(Explanation OR diagrammatic representation CAN be considered)*

  When blood pressure falls than normal in renal arteries, the sympathetic stimulation stimulates to secrete rennin. This interacts with angiotensinogen protein for its conversion into angiotensinogen I. Angiotensinogen converting enzyme converts angiotensinogen I into angiotensinogen II a potent vasoconstrictor. This angiotensinogen II constricts arteriolar smooth muscles- causes increase in peripheral resistance hence increase in blood pressure. Also, angiotensinogen II stimulates adrenal cortex to release aldosterone, acts on kidney to increase $Na^{++}$ reabsorption, increase passive water reabsorption, increase blood volume; regulation of blood pressure takes place. Angiotensinogen II stimulates vasomotor center of brain to increase blood pressure. Angiotensinogen II stimulates thirst area of hypothalamus to increase sensation of thirst thereby increase water intake.

***OR***




- **Hormonal regulation** - Major hormones involved in blood pressure regulation are - Aldosterone, Epinephrine, Norepinephrine, Anti-diuretic Hormone, Atrial Natriuretic Peptide (ANP), Parathyroid Hormone & Calcitonin.

**WINTER– 2023 EXAMINATION**

**MODEL ANSWER - ONLY FOR THE USE OF RAC ASSESSORS**

**Subject Title: HUMAN ANATOMY & PHYSIOLOGY- THEORY** Subject Code: **20114**

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | • **Aldosterone**– Increase $Na^{++}$ absorption by kidneys, promote $K^{+}$ excretion. $Na^{++}$ absorption- increase water reabsorption– increase extracellular fluid volume – increase blood volume – increase blood pressure.<br>• **Epinephrine & Norepinephrine**– Secreted by adrenal medulla. Increase cardiac output, increase rate, force of contraction. Arteriole vasoconstriction in abdominal organs, vasodilation in cardiac and skeletal muscles to help in regulation of blood pressure.<br>• **Anti-Diuretic Hormone/ Vasopressin** – Produced by hypothalamus and released by posterior pituitary. It causes vasoconstrictions and decreases water loss through urine, leading to an increase in blood pressure. | |
| **2** | **k** | **Name fundamental tissues of body. Classify simple epithelium with their locations.**<br>**Marking Scheme: Name fundamental tissue – 1M; Classification – 1M; Location-1M**<br>**Answer:**<br>**Name fundamental tissue.**<br>1. Epithelial tissue,<br>2. Connective tissue<br>3. Muscular tissue,<br>4. Nervous tissue<br>**Classification and Location of Simple epithelium**<br>i. **Simple squamous epithelium** - Lines of heart, air sac of lungs, glomerular capsule of kidney<br>ii. **Simple cuboidal epithelium** - Cover surface of ovary, lens of eye, kidney tubules, ducts of glands (Like thyroid, pancreases etc.)<br>iii. **Simple columnar epithelium** - Lines of GI track, bronchioles of Resp. track, uterine, gall bladder, central canal of spine etc.<br>iv. **Ciliated (Pseudo stratified) columnar epithelium** - Lining the uterine tubes, respiratory passages etc. | **3M** |
| **3** | | **Attempt ALL questions** | **20 M** |
| | | *Important Instructions: In case, multiple answer options are observed for the same sub question of question No. 3, the option (Answer) appearing first in the answer book shall be treated as answer and assessed accordingly.* | |
| **3** | **a** | **The exchange of gases take place in _____ the respiratory system.**<br>**Marking Scheme:** 1M for correct answer.<br>**Answer:** Alveoli | **1M** |
| **3** | **b** | **Name any two cranial nerves.**<br>**Marking Scheme:** 1M for any two cranial nerves. *(Consider any two name)*<br>**Answer:** Olfactory, optic, occulomotor, trochlear, trigeminal, abducens, facial, vestibulocochlear (Auditory), glossopharyngeal, vagus, spinal accessory, hypoglossal | **1M** |

