CBCS SCHEME

USN | | | | | | | | | | |

BBOC407

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024
Biology for Engineers (CSE)

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Discuss the various components of Eukaryotic cells.	10	L3	CO1
	b.	Identify the applications of stem cells.	5	L2	CO1
	c.	Explain the functions of vitamins.	5	L2	CO1
		OR			
Q.2	a.	Compare Prokaryotic and Eukaryotic cells.	10	L3	CO1
	b.	Explain the properties of Carbohydrates.	5	L2	CO1
	c.	Explain the functions of Lipids.	5	L2	CO1
		Module – 2			
Q.3	a.	Highlighting the properties of cellulose justify cellulose as an effective water filter.	10	L3	CO1
	b.	Explain the working and development of DNA vaccines by taking suitable example	10	L2	CO1
		OR			
Q.4	a.	What are Bioplastics? Justify the use of PHA as Bioplastic mentioning its properties and applications.	10	L3	CO1
	b.	Discuss the following : (i) Meat analogs of protein. (ii) Lipids as cleaning agents.	10	L2	CO1
		Module – 3			
Q.5	a.	What is Electro Encephalogram (EEG)? Discuss the types of Brain activity detected with EEG. Write any three applications.	10	L3	CO2
	b.	What are Pace Makers? Explain basic design and construction of Pace Makers.	10	L2	CO2
		OR			
Q.6	a.	Justify Lungs as purification system.	10	L3	CO2
	b.	Explain architecture of Rod and Core cells with suitable diagram.	10	L2	CO2
		Module – 4			
Q.7	a.	What is ultrasonography? Explain the uses and working principle.	10	L2	CO3
	b.	What is lotus leaf effect? Explain the mechanism and applications of super Hydrophobic effect.	10	L2	CO3
		OR			
Q.8	a.	The structure and design of Kingfisher beak lead to the design of Bullet trains. Explain.	10	L2	CO3
	b.	Explain the working and applications of Bionic Leaf Technology.	10	L2	CO3

		Module – 5			
Q.9	a.	Explain the use of Electrical tongue in food science.	10	L2	CO4
	b.	Explain the advantages and limitations of Artificial Intelligence for disease diagnosis.	10	L2	CO4
		OR			
Q.10	a.	Explain Bioengineering solutions for muscular dystrophy and Osteroporosis.	10	L2	CO4
	b.	Explain most commonly used Bioprinting Techniques.	10	L2	CO4

* * * * *

AY: 2024-25

Department: Computer Science Engineering SEE:2023-24
Subject with Sub. Code:Biology for Engineers (BKOC407) Semester / Division:IV/A
Name of Faculty: Prof.G.R.Sattigeri

Q.No.	Solution and Scheme	Marks

Module-1

Q1(a) Cell is the fundamental, structural & functional unit of all living organisms
A cell without well defined nucleus is called prokaryotic cell.
A cell with well defined nucleus is called Eukaryotic cell. Components of Eukaryotic cell.

① Plasma membrane: It surrounds the cell and acts a barrier controlling movements of substances in and out of the cell.
② Cytoplasm: jelly like substance that fills the cell providing a medium for movement of molecules
③ Nucleus: control center of the cell & contains DNA
④ Mitochondria: Power house of cell, produces ATP
⑤ Endoplasmic Reticulum: synthesis of lipids metabolism of carbohydrates, synthesis & modification of proteins
⑥ Golgi Apparatus: modifies, sorts and packages proteins & lipids.
⑦ Ribosomes: molecular machines responsible protein synthesis
⑧ Lysosomes: contain enzymes, that breakdown waste
⑨ Peroxisomes: break down fatty acids
⑩ Vacuoles: sacs that store water, nutrients & waste — 1X10=10

Q1(b) Applications of Stem cells.
Stem cells capable of differentiate into various types of cells & regenerate damaged tissues.

