MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)

MODEL ANSWER

SUMMER - 19 EXAMINATION

Subject Title: Human Anatomy & Physiology Subject Code: 0809

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 anyequivalent 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.

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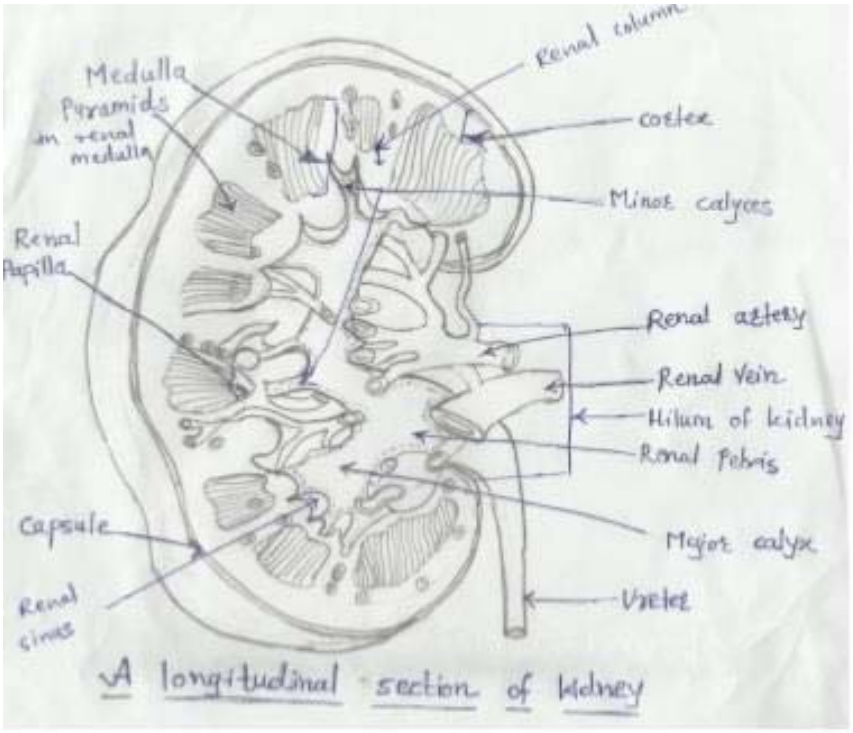
Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Solve any EIGHT of the following: (2marks each)**	**16M**
1	**a)**	**Define tissue. Name fundamental tissues of the body. (1 + 1)** Groups of cells which have the same physical characteristics and perform similar functions are termed as tissues. Fundamental tissues of body are:- 1) Epithelial tissue/Epithelium 2) Connective tissue 3) Muscular tissue 4) Nervous tissue	**2M**
1	**b)**	**State the functions of plasma proteins.** **Albumin** maintains the osmotic pressure of blood & also acts as carrier molecule for lipids & steroid hormones & some drugs. **Globulin:** immunoglobulins are produced by lymphocytes act as antibodies and is a part of immunity & transports some hormones and mineral salts. **Clotting factors**: The most abundant clotting factor is Fibrinogen, it is essential for blood clotting.	**2M**
1	**c)**	**Give functions of skeleton. (any 4 functions, 0.5 marks each)** Functions of skeleton: 1 It forms the supporting framework of the body. 2. Gives attachments to muscles & bones. 3. Forms the joint and hence helps in the movement of the body. 4. Forms the boundaries of the cranial, thoracic & pelvic cavities. 5. Heamopoiesis takes place due to presence of bone marrow. 6. They act as store house of calcium phosphate & other minerals salts.	**2M**

1	d)	**Name the arteries supplying blood to liver, intestine, diaphragm and kidneys. (0.5 mark each)** Arteries supplying blood to- **Liver:** hepatic artery **Kidney**: Left and right Renal arteries **Diaphragm**: Phrenic arteries **Intestine**: Superior & inferior mesenteric artery	**2M**
1	e)	**Draw a neat labelled diagram of L.S. of Kidney.** 	**2M**

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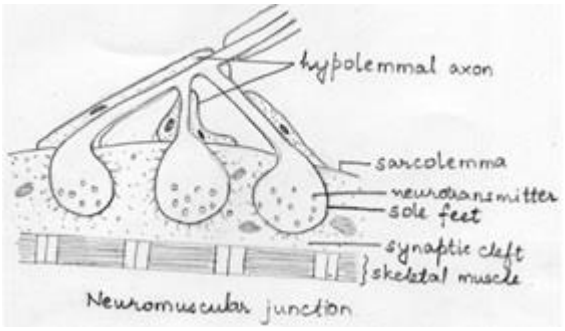
1 f) Compare the anatomy of sympathetic nervous system with that of parasympathetic nervous system. (any 4 points, 0.5 marks each) **2M**

Sr. No.	Sympathetic nervous system	Parasympathetic nervous system
1	This system enables the individual to adjust to exciting and stressful conditions (fight or flight)	This system acts as a peacemaker for the body allowing restoration processes to occur quietly and peacefully.
2	It is also called thoraco lumbar outflow.	It is also called cranio sacral outflow.
3	The preganglionic nerve fibre is short while the post ganglionic fibre which ends in effector organ is long.	The preganglionic nerve fibre is long while the post ganglionic fibre is short.
4	The post ganglionic nerve fibre secretes neurotransmitter called adrenaline or noradrenaline	The post ganglionic nerve fibre secretes neurotransmitter called acetylcholine.
5	It is also known as called adrenergic nervous system	It is also known as called cholinergic nervous system,
6	It has Alfa & beta receptors	It has muscarinic & nicotinic receptors
7	It is involved in expenditure of energy	It deals with restoration of body energy

1 g) Give functions of bile. (1 mark each) **2M**

Functions of bile:

1. Bile salts emulsify the fatty food which helps in further digestion of it.
2. Bile salts make cholesterol & fatty acids soluble & helps in absorption from small intestine.