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| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 3 | c | **Name the largest cell in the human body.**<br>**Marking Scheme:** 1M for correct answer.<br>**Answer:** The ovum or egg cell. | 1M |
| 3 | d | **Mechanical and chemical processes which break down ingested food into small molecules is called as_____**<br>**Marking Scheme:** 1M for correct answer.<br>**Answer:** Digestion | 1M |
| 3 | e | **Structure of the body away from the midline is called as_____**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:** Lateral | 1M |
| 3 | f | **The fluid that enters the glomerulus is:**<br>i. Serum<br>ii. Blood<br>iii. Water<br>iv. Mucus<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>ii. Blood | 1M |
| 3 | g | **Name the bones of auditory ossicles.**<br>**Marking Scheme:** 1M for any two correct names.<br>**Answer:**<br>Malleus, Incus, Stapes | 1M |
| 3 | h | **The function of the thoracic cage is:**<br>i. Protect the stomach<br>ii. Protect the Kidneys<br>iii. Protect the heart and lungs<br>iv. Protect the brain and spinal cord<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>iii. protect the heart and lungs | 1M |
| 3 | i | **Which of the following is not property of muscle?**<br>i. Elasticity<br>ii. Degradability<br>iii. Contractility<br>iv. Excitability<br>**Marking Scheme:** 1M for correct answer<br>**Answer:** ii. Degradability | 1M |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| 3 | j | **Define cardiac cycle.**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>The sequence of coordinated events which takes place during each heartbeat.<br>OR<br>The cardiac cycle is defined as a sequence of alternating contraction and relaxation of the atria and ventricles in order to pump blood throughout the body. | 1M |
| 3 | k | **Testosterone hormone is secreted by cells.**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:** Leydig cells | 1M |
| 3 | l | **Which statement is correct in case of cone cells in retina?**<br>i. Stimulated in dim light and do not produce colour vision.<br>ii. Responsible for colour vision<br>iii. Stimulated in bright light which do not produce colour vision.<br>iv. Stimulated in dim light which produce colour vision.<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>ii. Responsible for colour vision | 1M |
| 3 | m | **Define the term Anatomy.**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>The study of the structure of living things. | 1M |
| 3 | n | **Give an example of ball and socket joint**<br>**Marking Scheme:** 1 M for any one correct answer<br>**Answer:**<br>i. Hip joint (Femur and pelvic joint)<br>OR<br>ii. Shoulder joint (Humerus and Pectoral girdle joint) | 1M |
| 3 | o | **Acetylcholine in the nerve ending is broken down by an enzyme**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>Cholinesterase or Acetylcholinesterase | 1M |
| 3 | p | **What is ECG?**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>Electrocardiogram or recording of the functionality of the heart. | 1M |

| Q. No. | Sub No. | Answers | Marking Scheme |
|---|---|---|---|
| | | OR<br>An electrocardiogram (ECG) records the electrical signal from the heart to check for different heart conditions. | |
| 3 | q | **Which receptor is present in the nose?**<br>i. Photoreceptors<br>ii. Gustatory receptors<br>iii. Olfactory receptors<br>iv. Photoreceptors<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>iii. Olfactory receptors | **1M** |
| 3 | r | **Choose the correct sequence of respiratory organs in human**<br>i. Pharynx – Larynx - Bronchi – Trachea - Alveolus<br>ii. Pharynx – Larynx – Trachea – Bronchi – Alveolus<br>iii. Pharynx – Bronchi – Larynx – Trachea – Alveolus<br>iv. Pharynx – Trachea – Bronchi – Larynx – Alveolus<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>ii. Pharynx – Larynx – Trachea – Bronchi – Alveolus | **1M** |
| 3 | s | **Name various types of cartilages in body.**<br>**Marking Scheme:** 1M for any two correct cartilages (0.5M for each)<br>**Answer:**<br>Hyaline cartilage, Elastic cartilage and fibrocartilage | **1M** |
| 3 | t | **Posture, balance and equilibrium of body is regulated by which part of the brain?**<br>**Marking Scheme:** 1M for correct answer<br>**Answer:**<br>Cerebellum or Vestibular apparatus | **1M** |