Q.No.	Solution and Scheme	Marks
Q1b.	1) Disease treatment 2) Tissue generation 3) Drugs testing 4) Anti Aging effects 5) Placental stem therapy	05
Q1c.	Functions of Vitamins Vitamin A – Vision, Skin health Vitamin B – RBC formation, Vitamin C – Boosts immune system, Antioxidant Vitamin D – Bone health, Calcium absorption Vitamin E – Protect cell from damage Vitamin K – Blood clotting, bone healthete.	5M. Any5
	OR	
Q2a.	Comparision	1X10

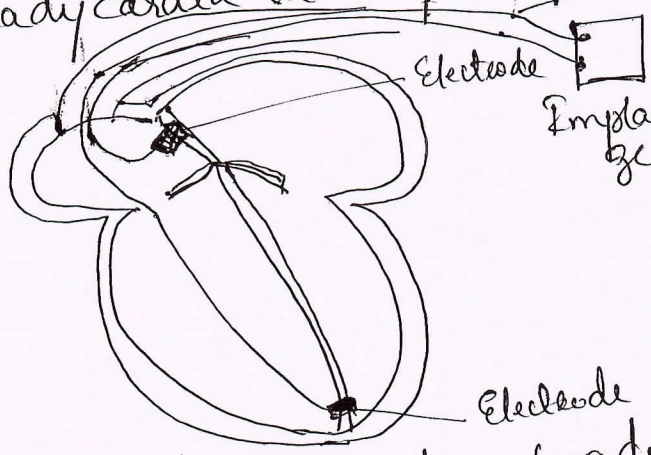
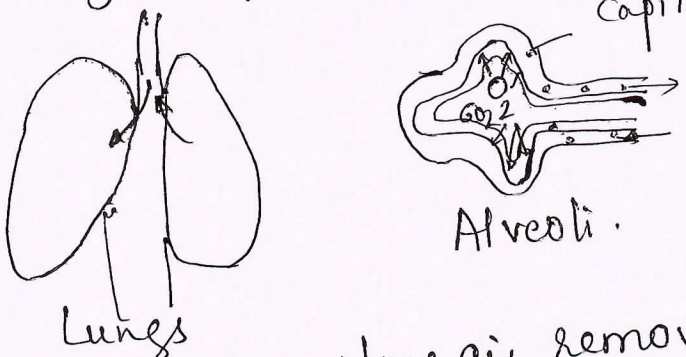
Particular	Prokaryotic	Eukaryotic
1) Nucleus	Absent	Present
2) Cell size	Smaller	Larger
3) Cell structure	Unicellular	Most Multicellular
4) Complexity	Simple	Complex
5) DNA	Circular	Linear
6) Mitochondria	Absent	Present
7) Golgi Apparatus	Absent	Present
8) Reproduction	Asexual	Sexual
9) Cell wall	Present	Absent
10) Example	Bacteria	Fungi, Animal, Plant

Q2b.	Properties of Carbohydeates A. Physical: Sweet taste, Open chains or rings	10M

