

USASTITUTE OF

BBOC407

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Biology for Engineers (CSE)

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.	Define Cell. Explain function and structure of cell.	7	L2	CO1
	b.	List the various hormones and write the functions of them.	7	L2	CO1
	c.	Demonstrate the properties and function of lipids.	6	L3	CO1
		OR #			
Q.2	a.	What are stem cells? Discuss the function of stem cells.	7	L2	CO1
	b.	List the vitamins and write the functions of them.	7	L2	CO1
	c.	Demonstrate the properties and function of nuclic acids.	6	L3	CO1
		Module – 2			
Q.3	a.	Define Biomolecule. List the classification of biomolecules with each one example in short in engineering application.	7	L2	CO2
	b.	Explain the applications of enzymes in biosensors and bio bleaching.	7	L2	CO2
	c.	What is DNA finger printing? Explain the process involved in DNA finger printing.	6	L3	CO2
		OR			
Q.4	a.	Explain the properties of cellulose as an effective water filter.	7	L2	CO2
	b.	List the properties of PHA and explain the engineering applications of PHA.	7	L2	CO2
	c.	Demonstrate whey as a protein.	6	L3	CO2
		Module – 3			
Q.5	a.	Define ECG. Explain in detail.	7	L2	CO3
	b.	How kidney will be used as a filteration system, explain with one type of dialysis example.	7	L2	CO3
	c.	Illustrate Brain as a CPU system.	6	L3	CO3
		1 of 2			
4-1		^			

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		OR		F 16	
Q.6	a.	Briefly discuss the various bio engineering solutions for muscular dystrophy.	7	L2	CO3
	b.	Explain robotic arms for Prosthetic device.	7	L2	CO3
	c.	Illustrate eye as a camera system.	6	L3	CO3
		Module -4			
Q.7	a.	Compare the process of photo synthesis to the functioning of photo synthesis to the functioning of photovoltaic cells.	7	L2	CO4
	b.	Super hydrophobic and self cleaning surfaces. Explain in detail.	7	L2	CO4
	c.	Write a note on Lotus leaf effect.	6	L3	CO4
		OR			
Q.8	a.	Compare HBOC's and PEC.	7	L2	CO4
	b.	How shark skin and swim suits are using biological concepts.	7	L2	CO4
	c.	Write a note on GPS technology.	6	L3	CO4
7		Module – 5			
Q.9	a.	Explain in detail flow AI will be used in all disease diagnosis.	7	L2	CO5
	b.	Demonstrate bioremediation and biomining.	7	L3	CO5
	c.	Explain muscular system as a scaffold. CMRIT LIBRARY CMRIT LIBRARY	6	L2	CO5
		BANGALOOR			
Q.10	a.	Explain in detail electrical nose in food science.	7	L2	CO5
	b.	Demonstrate bioprinting technique list all of them.	7	L3	CO5
	c.	Explain DNA origami and Bio computing.	6	L2	CO5

2 of 2



Sub:	BIOLOGY FOR COMPUTER ENGINEERS	Sub Code:	BBOC407	Branch:ISE						
Answer any FIVE FULL Questions Choosing one full Question from each module										

1. Cells are the fundamental units of life, and they play crucial roles in the functioning of living organisms. Here's how cells contribute to the functioning of organisms(5)

Structural Support: Cells form the structural framework of all living organisms. They provide shape, support, and organization to tissues, organs, and organ systems.

Metabolism: Cells carry out various metabolic processes necessary for life, such as respiration, photosynthesis (in plant cells), digestion, and synthesis of biomolecules like proteins, carbohydrates, and lipids.

Reproduction: Cells are responsible for the reproduction of organisms through processes like mitosis (in eukaryotes) and binary fission (in prokaryotes).

Communication: Cells communicate with each other through chemical signals, allowing them to coordinate activities and respond to changes in their environment.

Homeostasis: Cells maintain internal balance (homeostasis) by regulating factors like temperature, pH, and concentration of ions and molecules.

