

USN 

Internal Assessment Test 2 –July 2024

Sub:	BIOLOGY FOR COMPUTER ENGINEERS				Sub Code:	BBOC407	Branch:	ISE		
Date:	08/07/2024	Duration:	90 min's	Max Marks:	50	Sem/Sec:	IV A, B & C		OBE	
<u>Answer any FIVE FULL Questions</u>								MARKS	CO	RBT
1.	The structure and design of the Kingfisher's beak led to the design of the bullet trains. Interpret.					10	CO4	L3		
2.	Compare the process of photosynthesis to the functioning of photovoltaic cells.					10	CO4	L2		
3.	Using application of echolocation in ultrasonography explain echolocation					10	CO3	L3		
4.	Use a neat labeled diagram and explain the mechanism of filtration by the nephrons.					10	CO3	L3		
5.	Explain the various blood substitutes.					10	CO3	L2		
6.	Write a short note on i. Chronic obstructive pulmonary disease (5m) ii. Spirometry (5m)					10	CO3	L2		

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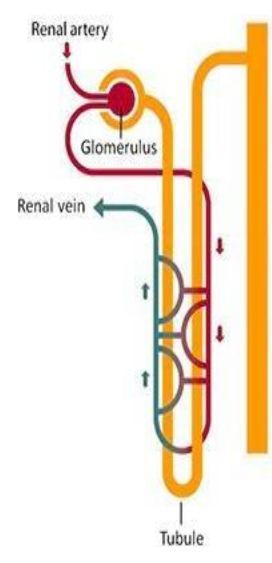
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SCHEME & SOLUTION
Internal Assessment Test 2 –July 2024

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Answer any FIVE FULL Questions								MARKS	CO	RBT
1.	<p>The structure and design of the Kingfisher's beak led to the design of the bullet trains. Interpret.</p> <p>The kingfishers have long, dagger-like bills.</p> <p>The bill is usually:</p> <ul style="list-style-type: none">• longer and more compressed in species that hunt fish, and• shorter and broader in species that hunt prey off the ground. <p>Relationship with humans:</p> <p>Kingfishers are generally shy birds, with following features:</p> <ul style="list-style-type: none">• large head supporting its powerful mouth,• bright plumage (Feathers) &• interesting behavior. <p>STRATEGY:</p> <ul style="list-style-type: none">✓ The secret is in the shape of the kingfisher's beak.✓ It has a long and narrow cone beak, that enters the water without creating a compression wave below the surface or a noisy splash above.✓ This helps bird to reach the fish in milliseconds, before the fish knows to flee.✓ Length of the beak is critical here: the longer it is, the more gradually the angle of wedge expands. <p>Potential:</p> <ul style="list-style-type: none">➤ Eiji Nakatsu, is the chief engineer of the company operating Japan's fastest trains.➤ He wondered if the kingfisher's beak might serve as a model to redesign trains.➤ So that they don't create thunderous noise when leaving tunnels.➤ As they tested different shapes for front of the new train, the train became quieter and more efficient as the geometry became more like the shape of a kingfisher's beak.➤ It required 15% less energy while traveling even faster than before.						10	CO4	L3	

2.	<p>Compare the process of photosynthesis to the functioning of photovoltaic cells.</p> <ul style="list-style-type: none"> ✓ Photosynthesis process is carried out by plants, algae, and some types of bacteria. ✓ They capture energy, from sunlight, to produce: <ol style="list-style-type: none"> 1. oxygen (O₂) and 2. chemical energy stored in glucose (a sugar). ✓ Herbivores then obtain this energy by eating plants, and carnivores obtain it by eating herbivores. ✓ During photosynthesis: plants take in CO₂ and water H₂O from the air and soil. <p>PHOTOVOLTAIC CELLS:</p> <ul style="list-style-type: none"> ✓ Sun's energy is captured by 2 engineering systems: photosynthetic plant cells and photovoltaic cells (PV). ✓ Photosynthesis converts solar energy into chemical energy. ✓ Photovoltaics turn solar energy into electricity which can be stored and used. ✓ One of the applications that contribute to bringing together photosynthesis and photovoltaics is the Photovoltaic cell. ✓ It's an electronic device that converts the energy of light directly into electricity by the photovoltaic effect ✓ It is defined as: The Device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. ✓ Solar cells are electrical building blocks of photovoltaic modules, known as solar panels. ✓ The common single-junction, silicon solar cell, can produce, a maximum open-circuit voltage of approximately 0.5 volts to 0.6 volts. <p>Application:</p> <ol style="list-style-type: none"> 1. Remote Locations 2. Stand-Alone Power. 3. Power in Space. 4. Building-Related Needs. 5. Military Uses. 6. Transportation. 	10	CO4	L2
3.	<p>Using application of echolocation in ultrasonography explain echolocation</p> <ul style="list-style-type: none"> ✓ It refers to sound above human audible limit of 20 kHz. ✓ Ultrasound of frequencies up to 10 MHz and beyond is used in medical diagnosis, therapy and surgery. ✓ In investigative applications: <ol style="list-style-type: none"> 1. An ultrasound source (transmitter) directs pulses into the body. 2. When the pulse encounters a boundary between organs or between two tissue regions of different densities, reflections of sound occur. ■ By scanning the body with Ultrasound and detecting echoes generated by various organs, a sonogram of the internal structure(s) can be generated. ■ The method is called diagnostic imaging by echolocation. 	10	CO3	L3