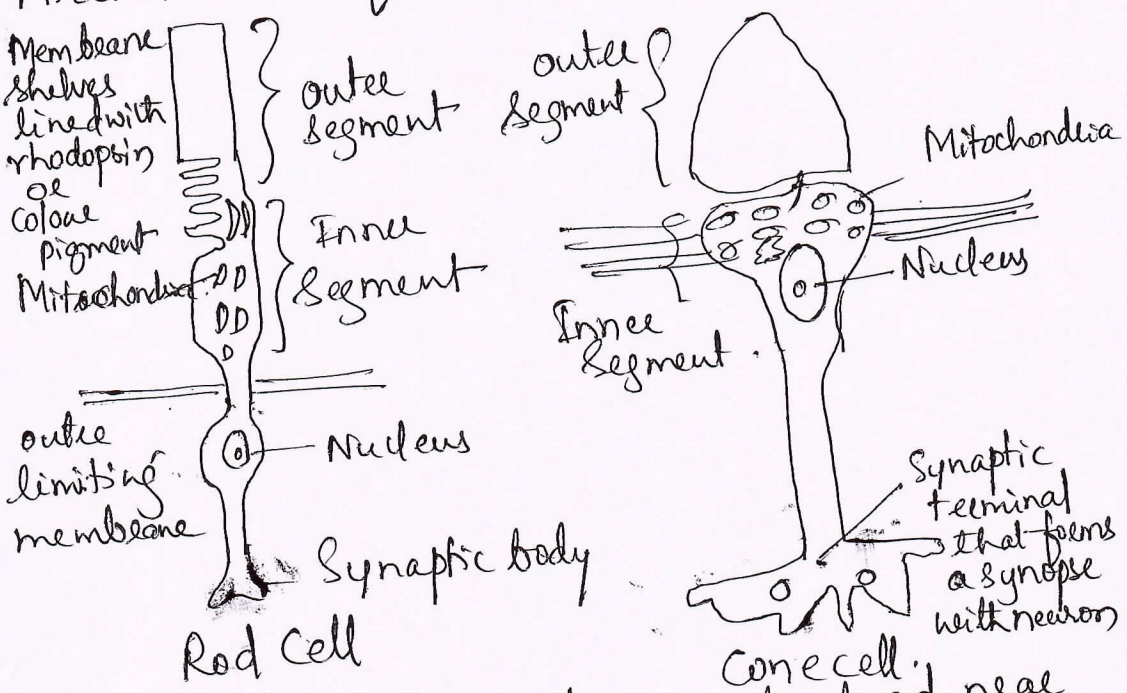
Q.No.	Solution and Scheme	Marks
	Soluble in water Solid in room temperature Stereoisomerism: molecules with same chemical formula have different structural configurations Optical rotation: they rotate plane polarized light Annomerism. Chemical: Osazone formation, Oxidation, Reduction to alcoholes	5M.
Q2(c)	Functions of Lipids (1) Energy storage: (2) Insulation (3) Cell membrane formation, structure (4) Harmone synthesis (5) Nutrient Transport - transport-fat soluble nutrients	1X5 5M.
	Module-2.	
Q3(a)	Properties of Cellulose (1) High Porosity (2) Biodegradability (3) Cost Effective (4) Good Mechanical strength (5) Chemical resistance. Filters based on cellulose pulp fibers do usually have large pores that facilitate water percolation but they do not sufficiently remove bacteria through size exclusion. It can effectively remove visible impurities Cellulose based filters less effective they can become clogged easily requiring frequent replacements	1X5=5M 05M

Q.No.	Solution and Scheme	Marks
Q3b.	**Working and development of DNA Vaccines.** A DNA vaccine is a type of vaccine that uses a piece of viral or bacterial DNA to stimulate an immune response against the pathogen. The vaccin works by introducing the pathogen's DNA into the body where it is taken up by cells and used to produce viral or bacterial proteins. These proteins are then displayed on the surface of the cells, which triggers an immune response and the production of antibodies against pathogen. DNA vaccine for rabies have advantajs. ① Efficacy ② Long-lasting protection ③ Ease of administration ④ Cost-Effective.	10M
Q4a.	Bioplastics are type of plastics which can be generated from natural resources such as starches and vegetable oils. PHA Polyhydroxyalkanoates are group of bioplastics that are biodegradable and compostable. They are produced by microorganisms from renewable resources like plant, oils and sugars. These are replacement of petrochemical-based plastics	02M 04M
	Properties ① Biodegradable. ② Bio Compatible ③ Resistant to water ④ Thermoplastic. Used in packaging and distribution & in medical science for their compatibility.	04M

Q.No.	Solution and Scheme	Marks
Q4(i)	Meat analogs of proteins. Meat substitutes are plant based foods designed to mimic the taste, texture and appearence of meat Quorn can be cubed, sliced, shredded, or minced has a texture similar to chicken. TVP is made from soyabeans, Tofu, HVP high biological protein	02M 03M
(ii)	Lipids as cleaning agents Lipids have surfact properties that make them suitable as cleaning agents because of ability to emulsify & dissolve grease and oils. Additionally lipids can form micells, which are tiny spherical structures that can surround and ~~drop~~ trap dirt particles making it easier to remove them. Advantages: ① Biodegradability ② Renewable ③ Effectiveness ④ Mildness ⑤ Cost - Effective Limitations: ① Stability ② Compatibility ③ Cost ④ Availability ⑤ Perfoemance	05M
Q5a.	Electro Encephalogeam (EEG): is a non invasive method for measuring the electrical activity of the brain Types of Brain activity - Delta waves (0.5-4 Hz) deepsleep, infancy, brain damage or dementia. - Theta Waves (4-8 Hz) sleep & relaxation, meditation & hypnosis. - Alpha waves (8-12 Hz) relaxed but not focussed. meditation & Creativity - Beta waves (12-30 Hz) - focussed on task, problem solving or decision making - Gamma waves (30-100 Hz) - high level cognitive process, attention, perception & memory	02M 05M