Defense: Some cells, like white blood cells in animals and certain cells in plants, play roles in defending the organism against pathogens and other harmful agents.

cell: -> "to de basse unit of life. To cell provides minimum sequisioned to perform essential The properties such as organization metabolism responsioness, movement and reproduction to live ? adependently Structuse of cell D plasma membrane, 4 (4 to plasm 3) pardens organists, ER, holgrappasatus Lysomeses Rinosems. Centroles cytoskeleton [Explaining_ Functions. Respiration, Storage & Mocessing, powers synthesis, Celulas Communication, wask management cell disson, movement [Explaining all above) Listing ou Harmones 1) Insulin -> Regulate blood ghipe 2) Testosterone -> Development of male reprodukte ting 3) Estrogen -> percupmers and function of female 9 (nowth Hormore -> 24 Stimulaty growth Cell reprodution

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Anutins :- Author regulate plant grounds
and development including cests

everywhim, africal dominance

cytothinnip := It regulates cest african.

Listing du Lipids properties

1) Hydrophobicity 3) Amphirathicity

2) Structural Diversity 4) Energy stroage

(1) Togulation 6) Lubrication.

Findian of Lipids

1) Energy Storage, 20 buttinal role, 2 fronting

4) Hormore Regulation, 5) (est signalling

6) Absorption of putstents [Explaining leath]

2. Stem cells are unique cells.

They have the ability to develop into various specialized cell types (cells in heart, kidney, eyes are all different)...

They play very crucial role in growth, mainly tissue repair.

Applications

Regenerative Medicine: Stem cells are used to regenerate damaged tissues & organs.

-Tissue Repair

- Orthopedic Treatments: Joint and bone regeneration

Treatment of Diseases

Blood Disorders: treating Anaemia, leukemia by replacing blood cells.

Neurological Disorders: In Parkinson and Alzheimer diseases.

Drug Development and Testing: For testing new drugs before using on animals.

Understanding Disease Mechanisms: In labs and controlled manner, diseases and their spread and control, can be studied using stem cells.

Cell-Based Therapies: To address various medical conditions and treating a particular malignant cell to stop spreading of disease.

Personalized Medicine: Tailoring treatments based on personalized traits and genetics and characteristics.

Stem (ell:) Are oridifferteated (ells with fee remarkable abouting to differentiate and Specialized (ell types. [Def] Charactersties.

Psey Renewal 20 0: Herritation

Application of Stem Cells.

Drissue Engineering, 1) Biomaterial 1) antegrades Biopointry 11 0844 grocening, and Development Biopointry 11 0844 grocening, and Development Other therapy 1) Descale modelling [Fiplaining all these)

properties and function of vitaming. Vitamin A -> Essential for vision immene function Vitamin B, -> Energy metabolism Nerove function vitamin B2 -> Energy production, metabolism of fats icostohyohads Vitumin B3 -> DNA sepair & cell signalising Vitamin B5 -> fattcy acid 841thesip vitamin c -> postioridant supports immue furtin Vitamin D -> Caletim absorption bone health vitamin E -> An antioxident that protects (ell membrane from oxidative damage property and function of Nuclic properties polonity. Double Helix Structure Base painty, mydrogen bondry, oxidicadhe Function: > Grendic information Storage, protein Synthesis, Gene expression Regulation, Energy transfer, catalysis, Immuse susponse, Changeal Stynalling 3.

Bipomoleule: Are Chemical compounds found in Living organisms that are essential for the survival of living cells and all life processes.

Classification of Biomoleules.

I cashohydrates

Monosalthariole of Salchoride polysalthorides

Monosalthariole of Salchoride polysalthorides

Tipids.

Dipids.

Proteins

Proteins

Dia RNA.

CARBOHYDRATES

These are class of organic compounds.

They play crucial role in biology and are important energy source.

They are composed of carbon (C), hydrogen (H), and oxygen (O) atoms and are classified based on their molecular structure and function.

General formula is C₁(H₂O)₁

Simple Carbohydrates obey this formula where as complex carbohydrates do not obey this formula.

Nucleic acids are biopolymers, macromolecules, essential to all known forms of life.

The 2 main classes of nucleic acids are:

Deoxyribonucleic acid (DNA) and Ribonucleic acid (RNA).

If the sugar is ribose, the polymer is RNA. if the sugar is the ribose derivative deoxyribose, the polymer is DNA.

bio bleaching 870-56ngors & Enzymes in Enzymes are commonly used in biosensons Chucope widage (nox) working of deflect Broxensons Biosessos ore analytical devices that biological recognision Brosengos have several advantage over traditioner sapped segpand the high analytical methods Schrifflity (Gox) (Lox) Cholinesterask ChE) (ALP) Alkaline phosphatoge, oreage, [Lignolytic Enzymes on 3:0 Bleauing. semanes color and brightne libes paper tettiles. It uses hydrogen perotide and Chorine [Explaining Advantages DNA Finger printery process involved in finger Is a technique osed in formit science + Paertily an indiviousal buted on slet unique working, "Sample collection, 3) DNA Ampification propole. BONA anaysiy 4) DNA compasision

4. **a.**Cellulose a complex carbohydrate, or polysaccharide, consisting of 3,000 or more glucose units.

