Course Title | Bio-inspired Design | Course No | To be filled by the office
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Specialization | Design (INT) | Structure (IPC) | 3 | 0 | 3
Offered for | UG/PG/DD/PhD | Status (Core / Elective) | Elective
Prerequisite | Concepts in engineering design | To take effect from | January 2019

Course Objectives
This course intended to give the student the exposure of bio-inspired design principles. Train the student in applying the bio-inspired methodologies for innovation. Introducing the student with different perspectives of bio-inspired design. Enlighten the future scope of this valuable domain.

Course Outcomes
After completion of this course, the student is able to:
1. Describe methods for creative design,
2. Identify mechanical working principles of biological phenomena - explain their construction, motion, and/or processing mechanisms - formalize the essence of these mechanisms in models - derive non-conventional design principles from these models,
3. Implement these design principles in innovative technical devices - summarize the transition process from the biological to the mechanical domain - present their design in drawings and working models.

Contents of the course
1. **Introduction** (6)
   Basic principles, building blocks, material property charts, how the study of nature’s designs can help engineers, examples of successful biomimetic designs.
   Mechanical design – hierarchical construction, bio-composites, structure & properties of bamboo, silks, bones, teeth, shells, antlers and beaks, impact resistance, fracture mitigation, damping, self-healing.

2. **The Bio Inspired Design Approach** (4)
   Finding the biological information, Dealing with friction, Innovative designing with ACRREx (Abstracting, Categorizing, Reflecting, Reformulating and Extending) method.

3. **Bio-inspired Design Methodology** (5)
   Problem solving, TRIZ, Innovation and efficiency, functions, Integration between biology design and innovation, methodology chart.

4. **Bio-Designing Perspectives**
   - **Materials and surfaces**: Muscles and artificial muscles, lotus effect, gecko adhesion, Desert beetle, pitcher plants, bio-fouling, coatings. Silver ant and heat dissipation, insulation of fur and feathers, constructal theory.
   - **Sensors**: Biological sensors, Bio-inspired sensors.
   - **Control**: Neural control, Robot controllers, Running, Robustness, Crawling - Soft robotics, Gliding & Flapping flight, Swimming.
   - **Bio-optics** – structural colors, compound eyes, antireflection, stealth, imaging
   - **Navigation** – short & long range navigation techniques of bees, ants, turtles & migratory birds.
   - **Bioconstruction**: Mechanical stiffness and motion, Hydrostatic stiffness and motion.
   - **Biopropulsion**: Macroscale walking, Macroscale flying.

*Bio-inspired design task*
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3. Lakhtakia A, Martin-Palma RJ (eds); *Engineered biomimicry*; Elsevier, 2013 |

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