		3. Bilirubin present in the bile is passed to the intestine where it gets converted to urobilin & stercobilin .Urobilin is excreted in the urine & stercobilin is excreted in the faeces.	
1	**h)**	**Why pituitary gland is known as master gland.** The pituitary gland secrets important hormones like growth hormone, prolactin, anti-diuretic hormone and oxytocin which directly act on the body and control important functions. It also secretes trophic hormones like TSH, gonadotrophic hormone, ACTH, which control secretion of other endocrine glands. Hence, it is called as master gland.	**2M**
1	**i)**	**Name different organs of respiratory system.** Nose, pharynx, Larynx, trachea, Bronchi (Two), bronchioles, alveoli, two lungs covered with pleura. Muscles of respiration- intercostal muscles & diaphragm.	**2M**
1	**j)**	**Describe Neuro-muscular junction in short.(2 marks for structure/ physiology)** **Neuromuscular junction**: The neuromuscular junction is the synapse between a large myelinated nerve and skeletal muscle fibre.  **Structure:** 1) Nerve fibre passes through muscle fibre called sarcolemma 2) The nerve fibre then spread to form many branches known as hypolemmal axon. 3) This hypolemmal axon is expanded into tube like feet called sole feet (synaptic knob) 4) The entire nerve ending is called as motor end plate 5) The space between sole feet and muscle fibre is called as synaptic cleft **Physiology of neuromuscular junction**:. Near the termination in the muscle, the axon branches into tiny fibres that form the motor end plate near the muscle fibre. When a nerve impulse reaches neuromuscular junction, the neuro transmitter released is	**2M**

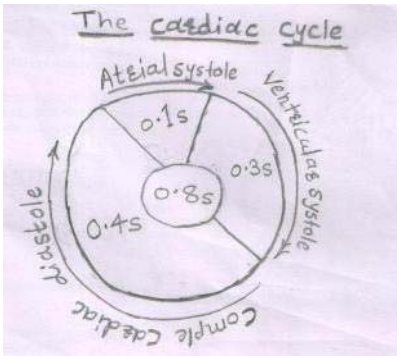
		sodium & calcium ions; as a result the muscle becomes depolarized. This causes muscle contraction. The acetyl choline is hydrolyzed by enzyme acetylcholine esterase .The calcium ion concentration is decreased in the muscle which causes repolarization which leads to relaxation of muscle.	
1	**k)**	**Explain how skin helps in maintain body temperature.** The center controlling temperature is situated in hypothalamus which is called heat regulating center. The vasomotor center in medulla oblongata also helps in regulating the body temperature. The amount of heat loss from the skin depends on the blood in the vessels which lie in the dermis. As the amount of heat in body increases, the vasomotor center is stimulated which causes vasodilatation of blood vessels in skin. Due to this, more amount of blood is passed through the skin which increases temperature of skin. As a result, sweat glands are stimulated by nerve impulses from the heat regulating center. Due to this more sweating occurs which gets evaporated to atmosphere, thus cooling the body. If the external temperature is low, or heat production is less, the vasomotor center causes vasoconstriction. Due to vasoconstriction, amount of blood flowing to the skin decreases which decreases the temperature of the skin and finally prevents heat loss from the body.	**2M**
1	**l)**	**Define Anatomy & Physiology. (1 + 1)** **Anatomy** -It is the study of structure of the body & its individual parts & their relation to one another. **Physiology** - It is the study of the functions of various parts and how they are integrated to produce a coordinated action of the whole body.	**2M**

2		**Solve any FOUR of the following: (3marks each)**	**12M**
2	**a)**	**Discuss physiology of menstrual cycle.** **Menstrual Cycle** -Series of events occurring regularly in females every 26-30 days, during reproductive years. Consists of series of changes that take place simultaneously in ovaries & uterine walls, stimulated by changes in blood level of hormones. Days of cycle are numbered from beginning of Menstruation (4), Proliferative phase (10), and Secretory phase (14). **Menstruation** Decrease level of progesterone & Estrogens stimulate release of PGs, causes constriction of arterioles in endometrium, leads to death of cells of stratum functionalis. Entire stratum functionalis sloughs off. Menstruation, only stratum basalis remains. Menstrual flow consists of 50-150ml of blood, tissue fluid, mucus & epithelial cells. Lasts for 4-5 days. **Proliferative phase** One of the follicles from both ovaries, develop and become dominant follicle, starts secreting estrogens. This follicle matures into Graafian follicle (diameter more than 20 mm). Estrogens stimulate repair of endometrium. Cells of stratum basalis undergo mitosis & produce new stratum functionalis. Thickness of endometrium doubles:5-10mm. LH causes rupture of mature follicle & ovulation. That is end of this phase. **Secretory phase** Under influence of LH ruptured follicle transforms into corpus luteum that secretes progesterone, estrogens. Promotes growth and coiling of endometrial glands, vascularisation of superficial endometrium & thickening of endometrium to 12 -18 mm. Under influence of progesterone secretory glands produce large amount of mucus. There is similar increase in secretion of watery mucus by glands of uterine tubes& cervical glands of vagina. If oocyte is not fertilised, degeneration of corpus luteum within 2 weeks into corpus albicans. Levels of progesterone & estrogens decrease, that causes menstruation & cycle continues. This phase is most constant part of cycle lasts for 14 days i.e. from 15 to 28 days.	**3 M**
2	**b)**	**Define endocrine gland. Enlist endocrine glands of human body. (1 + 2)** Endocrine glands are ductless glands which release their secretions (hormones) directly	**3M**