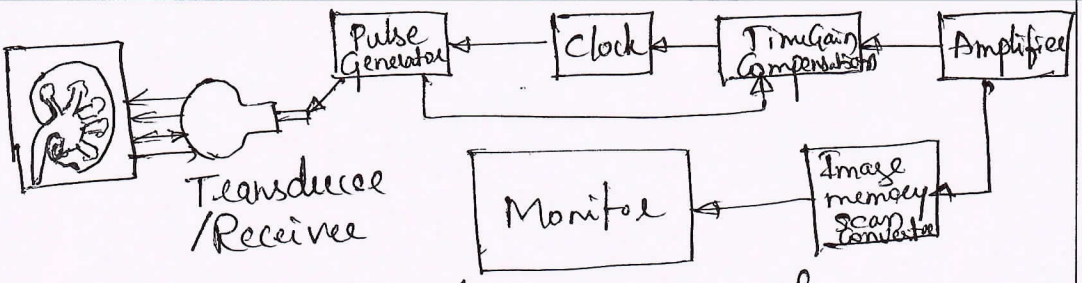
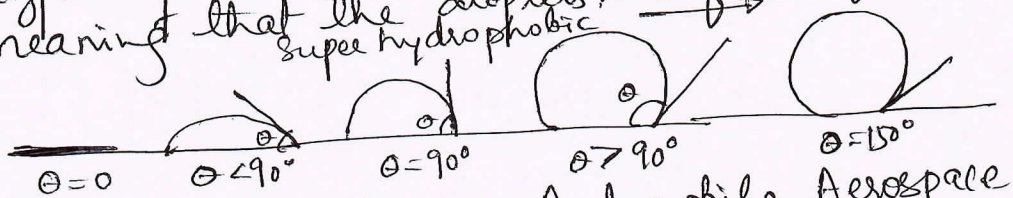
Q.No.	Solution and Scheme	Marks
Q5a.	Applications: Robotic arms for prosthetics. Solution for parkinson disease, Artificial brain	03M
Q5b.	Pacemaker is a small device that surgically implanted in the chest to regulate heart beat It is used to treat heart rhythem disorders such as bradycardia or arrhythmias:  It consists of Generator, Leads, Electrodes. It is made of medical grade plastic, metals, electronic components, adhesives	02M 05M 03M
	OR	
Q6a.	Lung as purification system.  The lung purifies air removing harmful substances and adding oxygen to the blood stream The process. 1) Filteration: The nose and mouth serve as a first line of defence against harmful substances in the air, such as dust, dirt and bacteria The tiny hairs in the nose, called cilia and mucus	

Q.No.	Solution and Scheme	Marks
Q6a,	trap these substances and prevent them from entering the lungs. ② Moisturization: The air is also humidified as it passes the moist lining of respiratory tract ③ Gas Exchange: Once the air reaches alveoli the gas exchange process occurs, where oxygen diffuses across the thin alveolar and capillary walls into the blood stream & CO_2 diffuses in the opposite direction from the blood stream into the alveoli to be exhaled. This process ensures the blood with fresh oxygen rich.	10M
Q6b	Architecture of Rod & Cone Cells.	



There are two photoreceptors are localized near the centre of the retina called the macula Rod cells are highly sensitive to light and function in night vision whereas Cone cells are capable of detecting wide spectrum of light photons and are responsible for colour vision, visual activity 10M.

Q7a. Ultrasonography is a medical imaging technique that uses high frequency sound waves to produce images of the internal organs & tissues of the body.