	<ul style="list-style-type: none"> ■ Diagnostic ultrasound(sonography or diagnostic medical sonography) : it's an imaging method that uses sound waves to produce images of structures within your body ■ Images provide valuable information for diagnosing and directing treatment for a variety of diseases. 			
<p>4. Use a neat labeled diagram and explain the mechanism of filtration by the nephrons.</p>	<ul style="list-style-type: none"> ■ Kidneys remove wastes and extra fluid from the body. ■ Kidneys also remove acid that is produced by the cells of the body and maintain a healthy balance of water, salts, and minerals in blood. ■ Healthy kidneys filter about a half cup of blood every minute, removing wastes and extra water to make urine. <p>MECHANISM OF FILTRATION:</p> <ul style="list-style-type: none"> ■ Each kidney is made up of about a million filtering units called nephrons. ■ Each nephron includes a filter, called the glomerulus, and a tubule. ■ The nephrons work through a two-step process: <ol style="list-style-type: none"> 1. the glomerulus filters blood, and 2. the tubule returns needed substances to your blood and removes wastes. ■ Wastes and extra water become urine. <p>The glomerulus filters your blood</p> <ul style="list-style-type: none"> ■ As blood flows into each nephron, it enters a cluster of tiny blood vessels—the glomerulus. ■ The thin walls of the glomerulus allow smaller molecules, wastes, and fluid—mostly water—to pass into the tubule. ■ Larger molecules, such as proteins and blood cells, stay in the blood vessel. ■ The tubule returns needed substances to your blood and removes wastes. <p>How does blood flow through my kidneys?</p> <ul style="list-style-type: none"> ■ Blood flows into the kidney through the renal artery. ■ This large blood vessel branches into smaller and smaller blood vessels until the blood reaches the nephrons. ■ In the nephron, blood is filtered by tiny blood vessels of glomeruli and then flows out of kidney through renal vein. ■ Blood circulates through your kidneys many times a day. ■ Most of the water and other substances that filter through your glomeruli are returned to blood by tubules. ■ Only 1 to 2 quarts become urine. ■ When the kidney doesn't function properly, Chronic kidney disease occurs. 	<p>10</p>	<p>CO3</p>	<p>L3</p>
		<p style="text-align: center;">The Nephron</p> 		