		into the blood. Endocrine glands: Pituitary gland, thymus gland, thyroid gland, parathyroid glands, pancreas (islets of Langerhans), adrenal glands, pineal gland, testes in male and ovaries in female.	
2	**c)**	**Describe composition and functions of gastric juice. (1 + 2)** Composition of Gastric juice- water, mineral salts, mucus, hydrochloric acid, Enzymes such as pepsinogen, and the intrinsic factor. Functions of Gastric Juice: 1. Water liquefies the food. 2. HCl acidifies the food & stops the action of salivary amylase. 3. HCl kills the microbes 4. Pepsinogen is activated to pepsin by HCl, This digests protein to peptones and peptides. 5. Intrinsic factor helps in absorption of vit. B12 from small intestine. 6. Mucus prevents mechanical injury to the stomach wall.	**3M**
2	**d)**	**What is Hypothalamus? Give its functions. (1 + 2)** **Hypothalamus:** The hypothalamus is composed of a number of groups of nerve cells. It is situated below and in front of the thalamus, immediately above the pituitary gland. The hypothalamus is linked to the posterior lobe of the pituitary gland by nerve fibers and to the anterior lobe by a complex system of blood vessels. Through these connections, the hypothalamus controls the output of hormones from both lobes of the gland. Following are functions of hypothalamus: 1) It controls Autonomic nervous system 2) It controls appetite & satiety 3) Regulation of thirst 4) Maintenance of emotional behavior, personality and social behavior. 5) Regulation of body temperature	**3M**

		6) It regulates and controls release of hormones from pituitary gland. 7) It regulates biological clock 8) It controls sexual behavior	
2	**e)**	**Discuss physiology of muscular contraction.** The motor pathway from the brain to the muscles involves two neurons. The upper motor neuron & the lower motor neuron. The axon of this neuron reaches the muscle. Near the termination in the muscle, the axon branches into tiny fibres that form the motor end plate near the muscle fibre. When a nerve impulse reaches neuromuscular junction, the neurotransmitter released is Acetyl choline at this junction. This changes the permeability of the cell membrane to sodium & calcium ions. As a result the muscle becomes depolarized. This causes muscle contraction. The acetyl choline is hydrolysed by enzyme acetylcholine esterase .The calcium ion concentration is decreased in the muscle which causes repolarization which leads to relaxation of muscle.	**3M**
2.	**f)**	**Explain the process of urine formation.** The Urine formation by kidney takes place in 3 steps:- 1) Glomerular Filtration 2) Selective reabsorption 3) Tubular secretion **1) Glomerular filtration: -** The glomerular filtering membranes acts as an ultrafilters. The particles like colloidal, soluble and cell free substances, smaller than endothelial pores are filtered. However big particles like plasma proteins are not filtered. The filtration takes place with the pressure of 35 mm of Hg. This pressure results from different forces involved in glomerular filtration. The GFR i.e. glomerular filtration rate is 120 ml/min, thus producing 170-180 litres of filtrate in a day. **2) Selective reabsorption:-** Out of 170-180 litres of filtrate, about 99% is reabsorbed, resulting in formation of 1-1.5 litre of urine per day. The filtrate contain major amount of water, which is reabsorbed to the extent of 99%. Depending upon the extent to which various substances are reabsorbed they are classified as: **a)High threshold substances:** They get absorbed completely eg. Glucose and potassium(100%), water (99%), calcium and sodium chloride (98-99%).	**3M**

		b) Low threshold substances: Absorbed to some extent eg. Urea , uric acid, phosphate. **c) No threshold substances:** These are not required by the body at all.eg. Creatinine, sulphates**.** **3) Tubular secretion:** The substances not required by body and not filtered in glomerular filtration are secreted by the tubules. Depending upon extent to which sodium ions are reabsorbed, potassium, & hydrogen ions are secreted, thus maintaining electrolyte balance of the body. Some metabolized substances like ammonia are also excreted. Thus the final filtrate of urine, is carried by collecting tubule to duct to the pelvis of kidney to ureter. The ureter opens in to urinary bladder where it is stored and finally excreted out.	
3		**Solve any FOUR of the following : (3 marks each)**	**12M**
3	**a)**	**Describe physiology of respiration**. The term respiration means exchange of gases between body cells & the environment. This involves two main processes. **–Breathing & exchange of gases**. The normal human has 12-15 breath per min. Each breath consists of inspiration, expiration & pause. **Inspiration** The simultaneous contraction of intercostal muscles & diaphragm increases the capacity of thoracic cavity. This reduces the pressure in the lungs. To equalise the pressure the air from atmosphere enters the lungs. The process of inspiration is active as it needs energy for muscle contraction.it lasts for 2 sec. **Expiration** Relaxation of intercostal muscles & diaphragm results in decrease in the space in the lungs. As a result, the pressure inside the lungs increases as compared to atmospheric pressure. The air from the lungs is expelled from the lungs. This process is passive as does not require energy. The expiration lasts for 3 sec. After expiration there is **pause** & then the next cycle begins. **Exchange of gases** The exchange of gases take place between blood & air (external respiration) & between blood & cells (internal respiration).	**3M**