Q.No.	Solution and Scheme	Marks
Q7 a.	 Working principle of Ultrasonography The ultrasonography machine emits high frequency sound waves (2-18MHz) that travel through the body & bounce back off the internal organs & tissues. The returning echoes are captured by the ultrasound machine & use to create images of the internal structures	10M
Q7b.	The ability of lotus leaves to repel water and self clean through their unique surface structure is known as lotus leaf effect! Super Hydrophobic Effect! This refers to the ability of certain surfaces to repel water and resist wetting. These are characterized by high contact angle between water droplets and surface typically over 150° & low contact angle hysteresis. meaning that the droplets roll of the surface easily.  Applications: Electronics, Automobile, Aerospace Industries	10M
Q8a.	King fisher beak & design of bullet train. The structure of beak of kingfisher minimize the impact of water resistance & streamlined entry. ① Streamlining: The beak is long & slender & sharply pointed which helps to reduce drag / air resistance	

Q.No	Solution and Scheme	Mar
Q8(a)	Surface tension: When bird hits the water it encounters the resistance caused by surface tension. The sharp beak of King fisher helps to pierce through water surface breaking surface tension. Minimizes splash. The use of Kingfisher beak as a design inspiration for the front of the bullet train. The front of the train because of streamlined design reduces air resistance & train travels at high speed. The smooth, tapered shape reduces the pressure difference between front & rear of the train reducing noise & vibration.	10M
Q8(b)	Bionic leaf Technology. A bionic leaf is a system that uses artificial photosynthesis process to convert the sunlight into usable forms of energy such as hydrogen & other biofuels. where light energy is used to split water molecules into hydrogen and oxygen. & hydrogen can be further used as a source of energy. Bionic leaf consists of photovoltaic cell that captures sunlight & converts into electrical energy & a catalyst like bacteria uses the electrical energy to split water into O_2 & H_2 ① Photosynthetic Organism: cyanobacterium or a genetically modified plant ② Light harvesting system ③ Catalysts: Enzymes like Hydrogenase Nitrogenase ④ Electron Transfer Pathway ⑤ Carbon dioxide Source. ⑥ Energy storage/conversion system ⑦ Control & Monitoring system.	10M

Q NO	Solution and Scheme	Marks
9 (a)	Electrical tongue in food Science. Electrical tongue is used to analyze the taste and flavour of food and beverages. The technology involves the measurement of electrical properties of a food or beverage sample. It typically consists of sensor array which is placed in contact with the food or beverage sample. ① Potentiometric Ion Selective Electrodes ② Voltametric Sensors. ③ Impedence Sensors. ④ Optical Sensors. ⑤ Conductometric sensors ⑥ Mass sensitive sensors. Adv: Non invasive, High throughput, Objective analysis, Cost effective	10M
9 (b)	Advantages & Limitations of AI in disease diagnosis. Advantages ① Image Analysis ② Data Analysis ③ Diagnosis ④ Personalized Medicine ⑤ Clinical decision Support Limitations ① Lack of understanding of underlying algorithms ② Bias opinion ③ Regulation ④ Cost	10M
9 (c)	Bio Engineering solutions for Muscular dystrophy and Osteoporosis. ① Gene therapy ② Stem cell therapy ③ Tissue Engineering ④ Exoskeleton Technology. ⑤ Exon skipping Therapy ⑥ Bioengineered Muscle scaffolds Bio Engineering solution for Osteoporosis. ① Bone tissue Engineering ② Growth factor delivery systems	

Q No	Solution & Scheme	Marks
Q10a	(3) Drug loaded scaffolds. (4) Bioresorbable implants (5) Assistive Devices & Robotics	10M
Q10b	Most commonly used Bioprinting Techniques. (1) Inkjet based Bioprinting It is like standard inkjet printing, bioink is loaded into cartridges & droplets of bioink are ejected through fine nozzles on to a substrate. The object is manufactured by layer technique. (2) Extrusion based Bioprinting. It uses syringe or similar mechanism to extrude the bioink through a nozzle. It also creates layer by layer (3) Laser assisted Bioprinting. It utilizes laser energy to precisely deposit bioinks onto a substrate. (4) Microvalve Bioprinting It employs micro ~~valve~~ valves to control the deposition of bioinks (5) Bioprinting with solid Freeform Fabrication	10M.

HOD
Mechanical Engineering
KLS Vishwanathrao Deshpande
Institute of Technology
Haliyal-581329

Dean Academics
KLS VDIT, HALIYAL