It is extremely abundant, easily renewable, and biodegradable.

It's insoluble in water: Due to inter- and intramolecular hydrogen bonding between hydroxyl groups of the neighboring cellulose chains.

Also, it is difficult to dissolve with common organic solvents.

The best application of cellulose is, Cellulose-based water filters.

b.Bioplastics are one type of plastic which can be generated from natural resources such as starches and vegetable oils.

Bioplastics are basically classified as bio based and/or biodegradable.

Not all bio-based plastics are biodegradable and similarly not all biodegradable plastics are bio based.

Bio plastics are said to be biodegradable if they are broken down with the effect of right environmental conditions and microbes.

The bioplastics are considered compostable, if, within 180 days, a complete microbial assimilation of the fragmented food source takes place in a compost environment.

Based upon this, we have PHA and PLA.

c.WHEY protein is a mixture of proteins isolated from whey (liquid by-product of cheese production)

Whey is left over, when, milk is coagulated during the process of cheese production.

It contains everything, that is soluble from milk, after the pH is dropped to 4.6, during coagulation.

It is a 5% solution of lactose in water.

It contains water soluble proteins of milk as well as some lipid content.

properties of cellolope as a water filter 1) High possity i @Brodegradability Blosseffectie Therewase resource Throad mechanical strength. Othermical resistance, Warge Busque area. Importance saye & cleanwater, sustainity explaining all above Aftordability, vessatiffy attendate to synthesic filkes. properties of PHA O Brodegradability of Bramputibility. 3) mechanical properties (4) processing. Enggappi: cation Trackaging of medical devices, of Mettiles. Agriculture multh films Doorsunds goods.) Automatil posts Delectronic devices.

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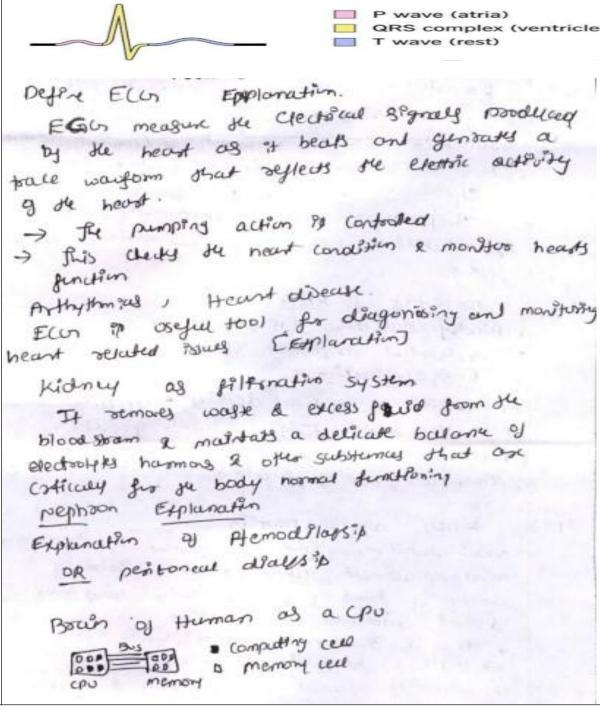
> High in branched - chain amino acous. -> commonly found in smoother & should. odietory supplement -) Amino actors that needs to build the opping BYSLE. It is the protein derived from the liquid that separates from milk during the Cheese making process.

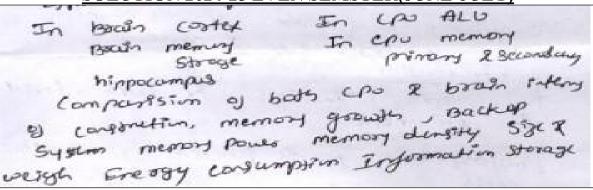
5. The human heart is a four-chambered muscular organ, shaped and sized roughly like a man's closed fist with two-thirds of the mass to the left of midline.

Electrocardiography (ECG) is a quick and easily accessible method for diagnosis and screening of **cardiovascular diseases** including **heart failure (HF)**. Artificial intelligence (AI) can be used for semi-automated ECG analysis. The aim of this evaluation was to provide an overview of AI use in HF detection from ECG signals and to perform a meta-analysis of available studies.