		Internal respiration- This is the exchange of gases bet blood & the body cells. The blood arriving at the tissues is saturated with O_2 & therefore has a higher PO_2 & lower PCO_2 than tissues. This creates concentration gradient bet capillary blood & the tissues& gaseous exchange takes place.O_2 diffuses from the blood into the tissues, & CO_2 diffuses from the cells into the venous end of the blood.	
3	**b)**	**Describe in brief the cardiac cycle.** **Cardiac cycle:** The events which occur in the heart during the circulation of blood during each heart beat is called cardiac cycle OR The series of events during one heart beat is known as cardiac cycle.  Events in cardiac cycle: (i) Atrial systole (0.1 sec) (ii) Ventricular systole (0.3 sec) (iii) Complete cardiac diastole (0.4 sec) Total 0.8 sec Description of cardiac cycle The superior & inferior vena cava transports the deoxygenated blood into right atrium. At the same time four pulmonary veins transport oxygenated blood into the left atrium. The heart action starts in the special cells of myocardium called SA node or sinoatrial node. It is situated near the opening of superior vena cava in the right atrium. These impulses from the SA node spreads over the atria, atria contracts, the AV valves open	**3M**

		and & blood flows to ventricles. (Atrial systole-0.1 sec) When the wave of contraction reaches AV node, it is stimulated & emits impulses which spread over AV bundle, bundle branches & Purkinje fibres resulting in contraction of ventricles pumping the blood into pulmonary artery & the aorta. (ventricular systole 0.3 sec). After the contraction of the ventricles there is complete cardiac diastole (0.4 sec) when both atria & ventricles relax. After this the next cycle begins.	
3	**c)**	**What are lymph nodes. (1M) Give their functions. (2M)** A lymph node or lymph gland is an oval or bean-shaped organ of the lymphatic system**,** that lie often in groups along the length of lymph vessels. **Functions** **a) Filtering & phagocytosis** Lymph is filtered by the reticular & lymphatic tissue as it passes through lymph nodes. The particulate matter may include bacteria, microbes, cells from malignant tumors, worn out & damaged tissue cells & inhaled particles. **b) Proliferation of lymphocytes** Activated T and B lymphocytes multiply in lymph nodes.	**3M**
3	**d)**	**Discuss in brief the process of coagulation of blood.(3M)** When the blood vessel is damaged, loss of blood is stopped by the following way. 1) Vasoconstriction: - When platelets come in contact with a damaged blood vessel they adhere to it. Serotonin is released which constricts the blood vessel. 2) Platelet plug formation: - The adhered platelets attract more platelets which form platelet plug. This forms temporary seal. 3) Coagulation- (blood clotting): The thromboplastin (prothrombinase) released by damaged tissue cells by extrinsic or intrinsic pathway. In presence of calcium ions it converts prothrombin to thrombin. Thrombin acts on fibrinogen & converts it to insoluble fibrin. The fibrin mesh traps blood cells. This is known as clotting.	**3M**

		Prothrombin+ Calcium+ Thromboplastin → Thrombin (inactive) (from damaged tissue) (active) Thrombin acts on ↓ Fibrinogen → Fibrin (soluble) (insoluble) Fibrin + Blood Cells → Clot	
3	**e)**	**Name any six cranial nerves with their functions.(0.5×6)**	**3M**

Name and No. of Cranial Nerve	**Function**
1. Olfactory (sensory)	Sense of smell
II. Optic (sensory)	Sense of sight Balance & posture of body
III. Oculomotor(motor)	Moving the eyeball ciliary muscle which alters the lens changing the refractive power(Focusing), circular muscle of iris causing constriction of pupil
IV. Trochlear(motor)	Movement of the eyeball
V. Trigeminal(mixed)	Chewing Sensation from the face
VI. Abducent(motor)	Movement of the eye
VII. Facial (mixed)	Sense of taste facial expression
VIII. Vestibulocochlear(sensory)	
a) Vestibular	Maintenance of balance
(b) Cochlear	Sense of hearing

		IX. Glossopharyngeal (mixed)	Secretion of saliva Sense of taste Movement of pharynx, swallowing	
		X. Vagus (mixed)	Movement and secretion of parts of respiratory & digestive system	
		XI. Accessory(motor)	Movement of the head, shoulders, pharynx and larynx	
		XII. Hypoglossal(motor)	Swallowing & speech (Movement of tongue)	
3	**f)**	**Give composition (1M) & functions of saliva.(2M)**		**3M**

Composition of saliva-P^H 5.8 -7.4

water

mineral salts

salivary amylase

mucus

lysosomes

immunoglobulin

blood clotting factor

Functions of saliva-

1. Chemical digestion of polysaccharides- the salivary amylase acts on the starch & reduces them to disaccharides.
2. Lubrication of food.
3. Cleaning & lubricating the mouth.
4. Nonspecific defense mech. due to lysosomes & immunoglobulin.
5. Sense of Taste by lubrication of food.

