



**ST. JOSEPH'S UNIVERSITY, BENGALURU -27**  
**Physics open elective – III SEMESTER**  
**SEMESTER EXAMINATION: October 2023**  
(Examination conducted in December 2023)  
**PH OE4: Biomimicry- Innovations Inspired by Nature**  
(For current batch students only)

Registration Number:
Date & session:

**Time: 2 hours**

**Max marks: 60**

**This paper contains 3 printed pages and 2 parts.**

**Part A**

**Answer any four questions. Each question carries 10 marks. 4x10=40**

1. a. Define biomimicry. How does it differ from biomorphism and bio-utilization?  
Give an example for each.  
b. What are the levels of Biomimicry? Give an example for each level.
2. Write down the physics concepts associated with the creatures given below.
  - a. fireflies
  - b. Mantis shrimp eyes
  - c. hummingbird
  - d. Blue morpho butterfly wings.
  - e. Gecko feet
  - f. Whale fins
  - g. spider silk
  - h. Moth eyes
  - i. Shark skins
  - j. jellyfish glow.

3. Match the nature-inspired innovations to their respective counterparts given below.

i. Insulation materials for extreme cold conditions	A. Blue Morpho Butterfly
ii. High-speed transportation design	B. Bees
iii. Robust and adaptable robotics	C. Bats
iv. Anti-counterfeiting technology for banknotes	D. Shark
v. Self-cleaning surfaces for buildings and products	E. Cats
vi. Swarm robotics and coordination algorithm	F. Cockroach
vii. Sonar technology for navigation and obstacle detection	G. Whale
viii. Improved road reflectors and retroreflectors.	H. Cheetah
ix. Swimsuits that reduce drag	I. Polar bear
x. Efficient wind turbine blade designs	J. Lotus

4. Cryptic clues are a type of word puzzle commonly found in cryptic crosswords. They consist of a definition and a wordplay component that, when combined, lead to the answer. Below are given 10 cryptic clues connected to biomimicry. Find them.

- a. Wall-climbing creature's sticky wisdom.
- b. Silk weaver's engineering marvel.
- c. Nature's hitchhiker's grabber.
- d. Vivid boxer's speedy strike
- e. Radiant heliotropism source.
- f. Ink-spiller's design muse.
- g. Speedy avian commuter's inspiration.
- h. Insects' mounds' influence in construction.
- i. Tiny water bear's secret to survival.
- j. Explosive insect's innovation.

5. Below given are 10 riddles related to biomimicry. Find the organism for each riddle.

- a. I'm the speedy sprinter of the wild, inspiring trains to go the extra mile. What am I?
- b. In the depths, my colors change, like biomimicry, I can rearrange.  
What sea creature am I?
- c. With hues so bright and vision keen, I'm a marvel of biomimicry unseen.  
What colorful critter am I?
- d. My vision's sharp, like a dagger's pierce, inspiring innovations for seeing things clear.  
What sea creature is this?
- e. In the insect world, I'm a parasite's foe, biomimicry hearing aids from me did grow.  
Who am I?
- f. In arid deserts, I breathe with ease, biomimicry's cool systems mimic by breeze.  
What am I?
- g. In the ocean's dance, I flip and play, biomimicry's sonar tech takes my lead today.  
Who am I?
- h. Beneath the waves, I glide and twist, biomimicry's turbines harness my mist. What am I?
- i. In the ocean's depths, I rule the scene, biomimicry's sleek designs make waves pristine.  
Who am I?
- j. my night vision is sharp, my gaze so wise, biomimicry's cameras mimic my prize.  
What eyes do I have?

## Part B

**This part consists of scenario-based questions. Answer any 4 questions. 4x5 = 20**

**Your answers must be very brief and to the point. Each question carries 5 marks.**

6. a. You visit a newly developed park that feels remarkably comfortable and uses minimal energy for lighting and climate control. What biomimicry systems could have been applied to create this eco-friendly urban space?

b. You spill coffee on your new shirt, but to your surprise, the coffee simply beads up and rolls off the fabric. What biomimicry-inspired technology could be behind this stain-resistant fabric?

7. a. You notice a new camera advertised as a night vision device that doesn't emit any light. What creature's vision might have inspired this innovative camera technology?

b. Your friend boasts about their newly built home that stays naturally cool in summer and warm in winter without excessive energy use. What biomimicry concept could explain this energy-efficient design?

8. a. Your neighbor has a robot that autonomously cleans their entire house without needing human intervention. What biomimicry-inspired design principles could enable this advanced cleaning technology?

b. You read about a new form of public transportation that claims to be exceptionally efficient, quiet, and environmentally friendly. What biomimicry applications could be behind this transportation innovation?

9. a. Your family member receives a medical implant that promotes rapid healing and integrates seamlessly with the body. Which biomimicry-inspired technology might have contributed to this medical breakthrough?

b. You're considering a new mode of transportation for your daily commute. You want something efficient and eco-friendly. What biomimicry-inspired transportation options might you explore, and which creatures or natural processes might have influenced them?

10.a. You're admitted to a hospital room with state-of-the-art technology. The room is designed for your comfort and recovery. What biomimicry concepts could be at play in this futuristic hospital room, and how do they enhance patient care?

b. Your new workplace is in a high-tech office building known for its sustainability and energy efficiency. How might biomimicry principles have been applied in the design and construction of this building, and what benefits do these principles bring to daily office life?