Evaluation of symptoms suggestive of HF currently demands physicians to valuate various parameters including imaging and laboratory data and the electrocardiogram

(ECG). Besides a standard examination that includes an ECG, imaging information, such as echocardiography or magnetic resonance imaging, is seen as gold standard in diagnosis of HF. Nevertheless, an adequate use of such imaging data is associated with relevant technical infrastructure and medical expertise. The ECG is a well-established, quick, and easily accessible method for diagnosis and screening of various cardiovascular diseases. It provides specific features that indicate presence of HF or prognosis in HF patients especially to rule out HF in case of a normal ECG. However, use of an ECG as primary diagnostic instrument often only yields insufficient diagnostic specificity. Further, general practitioner—based ECG reporting has varying results, introducing further diagnostic uncertainty.



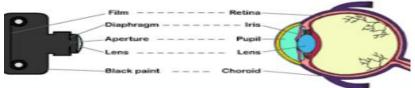


- 6.
- Muscular dystrophy is a group of diseases that cause progressive weakness and loss of muscle mass
- Awareness is increasing that :
- Osteoporosis is a major complication of Duchenne muscular dystrophy (DMD) and
- Its treatment, requires monitoring for early diagnosis and intervention to prevent clinically important sequelae.

Bioengineering solutions to musulas Dy goophy ettimusulur pystrophy is group & assords that result in progressive weakness muscles and degerration of skeletal 3 F5 HD Diseases 1) pm 0 2) Beckker chene theraphy stem cell therapy Exoskellton technology Tissue Engg [Explaining each] for southette These Device use motors actuaters These are controlled by impacte and serjoss. -> Some prosthetic arms also incorporate multire learning algoritus - myoeleuric controlo g sossotic us a camera System. Eye posts to the combra (on paring both eye & comera Drawing Explanation Fe pupil, Leveling he cosenea, The Tois, aptic nene The human eye is a wonderful instrument, relying on refraction and lenses to form

images.

- There are many similarities between the human eye and a camera, including:
- A diaphragm to control the amount of light that gets through to the lens. This is the shutter in a camera, and
- The pupil, at the center of the iris, in the human eye, is a lens to focus the light and create an image.
- The image is real and inverted. A method of sensing the image.
- In a camera, film is used to record the image; in the eye, the image is focused on the
 retina, and a system of rods and cones is the front end of an image-processing system
 that converts the image to electrical impulses and sends the information along the optic
 nerve to the brain.

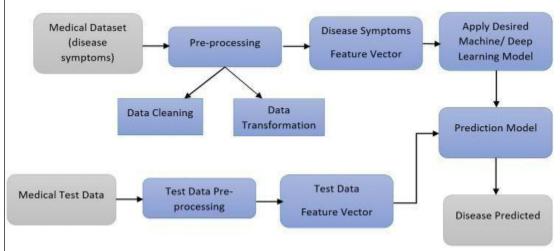


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 - The lotus leaf is well-known for having a highly water-repellent or superhydrophobic surface.
 - Thus the name lotus effect.
 - Water repellency mechanism is used in the development of self-cleaning materials.

- It has been studied in both natural and artificial systems.
- The self-cleaning function of superhydrophobic surfaces means removal of contaminating particles.
- It can be done by impacting or rolling water droplets.
- A unique self-cleaning mechanism:
- Here, the contaminated superhydrophobic surface is exposed to condensing water vapor
- The contaminants are removed by self-propelled jumping motion of the resulting liquid condensate
- The liquid condensate partially or fully covers the contaminating particles.
- The jumping motion of the surface is due to energy released by coalescence of condensed water around contaminants.
- 8. HBS Concerns that fueled development of blood substitutes are:
 - Shortages in blood supplies and Safety of donated blood
 - The 2 major types of blood substitutes are:
 - Volume expanders: Include solutions (saline) that are used to replace lost plasma volume, and
 - Oxygen therapeutics: These are agents that replace oxygen normally carried by hemoglobin in RBC
 - Of these 2 types development of oxygen therapeutics has been the most challenging.