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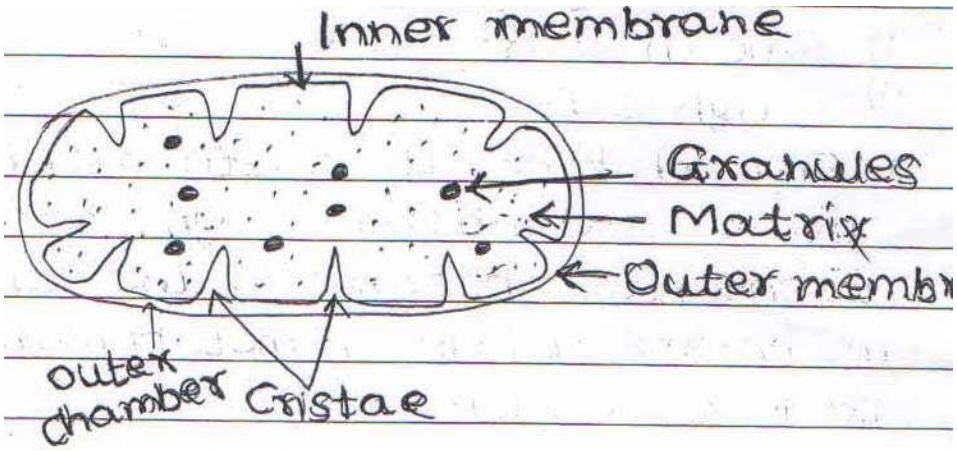
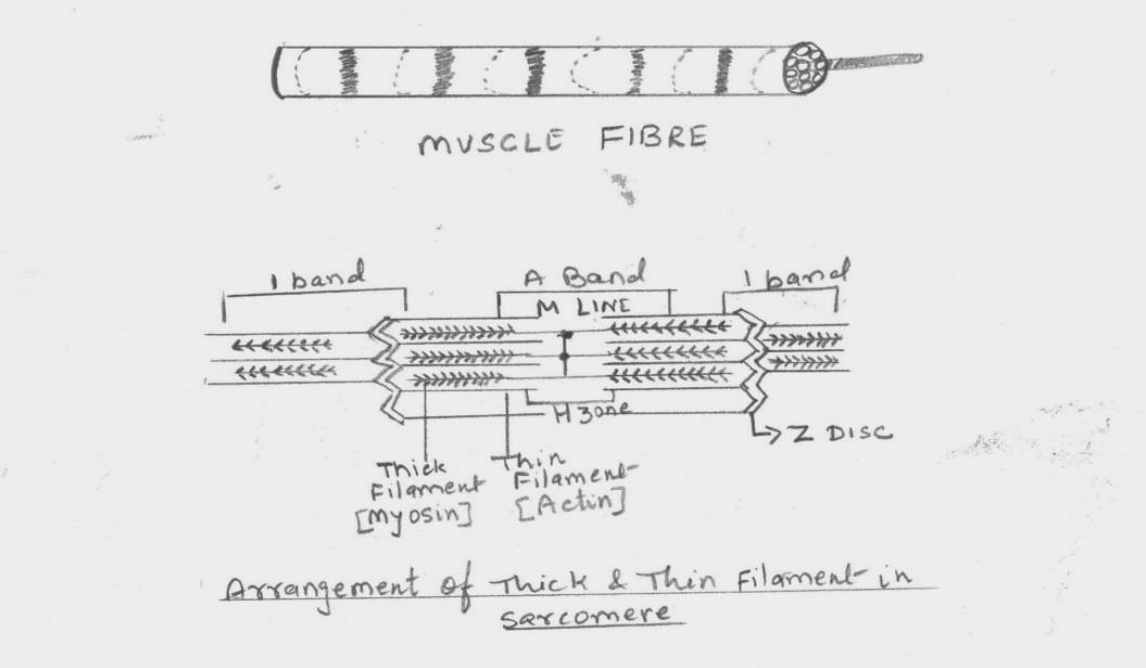
4		**Solve any FOUR of the following: (3marks each)**	**12M**
4	**a)**	**Describe the structure (1.5M) & function of mitochondria. (1.5M)**  **Structure**: They are sausage shaped str. in cytoplasm. It has a double unit membrane where the inner membrane contains folds known as cristae, forms shelves on which oxidative enzymes are present. The fluid filled cavity is known as matrix. They contain a special type of DNA, which is self-replicative. **Function:** It is known as power house of cell. They are involved in cellular respiration, the process by which chemical energy is made available in the cell. When nutrients and oxygen come in contact with the enzyme, they combine to form CO_2,water & energy, this is in the form of ATP. (aerobic oxidation) This ATP is used by the cell to do cellular functions	**3M**
4	**b)**	**Write functions (2M) & classification of WBC's.(1M)** WBCs are of two types based on the presence of granules in the cytoplasm as granulocytes and agranulocytes. They are further classified as - Granulocytes Agranulocytes 1. Neutrophils 1. Monocytes 2. Eosinophils 2. Lymphocytes 3.Basophils	**3M**

		Functions of Leukocytes • Neutrophils: Phagocytosis: destruction of bacteria & also remove the cell debris. • Eosinophils:-Phagocytize antigen-antibody complex, parasitic invasion; overcomes effects of histamine involved in inflammation during allergic reactions. • Basophils:-liberate heparin, histamine & serotonin at inflammation site in allergic reactions, that intensify overall inflammatory response • Lymphocytes: These are T & B cells. T cells provide cell mediated immunity & B cells produce antibodies & provide antibody mediated immunity. • Monocytes: Phagocytosis. Also produce interleukin 1 which act on hypothalamus & increase body temp. associated with microbial infection. Stimulates production of globulin by the liver & activated T lymphocytes.	
4	**c)**	**Classify joints with example of each class.(1M each)** A joint is a site at which any two or more bones articulate or come together. JOINTS FIBROUS JOINTS — e.g. Sutures of skull, Joint between tooth and alveolar socket CARTILAGINOUS JOINTS — e.g. Pubis symphysis, Joints between vertebrae (intervertebral discs) SYNOVIAL JOINTS **Synovial joints**: Classified into 6 types- 1.Ball and Socket joint e.g. Shoulder joint, Hip joint 2. Hinge joint e.g. Elbow joint, Knee joint, Ankle joint, interphalangeal joints.	**3M**