5.	<p>Explain the various blood substitutes</p> <ul style="list-style-type: none"> ■ Concerns that fueled development of blood substitutes are : <ul style="list-style-type: none"> ■ Shortages in blood supplies and ■ Safety of donated blood ■ The 2 major types of blood substitutes are: <ol style="list-style-type: none"> 1. Volume expanders: Include solutions (saline) that are used to replace lost plasma volume, and 2. Oxygen therapeutics: These are agents that replace oxygen normally carried by hemoglobin in RBC <ul style="list-style-type: none"> ■ Of these 2 types development of oxygen therapeutics has been the most challenging. ■ One of the first groups of agents developed and tested were Perfluorocarbons. ■ They effectively transport and deliver oxygen to tissues but cause complex side effects and are not metabolized by the body. ■ Other oxygen therapeutics include agents called Hemoglobin-Based Oxygen Carriers (HBOCs). ■ These are made by genetically or chemically engineering hemoglobin. ■ HBOC's Benefits: <ul style="list-style-type: none"> ✓ HBOC's do not require refrigeration. ✓ They are compatible with all blood types and ✓ They efficiently distribute oxygen to tissues. ■ A primary concern associated with HBOCs is their potential to cause severe immune reactions. ■ Blood from human umbilical cord has been studied so as to substitute RBC's for transfusion. ■ RBC's can be extracted from cord blood via sedimentation as the blood is cooled. ■ Research about the transfusion is ongoing. ■ Concern for their implementation are: <ul style="list-style-type: none"> ✓ Establishment of safe, effective and ethical procedures for cord blood collection. ✓ Development of criteria that help to ensure safe transfusion and ✓ Preservation of cord blood quality. <p>Hemoglobin-Based Oxygen Carriers:</p> <ul style="list-style-type: none"> ■ HBOCs are "made of" natural hemoglobins that were originally developed as blood substitutes. ■ Addition of HBOCs to traditional preservation protocols provides: <ul style="list-style-type: none"> ✓ more oxygen to organs, to meet their energy metabolic needs, ✓ prolongs preservation time, ✓ reduces ischemia-reperfusion injury to grafts, ✓ improves graft quality, and ✓ even increases the number of transplantable donors. 	10	CO3	L2
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	<p>Perfluorocarbons:</p> <ul style="list-style-type: none"> ■ PFCs remain in bloodstream for about 48 hours. ■ PFCs were the first group of artificial blood products studied by scientists, because of their oxygen-dissolving ability. ■ PFCs are usually white and are a good oxygen carriers. ■ PFCs must be emulsified before they can be given to patients, since they do not mix with blood. ■ Researchers are now trying to find out if they can reduce swollen brain tissue in traumatic brain injury using PFCs. ■ PFC particles may cause flu-like symptoms in some patients when they exhale these compounds. 			
6.	<p>Write a short note on</p> <p>i. Chronic obstructive pulmonary disease (5m)</p> <ul style="list-style-type: none"> ■ It's a chronic inflammatory lung disease that causes obstructed airflow from the lungs. ■ Symptoms include breathing difficulty, cough, mucus (sputum) production, and wheezing. ■ It's typically caused by long-term exposure to irritating gases or particulate matter, most often from cigarette smoke. ■ People with COPD are at increased risk of developing heart disease, lung cancer, and variety of other conditions. ■ Emphysema and chronic bronchitis are the 2 most common conditions that contribute to COPD. ■ These two conditions usually occur together and can vary in severity among individuals with COPD. <p>Symptoms:</p> <ul style="list-style-type: none"> ■ COPD symptoms often don't appear until significant lung damage has occurred, and they usually worsen over time, particularly if smoking exposure continues. <p>Signs and symptoms of COPD may include:</p> <ul style="list-style-type: none"> ➤ Shortness of breath, especially during physical activities ➤ Wheezing ➤ Chest tightness ➤ A chronic cough that may produce mucus (sputum) that may be clear, white, yellow, or greenish ➤ Frequent respiratory infections ➤ Lack of energy ➤ Unintended weight loss (in later stages) ➤ Swelling in ankles, feet, or legs <p>Tests may include:</p> <ul style="list-style-type: none"> ➤ Lung (pulmonary) function tests. 	10	CO3	L2

- Chest X-ray.
- CT scan.
- Arterial blood gas analysis.
- Laboratory tests.

- There's no current cure for COPD, but quitting smoking, using a spirometer, and following an exercise plan can help manage symptoms.

ii. Spirometry (5m)

- Spirometry uses a machine called a spirometer. A spirometer is a medical device that consists of a mouthpiece and a tube.
- They connect to a machine that measures your airflow.
- It is the most common of the pulmonary function tests.
- It measures lung function, specifically the amount and/or speed of air that can be inhaled and exhaled
- And used to diagnose Asthma, COPD and other conditions that affect breathing.
- Requirements of an acceptable spirometer are:
 1. Spirometers must be able to accumulate volume for ≥ 15 s.
 2. The measuring volume should be ≥ 8 L (body temperature and pressure, saturated).
 3. The accuracy of reading should be at least $\pm 3\%$ (or ± 0.05 L) with flows from 0–14 Liters per second.
 4. The total resistance to airflow at 14 Liters per second should be < 1.5 cm H₂O per Liters per second (< 0.15 kPa per Liters per second).