Human Blood Substitutes Hemoglobin Based origin curring Cetplanation phoantage & limitation of HBCs PFLS pestasocassons Advantage & Pisadvantage 3 hin & Friction sedeeling swin 5 norda Turbulence in water, Reducing Drag materius and polyworthure, Lycoa, Ispandex fabrics. High tech Avena powerskin carten Speedo Fustskin, TYR verso Explanation]. oltrai technology GIPS satellites, pecivers, control segment usersegment (Explination) positioning navigation, greght planning Approach & Landing, Aistraffic management.
Collession avoidance, Flight Data mording

- 9. AI can assist providers in a variety of patient care and intelligent health systems.
 - AI techniques are prevalent for disease diagnosis, drug discovery, and patient risk identification.
 - Detecting and forestalling spread of ailments require ongoing data and examination.
 - AI in health care aid in gathering and processing valuable data to programming surgeon robots.
 - AI describes the capability of a machine to study the way a human learns.
 - AI in healthcare alters how information gets composed, analysed, and developed for patient care.



Biomining & Bioremediation explaination

- Biomining is the process of using microorganisms (microbes) to extract metals of economic interest
- Biomining techniques may also be used to clean up sites that have been polluted with metals.
- Valuable metals are commonly found in solid minerals.
- Microbes can oxidize metals, allowing them to dissolve in water.
- This is the basic process behind most biomining.
- Another, biomining technique uses microbes to break down the surrounding minerals.
- This makes it easier to recover the metal of interest directly from the remaining rock.
- Bioremediation is a biotechnical process.
- It is a type of waste management technique which involves use of organisms to remove or utilize the pollutants from a polluted area.
- Bioremediation is of 3 types:

1)Biostimulation

2)Bioaugmentation

3)Intrinsic Bioremediation

Muscular system as a scafold explaination

Awareness is increasing that bone morbidity due to osteoporosis is a major complication of Duchenne muscular dystrophy (DMD) and its treatment and that

it requires monitoring for early diagnosis and intervention to prevent clinically important sequelae.

The traditional method of fabricating 3D muscle constructs involves casting myogenic cells within a cylindrically shaped collagen-I gel that is anchored at the ends to porous felts. Rapid-prototyping techniques for hydrogel molding can be used to vary local myofiber alignment and to design complex muscle structures, and advanced biomaterials can deliver angiogenic, myogenic, and pro-survival factors to cells in a spatiotemporally controlled fashion. In addition to using biomaterial scaffolds, scaffold-free muscle tissue constructs have been generated using magnetic fields that allow the controlled assembly of magnetically labeled cells, as well as thermo-responsive polymers that allow controlled cell detachment from culture surfaces.

Although hydrogels have been the dominant muscle-engineering scaffold in vitro, in vivo studies of muscle repair have mainly utilized acellular natural scaffolds, porous matrices made of degradable polymeric materials, or scaffold-free myoblast sheets.

10.

- ❖ E-noses have a series of sensors that correspond to components of an odor and analyzes its chemical makeup to identify it.
- ❖ They are much more sensitive than human noses as they have a greater number of receptor sensors with higher sensitivity.
- ❖ Our human nose is elegant, sensitive, and self-repairing, but the E-nose sensors do not fatigue or get the "flu".
- ❖ Further, the E-nose can be sent to detect toxic and otherwise hazardous situations that humans may wish to avoid.

The E-Nose devices are used in these Industries:

- Agricultural
- Petrochemical
- Chemical
- Food and beverage
- Packaging materials
- Plastics
- Pet food
- Pulp and paper
- Medical research
- Military

Bio printing is defined as the printing of structures consisting of living cells, bio materials and active bio molecules.

Controllable microstructures with a high degree of reproducibility and scalability.

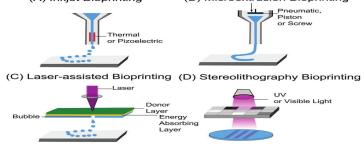
A solution for the organ shortages and Significant potential of drug delivery & cancer studies

Hydrogels are attractive materials for bio printing.

They are enormous three dimensional network of polymer chains holding a mass of water

(A) Inkjet Bioprinting

(B) Microextrusion Bioprinting



DNA origami is the nanoscale folding of DNA to create arbitrary two- and three-dimensional shapes at the nanoscale. The specificity of the interactions between complementary base pairs makes DNA a useful construction material, through design of its base sequences. DNA is a well- understood material that is suitable for creating scaffolds that hold other molecules in place or to create structures all on its own.

BIOCOMPUTING:

A computer that uses components of biological origin (such as molecules of DNA) instead of electrical components.

Main component used is DNA. The main application is in disease prediction and disease diagnosis.