		3.Gliding joint e.g. Joint between carpals, joint between tarsals,joints bet. Spinal vertebrae. 4.Pivot joint e.g. Joint between atlas and axis, Radioulnar joints 5. Condyloid joint e.g temporomandibular, metacarpophalangeal and metatarsophalangeal joints. 6. Saddle joint e.g. Joint between trapezium & first metacarpal bone.	
4	**d)**	**Describe the terms Angina pectoris (1.5M) & stenosis.(1.5M)** **(ii) Angina pectoris:** Angina pectoris is the medical term for chest pain or discomfort due to coronary heart disease. Angina is a symptom of a condition called myocardial ischemia. It occurs when the myocardium doesn't get sufficient blood (hence as much oxygen) as it needs, because one or more of the coronary arteries is narrowed. The symptoms are typical pain radiating from neck, left shoulder, left arm& left finger. **ii)Stenosis:** An abnormal narrowing in a blood vessel or other tubular organ or structure.	**3M**
4	**e)**	**Discuss different functions of kidneys.(0.5×6M)** **1. Formation of urine:** Each kidney consists of a functional unit called as nephron. Thus kidney filter waste product from blood plasma & secrete it in the form of urine. The waste products are urea, uric acid, creatinine, ammonium ions etc. **2. Maintenance of water balance and urine output:** Anti-Diuretic Hormone increases the reabsorption of water from the distal convoluted tubule & collecting tubule of the kidneys reduce urine output. **3. Maintenance of electrolyte balance:** Aldosteron, calcitonin& parathhormone help kidney to maintain electrolyte balance. **4. Maintenance of pH balance (Acid-base balance):** Excretion of H^+ ions by tubular cells & reabsorption of sodium & bicarbonate ions in the blood & maintain alkalinity of blood. If H^+ ions are required by blood, potassium ions may be secreted or excreted for exchange& chloride ions are reabsorbed to regulate acid base balance. Here maintaining the acidity of blood by HCl formation. **5. Maintenance of blood pressure:** Kidney maintains the blood pressure by Renin	**3M**

		Angiotensin Aldosterone system. **6. Formation of erythropoietin hormone for erythropoiesis.**	
4	**f)**	**Give the microscopic structure of skeletal muscles.** (3M) The fibres (cell) are cylindrical and has many nuclei. A muscle consists of no. of muscle fibres.It shows series of dark & light filaments. Each muscle fibre contains several hundred to several thousand myofibril. These myofibril contains two structural proteins known as actin & myosin filaments lining side by side. Each muscle fibre contains 1500 myosin filaments & 3000 actin filaments. The thick filaments are myosin & thin filaments are actin. The myofibril have alternate light & dark bands because light band contains only actin filaments whereas dark band contains myosin filaments along with end of actin filaments. The actin filament is attached to dense stripe called as Z line or Z disc ,which is made up of filamentous proteins. The portion of myofibril lying between two successive Z disc called sarcomere. Several sarcomere build up the myofiril. Several thousands of myofibril grouped together to form muscle fibre. Several muscle fibre group together to form muscle.  Arrangement of Thick & Thin Filament in sarcomere	**3M**

5		**Solve any FOUR of the following :(3marks each)**	**12M**
5	**a)**	**Name different organs of male reproductive system with their functions.**	**3M**

The male reproductive system consists of the following organs:

Testes 2 } Scrotum

Epididymides 2 }

Deferent ducts 2

Spermatic cords 2

Seminal vesicles 2

Ejaculatory ducts 2

Prostate gland 1

Penis 1

Scrotum : It is a pouch of deeply pigmented skin, fibrous and connective tissue and smooth muscle. It is divided into two compartments each of which contains one testis, one epididymis and testicular end of spermatic cord. It maintains optimal temperature for spermatogenesis

Testis: Spermatogenesis, secrete male hormone testosterone

Epididymides : It is the site of sperm maturation

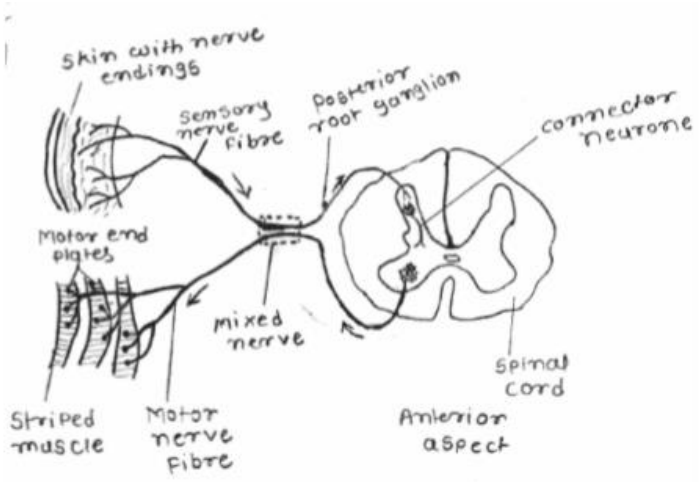
Deferent ducts (Vas deferens): Storage of sperms and also conveys sperms from epididymis to urethra

Spermatic cords : Suspends the testis in the scrotum

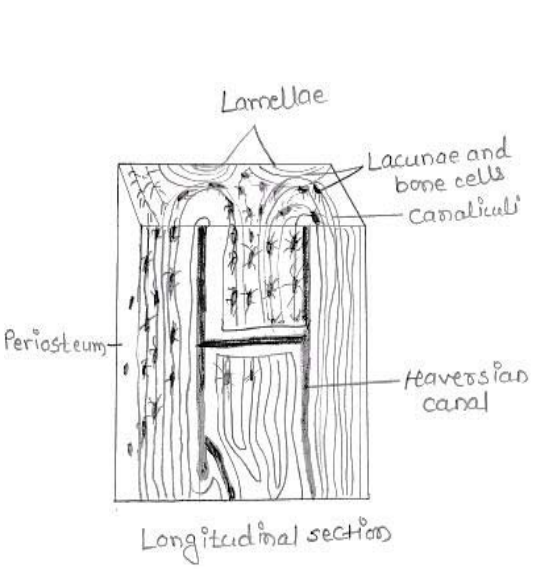
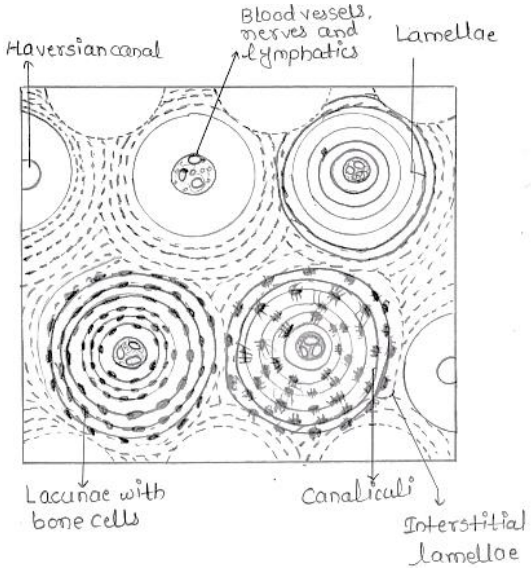
Seminal vesicles: Accessory gland which secretes seminal fluid

Ejaculatory ducts: Eject spermatozoa & seminal fluid into prostatic urethra prior to ejaculation

Prostate gland: It secrets prostatic fluid

5	b)	**What is reflex action? (1M) Draw a neat labelled structure of Reflex arc.(2M)** A reflex action is an involuntary & immediate motor response to a sensory stimulus.  	3M
5	c)	**Explain the terms- vital capacity, tidal volume and residual volume (each 1 mark)** **Vital capacity:** This is the maximum volume of air which can be moved into & out of the lungs during forceful breathing. Normal value is about 3-5 lit. VC=Tidal volume + IRV + ERV **Tidal volume:** It is the volume of air moved in & out of lungs during each cycle of normal breathing. Normal value is 500 ml at rest **Residual volume:** It is the volume of air remaining in lungs after forced expiration. Normal value is 1.2 L in males and 1.1 L in females	3M
5	d)	**Describe digestion of carbohydrates** Digestion of carbohydrate involves formation of monosaccharides from carbohydrates by action of enzymes. In mouth- salivary amylase converts polysaccharides present in the food to disaccharides. In small intestines- further as the chyme reaches the small intestine, pancreatic amylase converts polysaccharides to disaccharides. The disaccharides are acted upon brush border enzymes and convert into monosaccharides. Sucrase converts sucrose to glucose	3M

		and fructose. Maltase converts maltose to glucose. Lactase converts lactose to glucose and galactose and alpha dextrinaze convert alpha dextrin into glucose.	
5	**e)**	**Explain the terms universal donor and universal recipient** Blood group "O" is called as Universal donor and Blood group "AB" is called as Universal recipient. Individuals have different antigens on the surface of their RBCs. These antigens determine their blood groups. Blood group 'O' has neither A nor B antigen on their cell membrane. There will be no agglutination and thus blood can be safely transfused into A, B, AB and O. but can receive from only O.Therefore, blood group O is called universal donor. Whereas blood group AB has neither antiA nor antiB antibodies. Transfusion of any group into these individuals is safe since there are no antibodies to react with them. But can donate only to AB. Hence it is called as universal recipient.	**3M**
5	**f)**	**Describe different layers of stomach** The wall of the stomach is composed of four layers. i) Serosa ii) Muscularis iii) Submucosa iv) Mucosa **Serosa:** Outermost covering of the stomach and made up of serous membrane lining known as peritoneum. **Muscularis:** Located below serosa and is composed of three smooth muscle layer An outer layer of longitudinal fibres A middle layer of circular fibres An inner layer of oblique fibres Muscles of these layers helps in churning motion characteristic of gastric activity as well as peristaltic movement. Circular muscle is strongest in pylorus and pyloric sphincter **Submucosa:** Made up of areolar connective tissue containing collagen and some elastic fibres which bines the muscle layer to the mucosa.it contains blood vessels, nerves, lymph vessels and lymphoid tissue. **Mucosa:** innermost layer of the stomach wall. It consist of three layers of tissue mainly mucus membrane, lamina propria and muscularis mucosa. Numerous gastric glands are	**3M**

		present below the surface in the mucus membrane.	
6		**Solve any FOUR of the following :(4 marks each)**	**16M**
6	**a)**	**Describe microscopic structure of the bone** There are two types of bone tissues: **Compact bone:** It consist of large number of units called haversian systems(osteon) which have well defined characteristics i) A central haversion canal runs longitudinally and contains blood, lymph, capillaries and nerves. The matrix is solid and hard. It contain calcium and phosphorus mineral salts giving hardness to bone. ii) The canals are surrounded by concentric plates of bones known as lamellae. Lamellae consist of mineral salts giving hardness to bone. iii) Between the lamella, there are spaces called lacunae containing lymph and bone cells called osteocytes iv) The haversion canals and the lacunae are linked with fine channels called canaliculi. v) In the spaces between the haversian system there are interstitial lamellae **Cancellous bone:** It looks like a sponge. It does not contain osteons. There are fewer lamellae as compare to compact bone. Red bone marrow is always present in cancellous tissue   	**4M**

6	b)	**Explain role of haemoglobin in the process of respiration** To carry out oxygen from lung to tissue and carbon dioxide from tissue to lung.During transport of oxygen from lung Hb combine with oxygen to form oxyhaemoglobin which is transported to tissue. The oxyhaemoglobin in tissue is dissociated into oxygen and free Hb..This free Hb is combine with carbon dioxide in tissue to form carboxyhaemoglobin which is carried to lung and get dissociated into free carbon dioxide and Hb in lung, where free carbon dioxide is exhaled throughout the body. Thus Hb is involved in transport of waste product carbon dioxide through excretory organ like lungs.	**4M**
6	c)	**Name the abnormal constituents of urine with name of disease they signify** Following are the abnormal constituents and their related diseases. Proteins, sugar, ketone bodies, bile pigments and blood are the abnormal constituents of urine. These abnormal constituents appear in urine in different pathological conditions. **Proteins:** proteinurea for example in glomerulonephritis The presence of albumin and globulin in urine is called albuminurea. It results from Nephritis, renel tuberculosis, bacterial infection of kidney, mercury poisoning etc. **Sugar:** Glycosuria is a condition in which sugar appears in the urine in different pathological conditions such as Diabetes mellitus **Ketone bodies:** presence of ketone bodies in urine is ketonuria due to starvation and diabetes mellitus **Blood:** Presence of blood in urine is haematuria due to inflammation of glomeruli **Bile pigments and salts:** Its presence in urine is known as billirubin urea. It indicates pathological condition such as liver failure.	**4M**
6	d)	**Discuss choroid, ciliary body and iris of eye** **Choroid:** It is the middle vascular layer. It is very rich in blood vessels and is deep chocolate brown in colour. Light enters the eye through the pupil, stimulates the sensory receptors in the retina and is then absorbed by the choroid. **Ciliary body:** It is the anterior continuation of the choroid consists of ciliary muscles and secretory epithelial cells. The lens is attaché to ciliary body by radiating suspensory	**4M**

these ligaments control the shape of the lens. The epithelial cell secretes the aqueous fluid into the anterior segment of the eye. Ciliary body is supplied by parasympathetic branches of the oculomotor nerve. Stimulation causes contraction of the ciliary muscle and accommodation of the eye

Iris: it is visible colour part of the eye and extends anteriorly from the ciliary body, lying behind the cornea and in front of the lens. It divides anterior portion of the eye into anterior and posterior chambers which contain aqueous fluid secreted by the ciliary body. It is circular body composed of pigment cells and two layers of smooth muscle fibres, one circular and other radiating. In the centre is an aperture called pupil.

The iris supplied by parasympathetic and sympathetic nerves. Parasympathetic stimulation constrict the pupil and sympathetic stimulation dilate the pupil.

6 e) Discuss structural and functional differences between artery and vein **4M**

Sr. No	Artery	Vein
1	Arteries are the blood vessels which carry the blood away from the heart.	Veins are the blood vessels which bring the blood towards the heart
2	All arteries except pulmonary artery carry oxygenated blood.	veins except pulmonary veins bring deoxygenated blood.
3	Arteries are thick walled. In artery tunica media is thick.	Veins are thin walled. In veins tunica media is thin.
4	Arteries are elastic	Veins are less elastic.
5	Lumen of the artery is smaller as compared to vein.	Lumen of the vein is larger as compared to artery.
6	Arteries are branched into arterioles	Venules reunite to form veins.
7	They are reddish in colour	They are bluish in colour
8	They do not contain valves	They contain valves

6	f)	**Explain in short, factors affecting on Heart rate** **Autonomic nervous system:** A balance between sympathetic and parasympathetic activity is the most important factor in determining the heart rate **Circulating chemicals:** adrenaline and noradrenaline secreted by the adrenal medulla increases the heart rate. Thyroxin increases the heart rate. Hypoxia and elevated carbon dioxide levels stimulate heart rate. Electrolyte imbalances like increase in the potassium and calcium level decreases the heart rate. Some drugs such as beta receptor antagonist increases the heart rate. **Position:** when the person is upright, the heart rate is usually faster than when lying down. **Exercise:** active muscles need more blood than resting muscles and this is achieved by an increased heart rate and selective vasodilation. **Emotional states:** During excitement, fear and anxiety heart rate is increased. **Gender:** the heart rate is faster in women than men **Age:** in babies and small children the heart rate is more rapid than in older children and adults. **Temperature:** the heart rate rises and falls with body temperature **Baroreceptor reflex:** these are the nerve endings sensitive to pressure changes within the vessel, situated in aorta and in carotid sinuses. Rise in BP in arteries stimulates baroreceptors increasing their input to the CVC. The CVC responds by increasing parasympathetic nerve activity to the heart, this slows the heart down. At the same time sympathetic stimulation to the blood vessels is inhibited, causing vasodilation. The net result is systemic fall in BP. Conversely if the pressure within the arteries falls then rate of baroreceptor discharge also falls. The CVC respond by increasing sympathetic drive to the heart to speed it up. Sympathetic activity in blood pressure also increased and leads to vasoconstriction.	**4M**

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MODEL ANSWER

SUMMER - 19 EXAMINATION

Subject Title: Human Anatomy & Physiology Subject Code: 0809